INTERSTATE ACCESS REQUEST

INTERSTATE 65 IN SOUTHERN WILLIAMSON COUNTY

WILLIAMSON COUNTY

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FOR THE
TENNESSEE DEPARTMENT OF
TRANSPORTATION
PLANNING DIVISION

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EXECUTIVE SUMMARY

This I-65 Interchange Access Request (IAR) is being made by the following local municipalities: Williamson County, the City of Spring Hill, and the Town of Thompson's Station. The proposed interchange is in the Nashville Area MPO Long Range Transportation Plan as a 2030 FHWA/state funded project.

The primary purpose and need for the new I-65 access between Saturn Parkway and SR 840 (see Figure E1) is to address regional accessibility and traffic congestion on the arterial and collector road system in the area bound by Saturn Parkway on the south, SR 840 on the north, US 31 (Columbia Pike) on the west, and I-65 on the east. Along I-65, the Saturn Parkway and SR 840 interchanges are 6 miles apart from the nearest gore for both intersections. Those two interchanges on I-65 offer only indirect access to the area. Once a motorist is on Saturn Parkway they must utilize the Port Royal Road, Kedron Road, or U.S. 31 interchange to gain direct access to the area. Likewise, SR 840 does not offer direct access to the area. Instead, a motorist must use the US 431 (Lewisburg Pike) or US 31 (Columbia Pike) interchanges on SR 840.

US 31 (Columbia Pike) contains one lane in each direction plus left turn lanes at key locations and experiences a poor level of service (LOS) with a 2012 daily traffic volume of 23,500 as recorded by the City of Spring Hill. Lower classified roads like Buckner Lane, Thompson's Station Road, Clayton Arnold Road, Pantall Road, Buckner Road, and Critz Lane are currently providing access to the area, and many of these roads lack appropriate design features to handle the volumes they carry. Many have vertical and horizontal curve deficiencies. Port Royal Road will experience approximately 16,000 vehicles per day in 2037 according to the Nashville Area MPO TDM. This seems to be a low projection because the City of Spring Hill counted 13,203 vehicles per day on that road in 2012. If a new interchange is not built on I-65 between Saturn Parkway and SR 840, Port Royal Road will need to be widened to two lanes per direction plus turn lanes. The limits of the widening should be from the Saturn Parkway westbound ramp terminals to Old Port Royal Road.

Two Build alternatives were examined including locating a new diamond interchange at Thompson's Station Road where it passes over I-65 or a new diamond interchange at the proposed extension of Buckner Road. This extension would run on new alignment from Buckner Lane to US 431 (Lewisburg Pike). Either location would provide the accessibility needed in the area and relieve poor levels of service, but the proposed Buckner Road extension, Build Alternative 1, is preferred and recommended. The costs associated with Build Alternative 1, a new interchange on I-65 at the extension of Buckner Road are as follows:

ROW Acquisition: $2,655,000

Construction: $29,191,000

Utility Relocation: $100,000

TOTAL: $31,946,000

This study includes analysis of the engineering feasibility and identifies the improvements that will best meet the existing and projected future regional accessibility needs of the I-65 corridor between Saturn Parkway and SR 840. Final approval of the IAR will be requested once all of the National Environmental Policy Act (NEPA) requirements have been met and a determination that this IAR and any potential changes from the NEPA process have been addressed, and the project is in an appropriate Long Range Transportation Plan (LRTP), Transportation Improvement Plan (TIP), or Statewide Transportation Improvement Plan (STIP).

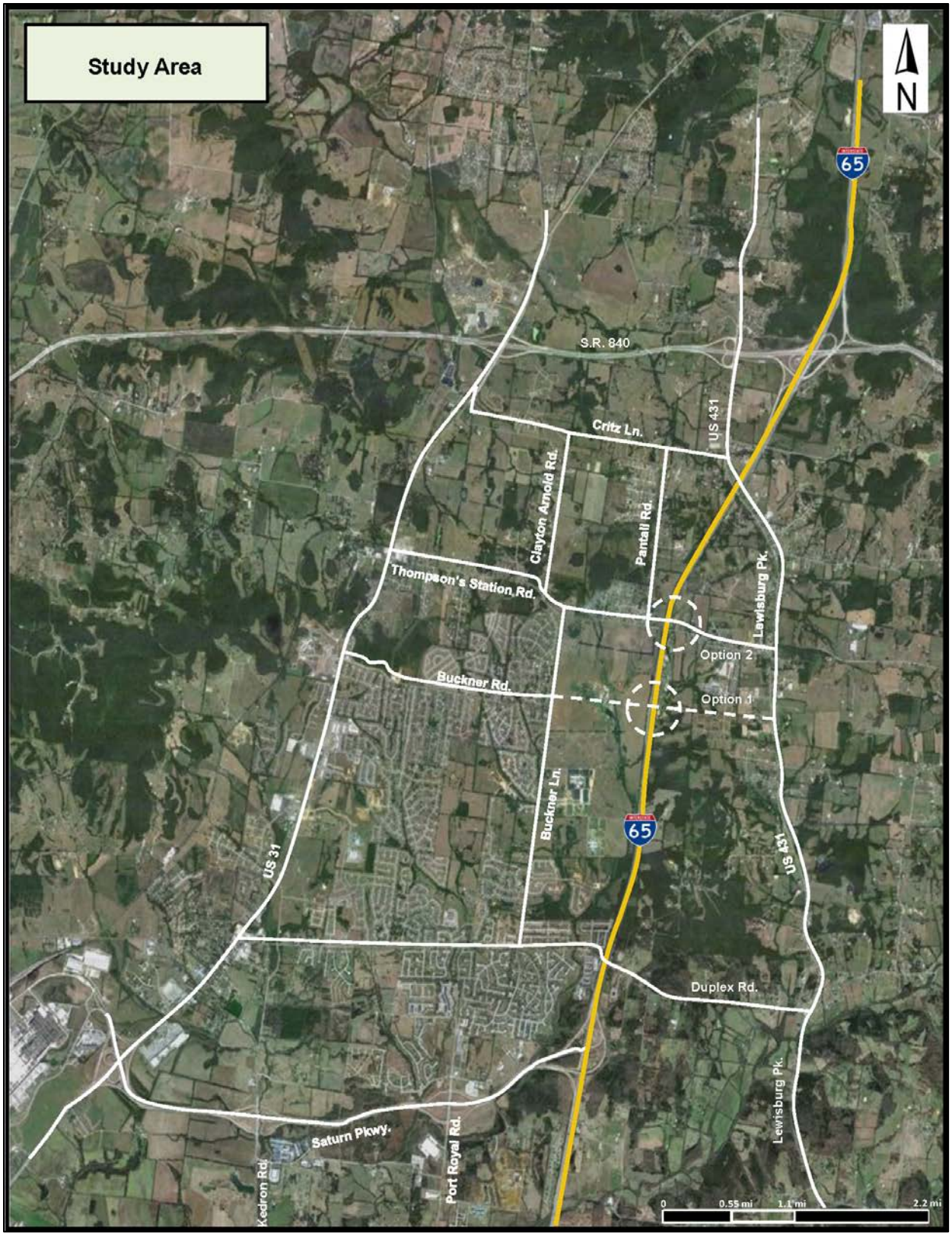


FIGURE E1- STUDY AREA

CHAPTER 1

INTRODUCTION

A. STUDY BACKGROUND

This study (see Figure 1 for the Vicinity Map) is the result of a joint effort between Williamson County, the Town of Thompson's Station and the City of Spring Hill. The three governmental entities recognize the potential need for an additional Interstate access point in southern Williamson County and commissioned this study to determine if one is justified. The southern Williamson County area (including Thompson's Station and Spring Hill) has grown at a rapid pace over the past twenty years and continues to experience a high level of growth and interest in economic investment into the community from the private sector. While the area is fortunate to have excellent schools, an excellent jobs base (including the General Motors assembly plant and recently announced Mars Pet Care headquarters), and relatively affordable housing, the transportation network in the area is lacking. The primary concerns include a lack of multi-lane roadway facilities to accommodate the efficient movement of people and goods and the lack of an Interstate access point that is central to the population base of the community. This study provides an assessment of existing and projected land uses and traffic and the potential for a new Interstate 65 interchange.

The proposed interchange is a proposed 2030 FHWA and State funded project in the Nashville Area MPO's Long Range Transportation Plan (LRTP). This status as an illustrative project will need to change to a short term project that would require planning, design, and construction to occur within eight years. The proposed interchange is not in the statewide Long Range Transportation Plan. The Spring Hill Major Thoroughfare Plan includes a proposed I-65 interchange to be located somewhere between SR 840 and Saturn Parkway.

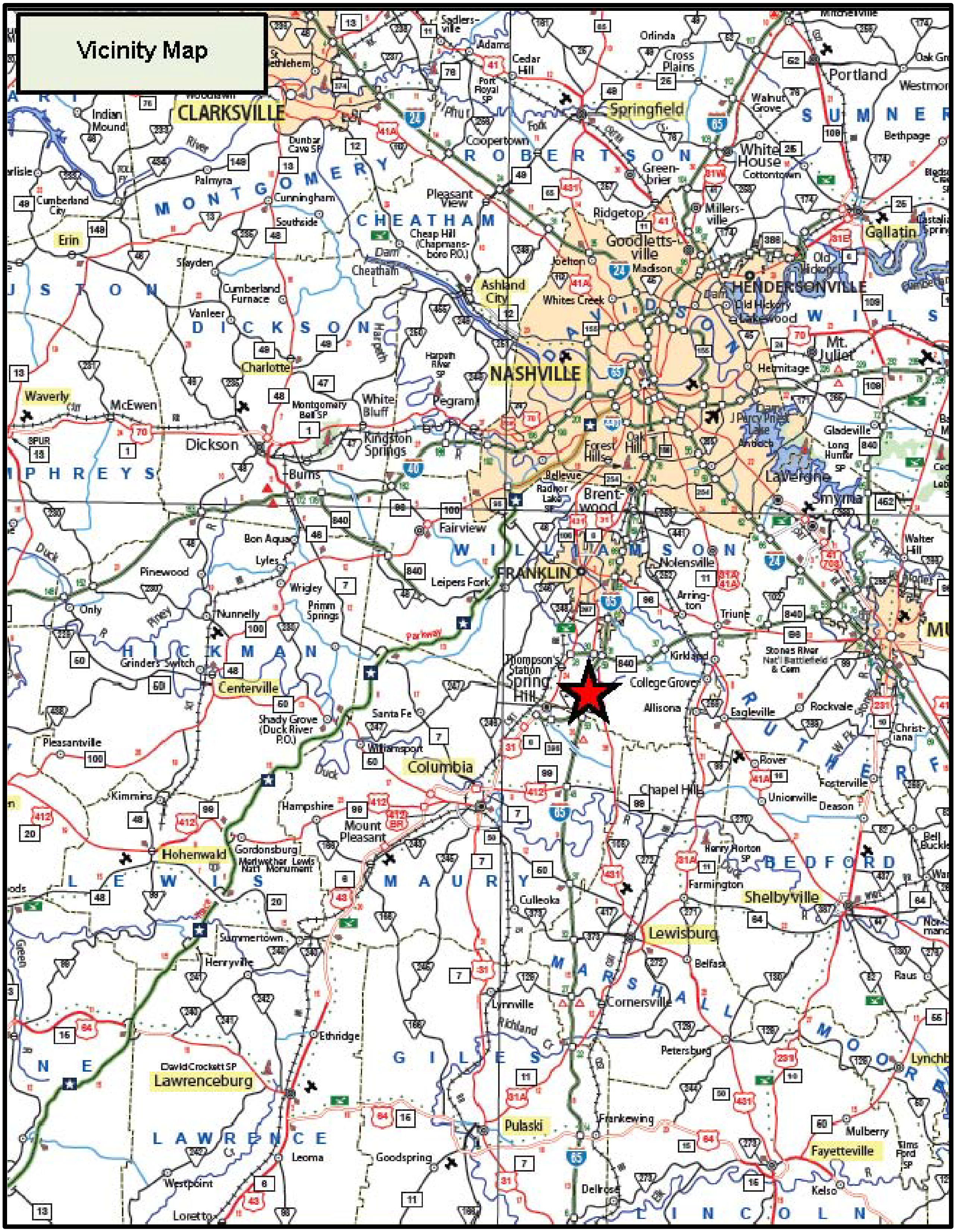


FIGURE 1- VICINITY MAP

B. DESCRIPTION OF STUDY AREA

The proposed interchange along I-65 would be located in Williamson County at either Thompson's Station Road or the extension of Buckner Road. Figure 2 depicts the study area. SR 840 to the north and Saturn Parkway to the south are the nearest existing interchanges and are approximately 23,800 feet apart, or 4.50 miles. Thompson's Station Road crosses over I-65 on a two lane bridge and is approximately 1.70 miles from the SR 840 ramps and 2.80 miles from the Saturn Parkway ramps. Conversely, the extension of Buckner Road would fall about 2.10 miles south of the SR 840 interchange ramps and 2.40 miles north of the Saturn Parkway ramps.

An interchange on I-65 at Thompson's Station Road or Buckner Road would have widespread impacts to the surrounding street system in Williamson County and Maury County. More to the point, the network of US, state, and local roads shown in Figure 2 will realize impacts. Three north-south oriented roads- US 31 (Columbia Pike), US 431 (Lewisburg Pike), and Buckner Lane will see a redistribution of traffic if a new interchange is constructed on I-65 between SR 840 and Saturn Parkway. Also expected to benefit from a new interchange on I-65 are Clayton Arnold Road and Pantall Road (shown in Figure 2). These two north-south roads accommodate a substantial amount of commuter trips between Williamson County and Nashville that are avoiding congestion on US 31 and I-65.

East-west oriented roads that will be impacted by a new interchange on I-65 include Saturn Parkway, Duplex Road, Buckner Road, Thompson's Station Road, Critz Lane, and SR 840.

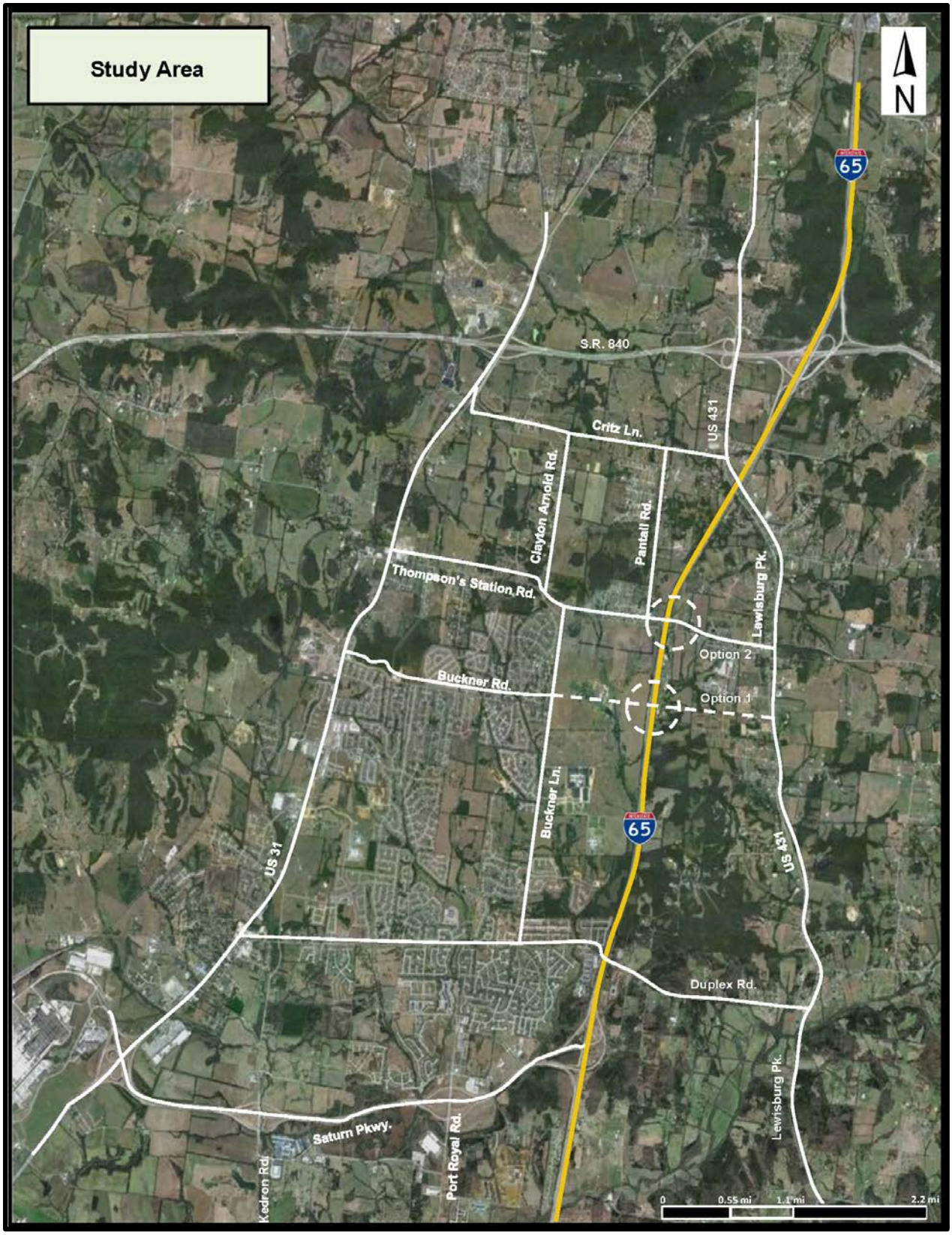


FIGURE 2- STUDY AREA

C. PURPOSE AND NEED

Williamson County, Maury County, Spring Hill, and Thompson's Station have all experienced substantial growth and development over the last twenty years resulting in congestion on the street system. This growth is expected to continue as these counties and municipalities meet the residential and commercial needs of the region. The area; generally bound by SR 840 on the north, Saturn Parkway on the south, I-65 on the east, and US 31 (Columbia Pike) on the west; and comprised of the aforementioned two cities and two counties, experience a significant amount of commuter trips that occur between the area and Nashville, Franklin, Brentwood, and Murfreesboro.

Commuters between the area and cities to the north utilize the major north-south arterials; US 31 (Columbia Pike) and US 431 (Lewisburg Pike); as well as I-65. Commuters using I-65 have two interchange choices to access the area including SR 840 and Saturn Parkway, which are 4.5 miles apart. This separation between interchanges and congestion on the freeway and arterials have resulted in commuters using minor arterial and collector alternatives like Buckner Lane, Clayton Arnold Road, Pantall Road, Critz Lane, Thompson's Station Road, and Buckner Road.

A proposed new interchange on I-65 would provide the following benefits related to regional accessibility:

- Improve the level of service on I-65 near Saturn Parkway
- Result in about 4,000 daily trips being diverted from I-65, north of Saturn Parkway
- Result in about 7,400 daily trips being diverted from Saturn Parkway, west of I-65
- Divert about 1,600 daily trips from an over-capacity US 31
- Divert about 5,200 daily trips from Lewisburg Pike (US 431)
- Improve the level of service at the SR 840 and Lewisburg Pike (US 431) interchange..

US 31 is a two lane roadway with turn lanes, yet it accommodates approximately 23,500 vehicles per day in 2012. Hence, a high level of corridor congestion occurs. In fact, using Chapter 15 methodology in the 2010 *Highway Capacity Manual*, US 31 is over-capacity today and conditions will worsen in the future. US 31 would be especially problematic to widen because of development along both sides of the highway.

A proposed new interchange on I-65 at Buckner Road or Thompson's Station Road will improve regional accessibility for the local communities, relieve congestion on the existing street system, and improve the level of service (LOS) on some segments of I-65. The most significant example of improvement to I-65 is south of the proposed new interchange where an improved LOS would be realized. The greatest improvement would occur at the I-65 and Saturn Parkway interchange where the northbound merge and southbound diverge would improve from LOS F to LOS D. This improvement is created because the new interchange will divert almost 4,000 daily trips from that segment of I-65.

Another regional improvement is expected at the SR 840 and Lewisburg Pike (US 431) interchange. In the PM peak hour, the eastbound SR 840 ramp terminal with Lewisburg Pike

should improve from LOS F without the new interchange to LOS E with the proposed new interchange.

A new interchange on I-65 will also stimulate economic development; both related to the interchange itself and that which would benefit from better I-65 access. At either location there is a significant amount of developable property that would be attractive from the standpoint of accessibility and visibility.

CHAPTER 2

EXISTING CONDITIONS

A. EXISTING NETWORK

Near the proposed interchange at either the proposed Buckner Road extension or Thompson's Station Road, I-65 carries two lanes in each direction and has a posted speed limit of 70 mph. The grade is relatively flat in the area of the potential interchange, but is considered rolling in the overall study area.

Figure 3 illustrates the road system in the proposed interchange environs and the geometrics (number of approach lanes) at key intersections. It also shows traffic control devices at these key intersections. SR 840 has two lanes per direction. All of the other roads within the study area have one lane in each direction.

B. CRASH HISTORY AND ANALYSIS

Existing crash data on I-65 near Thompson's Station Road and Buckner Road were not obtained because a new interchange will not mitigate typical freeway link crashes. A new interchange will increase the potential of crashes caused by side friction from merging and diverging. However, properly designed merge and diverge lanes will minimize the negative impact of a new interchange.

C. GEOMETRIC DEFICIENCIES

I-65 is a standard two-lane per direction freeway with full width shoulders. Consequently, geometric deficiencies do not exist. In 2012, the I-65 freeway segments between Saturn Parkway and SR 840 operate at LOS B and C, northbound and southbound, respectively, in the AM peak hour and LOS B and C, northbound and southbound in the PM peak hour, respectively. Therefore, the number of lanes for today's traffic is adequate.

D. EXISTING TRAFFIC

The Nashville Area MPO TDM was utilized to project traffic in the 2037 design year with and without a new interchange on I-65 between Saturn Parkway and SR 840. The TDM used 2008 as the base year; hence this study uses 2008 TDOT AADTs to compare to the results of the TDM. Figures 4A and 4B depict 2008 daily traffic from TDOT counts and the TDM.

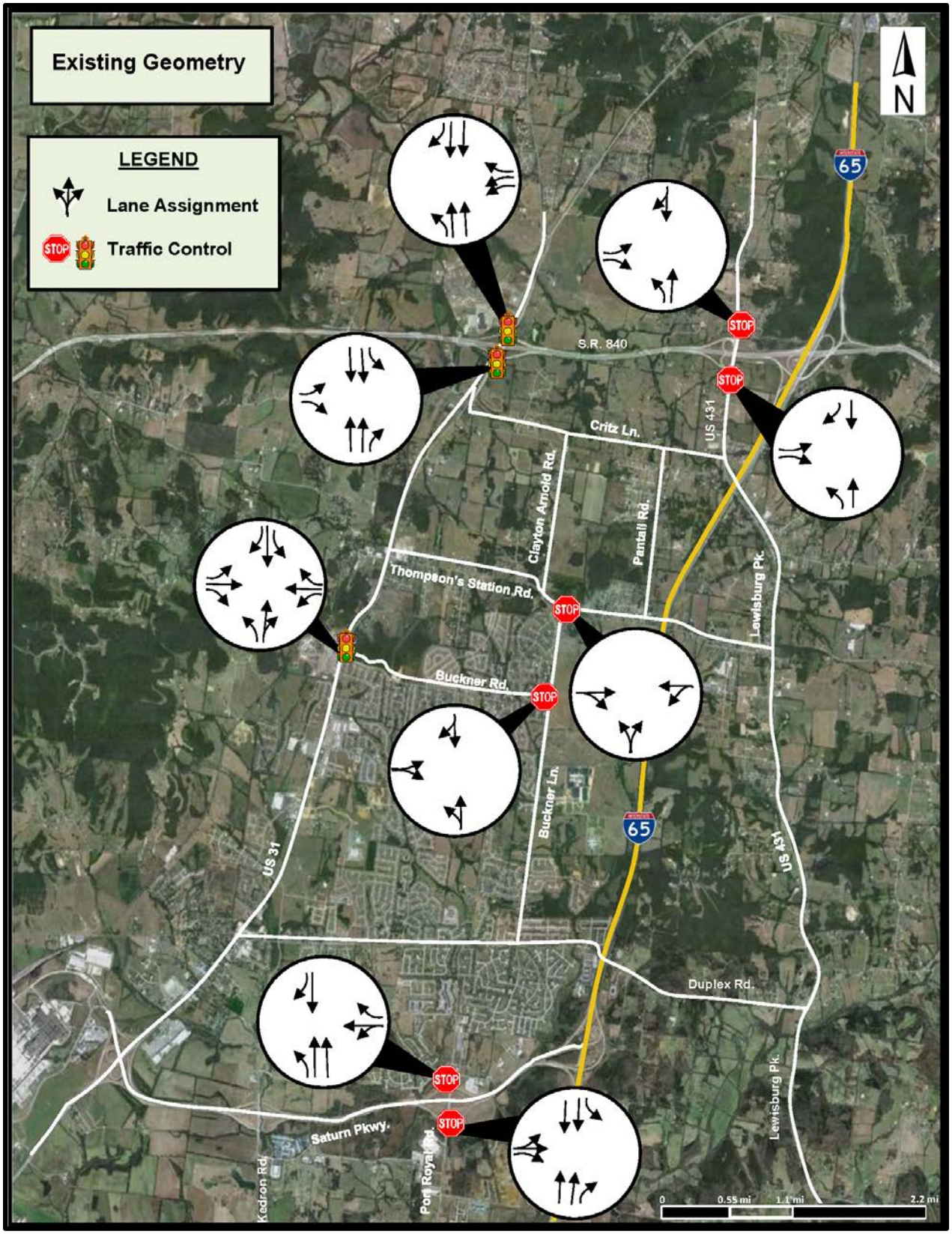


FIGURE 3- EXISTING ROAD NETWORK

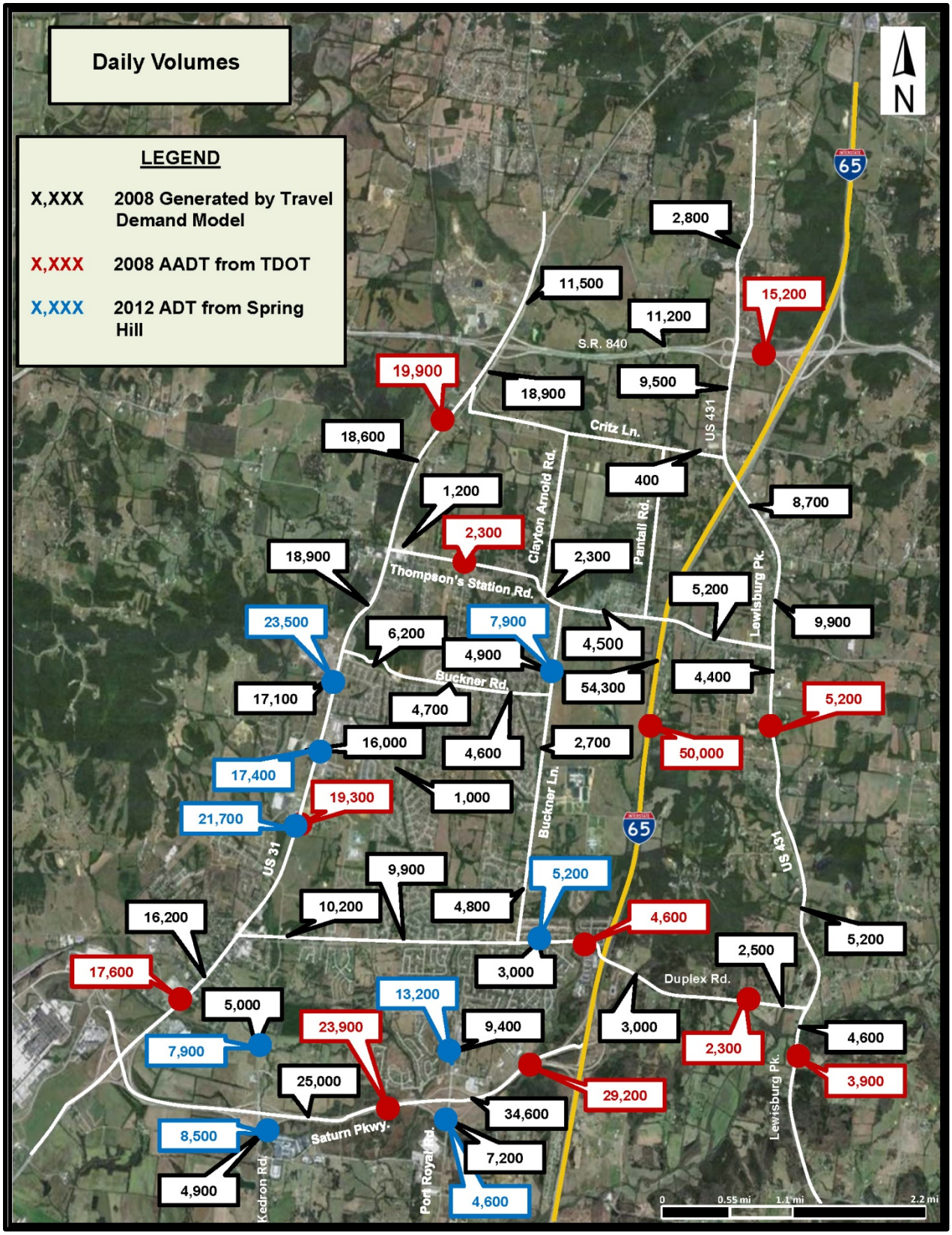


FIGURE 4A- EXISTING DAILY TRAFFIC VOLUMES

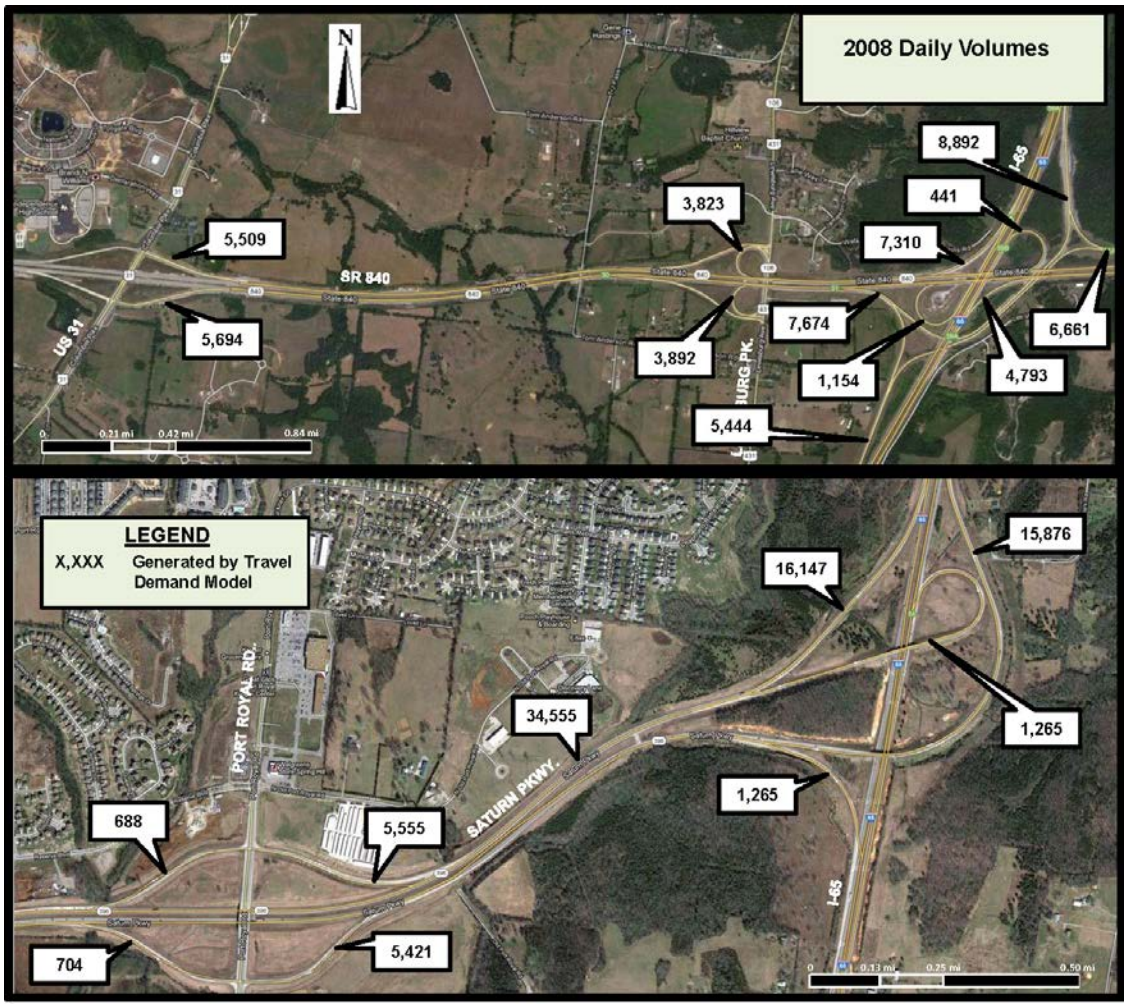


FIGURE 4B- EXISTING DAILY TRAFFIC VOLUMES: FREEWAY INSET

In 2008, I-65 accommodated an Average Annual Daily Traffic (AADT) volume of 50,001 between Saturn Parkway and SR 840. Saturn Parkway's 2008 AADT was 29,233 between I-65 and Port Royal Road and 23,877 between Port Royal Road and Kedron Road. US 31 (Columbia Pike) accommodates between 17,634 vpd on the southern part of the study area and 19,891 vpd near SR 840. US 431 (Lewisburg Pike) has AADTs ranging from 9,850 vpd north of Thompson's Station Road to 4,586 vpd south of Duplex Road.

Spring Hill conducts their own 24-hour segment counts each year and those relevant to this study are shown in Figure 4. The Spring Hill ADTs suggest that traffic growth has occurred from 2008 to 2012.

Intersection turning movement counts were made at the study area intersections in winter 2012 and a summary of that data is included in Appendix 1 Figure A1. Also included in Appendix 1 Figure A2 is projected year 2017 AM and PM peak hour traffic volumes at the study area

intersections. The AM peak hour generally begins at 7:00 or 7:15 and the PM peak hour at 4:45 or 5:00.

E. EXISTING LAND USE AND ZONING

Spring Hill

Spring Hill covers approximately 17 square miles and is located 35 miles south of Nashville, TN. The city is situated within two counties, Maury and Williamson, and is part of the greater Cumberland Region that includes Cheatham, Davidson, Dickson, Maury, Montgomery, Robertson, Rutherford, Sumner, Williamson and Wilson counties. Like most middle Tennessee cities, Spring Hill experienced a tremendous amount of growth between 1990 and 2006. However, the population growth in Spring Hill has surpassed the typical growth rates of other cities in the region. While other cities in the region have experienced significant annual growth rates of 5-6%, Spring Hill has experienced annual growth rates much higher. Spring Hill's population grew to 29,036 in 2010, an increase of 276% between 2000 and 2010. The population in 1990 was only 1,464 thus representing a percentage growth of 1,883% over a 20 year period. This represents a tremendous amount of growth that has been the result of several factors including, but not limited to:

- The opening of the GM automotive plant in 1990
- Proximity to major employment centers such as Franklin, Brentwood and Nashville
- Highly rated public schools
- Affordable housing

Land uses within the City are predominantly residential and commercial with some industrial uses. However, residential uses are most prominent within the city. The primary commercial areas of Spring Hill are at the Saturn Parkway/Port Royal Road interchange, Saturn Parkway/U.S. 31 interchange and the entire length of U.S. 31 from Saturn Parkway to the Buckner Road intersection. The industrial uses are adjacent to the south side of Saturn Parkway and on the west side of U.S. 31 just south of Saturn Parkway.

Thompson's Station

The Town of Thompson's Station is located approximately 25 miles southwest of Nashville, in southern Williamson County between Franklin and Spring Hill. According to the 2010 Census, Thompson's Station has a population of 2,194 people. The population in 2000 was 1,283 thus resulting in a 71 percent increase between 2000 and 2010.

Thompson's Station has been recognized for its rural atmosphere characterized by low density housing, agricultural areas and acres of open land and natural resources, including the West Harpeth River and its tributaries. However, Thompson's Station is located in close proximity to Franklin and Cool Springs, a large commercial hub providing numerous economic resources. In

recent years, higher density housing has started to occur in locations suitable to providing easy access to commercial activities.

Land uses within the Town are predominantly residential and agricultural with some commercial uses. The more intense residential uses are primarily located around the Town Hall and adjacent to Critz Lane and Thompson's Station Road. The primary commercial areas of Thompson's Station are located around the Town Hall and at the corner of U.S. 31 and Thompson's Station Road. However, recent development in the form of a corporate headquarters has begun at the southeast corner of the U.S. 31 and State Route 840 interchange.

Existing Land Use – Buckner Road Interchange

The Buckner Road Extension at I-65 proposed interchange location consists of 4 quadrants of which 2 are in the corporate limits of the City of Spring Hill. The other 2 quadrants are in the Town of Thompson's Station or unincorporated and in Williamson County. The existing land uses on these 4 quadrants are as follows:

- **Northeast Quadrant of Buckner Road Extension and I-65** – Rural Agriculture and Low Density Residential
- **Northwest Quadrant of Buckner Road Extension and I-65** – Rural Agriculture
- **Southeast Quadrant of Buckner Road Extension and I-65** – Rural Agriculture
- **Southwest Quadrant of Buckner Road Extension and I-65** – Rural Agriculture

All four quadrants of the Buckner Road Extension interchange are rural/ agricultural in nature with some large lot single family housing. However, there are heavy residential populations and two schools in very close proximity, Summit High School and Spring Station Middle School.

The zoning for the two quadrants that fall within the corporate limits of the City of Spring Hill is as follows (map of zoning classifications follows):

- **Northwest Quadrant of Buckner Road Extension and I-65** – Ag zoning - Intended to preserve the rural character of land within the planning region specifically allowing agricultural purposes, those buildings necessary to support those purposes and low density residential development. This district may include areas and lands not suitable for development due to limitations of soil, geology or topography. This district will include community facilities, public utilities and open uses which specifically serve the residents of the district. Facilities which are enhanced by an open environment and which do not deter from the overall rural character of the district are also included. Minimum lot size is 2 acres.
- **Southwest Quadrant of Buckner road Extension and I-65** - Ag zoning - Intended to preserve the rural character of land within the planning region specifically allowing agricultural purposes, those buildings necessary to support those purposes and low density residential development. This district may include areas and lands not suitable for development due to limitations of soil, geology or topography. This district will include community facilities, public utilities and open uses which specifically serve the

residents of the district. Facilities which are enhanced by an open environment and which do not deter from the overall rural character of the district are also included. Minimum lot size is 2 acres.

The zoning for the one quadrant that falls within the corporate limits of the Town of Thompson's Station is as follows (map of zoning classifications follows):

- **Northeast Quadrant of Buckner Road Extension and I-65** – Low Intensity zoning – Intended for low density residential development designed to maintain a rural character. This district will consist of single-family detached dwellings and their accessory structures. Minimum lot size is 1 acre.

The zoning for the one quadrant that is unincorporated follows (Williamson County Zoning):

- **Southeast Quadrant of Buckner Road Extension and I-65** – Rural Development 1 zoning – Intended to support and protect the rural character of Williamson County east of I-65 but also allow for low-density residential development where appropriate infrastructure is available. The district is also intended to support agricultural uses that are more prevalent in the eastern areas of the County. Development in the RD-1 district should respect the natural resources with a focus on conservation subdivisions as the primary form of residential development emphasized in the Williamson County Comprehensive Land Use Plan. Maximum gross residential density = 1 unit per acre. Minimum lot area for traditional subdivisions = 1 acre. Minimum lot area for conservation subdivision = 10,000 square feet.

Existing Land Use – Thompson's Station Road Interchange

The Thompson's Station Road at I-65 proposed interchange location consists of 4 quadrants of which 3 are in the corporate limits of the Town of Thompson's Station. The existing land uses on these 4 quadrants are as follows:

- **Northeast Quadrant of Thompson's Station Road and I-65** – Rural Agriculture and Low Density Residential
- **Northwest Quadrant of Thompson's Station Road and I-65** – Rural Agriculture and Low Density Residential
- **Southeast Quadrant of Thompson's Station Road and I-65** – Rural Agriculture and Low Density Residential
- **Southwest Quadrant of Thompson's Station Road and I-65** – Rural Agriculture

All four quadrants of the Thompson's Station Road interchange are rural/agricultural in nature with some large lot single family housing. However, there are heavy residential populations in very close proximity.

The zoning for the three quadrants that fall within the corporate limits of the Town of Thompson's Station is as follows (see Figure 5):

- **Northeast Quadrant of Thompson's Station Road and I-65** – Planned Neighborhood District zoning– Intended to provide for the creation of neighborhood development in areas that are relatively undeveloped and that are determined not to have existing defined neighborhood characteristics. This district is also intended to provide developmental flexibility in that bulk and performance standards will be procedurally established. It will also provide for the Town's input on design and architectural aspects of the plan through the planning and legislative process.
- **Northwest Quadrant of Thompson's Station Road and I-65** – Low Intensity zoning – Intended for low density residential development designed to maintain a rural character. This district will consist of single-family detached dwellings and their accessory structures. Minimum lot size is 1 acre.
- **Southeast Quadrant of Thompson's Station Road and I-65** – High Intensity zoning and Low Intensity zoning. High Intensity – Intended for higher density residential development where urban services and facilities, including public sewer, are provided or where the extension of such services and facilities will be available prior to development. This district may permit for the development of multi-family units with a plan that incorporates cluster development. Minimum lot size is 20,000 square feet.

  Low Intensity zoning – See description in Northwest Quadrant.

The zoning for the one quadrant that falls within the corporate limits of the City of Spring Hill is as follows (see Figure 5):

- **Southwest Quadrant of Thompson's Station Road and I-65** – R-2 and Ag zoning. R-2 – Intended to provide a medium density, single-family residential environment having good access to public water, schools and other community facilities, but well separated from heavy traffic and other incompatible activities. Minimum lot size is 10,000 square feet.

  Ag zoning - Intended to preserve the rural character of land within the planning region specifically allowing agricultural purposes, those buildings necessary to support those purposes and low density residential development. This district may include areas and lands not suitable for development due to limitations of soil, geology or topography. This district will include community facilities, public utilities and open uses which specifically serve the residents of the district. Facilities which are enhanced by an open environment and which do not deter from the overall rural character of the district are also included. Minimum lot size is 2 acres.

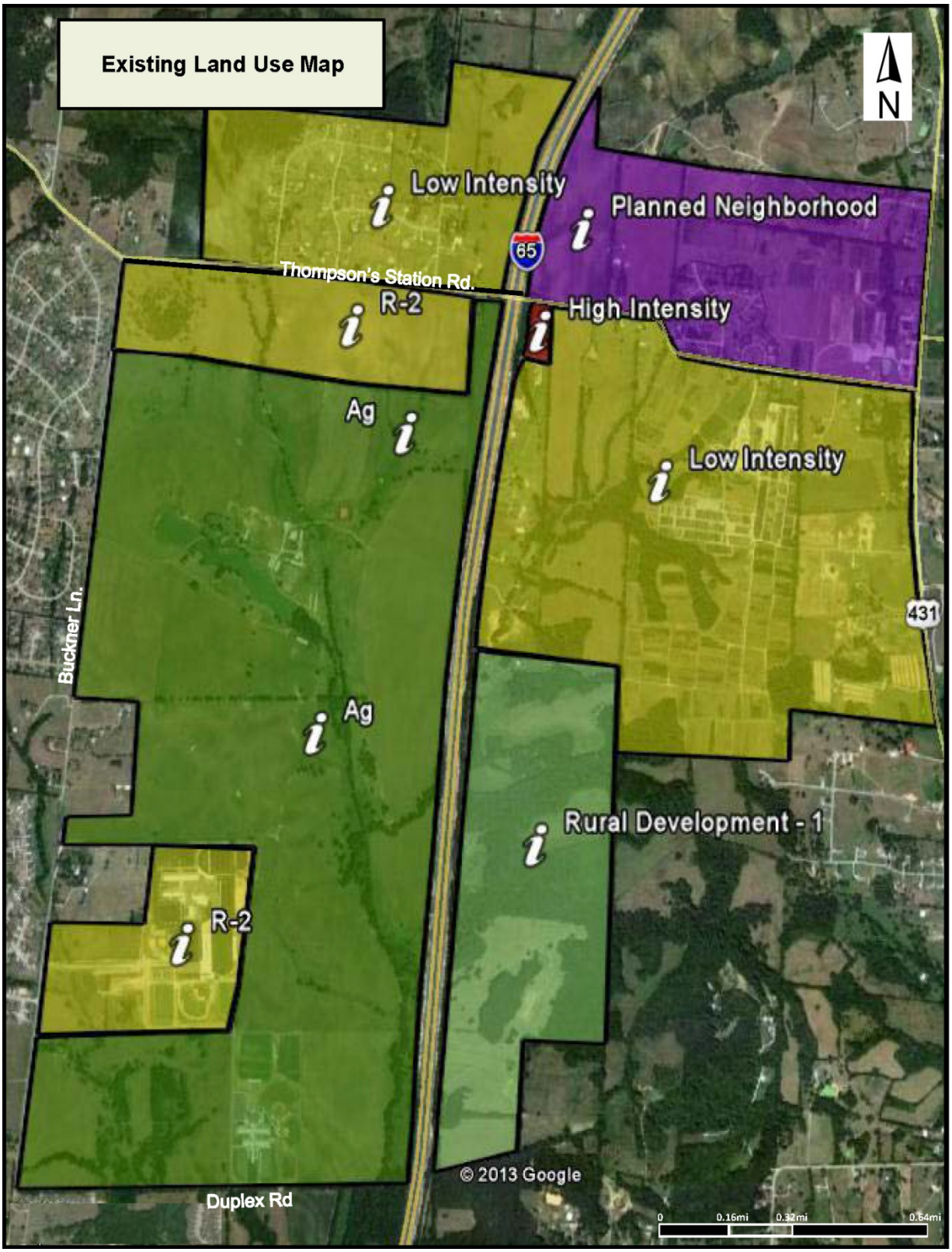


FIGURE 5- EXISTING ZONING CLASSIFICATIONS

F. PRELIMINARY ENVIRONMENTAL CONSTRAINTS

Environmental Constraints

The environmental constraints for both interchange locations will be virtually the same due to the fact that they are in such close proximity.

According to the United States Geological Survey (USGS), a blue-line stream, Aenon Creek, runs north-south within the study area between Buckner Lane and I-65. In addition, unnamed tributaries to Aenon Creek run north-south both west and east of I-65 within the study area. According to the Tennessee Department of Environment and Conservation (TDEC), neither Aenon Creek nor its tributaries are known exceptional waters or 303(d) listed streams.

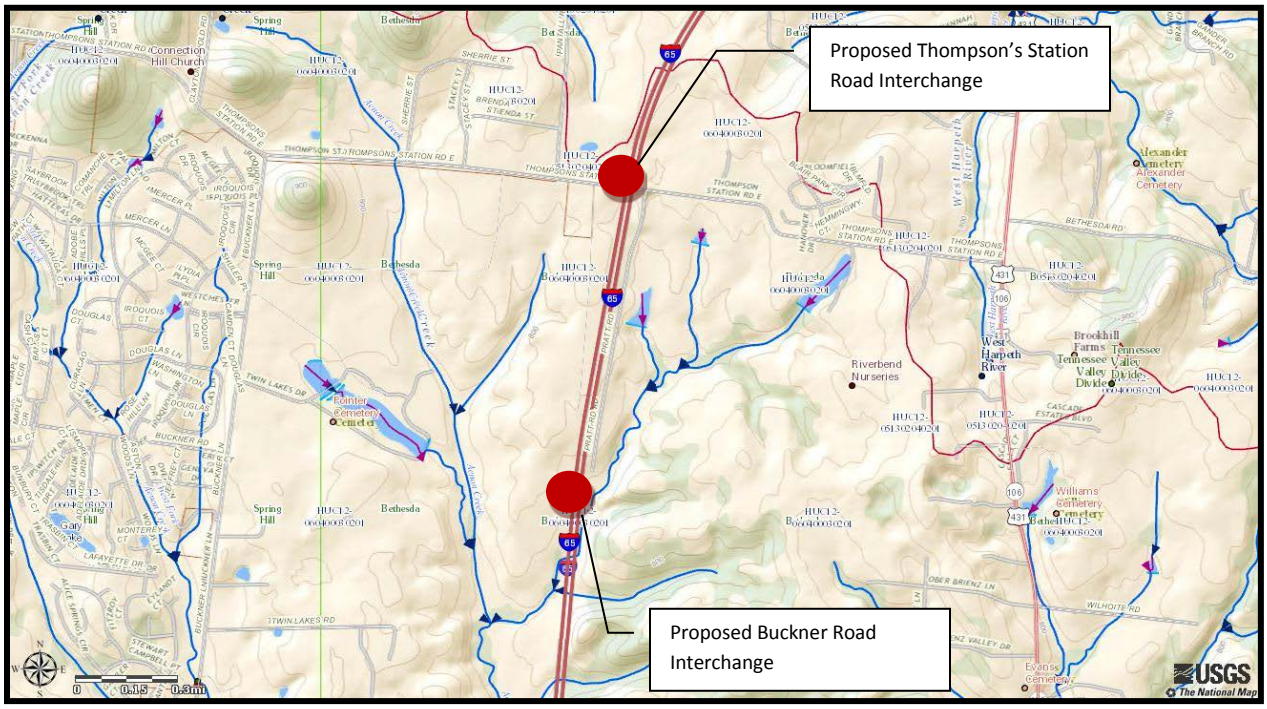


FIGURE 6- STUDY AREA TOPOGRAPHY

The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) indicates that no flood zones are located within the study limits of Thompson's Station Road or the proposed Buckner Road Extension. These maps are included in Appendix 4- FEMA and Soil Maps.

The topography within the study area (see Figure 6) is rolling to mountainous according to the USGS. According to the United States Department of Agriculture (USDA) National Resources Conservation Service (NRCS) Web Soil Survey, several soil types are present. They include Armor silt loams (ArB and ArB2), Culleoka silt loams (CkD), Donerail silt loams (DoC2), Egam silt loams (Eg), Huntington silt loams (Hu), Maury silt loams (MbC2), Stiversville clay loams

(SrC3), and Stiversville silt loams (StB2 and StC2). Slopes range from 2 to 20 percent, with a majority in the 5 to 12 percent range. The soil survey map is included in Appendix 4.

Finally, according to the USGS, a cemetery named Pointer Cemetery is located between Buckner Lane and I-65 and north of the proposed Buckner Road Extension.

CHAPTER 3

FUTURE CONDITIONS

A. FUTURE TRAFFIC VOLUMES

Traffic projections were made for 2037 because it is 20 years beyond the baseline year- 2017. The Nashville Area MPO TDM has an out-year of 2035, so all model generated traffic volumes were adjusted by two years using the same growth rate that the model projected. Future year 2037 traffic projections were based solely on the TDM and the land use projections in it. Appendix 1 Figures A3A and A3B present the projected TDM-generated daily traffic volumes in 2037 with the No Build scenario. That is to say, with the existing plus committed network (E+C) but without the proposed new I-65 interchange near Thompson's Station Road or Buckner Road. No new roads are planned with the E+C network, except extending SR 840 to the west, and no major widening is expected to any road segment.

Some selected 2008 model generated daily traffic volumes were compared to the TDM-generated daily traffic volumes and the resulted shown in Table 1.

Table 1- TDM Generated AADT Comparison with 2037 E+C Network

ROAD	LOCATION	2008	2037	PERCENT INCREASE	ANNUAL PERCENT INCREASE
I-65	Between Saturn Pky and SR 840	54,283	79,515	46.48	1.60
Saturn Parkway	Between I-65 and Port Royal Road	34,555	49,108	42.12	1.45
SR 840	Between US 431 and US 31	11,203	58,746	424.38	14.63
US 431	Between SR 840 and Critz Lane	9,506	18,382	93.37	3.22
US 431	Just South of Thompson's Station Rd.	4,424	10,767	143.38	4.94
US 31	Between SR 840 and Critz Lane	18,933	25,630	35.37	1.22
US 31	Just South of Buckner Rd.	17,113	23,314	36.24	1.25
Thompson's Station Rd.	Between Buckner Ln. and Clayton Arnold Rd.	2,250	9,602	326.76	11.27
Buckner Road	Just East of US 31	4,744	7,980	68.21	2.35

Most of the major interstate, US and state routes are expected to realize modest growth in traffic from 2008 through 2037. The daily traffic on US 31 (Columbia Pike) will increase by only approximately 1.25 percent per year, which is approximately 35 or 36 percent total growth in the 29 year time span. This small increase is attributed to existing capacity constraint on US 31 (Columbia Pike) as well as the travel desires of the public as captured in the TDM. More substantial traffic growth will occur on US 431 (Lewisburg Pike) with a 3.22 percent annual growth rate expected between SR 840 and Critz Lane and a 4.94 percent annual growth rate expected just south of Thompson's Station Road. Significant traffic growth will occur on SR 840, in part because it will be extended westward to I-40 thereby serving more through trips. Thompson's Station Road will experience traffic growth at a rate of 11.27 percent per annum with the total growth approximating 327 percent.

A review of the land use data supports this growth rate on Thompson's Station Road; the area has significant growth potential with substantial undeveloped property available and utilities either readily available or available at a relatively low cost. Projected traffic growth on Thompson's Station Road is indicative of all the collector and local roads in the general vicinity of the proposed interchange.

Year 2017 and 2037 intersection and ramp traffic volumes were estimated by increasing the 2012 counts by growth factors derived from the TDM. This methodology assures that future traffic is well grounded in actual existing traffic patterns. Future TDM generated daily traffic was obtained and compared with the 2008 values. The percentage increase was then applied to each intersection approach. At closely spaced intersections, traffic projections were balanced and smoothed to account for varying growth rates.

B. FUTURE LAND USE

Future land use has been developed in comprehensive plans for Williamson County, Thompson's Station, and Spring Hill. This information, shown in Figure 7, was used to project future land use in the vicinity of the Thompson's Station Road and Buckner Road interchanges.

Future Land Use – Buckner Road Interchange

The future land uses of the 4 quadrants of the Buckner Road interchange are as follows:

- **Northwest Quadrant of Buckner Road Extension and I-65** – The City of Spring Hill has designated this area as District-Mixed Use Community in the *Spring Hill Comprehensive Plan*. District-Mixed Use Community is intended to create mixed use communities that reflect a mix of residential, commercial, office, and open space. These districts are generally characterized by compact, mixed-use development typical of traditional neighborhood developments. Buildings have shallow setbacks and use the building structure to frame the street.
- **Southwest Quadrant of Buckner Road Extension and I-65** – The City of Spring Hill has designated this area as District-Mixed Use Community in the *Spring Hill Comprehensive Plan*. District-Mixed Use Community is intended to create mixed use communities that reflect a mix of residential, commercial, office, and open space. These districts are generally characterized by compact, mixed-use development typical of traditional neighborhood developments. Buildings have shallow setbacks and use the building structure to frame the street.
- **Northeast Quadrant of Buckner Road Extension and I-65** – Thompsons's Station, in the *Comprehensive Plan for Thompson's Station*, wants to preserve the rural characteristics of the community. Currently, the quadrant has Low Intensity zoning, which consists of residential lots of at least one (1) acre in size. It is expected that this zoning will remain in place unless and until Thompson's Station revisits the issue if an interchange is constructed at this location.
- **Southeast Quadrant of Buckner Road Extension and I-65** – Williamson County proposes to promote Rural Development of the area near the interchange in the *Williamson County Comprehensive Land Use Plan*. These Rural Development areas

are intended to encourage agricultural uses as well as residential areas with large lots; generally one (1) acre per dwelling unit or larger. In addition, institutional uses such as schools and churches as well as parks and recreational uses are encouraged.

Future Land Use – Thompson's Station Road Interchange

The future land uses of the 4 quadrants of the Thompson's Station Road interchange are as follows:

- **Northeast Quadrant of Thompson's Station Road and I-65** – Thompsons's Station, in the *Comprehensive Plan for Thompson's Station*, wants to preserve the rural characteristics of the community. Currently, the quadrant has Planned Neighborhood District zoning, which is intended to provide comprehensive development of areas that are relatively undeveloped. It is expected that this zoning will remain in place unless and until Thompson's Station revisits the issue if an interchange is constructed at this location.
- **Northwest Quadrant of Thompson's Station Road and I-65** – Thompsons's Station, in the *Comprehensive Plan for Thompson's Station*, wants to preserve the rural characteristics of the community. Currently, the quadrant has Low Intensity zoning, which consists of residential lots of at least one (1) acre in size. It is expected that this zoning will remain in place unless and until Thompson's Station revisits the issue if an interchange is constructed at this location.
- **Southeast Quadrant of Thompson's Station Road and I-65** – Thompsons's Station, in the *Comprehensive Plan for Thompson's Station*, wants to preserve the rural characteristics of the community. Currently, the quadrant has Low Intensity zoning, which consists of residential lots of at least one (1) acre in size. It is expected that this zoning will remain in place unless and until Thompson's Station revisits the issue if an interchange is constructed at this location.
- **Southwest Quadrant of Thompson's Station Road and I-65** – The City of Spring Hill has designated this area as District-Mixed Use Community in the *Spring Hill Comprehensive Plan*. District-Mixed Use Community is intended to create mixed use communities that reflect a mix of residential, commercial, office, and open space. These districts are generally characterized by compact, mixed-use development typical of traditional neighborhood developments. Buildings have shallow setbacks and use the building structure to frame the street.

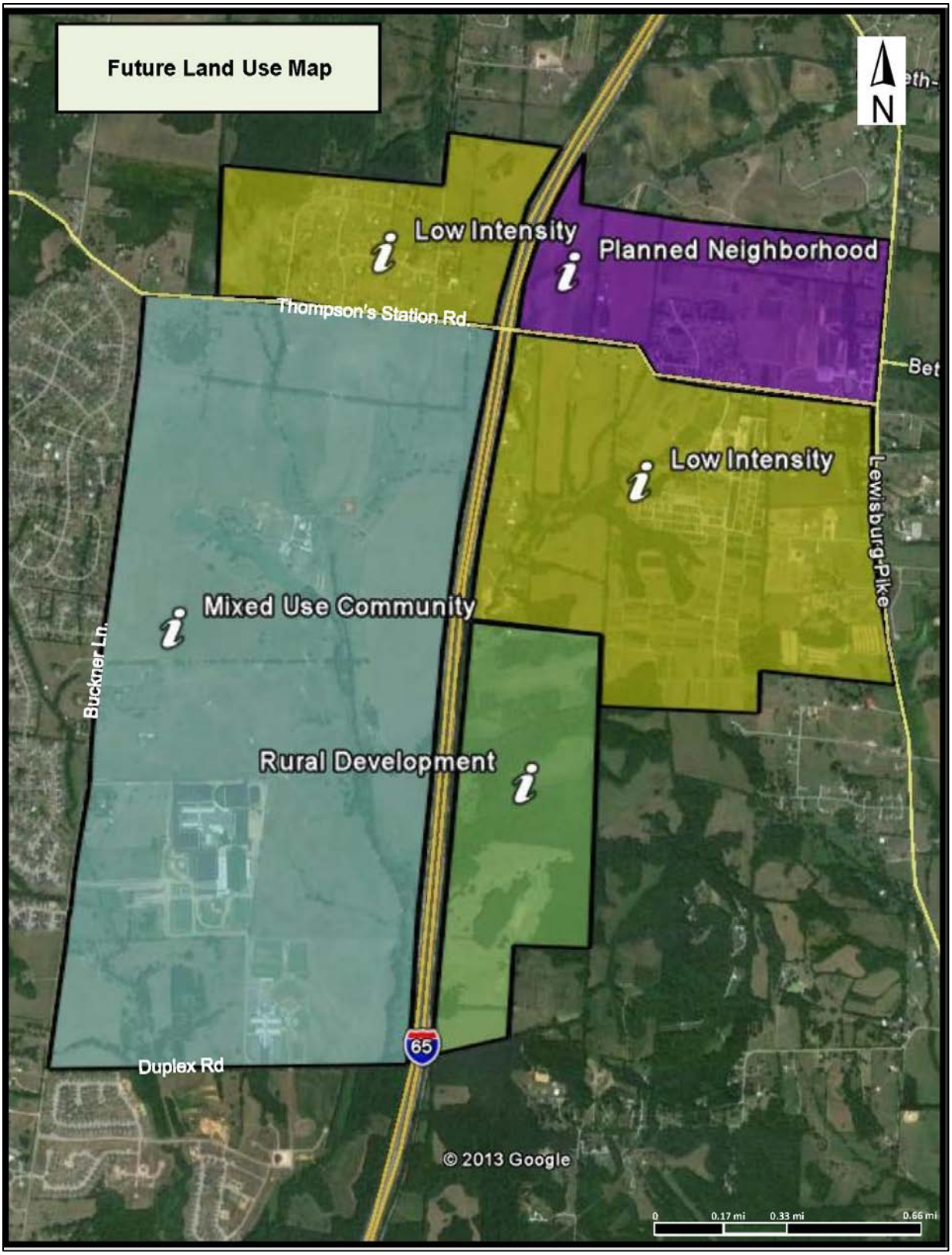


FIGURE 7- FUTURE ZONING CLASSIFICATIONS

CHAPTER 4

CONCEPTUAL ALTERNATIVES

A. NO BUILD

The No Build alternative would include the E+C network through the 2037 design year, but exclude a new interchange on I-65 at either Thompson's Station Road or Buckner Road.

Figure 8 illustrates committed projects included in the Nashville Area MPO LRTP, the Spring Hill Major Thoroughfare Plan, and/or the Williamson County Major Thoroughfare Plan. All of these projects have a direct or indirect bearing on the proposed new I-65 interchange. Figure 8 categorizes the projects by plan in which they are included. All of the committed projects except the proposed interchange, were included in the Nashville Area MPO Travel Demand Model's E+C road network.

Over the course of the next 25 years from 2012 to 2037, some minor intersection improvements can be expected to occur to mitigate local traffic congestion. These minor improvements will take the form of turn lanes and traffic signals. Appendix 1 Figure A4 illustrates proposed intersection improvements that are not part of the E+C network, but are expected to occur as traffic volumes increase. It would not be accurate to evaluate the effect of a new interchange on I-65 without assuming that some localized improvements will be made in the interim. The recommended spot improvements include traffic signals at all junctions not currently signalized and turn lanes to the maximum extent possible to mitigate delays. Each of these proposed No Build improvements were tested for their effectiveness using the Synchro software.

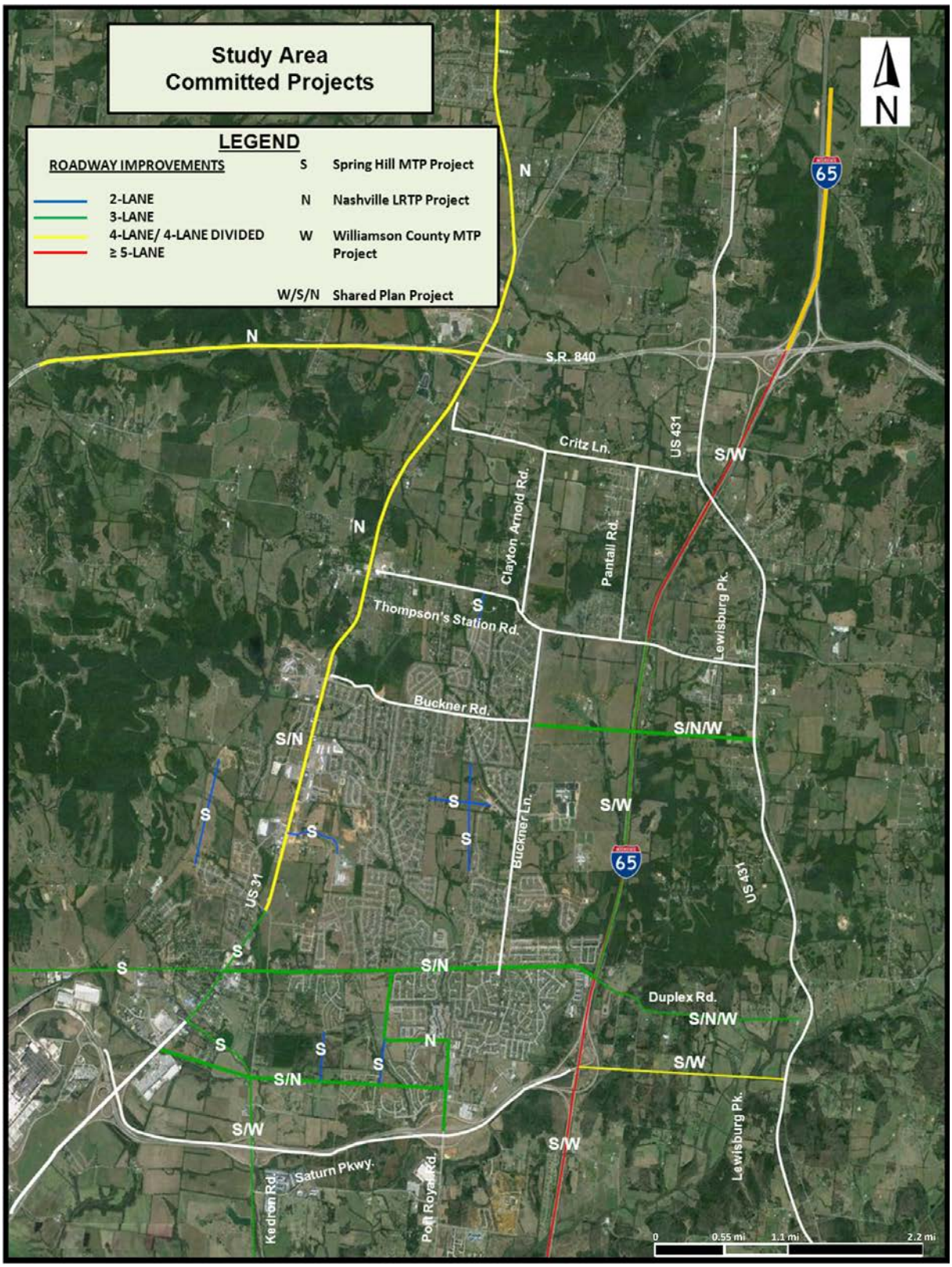


FIGURE 8- STUDY AREA COMMITTED PROJECTS

B. BUILD ALTERNATIVE 1

Build Alternative 1 includes a diamond interchange at a road crossing I-65 that represents an extension of Buckner Road. Appendix 1 Figure A5 depicts the concept including proposed traffic signals, the proposed intersection geometrics, and typical section of the proposed Buckner Road extension as well as the typical section recommended for Buckner Lane. Given the location and projected traffic volumes, a diamond interchange will be the most appropriate configuration at Buckner Road. One lane ramps are proposed but the exit ramps should widen to two lanes on their approach to the proposed Buckner Road extension to accommodate a right turn lane on the southbound off ramp and a left turn lane on the northbound off ramp.

As seen in Appendix 1 Figure A5 the new alignment of Buckner Road and existing alignment of Buckner Lane will need to be two lanes in each direction with a median for left turns. The intersection of Buckner Road and Buckner Lane will need to be signalized and have left and right turn lanes on most approaches. In fact, a dual westbound left turn lane will be required from the proposed Buckner Road extension to southbound Buckner Lane to accommodate a large amount of projected traffic.

Buckner Road will need to be improved near Buckner Lane but otherwise its two lane cross section is adequate to accommodate the projected traffic volumes. However, general alignment improvements and spot widening not specified in this document will need to be made.

Build Alternative 1 includes the spot improvements that were assumed as part of the No Build alternative.

Build Alternative 1 will cost an estimated $31,946,000. A functional layout of this alternative is included in Appendix 2- Build Alternative Maps. Pratt Road will need to be relocated as shown to approximately 500 feet south of the proposed ramp terminal. The northbound and southbound ramp terminals are approximately 1,200 feet apart, so good traffic signal spacing is provided.

C. BUILD ALTERNATIVE 2

Build Alternative 2 is similar to Alternative 1 except the interchange would be located at Thompson's Station Road as shown in Appendix 2. Thompson's Station Road will require widening from US 431 (Lewisburg Pike) to Clayton Arnold Road to four lanes plus a median for left turns. Likewise, Buckner Lane will need to be widened to a similar typical section from Thompson's Station Road to a location south of Buckner Road where the road would transition back to one lane in each direction. A multi-lane segment of Buckner Lane is required to accommodate two through lanes in each direction at Buckner Road.

Build Alternative 2 will require more lanes on the on and off ramps oriented to the north towards Nashville so that traffic will operate at an acceptable LOS. Two eastbound left turn lanes are recommended on Thompson's Station Road that will require the northbound on ramp to I-65 to be two lanes as well. The two lane on ramp will need to be extended northwards an appropriate distance (see functional design) to allow reduction into one lane. On the southbound off ramp

approach to Thompson's Station Road, three lanes are recommended including an exclusive left turn lane; an exclusive right turn lane; and a shared left, through, and right turn lane.

Build Alternative 2 includes the spot improvements that were assumed as part of the No Build alternative.

Build Alternative 2 will cost an estimated $33,709,000. A functional layout of this alternative is included in Appendix 2. Both Pratt Road and Pantall Road will need to be relocated as shown to approximately 500 feet from the interchange ramp terminals. The existing two lane bridge for Thompson's Station Road will need to be demolished and replaced with a new multilane structure.

CHAPTER 5

TRAFFIC ANALYSIS

A. CAPACITY ANALYSIS METHODOLOGY AND ASSUMPTIONS

A capacity and LOS analysis was conducted for the study area intersections, both signalized and unsignalized, using the Synchro software. Freeway link, merge, and diverge maneuvers were analyzed using the 2010 Highway Capacity Software that is based on the 2010 HCM published by the Transportation Research Board (TRB). AM and PM peak hour LOS analyses were performed for the 2017 baseline year, the 2037 No Build scenario, the 2037 Build scenario- Alternative 1, and the 2037 Build scenario- Alternative 2. For the No Build scenario, the E+C street network was used plus recommended spot improvements described in Appendix 1 Figure A4. For the Build scenarios (Alternative 1 and 2) the spot improvements were assumed to be a given, and roads immediately adjacent to the proposed interchange were sized according to the Synchro analysis and the objective of providing an acceptable LOS of D or better in 2037.

The freeway LOS analysis was based on 12 foot lanes, 10 foot shoulders, no lateral obstructions, rolling terrain, 2 percent trucks, no recreational vehicles, a 70 mph free flow speed, a peak hour factor (PHF) of 0.92, and a ramp density of 1 per 4.5 miles. Intersection LOS analysis also assumed a PHF of 0.92.

Signalized and unsignalized intersections were evaluated based on estimated intersection delays, which is related to LOS. LOS and capacity are the measurements of an intersection's ability to accommodate traffic volumes. LOSs for intersections range from A to F. LOS A is the best, and LOS F is failing. For signalized intersections, a LOS of A has an average estimated intersection delay of less than 10 seconds, and LOS F has an estimated delay of greater than 80 seconds. A LOS of C and D are typical design values. Within urban areas, a LOS D, delay between 35 and 55 seconds, is considered acceptable by the Institute of Transportation Engineers (ITE) for signalized intersections.

Unsignalized intersection LOSs have lower thresholds of delays. A LOS of F exceeds estimated delays of 50 seconds. For urban arterials, minor approaches may frequently experience LOS E. A full LOS description for signalized and unsignalized intersections is presented in Table 2.

Table 3 presents the LOS definition for freeway links, which is based on lane density and is expressed as passenger cars per mile per lane.

Merge and diverge maneuvers are also evaluated according to density with the criteria being passenger cars per mile per lane. Table 4 presents LOS density ranges for on and off ramps.

Table 2 – Level of Service Definition for Intersections

LEVEL OF SERVICE	INTERSECTION DELAY (SECONDS/VEHICLE)	
	SIGNALIZED	UNSIGNALIZED
A	0-10	0-10
B	10-20	10-15
C	20-35	15-25
D	35-55	25-35
E	55-80	35-50
F	>80	>50

Table 3- Level of Service Definition for Freeway Links

LEVEL OF SERVICE	FREEWAY TRAFFIC FLOW CONDITIONS	DENSITY (PC/MILE/LANE)
A	Motorist are able to travel at free flow speeds and are almost completely unimpeded in their ability to maneuver in the traffic stream.	0-10
B	Free flow speeds are maintained and the ability to maneuver within the traffic stream is only slightly restricted. The general level of physical and psychological comfort provided to drivers is still high. The effects of minor incidents and breakdowns is easily absorbed.	10-18
C	Traffic flow at near the free-flow speeds. Freedom to maneuver in the traffic stream is noticeably restricted and lane changes require more care and vigilance on the part of the driver. Minor incidents may still be absorbed, but local determination in service quality will be significant.	18-26
D	Speeds begin to decline with increasing flows, with density increasing more quickly. Freedom to maneuver within the traffic stream is seriously limited and drivers experience reduced physical and psychological comfort levels. Even minor incidents can be expected to create queuing because the stream has little space to absorb disruptions.	26-35
E	Freeway is operating at capacity. Operations are highly volatile because there are virtually no usable gaps within the traffic stream, leaving little room to maneuver. Any disruption to the traffic stream, such as vehicles entering from a ramp or a vehicle changing lanes, can establish a disruption wave that propagates throughout the upstream traffic flow.	35-45
F	Breakdown, or unstable flow.	>45

Table 4- Level of Service Definition for Freeway Ramp Areas

LEVEL OF SERVICE	RAMP AREA TRAFFIC FLOW CONDITIONS	DENSITY (PC/MILE/LANE)
A	Unrestricted operation.	0-10
B	Merging and diverging maneuvers noticeable to drivers.	10-20
C	Influence area speeds begin to decline.	20-28
D	Influence area turbulence becomes intrusive.	28-35
E	Turbulence felt by virtually all drivers.	>35
F	Ramp and freeway queues form.	Demand Exceeds Capacity

Table 5 describes general daily traffic LOS limits for Class II two lane roadways as per Chapter 15 of the 2010 HCM.

Table 5- Daily Traffic Level of Service Limits for Class II Two Lane Highways

		Class II Level			
K-Factor	D-Factor	LOS B	LOS C	LOS D	LOS E
0.10	50%	4,400	8,800	16,300	28,000
0.10	55%	3,700	7,900	14,400	27,100
0.10	60%	3,300	7,100	13,100	24,900
0.10	65%	3,000	5,300	11,900	23,000
0.12	50%	3,700	7,400	13,600	23,400
0.12	55%	3,100	6,500	12,000	22,600
0.12	60%	2,700	5,900	10,900	20,700
0.12	65%	2,400	4,400	9,900	19,100

Source: Exhibit 15-30; Chapter 15/Two Lane Highways in the 2010 Highway Capacity Manual

According to the 2010 HCM, Class II two lane highways are facilities where motorists do not necessarily expect to travel at high speeds. The HCM also says they are most often used for relatively short trips. Class III highways serve moderately developed areas often passing through small towns or recreational areas. Local traffic often mixes with through traffic. US 31 (Columbia Pike) is a cross between a Class II and Class III highway. However, the HCM does not provide a planning LOS for Type III highways, so the Type II LOS criteria are being used.

B. EXISTING/BASELINE 2017 NO BUILD WITH SPOT IMPROVEMENTS

Intersection capacity and LOS analysis were performed for the 2017 baseline conditions and the results are shown in Table 6. The LOS analysis assumes that the spot improvements discussed in Section A of Chapter 4 will be needed by 2017. A 2017 baseline capacity and LOS analyses were also conducted for the I-65 northbound and southbound freeway segments between Saturn Parkway and SR 840. Unlike the intersections, no freeway improvements were assumed to have occurred by 2017. The results of the 2017 freeway analysis are displayed in Table 7.

According to 2012 Spring Hill counts, US 31 (Columbia Pike) accommodates up to 23,483 vehicles per day. Its traffic is very directional, especially near SR 840 with peak hour distributions measured at 66 percent in the AM peak hour and 73 percent in the PM peak hour. At 65 percent directional distribution and a K-factor of 0.10, the daily LOS F and capacity upper limit on a Class II highway is 23,000 vehicles per day. Therefore, US 31 (Columbia Pike) is currently operating and will continue to operate in 2017 over-capacity.

C. 2037 NO BUILD ANALYSIS

Appendix 1 Figures A3A and A3B show the TDM's projected 2037 No Build daily traffic volumes for the E+C street network. The 2037 No Build daily projections were used to estimate peak hour traffic on I-65, Saturn Parkway, and the surrounding arterial and collector street network. Peak hour traffic projections for I-65 and Saturn Parkway are depicted in Appendix 1 Figure A8. Year 2037 No Build intersection traffic projections are shown in Appendix 1 Figure A7.

Figure 8 in the previous chapter depicts the committed road projects within the study area. These road projects were part of the No Build scenario. No Build I-65 and Saturn Parkway freeway service levels are presented in Table 8 for links, merge, and diverge points. The analysis assumes that I-65 contains two lanes per direction as it does today. In the PM peak hour, southbound I-65 will operate at LOS F between SR 840 and Saturn Parkway. Likewise, in the AM peak hour, northbound I-65 will also operate at LOS F. All other segments will operate at an acceptable LOS in 2037 under No Build conditions.

The merge and diverge operation is indicative of the I-65 segment analysis indicating northbound congestion in the morning and southbound congestion in the afternoon. The eastbound Saturn Parkway on ramp at I-65 and the I-65 northbound off ramp to SR 840 will both operate at LOS F in the AM peak hour. In the PM peak hour the on ramp from SR 840 to southbound I-65 will operate at LOS E. Additionally, the southbound I-65 off ramp to Saturn Parkway will also operate at LOS F in the PM peak hour. All other merge and diverge maneuvers will operate at an acceptable LOS in 2037 without a proposed interchange on I-65 at Buckner Road or Thompson's Station Road.

US 31 should continue to operate over-capacity in 2037 unless it is widened and improved. Widening US 31 to a multi-lane typical section from SR 840 to Saturn Parkway is estimated to cost between 90 and 100 million dollars and require significant taking of businesses.

Table 6- Intersection Level of Service: 2017

INTERSECTION	TRAFFIC CONTROL	PEAK PERIOD	2017 V/C	2017 DELAY	2017 LOS
SR840 WB Ramp at Columbia Pike US31	SIGNAL	AM	0.64	12.5	B
		PM	0.54	10.4	B
SR840 EB Ramp at Columbia Pike US31	STOP EBL/EBR	AM	0.80 / 0.40	115.1 / 25.3	F / D
		PM	0.00 / 0.00	0.0 / 0.0	A / A
SR840 WB Ramp at Lewisburg Pike	STOP EB/NBL	AM	0.99 / 0.04	60.1 / 7.7	F / A
		PM	1.43 / 0.01	212.3 / 8.6	F / A
SR840 EB Ramp at Lewisburg Pike	STOP EB/NBL	AM	0.64 / 0.41	131.8 / 9.4	F / A
		PM	0.18 / 0.36	26.6 / 14.9	D / B
Thompson's Station Rd. at Buckner Lane	STOP NB/WBL	AM	3.29 / 0.20	>999.9 / 7.2	F / A
		PM	0.63 / 3.17	>12.9 / >999.9	B / F
Buckner Rd. at Columbia Pike US31	SIGNAL	AM	0.65	14.6	B
		PM	0.71	14.7	B
Buckner Rd. at Buckner Lane	STOP EB/NBL	AM	2.51 / 0.10	728.5 / 2.4	F / A
		PM	0.46 / 0.10	27.1 / 3.6	D / A
Saturn Pkwy WB Ramp at Port Royal Rd.	STOP WB/NBL	AM	0.44 / 0.14	16.7 / 10.5	C / B
		PM	1.74 / 0.07	360.9 / 9.3	F / A
Saturn Pkwy EB Ramp at Port Royal Rd.	STOP EB/SBL	AM	1.46 / 0.54	289.4 / 10.9	F / B
		PM	0.17 / 0.14	12.2 / 7.7	B / A

Table 7- Freeway Level of Service: 2017

SEGMENT	LOCATION	PEAK PERIOD	SPACE MEAN SPEED (MPH)	DENSITY (PC/M/LN)	LOS
Section Analysis					
Southbound I-65	SR-840 to Saturn Parkway	AM	70.0	16.4	B
		PM	63.3	30.9	D
Northbound I-65	Saturn Parkway to SR-840	AM	57.5	38.9	E
		PM	70.0	17.3	B

Table 8- Freeway Level of Service: 2037 No Build

SEGMENT	LOCATION	PEAK PERIOD	SPACE MEAN SPEED (MPH)	DENSITY (PC/M/LN)	LOS
Diverge Analysis					
I-65 NB Offramp	I-65 NB to SR-840	AM	59.4	**	F
		PM	66.0	20.4	C
I-65 SB Offramp	I-65 SB to Saturn	AM	62.8	1.0	A
		PM	58.3	**	F
Saturn Parkway WB	Saturn Parkway WB Offramp to Port	AM	49.1	1.0	A
		PM	47.7	15.7	B
Saturn Parkway Offramp EB	Saturn Parkway EB Offramp to I-65 SB	AM	49.3	20.3	C
		PM	49.3	2.4	A
Merge Analysis					
SR 840 Onramp	SR 840 Onramp to I-65 SB	AM	61.2	21.8	C
		PM	50.7	37.0	E
Saturn Parkway Onramp EB	Saturn Parkway EB Onramp to I-65 NB	AM	46.0	**	F
		PM	62.9	17.9	B
Port Royal Rd Onramp EB	Port Royal Onramp to Saturn Parkway	AM	59.9	25.9	C
		PM	62.9	10.1	B
Section Analysis					
Southbound I-65	S 840 to Saturn Parkway	AM	69.4	20.5	C
		PM	52.6	46.2	F
Northbound I-65	Saturn Parkway to SR 840	AM	41.4	66.8	F
		PM	69.0	21.7	C
Westbound Saturn Pkwy	I-65 to Port Royal Road	AM	70.0	7.6	A
		PM	69.3	20.9	C
Eastbound Saturn Pkwy	Port Royal Road to I-65	AM	66.9	25.7	C
		PM	70.0	9.6	A

NOTE: ** Exceeded calculation parameters.

Year 2037 No Build intersection operation projections are summarized in Table 9. As previously discussed, some spot improvements were assumed and these, as well as a no-improvement scenario, are shown in Table 9. Every unsignalized intersection will require a traffic signal by 2037. With signalization and optimum turn lanes, all study area intersections will operate at an acceptable LOS except:

- SR 840 Eastbound off ramp at US 431 (Lewisburg Pike): LOS F in the PM Peak Hour
- Thompson's Station Road at Buckner Lane: LOS F in the PM Peak Hour
- Buckner Road at US 31 (Columbia Pike): LOS E in the PM Peak Hour.

Table 9- Intersection Level of Service: 2037 No Build

INTERSECTION	TRAFFIC CONTROL	PEAK PERIOD	2037- NO BUILD V/C	DELAY	LOS
SR840 WB Ramp	**SIGNAL**	**AM**	**0.77**	**13.3**	**B**
at Columbia Pike US31		**PM**	**0.86**	**16.0**	**B**
	SIGNAL	*AM*	*0.78*	*13.9*	*B*
	Extended Turn Lane	*PM*	*0.87*	*17.2*	*B*
SR840 EB Ramp	**STOP**	**AM**	**2.08 / 1.04**	**716.6 / 97.9**	**F / F**
at Columbia Pike US31	**EBL/EBR**	**PM**	**>5.00 / >5.00**	**>999.9 / >999.9**	**F / F**
	SIGNAL	*AM*	*0.59*	*6.2*	*A*
		PM	*0.75*	*7.0*	*A*
SR840 WB Ramp	**STOP**	**AM**	**2.75 / 0.07**	**849.2 / 8.1**	**F / A**
at Lewisburg Pike	**EB/NBL**	**PM**	**>5.00 / 0.03**	**>999.9 / 9.8**	**F / A**
	SIGNAL	*AM*	*0.85*	*18.2*	*B*
	Add Turn Lanes	*PM*	*0.76*	*7.5*	*A*
SR840 EB Ramp	**STOP**	**AM**	**>5.00 / 0.71**	**>999.9 / 14.4**	**F / B**
at Lewisburg Pike	**EB/NBL**	**PM**	**>5.00 / 1.06**	**>999.9 / 106.8**	**F / F**
	SIGNAL	*AM*	*0.81*	*9.2*	*A*
	Add Turn Lanes	*PM*	*1.34*	*198.1*	*F*
Thompson's Station Rd.	**STOP**	**AM**	**3.29 / 0.20**	**>999.9 / 7.2**	**F / A**
at Buckner Lane	**NB/WBL**	**PM**	**>5.00 / 1.97**	**>999.9 / 459.9**	**F / F**
	SIGNAL	*AM*	*0.66*	*22.1*	*C*
	Add Turn Lanes	*PM*	*1.09*	*85.8*	*F*
Buckner Rd.	**SIGNAL**	**AM**	**0.75**	**15.3**	**B**
at Columbia Pike US31		**PM**	**1.16**	**35.5**	**D**
	SIGNAL	*AM*	*0.84*	*35.9*	*D*
		PM	*0.95*	*56.1*	*E*
Buckner Rd.	**STOP**	**AM**	**>5.00 / 0.21**	**>999.9 / 6.5**	**F / A**
at Buckner Lane	**EB/NBL**	**PM**	**2.98 / 0.52**	**>999.9 / 26.7**	**F / D**
	SIGNAL	*AM*	*0.99*	*41.9*	*D*
	Add Turn Lanes	*PM*	*0.75*	*9.6*	*A*
Saturn Pkwy WB Ramp	**STOP**	**AM**	**0.61 / 0.27**	**27.5 / 14.5**	**D / B**
at Port Royal Rd.	**WB/NBL**	**PM**	**3.11 / 0.12**	**>999.9 / 11.0**	**F / B**
	SIGNAL	*AM*	*0.54*	*13.0*	*B*
	Add Turn Lanes	*PM*	*0.97*	*43.0*	*D*
Saturn Pkwy EB Ramp	**STOP**	**AM**	**>5.00 / 0.83**	**>999.9 / 20.2**	**F / C**
at Port Royal Rd.	**EB/SBL**	**PM**	**2.27 / 0.44**	**676.7 / 10.4**	**F / B**
	SIGNAL	*AM*	*0.86*	*24.5*	*C*
	Add Turn Lanes	*PM*	*0.60*	*9.1*	*A*

D. 2037 BUILD ALTERNATIVE 1 ANALYSIS

Year 2037 Build Alternative 1 projected daily traffic volumes are depicted in Appendix 1 Figures A9A and A9B. Appendix 1 Figures A10A and A10B are companion illustrations showing the daily traffic volume difference between the No Build and Build Alternative 1 scenario. A new interchange at Buckner Road on I-65 would result in a daily traffic increase on I-65 of 13,695 vpd north of Buckner Road and a daily traffic decrease on I-65 of 3,963 vpd south of Buckner Road. US 431 (Lewisburg Pike) would realize a drop in daily traffic of 4,459 to 5,164 north of the proposed Buckner Road extension. Saturn Parkway would benefit from a new interchange at Buckner Road, especially between I-65 and Port Royal Road with a decrease in daily traffic of 7,354 expected. US 31 (Columbia Pike) will benefit to a lesser extent with a new interchange at Buckner Road as indicated by the change in daily traffic. A drop of 1,602 daily trips will occur between SR 840 and Critz Lane and a drop of 1,324 vpd will occur between Duplex Road and Saturn Parkway. The Build Alternative 1 concept will attract 19,983 vpd to the proposed Buckner Road extension. Thompson's Station Road will realize a loss of 4,360 to 5,097 vpd.

Commuter trips between Nashville and Williamson County that are using Lewisburg Pike, US 31 (Columbia Pike), Clayton Arnold Road, Pantall Road, Critz Lane and Thompson's Station Road will benefit from Build Alternative 1; a new interchange on I-65 at Buckner Road. Moreover, commuter trips currently using Saturn Parkway and Port Royal Road will also find the new interchange useful.

Build Alternative 1 peak hour traffic projections are shown in Appendix 1 Figures A11 and A112

Appendix 1 Figures A13 and A14 show freeway service levels for both the No Build and Build Alternative 1 scenario. Table 10 presents a freeway LOS summary under the Build Alternative 1 scenario.

In the AM peak hour, northbound I-65 will continue to operate at LOS F north and south of a proposed Buckner Road interchange. Northbound I-65 density will be higher north of the proposed interchange and lower south of the proposed interchange than the density if no new interchange were constructed. The opposite effect would occur south of the proposed Buckner Road interchange with northbound AM peak hour density lower than if no new interchange were constructed. In the PM peak hour, the southbound segment of I-65 will operate at LOS F north of the proposed Buckner Road extension and LOS D south of the proposed Buckner Road extension. Hence, the impact of a new interchange at the proposed Buckner Road extension will mitigate a poor LOS as southbound I-65 traffic is diverted to Buckner Road.

No AM peak hour change in segment LOS will occur on Saturn Parkway in either direction if the Buckner Road interchange is constructed. Conversely, an improvement from LOS C to LOS B will take place in the PM peak hour, westbound direction, if an interchange is constructed at Buckner Road.

Since southbound I-65 will operate at LOS F in the PM peak hour, it stands to reason that the diverge maneuver to Buckner Road will operate at LOS F as well. By 2037, I-65 between Saturn

Parkway and SR 840 will need to be four lanes in both directions, matching the typical section it will have north of SR 840.

Table 10- Freeway Level of Service: 2037 Build Alternative 1

SEGMENT	LOCATION	PEAK PERIOD	SPACE MEAN SPEED (MPH)	DENSITY (PC/M/LN)	LOS
Diverge Analysis					
I-65 NB Offramp	I-65 NB to SR-840	AM	59.7	**	F
		PM	66.2	22.9	C
I-65 SB Offramp	I-65 SB to Saturn	AM	63.2	1.0	A
		PM	59.2	1.0	A
Saturn Parkway WB	Saturn Parkway WB Offramp to Port	AM	49.2	1.0	A
		PM	48.3	12.3	B
Saturn Parkway Offramp EB	Saturn Parkway EB Offramp to I-65 SB	AM	49.3	16.8	B
		PM	49.3	0.3	A
I-65 NB Offramp	I-65 NB to Buckner Road	AM	57.4	**	F
		PM	57.2	24.4	C
I-65 SB Offramp	I-65 SB to Buckner Road	AM	55.4	29.4	D
		PM	54.0	**	F
Merge Analysis					
SR 840 Onramp	SR 840 Onramp to I-65 SB	AM	60.3	25.2	C
		PM	37.0	**	F
Saturn Parkway Onramp EB	Saturn Parkway EB Onramp to I-65 NB	AM	53.6	30.8	D
		PM	63.3	15.8	B
Port Royal Rd Onramp EB	Port Royal Onramp to Saturn Parkway	AM	61.0	23	C
		PM	62.9	9.8	A
Buckner Road Onramp NB	Buckner Road Onramp to I-65 NB	AM	29.1	**	F
		PM	60.8	23.6	C
Buckner Road Onramp SB	Buckner Road Onramp to I-65 SB	AM	62.4	16.2	B
		PM	58.6	29.0	D
Section Analysis					
Southbound I-65	SR 840 to new interchange	AM	67.7	24.3	C
		PM	40	70.3	F
Northbound I-65	new interchange to SR 840	AM	23.3	137.8	F
		PM	66.7	26.0	D
Southbound I-65	new interchange to Saturn Parkway	AM	70	16.9	B
		PM	60.7	34.6	D
Northbound I-65	Saturn Parkway to new interchange	AM	50.7	49.1	F
		PM	69.7	19.4	C
Westbound Saturn Pkwy	I-65 to Port Royal Road	AM	70	6.5	A
		PM	70	17.9	B
Eastbound Saturn Pkwy	Port Royal Road to I-65	AM	68.8	22.0	C
		PM	70	7.9	A

NOTE: ** Exceeded calculation parameters.

Anticipated intersection conditions in 2037 with the Build Alternative 1 scenario are shown in Table 11. A new interchange at the proposed Buckner Road extension will create PM peak hour LOS improvements at three intersections:

- Thompson's Station Road at Buckner Lane: from LOS F to B
- Buckner Road at US 31 (Columbia Pike): LOS E to D
- Saturn Parkway Westbound Ramp at Port Royal Road: LOS D to B

The I-65 at Buckner Road signalized ramp terminals will operate at a good LOS of B or C in 2037.

Table 11- Intersection Level of Service: 2037 Build Alternative 1

INTERSECTION	TRAFFIC CONTROL	PEAK PERIOD	2037- BUILD ALTERNATIVE 1		
			V/C	DELAY	LOS
SR840 WB Ramp	**SIGNAL**	**AM**			
at Columbia Pike US31		**PM**			
	SIGNAL	*AM*	*0.78*	*13.9*	*B*
	Extended Turn Lane	*PM*	*0.86*	*18.1*	*B*
SR840 EB Ramp	**STOP**	**AM**			
at Columbia Pike US31	**EBL/EBR**	**PM**			
	SIGNAL	*AM*	*0.61*	*6.5*	*A*
		PM	*0.79*	*7.8*	*A*
SR840 WB Ramp	**STOP**	**AM**			
at Lewisburg Pike	**EB/NBL**	**PM**			
	SIGNAL	*AM*	*0.70*	*10.3*	*B*
	Add Turn Lanes	*PM*	*0.60*	*5.5*	*A*
SR840 EB Ramp	**STOP**	**AM**			
at Lewisburg Pike	**EB/NBL**	**PM**			
	SIGNAL	*AM*	*0.67*	*4.5*	*A*
	Add Turn Lanes	*PM*	*1.05*	*83.5*	*F*
Thompson's Station Rd.	**STOP**	**AM**			
at Buckner Lane	**NB/WBL**	**PM**			
	SIGNAL	*AM*	*0.38*	*15.0*	*B*
	Add Turn Lanes	*PM*	*0.50*	*14.2*	*B*
Buckner Rd.	**SIGNAL**	**AM**			
at Columbia Pike US31		**PM**			
	SIGNAL	*AM*	*0.75*	*30.7*	*C*
		PM	*1.06*	*49.4*	*D*
Buckner Rd.	**STOP**	**AM**			
at Buckner Lane	**EB/NBL**	**PM**			
	SIGNAL	*AM*	*0.85*	*27.3*	*C*
	Add Turn Lanes	*PM*	*0.90*	*36.4*	*D*
Saturn Pkwy WB Ramp	**STOP**	**AM**			
at Port Royal Rd.	**WB/NBL**	**PM**			
	SIGNAL	*AM*	*0.29*	*8.1*	*A*
	Add Turn Lanes	*PM*	*0.62*	*16.1*	*B*
Saturn Pkwy EB Ramp	**STOP**	**AM**			
at Port Royal Rd.	**EB/SBL**	**PM**			
	SIGNAL	*AM*	*0.64*	*13.2*	*B*
	Add Turn Lanes	*PM*	*0.44*	*9.6*	*A*
I-65 Southbound Ramp	**STOP**	**AM**			
at Buckner Lane	**WB/NBL**	**PM**			
	SIGNAL	*AM*	*0.72*	*26.5*	*C*
	Add Turn Lanes	*PM*	*0.88*	*29.0*	*C*
I-65 Northbound Ramp	**STOP**	**AM**			
at Buckner Lane	**EB/SBL**	**PM**			
	SIGNAL	*AM*	*0.79*	*15.1*	*B*
	Add Turn Lanes	*PM*	*0.67*	*11.9*	*B*

E. 2037 BUILD ALTERNATIVE 2 ANALYSIS

Build Alternative 2 proposes a new I-65 interchange that would be located at Thompson's Station Road, which spans over I-65 as it runs between US 31 (Columbia Pike) and US 431 (Lewisburg Pike).

Appendix 1 Figures A15A, A15B, A16A, and A16B illustrate projected 2037 daily traffic and the differential between No Build and Build Alternative 2 conditions. The daily traffic on most study area roads is very similar to the Build Alternative 1 scenario- a new interchange on I-65 at the proposed Buckner Road extension. Because Thompson's Station Road is north of the proposed Buckner Road extension, an interchange there will have less impact on Saturn Parkway. Some motorists using the Saturn Parkway at Port Royal Road interchange will not find the Thompson's Station Road interchange as attractive as the Buckner Road interchange because of where they live and how much backtracking they must do.

The order-of-magnitude impact on US 431 (Lewisburg Pike) and US 31 (Columbia Pike) is similar to that which will be experienced if the interchange were constructed at the proposed Buckner Road extension. A daily traffic projection of 17,011 is expected on Thompson's Station Road, west of I-65. An interchange at Thompson's Station Road will add 18,429 vehicles per day to I-65, north of the potential interchange as compared to 13,695 if the interchange were constructed at the proposed Buckner Road extension.

Build Alternative 1 peak hour traffic projections are shown in Appendix 1 Figures A17 and A18.

Appendix 1 Figures A19 and A20 as well as Table 12 present the results of the capacity and LOS analysis with 2037 traffic superimposed on the Build Alternative 2 network. I-65 southbound will operate at LOS F in the PM peak hour between SR 840 and the new interchange at Thompson's Station Road. Between the new interchange at Thompson's Station Road and Saturn Parkway, it should operate at LOS E in the PM peak hour. In contrast, an interchange at Buckner Road mitigates the LOS F between it and Saturn Parkway. Both of these northbound segments on I-65 will operate at LOS F in the AM peak hour. A new interchange on I-65 at Thompson's Station Road will have minimal effect on the Saturn Parkway link LOSs between I-65 and Port Royal Road. Good service levels will exist in 2037 under the No Build scenario and good service levels are expected in 2037 under the Build Alternative 2 scenario.

Both the northbound diverge from I-65 to Thompson's Station Road and the northbound merge from Thompson's Station Road onto I-65 will operate at LOS F in the 2037 AM peak hour. This analysis was based on I-65 having two lanes per direction, thus no widening from its existing configuration. In the 2037 PM peak hour the southbound off ramp diverge to Thompson's Station Road will also operate at LOS F. However, the southbound merge from Thompson's Station Road onto I-65 will operate at LOS D. These poor projected merge/diverge service levels are more a function of heavy freeway traffic than heavy ramp traffic.

A new interchange on I-65 at Thompson's Station Road will have a similar impact on the study area intersections as does a new interchange at the proposed Buckner Road extension. Table 13 summarizes the projected service levels in 2037 with the Build Alternative 2 street network. This new interchange would improve service levels as follows:

- Thompson's Station Road at Buckner Lane: from LOS F to B
- Buckner Road at US 31 (Columbia Pike): LOS E to D
- Saturn Parkway Westbound Ramp at Port Royal Road: LOS D to C

The I-65 at Thompson's Station Road signalized ramp terminals will operate at a good LOS of B or C in 2037.

Table 12- Freeway Level of Service: 2037 Build Alternative 2

SEGMENT	LOCATION	PEAK PERIOD	SPACE MEAN SPEED (MPH)	DENSITY (PC/M/LN)	LOS
Diverge Analysis					
I-65 NB Offramp	I-65 NB to SR-840	AM	57.7	**	F
		PM	65.3	24.1	C
I-65 SB Offramp	I-65 SB to Saturn	AM	63.1	1.0	A
		PM	59.0	0.4	A
Saturn Parkway WB	Saturn Parkway WB Offramp to Port	AM	49.2	1.0	A
		PM	47.8	13.2	B
Saturn Parkway Offramp EB	Saturn Parkway EB Offramp to I-65 SB	AM	49.3	17.4	B
		PM	49.3	0.7	A
I-65 NB Offramp	I-65 NB to Thompson Station Road	AM	57.5	**	F
		PM	57.3	23.8	C
I-65 SB Offramp	I-65 SB to Thompson Station Road	AM	55.3	30.3	D
		PM	53.9	**	F
Merge Analysis					
SR 840 Onramp	SR 840 Onramp to I-65 SB	AM	60.0	26.0	C
		PM	32.7	**	F
Saturn Parkway Onramp EB	Saturn Parkway EB Onramp to I-65 NB	AM	54.0	30.5	D
		PM	63.4	15.2	B
Port Royal Rd Onramp EB	Port Royal Onramp to Saturn Parkway	AM	60.8	23.4	C
		PM	62.9	8.6	A
Thompson Station Road Onramp NB	Thompson Station Road Onramp to I-65	AM	22.5	**	F
		PM	60.6	24.3	C
Thompson Station Road Onramp SB	Thompson Station Road Onramp to I-65	AM	62.4	16.3	B
		PM	58.3	29.5	D
Section Analysis					
Southbound I-65	SR 840 to new interchange	AM	67.1	25.3	C
		PM	36.6	79.2	F
Northbound I-65	new interchange to SR 840	AM	18.6	178.2	F
		PM	66	27.1	D
Southbound I-65	new interchange to Saturn Parkway	AM	70	16.9	B
		PM	60	35.5	E
Northbound I-65	Saturn Parkway to new interchange	AM	51.2	48.3	F
		PM	69.8	18.9	C
Westbound Saturn Pkwy	I-65 to Port Royal Road	AM	70	6.9	A
		PM	69.9	18.7	C
Eastbound Saturn Pkwy	Port Royal Road to I-65	AM	68.6	22.6	C
		PM	70	8.2	A

NOTE: ** Exceeded calculation parameters.

Table 13- Intersection Level of Service: 2037 Build Alternative 2

INTERSECTION	TRAFFIC CONTROL	PEAK PERIOD	2037- BUILD ALTERNATIVE 2		
			V/C	DELAY	LOS
SR840 WB Ramp	**SIGNAL**	**AM**			
at Columbia Pike US31		**PM**			
	SIGNAL	*AM*	*0.81*	*14.5*	*B*
	Extended Turn Lane	*PM*	*0.85*	*18.4*	*B*
SR840 EB Ramp	**STOP**	**AM**			
at Columbia Pike US31	**EBL/EBR**	**PM**			
	SIGNAL	*AM*	*0.63*	*6.6*	*A*
		PM	*0.79*	*8.5*	*A*
SR840 WB Ramp	**STOP**	**AM**			
at Lewisburg Pike	**EB/NBL**	**PM**			
	SIGNAL	*AM*	*0.65*	*9.9*	*A*
	Add Turn Lanes	*PM*	*0.56*	*4.8*	*A*
SR840 EB Ramp	**STOP**	**AM**			
at Lewisburg Pike	**EB/NBL**	**PM**			
	SIGNAL	*AM*	*0.63*	*3.8*	*A*
	Add Turn Lanes	*PM*	*1.02*	*62.5*	*E*
Thompson's Station Rd.	**STOP**	**AM**			
at Buckner Lane	**NB/WBL**	**PM**			
	SIGNAL	*AM*	*0.70*	*9.6*	*A*
	Add Turn Lanes	*PM*	*0.76*	*19.7*	*B*
Buckner Rd.	**SIGNAL**	**AM**			
at Columbia Pike US31		**PM**			
	SIGNAL	*AM*	*0.67*	*26.0*	*C*
		PM	*0.84*	*38.9*	*D*
Buckner Rd.	**STOP**	**AM**			
at Buckner Lane	**EB/NBL**	**PM**			
	SIGNAL	*AM*	*0.83*	*18.8*	*B*
	Add Turn Lanes	*PM*	*0.89*	*20.7*	*C*
Saturn Pkwy WB Ramp	**STOP**	**AM**			
at Port Royal Rd.	**WB/NBL**	**PM**			
	SIGNAL	*AM*	*0.38*	*13.7*	*B*
	Add Turn Lanes	*PM*	*0.92*	*32.5*	*C*
Saturn Pkwy EB Ramp	**STOP**	**AM**			
at Port Royal Rd.	**EB/SBL**	**PM**			
	SIGNAL	*AM*	*0.74*	*15.0*	*B*
	Add Turn Lanes	*PM*	*0.52*	*9.9*	*A*
I-65 Southbound Ramp	**STOP**	**AM**			
at Thompson Station Roa	**WB/NBL**	**PM**			
	SIGNAL	*AM*	*0.69*	*21.0*	*C*
	Add Turn Lanes	*PM*	*0.70*	*19.0*	*B*
I-65 Northbound Ramp	**STOP**	**AM**			
at Thompson Station Roa	**EB/SBL**	**PM**			
	SIGNAL	*AM*	*0.72*	*25.4*	*C*
	Add Turn Lanes	*PM*	*0.57*	*16.5*	*B*

CHAPTER 6

CONSTRUCTION

A. CONSTRUCTABILITY

Two alternatives for a new interchange on I-65 are shown in Appendix 1- Report Illustrations. Alternative 1 is a new interchange at a proposed extension of Buckner Road. Alternative 2 is a new interchange where Thompson's Station Road crosses I-65. From a constructability standpoint, the Buckner Road interchange will be easier to construct than the Thompson's Station Road interchange. This is due to the fact that the Buckner Road interchange will be constructed where no existing road or overpass exists. On the other hand, the Thompson's Station Road interchange will be constructed at the location of an existing road that crosses I-65 via a bridge. Therefore, lane closures on Thompson's Station Road and I-65 will be required to demolish the Thompson's Station Road bridge over I-65. In addition, Thompson's Station Road will be closed for the remainder of construction after the bridge is demolished. It is recommended that any necessary lane closures on I-65 take place at night in order to minimize traffic disruption on the interstate.

Construction of each alternative must be phased in order maintain traffic at acceptable levels on I-65 as well as the surrounding roadway network. The construction phasing options have been developed to address several critical items:

- Maximize traffic operations during construction while recognizing that motorists will experience some additional delays due to construction
- Minimize the number of phases required
- Maintain the existing number of lanes on I-65 during ramp construction
- Maintain safety for both motorists and construction workers

Alternative 1 will include the following phases:

- Phase 1 – Construct the Buckner Road extension from Buckner Lane to Lewisburg Pike (US 431) and relocate Pratt Road in preparation for the interchange. Buckner Lane will also be widened at the Buckner Road intersection to provide turn lanes on Buckner Lane.
- Phase 2 – Construct the bridge over I-65 for the interchange. Maintain traffic on I-65 during construction of the bridge
- Phase 3 – Construct interchange ramps and tie into the Buckner Road extension. Open to traffic.

Alternative 2 will include the following phases:

- Phase 1 – Relocate Pantall Road and Pratt Road in preparation for the interchange construction.

- Phase 2 – Close Thompson's Station Road between Pantall Road and Pratt Road and demolish the Thompson's Station Road bridge. Minimize disruption to I-65 by closing lanes and performing demolition at night. Construct Thompson's Station Road and Buckner Lane improvements.
- Phase 3 – Construct the bridge over I-65 for the interchange. Maintain traffic on I-65 during construction of the bridge.
- Phase 4 – Construct the interchange ramps and tie into Thompson's Station Road. Open Thompson's Station Road and the interchange to traffic.

B. INITIAL COST ESTIMATE OF EACH BUILD ALTERNATIVE

The cost estimate for the construction of a new interchange on I-65 consists of not only the interchange itself but also the affected roadway network in the vicinity of the interchange. For example, Alternative 1 includes the cost of the interchange as well as the Buckner Road extension, which will be needed to tie the interchange to the road network. Also, the addition of turn lanes to Buckner Lane at Buckner Road will be needed to accommodate additional traffic that will access the new interchange.

Alternative 2 includes the cost of the interchange as well as improvements to Thompson's Station Road and Buckner Lane, which will be needed to accommodate additional traffic that will access the new interchange as well as additional traffic that will travel into Spring Hill from the new interchange.

The estimated cost for constructing Alternatives 1 and 2 are summarized in Tables 14 and 15, respectively. Separate costs are provided for each of the major construction items.

Detailed costs estimates are included in Appendix 3- Cost Estimates.

Table 14- Summary of Cost Estimate (Build Alternative 1)

Alternative 1 Cost Component	New Buckner Road Interchange	Buckner Road Extension	Buckner Lane Improvements	Relocated Pratt Road	Total Project
Right-of-Way	$ 1,965,000	$ 525,000	$ 24,000	$ 141,000	$ 2,655,000
Clearing and Grubbing	$ 138,800	$ 43,800	$ 2,000	$ 11,800	$ 196,400
Earthwork	$ 4,469,300	$ 1,407,500	$ 29,200	$ 377,200	$ 6,283,200
Drainage	$ 608,500	$ 317,200	$ 41,600	$ 163,600	$ 1,130,900
Utilities	$ -	$ -	$ 19,500	$ 80,700	$ 100,200
Structures	$ 2,340,000	$ -	$ -	$ -	$ 2,340,000
Paving	$ 3,916,700	$ 1,864,100	$ 105,200	$ 622,800	$ 6,508,800
Roadway and Pavement Appurtenances	$ 73,400	$ 378,900	$ -	$ -	$ 452,300
Topsoil	$ 205,400	$ 16,000	$ 2,100	$ 8,200	$ 231,700
Seeding	$ 93,800	$ 7,400	$ 1,000	$ 3,800	$ 106,000
Fencing	$ 114,500	$ -	$ -	$ -	$ 114,500
Signing	$ 487,500	$ 7,600	$ 1,000	$ 3,900	$ 500,000
Pavement Markings	$ 38,000	$ 20,700	$ 3,900	$ 12,800	$ 75,400
Signalization	$ 300,000	$ 150,000	$ 150,000	$ -	$ 600,000
Guardrail	$ 244,000	$ 126,800	$ 16,700	$ 64,600	$ 452,100
Other Construction Items (15%)	$ 2,249,300	$ 729,800	$ 59,500	$ 223,500	$ 3,262,100
Maintenance of Traffic	$ 97,500	$ 20,000	$ 13,000	$ 5,000	$ 135,500
Mobilization (5%)	$ 867,100	$ 280,700	$ 23,500	$ 85,900	$ 1,257,200
Engineering and Contingency (10%)	$ 1,820,900	$ 589,600	$ 49,200	$ 180,500	$ 2,640,200
Preliminary Engineering (10%)	$ 2,003,000	$ 648,500	$ 54,200	$ 198,600	$ 2,904,300
Total Cost	**$ 22,032,700**	**$ 7,133,600**	**$ 595,600**	**$ 2,183,900**	**$ 31,945,800**

Table 15- Summary of Cost Estimate (Build Alternative 2)

Alternative 2 Cost Component	New Thompsons Station Road Interchange	Thompsons Station Road Improvements	Buckner Lane Improvements	Relocated Pratt Road	Relocated Pantall Road	Total Project
Right-of-Way	$ 2,043,000	$ 165,000	$ 84,000	$ 81,000	$ 568,000	$ 2,941,000
Clearing and Grubbing	$ 145,300	$ 13,800	$ 7,000	$ 6,800	$ 1,500	$ 174,400
Earthwork	$ 4,684,200	$ 221,300	$ 111,200	$ 217,000	$ 43,100	$ 5,276,800
Drainage	$ 565,800	$ 316,600	$ 158,700	$ 94,900	$ 20,100	$ 1,156,100
Utilities	$ 802,200	$ 177,900	$ 192,400	$ 48,400	$ 8,900	$ 1,229,800
Structures	$ 2,633,500	$ -	$ -	$ -	$ -	$ 2,633,500
Paving	$ 3,180,000	$ 1,975,800	$ 1,030,200	$ 395,800	$ 72,300	$ 6,654,100
Roadway and Pavement Appurtenances	$ 57,900	$ 388,300	$ 183,900	$ -	$ -	$ 630,100
Topsoil	$ 257,100	$ 16,000	$ 8,000	$ 4,700	$ 1,000	$ 286,800
Seeding	$ 117,300	$ 7,300	$ 3,700	$ 2,200	$ 500	$ 131,000
Fencing	$ 111,800	$ -	$ -	$ -	$ -	$ 111,800
Signing	$ 487,500	$ 7,600	$ 3,800	$ 2,300	$ 500	$ 501,700
Pavement Markings	$ 35,500	$ 24,400	$ 18,100	$ 7,400	$ 1,800	$ 87,200
Signalization	$ 300,000	$ 150,000	$ 150,000	$ -	$ -	$ 600,000
Guardrail	$ 226,300	$ 126,200	$ 63,400	$ 37,200	$ 7,700	$ 460,800
Other Construction Items (15%)	$ 2,347,100	$ 538,500	$ 302,200	$ 134,700	$ 108,800	$ 3,431,300
Maintenance of Traffic	$ 65,000	$ 98,200	$ 52,000	$ 5,000	$ 5,000	$ 225,200
Mobilization (5%)	$ 903,000	$ 211,400	$ 118,400	$ 51,900	$ 41,900	$ 1,326,600
Engineering and Contingency (10%)	$ 1,896,300	$ 443,900	$ 248,700	$ 108,900	$ 88,100	$ 2,785,900
Preliminary Engineering (10%)	$ 2,085,900	$ 488,200	$ 273,500	$ 119,900	$ 97,000	$ 3,064,500
Total Cost	**$ 22,944,700**	**$ 5,370,400**	**$ 3,009,200**	**$ 1,318,100**	**$ 1,066,200**	**$ 33,708,600**

CHAPTER 7

SUMMARY

A. FHWA 8 POINTS

Policy Point 1: *"The need being addressed by the request cannot be adequately satisfied by existing interchanges to the interstate, and/or local roads and streets in the corridor can neither provide the desired access, nor can they be reasonably improved (such that as access control along surface streets, improving traffic control, modifying ramp terminals and intersections, adding turn bays, or lengthening storage) to satisfactorily accommodate the design-year traffic deman*ds (23 CFT 625 2 (a))."

I-65 has two interchanges serving the sections of Williamson and Maury Counties that are the subject of this Interchange Access Request (IAR). They are SR 840 and Saturn Parkway and are approximately 4.5 miles apart. Neither of these two interchanges directly services the area. Instead, the area is directly served by the Saturn Parkway at Port Royal Road interchange and the SR 840 at US 431 (Lewisburg Pike) interchange neither of which is centrally located to the population base.

The proposed new interchange on I-65 at Buckner Road will result in a reduction of approximately 4,000 trips per day on I-65 near Saturn Parkway. This reduction of traffic will directly impact the LOS on I-65 mainline and I-65 diverge/merge movements with Saturn Parkway. These improvements are shown in Appendix Figures A11 and A12 and Tables 8 and 12 of the main report. In the 2037 design year, the new interchange would improve the northbound merge (AM peak) and southbound diverge (PM peak) on I-65 at Saturn Parkway from LOS F to LOS D. In the PM peak hour of 2037, I-65 southbound would realize a LOS improvement from F to D north of Saturn Parkway if the new interchange is constructed.

Segments of US 31 (Columbia Pike) operate at LOS F today according to the planning level capacity analysis summarized in Section 5B of this report. The TDM does not assign many future trips to US 31 (Columbia Pike) because it is operating under a capacity constraint. So, a minimum increase in 2037 projected traffic is expected unless more capacity is provided. In other words, this road cannot accommodate any more traffic than it does today even though there is substantial demand. Widening US 31 (Columbia Pike) to provide two lanes per direction plus a turn lane would be extremely costly at $90-$103 million in 2014.

Policy Point 2: *"The need being addressed by the request cannot be adequately satisfied by reasonable transportation system management (such as ramp metering, mass transit and HOV facilities), geometric design, and alternative improvements to the interstate without the proposed change in access (23 CFR 625.2(a))."*

The need for a new interchange on I-65 between Saturn Parkway and SR 840 is being generated by insufficient north-south corridor capacity and a lack of accessibility to the area. The existing interchanges on I-65 (Saturn Parkway and SR 840) are approximately 4.5 miles

apart. The Saturn Parkway and Port Royal Road interchange will require spot improvements, but these will not by themselves meet the access needs of the area adequately. On the northern end of the study area, the interchange of SR 840 and US 431 (Lewisburg Pike) will operate at LOS F in 2037 and consequently one more northbound and southbound through lane will be needed. However, even with one additional through lane on US 431 (Lewisburg Pike), access to the area will be inadequate.

Major geometric and roadway widening improvements were contemplated but dismissed because of their cost or ineffectiveness. The most obvious would be to widen US 31 (Columbia Pike) to two lanes in each direction with a median or center turn lane. This improvement lacks the regional accessibility enhancement that a new interchange would provide and would be extremely costly to implement- $90-$103 million in 2014.

Regionally, accessibility deficiencies cannot be mitigated with transportation system management improvements like HOV lanes and ramp metering. Although I-65 will experience LOS deficiencies in 2037 and these may be relieved in part with TSM improvements, the need for regional accessibility cannot be met with those types of improvements.

The Regional Transit Authority (RTA) operates an express bus service route, 95X, from Spring Hill to downtown Nashville that utilizes I-65 and makes a counterclockwise loop around the study area (Saturn Parkway, US 31 (Columbia Pike), and SR 840) of this IAR. A vanpool service offered by the Transportation Management Group serves Williamson and Maury Counties. In the long term, better transit service is desirable for Williamson and Maury Counties, but the existing and anticipated future development patterns do not and will not result in land use density sufficient to make it effective in substantially relieving traffic congestion. The Nashville Area MPO TDM takes into consideration transit use, so the projected traffic volumes on the street network were made accordingly.

Policy Point 3: *"An operational and safety analysis has concluded that the proposed change in access does not have a significant adverse impact on the safety and operation of the Interstate facility or on the local street network based on both the current and the planned future traffic projections. The analyses shall, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access (23 CFR 625(a), 655.603(d), and 771.111(f))."*

"Requests for a proposed change in access must include a description and assessment of the impacts and ability of the proposed changes to safely and efficiently collect, distribute and accommodate traffic on the interstate facility, ramps, intersections of ramps with cross roads. and local street network (23 CFR 625 2(a) and 655.603(d)). Each request must also include a conceptual plan of the type and location of the signs proposed to support each design alternative (23 U.S.C. 109(d) and 23 CFR 655.603(d)."

A new interchange on I-65 at Buckner Road will be nearly equidistant between two existing interchanges that are about 4.5 miles apart. A new interchange at Thompson's Station Road would not be equidistant between the existing interchanges, but would be far enough away from them so as not to impact their operation. As such, the merge and diverge operations of the new

interchange, in either location, will not have an impact on the Saturn Parkway or SR 840 on and off ramps. The ramp terminal intersections at either Buckner Road or Thompson's Station Road will operate at LOS C or better in 2037 and lane storage capacity can be provided to minimize queues and assume that queues do not extend back to I-65.

Side friction created by merge and diverge maneuvers are inevitable with a new interchange, but the impact can be minimized with proper design. In the AM peak hour, the northbound merge and diverge maneuvers for both Build scenarios will operate at LOS F if I-65 remains two lanes per direction. In the PM peak hour the southbound diverge maneuver onto Buckner Road or Thompson's Station Road will operate at LOS F. All of the merge or diverge LOSs can be attributed to high freeway volumes in only two lanes instead of high ramp volumes. Tables 10 and 12 in Sections 5D and 5E provide a summary of all I-65 service levels including the link analysis, merge analysis, and diverge analysis.

A new interchange on I-65 at Buckner Road or Thompson's Station Road will create a slightly less safe segment of freeway because of the side friction caused by merge and diverge maneuvers. A functional design plan of both Build scenarios (see Appendix 2- Build Alternative Maps) demonstrates that appropriate ramp merge and diverge lanes can be constructed so a decrease in safety can be minimized.

<u>Policy Point 4</u>: *"The proposed access connects to a public road only and will provide for all movements. Less than "full interchanges" may be considered on a case-by-case basis for applications requiring special access for managed lanes (e.g. transit, HOVs, HOT lanes) or park and ride lots. The proposed access will be designed to meet or exceed current standards (23 CFR 625.2(a), 625.4(a)(2), and 655.603(d))."*

A diamond interchange is proposed in either Build scenario so the northbound and southbound on and off ramps will make all movements possible. Build Alternative 1 will connect to the extension of Buckner Road, which will be a public road. Build Alternative 2 would connect to Thompson's Station Road, which is also a public road.

<u>Policy Point 5</u>: *"The proposal considers and is consistent with local and regional land use and transportation plans. Prior to receiving the final approval, all requests for new or revised access must be included in an adopted Metropolitan Transportation Plan, in the adopted Statewide or Metropolitan Transportation Improvement Program (STIP or TIP) and the Congestion Management Process within the transportation management areas, as appropriate, and as specified in 23 CFR part 450, and the transportation conformity requirements of 40 CFR parts 51 and 93."*

Design year traffic projections for the proposed new I-65 access point were based on land use projections from the Nashville Area MPO TDM. Additionally, the future traffic volumes and analysis in this I-65 access request are based on the Existing plus Committed (E+C) street network included in the Nashville Area MPO Regional Transportation Plan.

A proposed new interchange on I-65 between Saturn Parkway and SR 840 is in the Nashville Area MPO Regional Transportation Plan as an illustrative project.

A proposed new interchange is also included as a priority project in the Spring Hill Major Thoroughfare Plan and is consistent with the City's Comprehensive Plan.

Policy Point 6: *"In corridors where the potential exists for future multiple interchange additions, a comprehensive corridor or network study must accompany all requests for new or revised access with recommendations that address all of the proposed and desired access changes within the context of a longer-range system or network plan (23 U.S.C. 109(d), 23 625.2(a), 655.603(d) and 771.111)."*

There are no potential future interchanges in the I-65 corridor between Saturn Parkway and SR 840 besides the one which is the subject of this IAR. A new interchange on I-65 at either Buckner Road or Thompson's Station Road will meet the long term 2037 access and mobility needs of the area. Moreover, the ramp terminals at a new interchange (either Build Alternative 1 or 2) should operate at LOS B or C if they are constructed as shown in the functional design plans (see Appendix 2 Figures for the functional design plans). This Interchange Access Request (IAR) is being funded by the three city and county governments in the area including Williamson County, City of Spring Hill, and Town of Thompson's Station. As such, these three communities are working together and the results of this study are supported by all of them.

Policy Point 7: *"When a new or revised access point is due to a new, expanded or substantial change in current or planned future development or land use, requests must demonstrate appropriate coordination has occurred between the development and any proposed transportation system improvements (23 CFR 625.2(a) and 655.603(d)). The request must describe the commitments agreed upon to assure adequate collection and dispersion of the traffic resulting from the development with adjoining local street network and interstate access point (23 CFR 625.2(a) and 655.603(d))."*

The proposed new interchange on I-65 between Saturn Parkway and SR 840 is not being proposed as a result of a substantial change in current land use or planned future development. Instead, the new access point on I-65 is being proposed to provide better access to the area and to mitigate traffic congestion on US 31 (Columbia Pike), US 431 (Lewisburg Pike), Lane. Year 2037 design year traffic projections were based on the Nashville Area MPO TDM projected land use plan.

Policy Point 8: *"The proposal can be expected to be included as an alternative in the requested environmental evaluation, review and processing. The proposal should include supporting information and current status of the environmental processing (23 CFR 771.111)."*

Section 2E of this IAR discusses known social and environmental issues that could be affected by a new interchange on I-65 at Buckner Road or Thompson's Station Road. The preliminary review of environmental characteristics in the area did not uncover any issues that would prevent the proposed new I-65 interchange project from moving forward. The conclusions of this report will be presented to FHWA for their review. The local communities sponsoring this access request realize that this is only the first step of environmental assessment and subsequent approval.

B. CONCLUSIONS AND RECOMMENDATIONS

Results of the analysis indicate that a new I-65 interchange at Buckner Road extension, Build Alternative 1, will meet the purpose and need of this project by providing better access to the area. A new interchange at Buckner Road extension is favored over a new interchange at Thompson's Station Road because it will cost about $1.763 million less to construct it and associated other road improvements. A new interchange at either location allows traffic to redistribute from less desirable corridors. Both interchange locations would also provide good economic development potential. The estimated cost of this new interchange, extending Buckner Road, and improvements to Buckner Lane is $31.945 million.

C. NEXT STEPS

This report is the first documented evaluation of the impacts of a new interchange on I-65 at Buckner Road extension. If approved by FHWA and supported by stakeholders, this option will be carried forward to preliminary design and NEPA environmental evaluation.

INTERSTATE ACCESS REQUEST

I-65 in Southern Williamson County

APPENDIX

APPENDIX 1- REPORT ILLUSTRATIONS

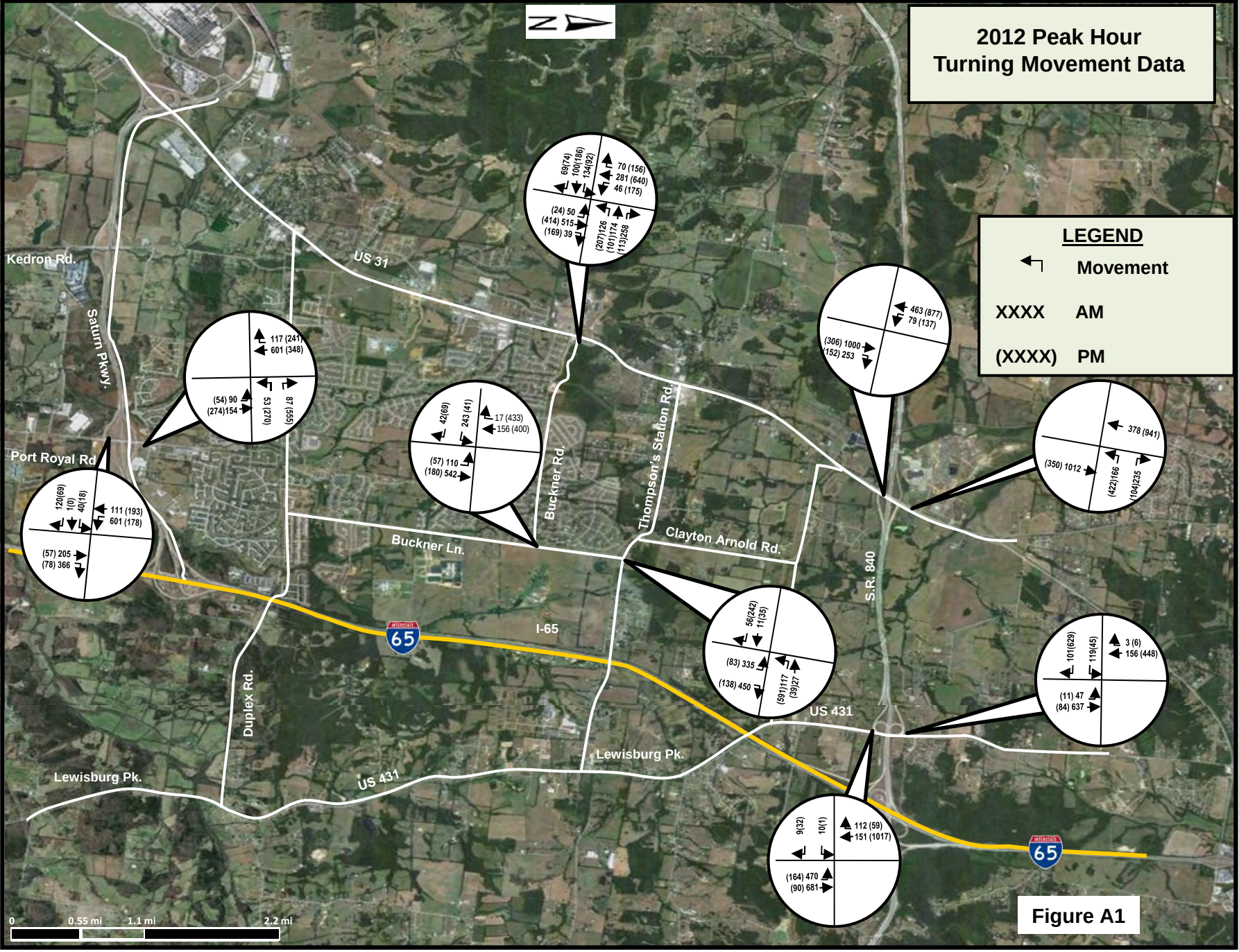

2012 Peak Hour
Turning Movement Data
LEGEND
Movement
XXXX AM
(XXXX) PM
Kedron Rd.
Saturn Pkwy.
Port Royal Rd
US 31
Buckner Rd.
Thompson's Station Rd.
Buckner Ln.
Clayton Arnold Rd.
S.R. 840
I-65
US 431
Duplex Rd.
Lewisburg Pk.
Lewisburg Pk.
US 431
69(74)
100(186)
134(92)
70 (156)
281 (640)
46 (175)
(24) 50
(414) 515
(169) 39
(207)126
(101)174
(113)258
117 (241)
601 (348)
(54) 90
(274)154
53 (270)
87 (555)
42(69)
243 (41)
17 (433)
156 (400)
(57) 110
(180) 542
463 (877)
79 (137)
(306) 1000
(152) 253
378 (941)
(350) 1012
(422)166
(104)235
120(69)
1(0)
40(18)
111 (193)
601 (178)
(57) 205
(78) 366
56(242)
11(35)
(83) 335
(138) 450
(591)117
(39)27
101(629)
119(45)
3 (6)
156 (448)
(11) 47
(84) 637
9(32)
10(1)
112 (59)
151 (1017)
(164) 470
(90) 681
0
0.55 mi
1.1 mi
2.2 mi

Figure A1

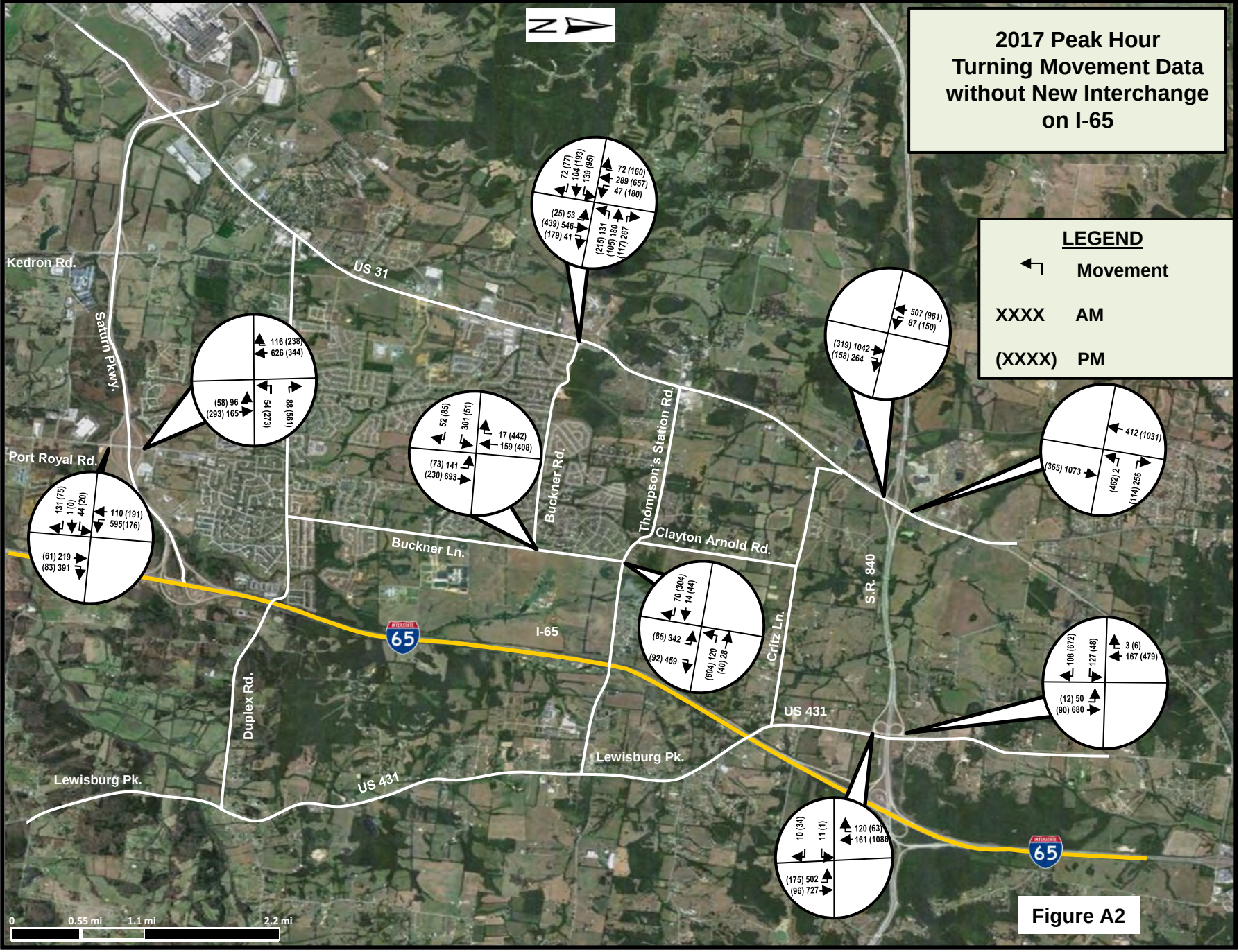

2017 Peak Hour
Turning Movement Data
without New Interchange
on I-65
LEGEND
Movement
XXXX AM
(XXXX) PM
N
Kedron Rd.
Saturn Pkwy.
Port Royal Rd.
US 31
Buckner Ln.
Buckner Rd.
Thompson's Station Rd.
Clayton Arnold Rd.
Critz Ln.
S.R. 840
I-65
US 431
Duplex Rd.
Lewisburg Pk.
72 (77)
104 (193)
139 (95)
72 (160)
289 (657)
47 (180)
(25) 53
(439) 546
(179) 41
(215) 131
(105) 180
(117) 267
116 (238)
626 (344)
(58) 96
(293) 165
54 (273)
88 (595)
52 (85)
301 (51)
17 (442)
159 (408)
(73) 141
(230) 693
507 (961)
87 (150)
(319) 1042
(158) 264
412 (1031)
(365) 1073
(462) 2
(114) 256
131 (75)
1 (0)
44 (20)
110 (191)
595(176)
(61) 219
(83) 391
70 (304)
14 (44)
(85) 342
(92) 459
(604) 120
(40) 28
108 (672)
127 (48)
3 (6)
167 (479)
(12) 50
(90) 680
10 (34)
11 (1)
120 (63)
161 (1086)
(175) 502
(96) 727
0
0.55 mi
1.1 mi
2.2 mi

Figure A2

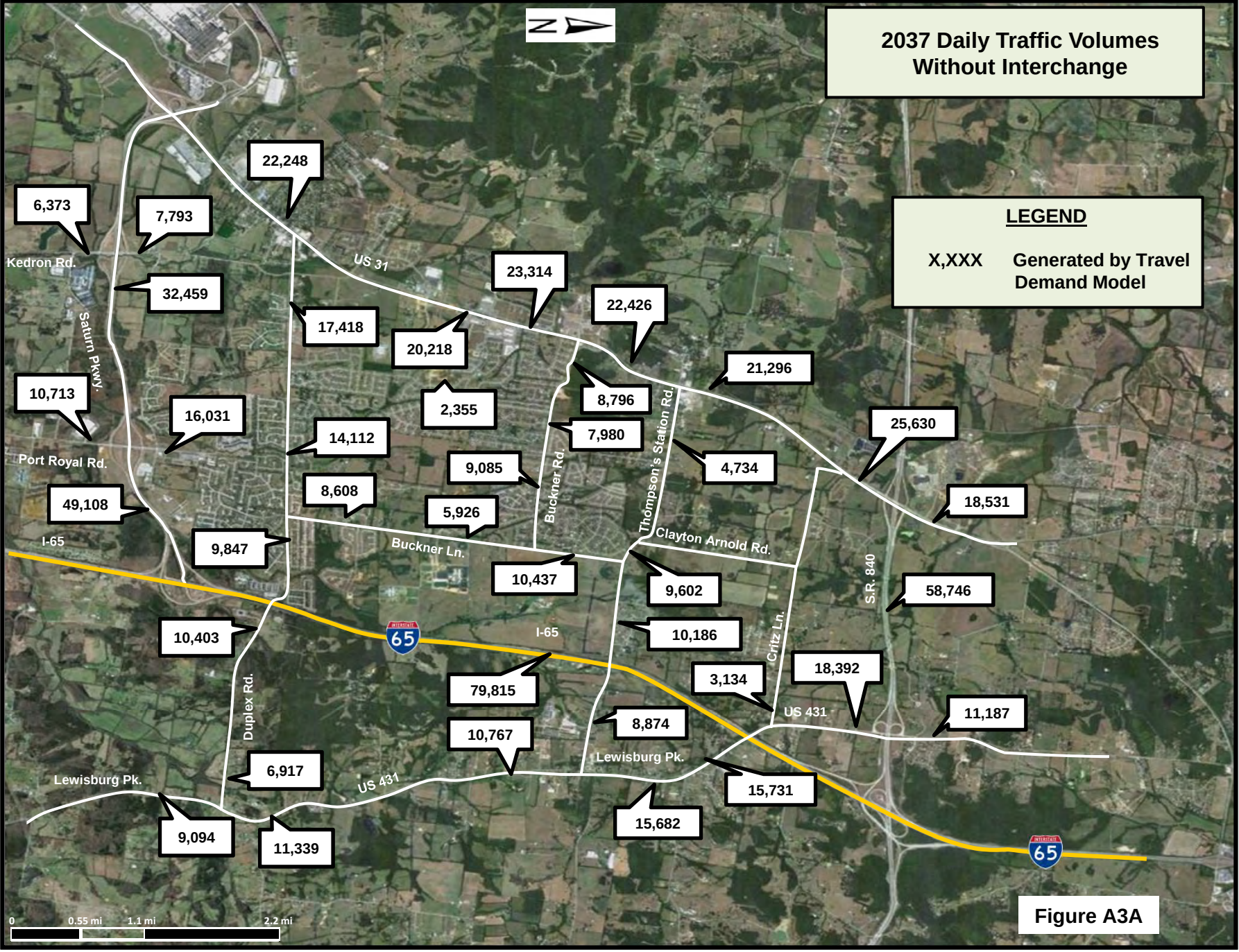

2037 Daily Traffic Volumes
Without Interchange
LEGEND
X,XXX Generated by Travel Demand Model
N
22,248
6,373
7,793
Kedron Rd.
US 31
23,314
32,459
22,426
17,418
20,218
Saturn Pkwy.
21,296
10,713
8,796
2,355
16,031
7,980
25,630
14,112
Port Royal Rd.
9,085
Buckner Rd.
Thompson's Station Rd.
4,734
8,608
49,108
5,926
18,531
I-65
9,847
Buckner Ln.
Clayton Arnold Rd.
10,437
9,602
S.R. 840
58,746
10,403
I-65
10,186
Critz Ln.
18,392
79,815
3,134
US 431
11,187
Duplex Rd.
8,874
10,767
Lewisburg Pk.
6,917
US 431
15,731
Lewisburg Pk.
15,682
9,094
11,339
0
0.55 mi
1.1 mi
2.2 mi

Figure A3A

2037 Daily Traffic Volumes
Without Interchange
N
SR 840
State 840
LEWISBURG PK.
I-65
2,403
9,488
2,757
9,336
9,981
9,348
20,829
23,953
10,576
11,028
3,972
30,210
17,241
7,113
0
0.21 mi
0.42 mi
0.84 mi

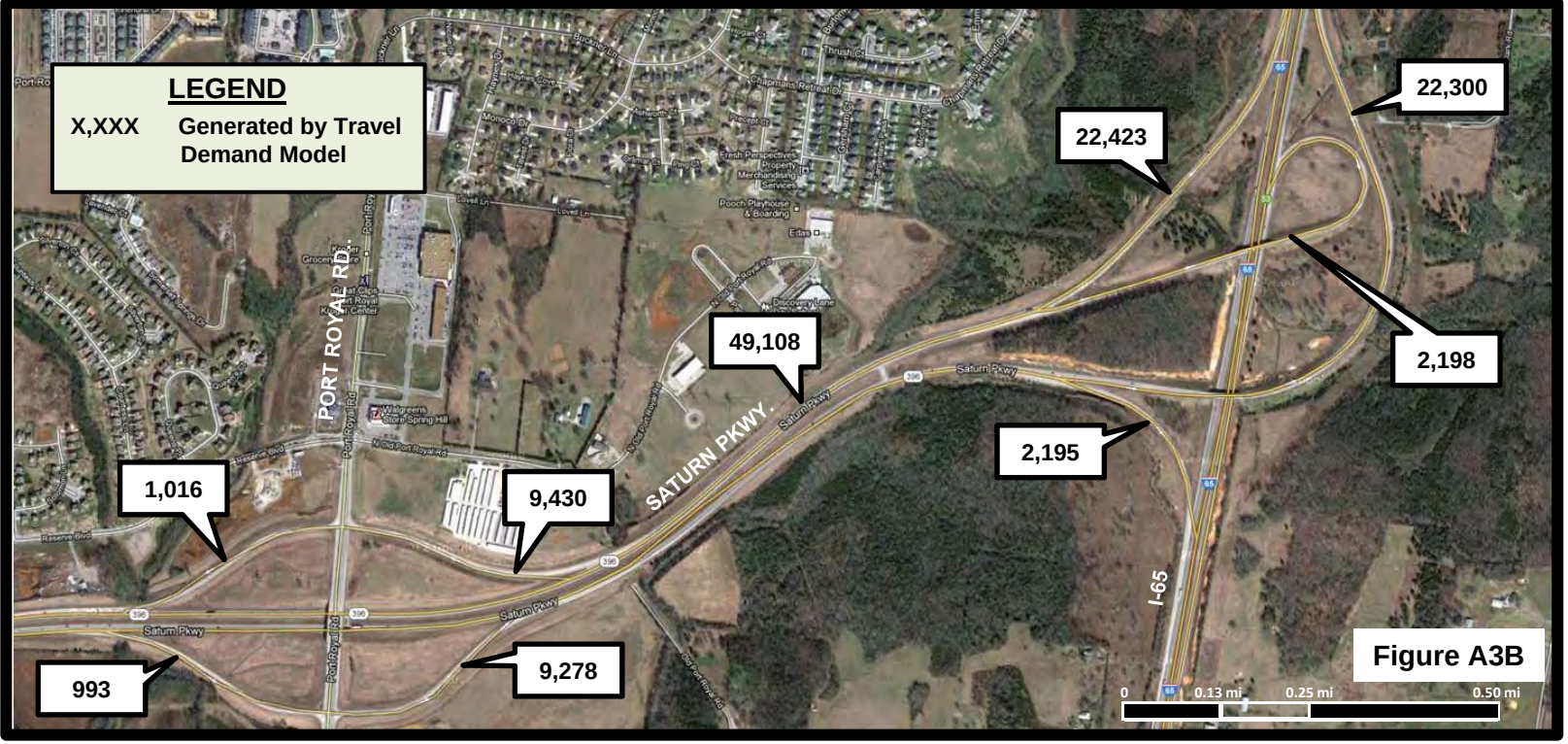

LEGEND
X,XXX Generated by Travel Demand Model
PORT ROYAL RD.
SATURN PKWY.
I-65
1,016
993
9,430
9,278
49,108
22,423
22,300
2,198
2,195
0
0.13 mi
0.25 mi
0.50 mi

Figure A3B

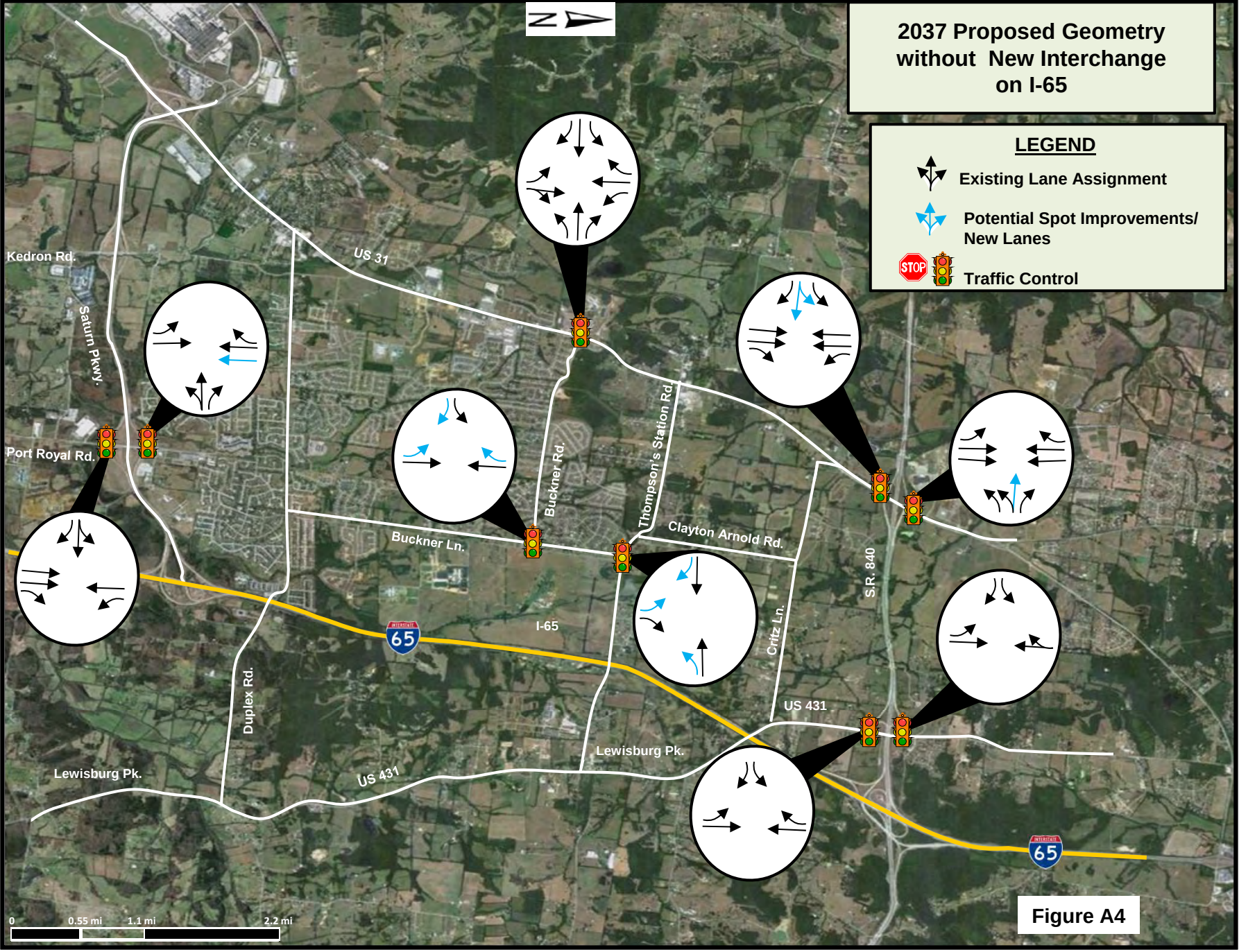

2037 Proposed Geometry without New Interchange on I-65
LEGEND
Existing Lane Assignment
Potential Spot Improvements/ New Lanes
Traffic Control
N
Kedron Rd.
Saturn Pkwy.
Port Royal Rd.
US 31
Buckner Rd.
Thompson's Station Rd.
Buckner Ln.
Clayton Arnold Rd.
S.R. 840
Critz Ln.
I-65
Duplex Rd.
US 431
Lewisburg Pk.
Lewisburg Pk.
US 431
0
0.55 mi
1.1 mi
2.2 mi

Figure A4

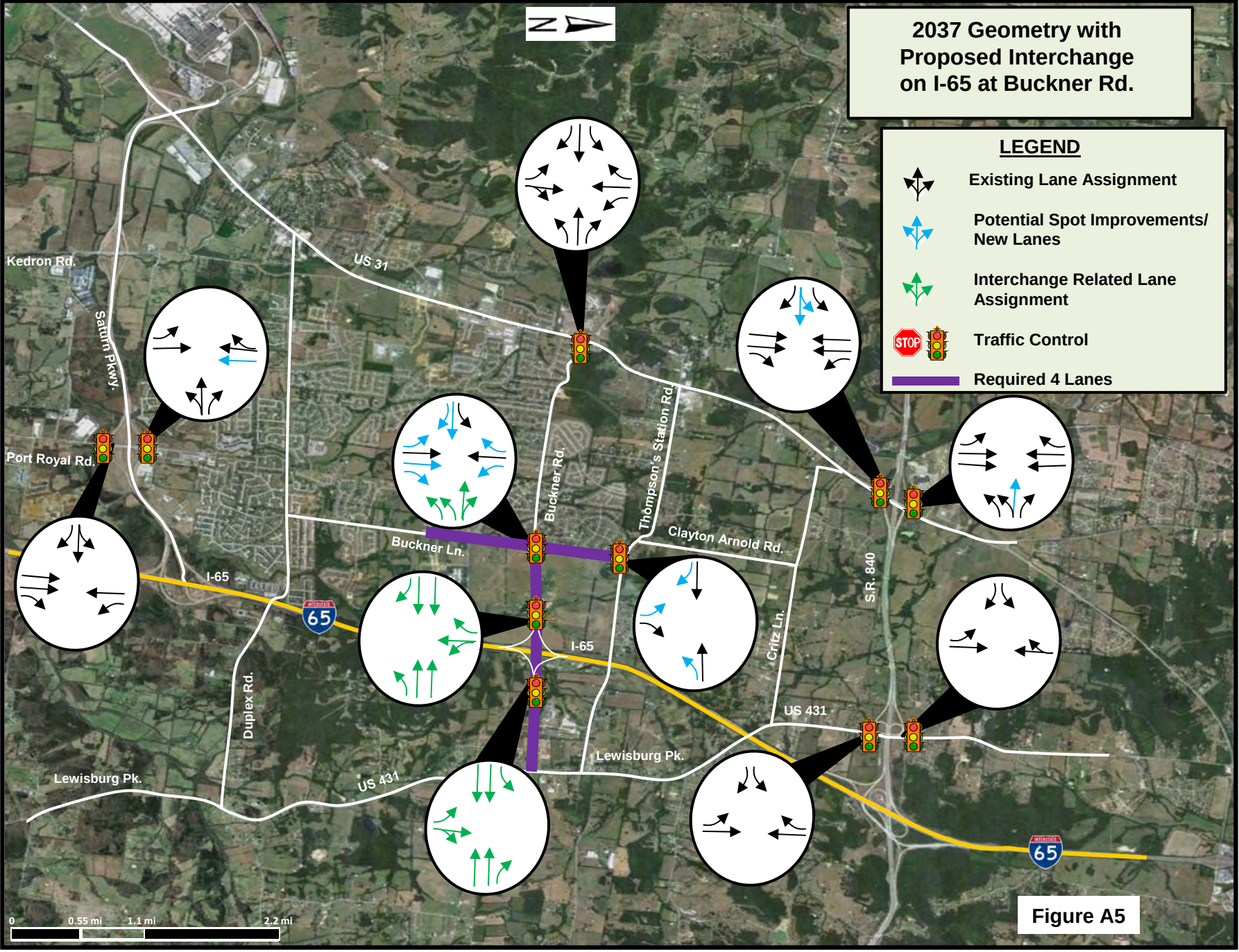

2037 Geometry with Proposed Interchange on I-65 at Buckner Rd.
LEGEND
Existing Lane Assignment
Potential Spot Improvements/ New Lanes
Interchange Related Lane Assignment
Traffic Control
Required 4 Lanes
Kedron Rd.
Saturn Pkwy.
Port Royal Rd.
US 31
Buckner Rd.
Thompson's Station Rd.
Buckner Ln.
Clayton Arnold Rd.
I-65
Critz Ln.
S.R. 840
Duplex Rd.
US 431
Lewisburg Pk.
0
0.55 mi
1.1 mi
2.2 mi

Figure A5

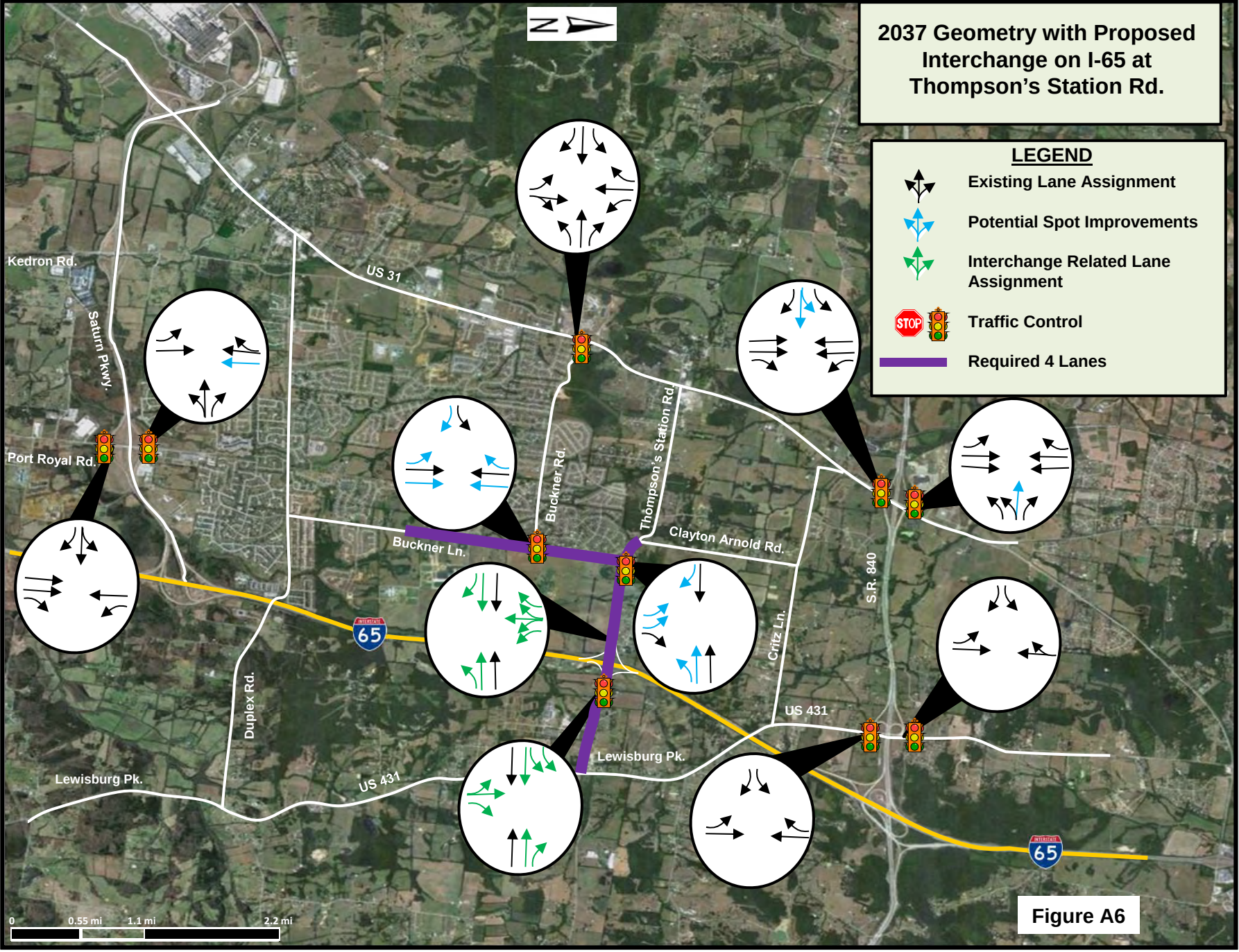

2037 Geometry with Proposed Interchange on I-65 at Thompson's Station Rd.
LEGEND
Existing Lane Assignment
Potential Spot Improvements
Interchange Related Lane Assignment
Traffic Control
Required 4 Lanes
Kedron Rd.
Saturn Pkwy.
Port Royal Rd.
US 31
Buckner Rd.
Thompson's Station Rd.
Buckner Ln.
Clayton Arnold Rd.
S.R. 840
Critz Ln.
65
Duplex Rd.
US 431
Lewisburg Pk.
Lewisburg Pk.
US 431
65
0
0.55 mi
1.1 mi
2.2 mi

Figure A6

2037 Peak Hour Traffic without New Interchange

LEGEND

X,XXX	AM Generated by Travel Demand Model
(X,XXX)	PM Generated by Travel Demand Model

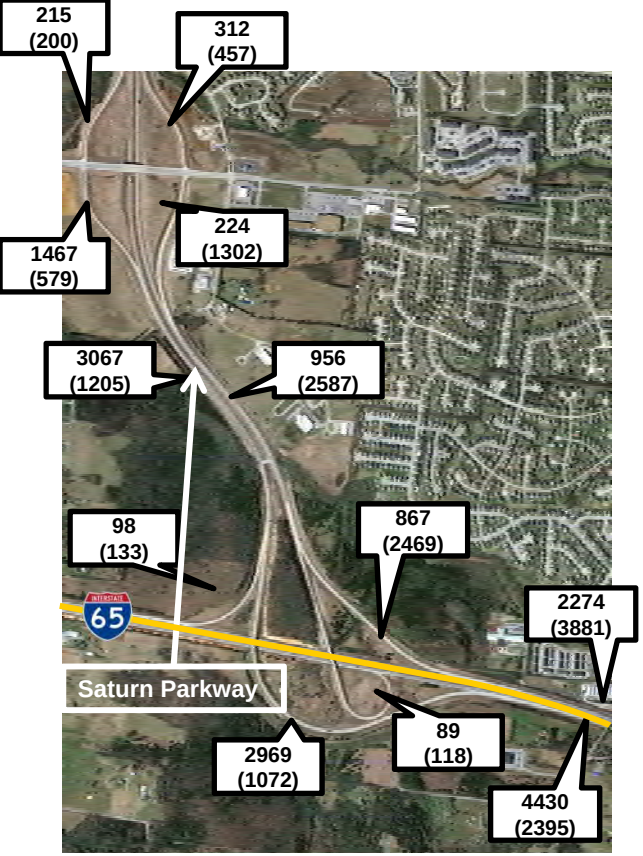


Figure A7

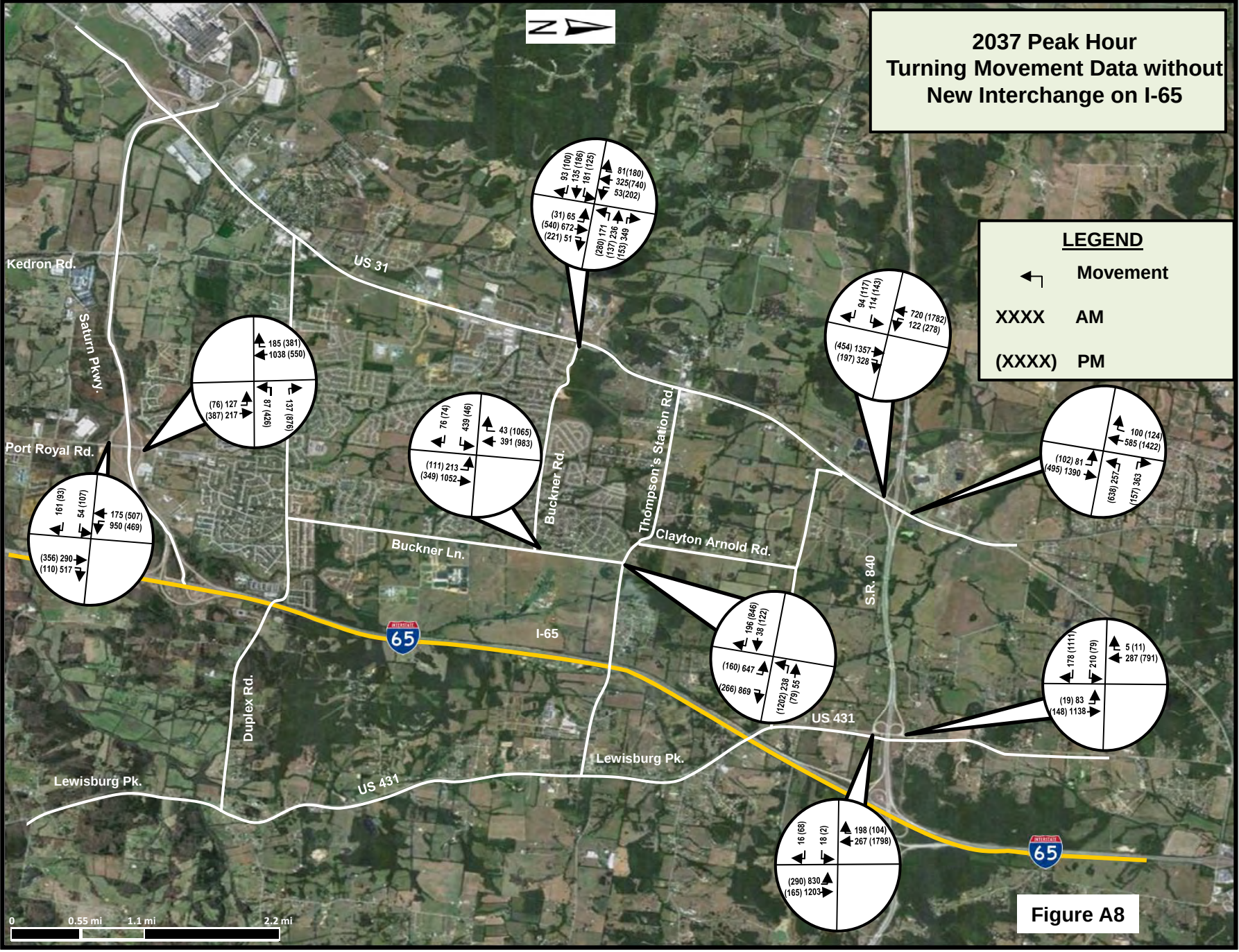

2037 Peak Hour
Turning Movement Data without
New Interchange on I-65
LEGEND
Movement
XXXX AM
(XXXX) PM
N
Kedron Rd.
Saturn Pkwy.
Port Royal Rd.
US 31
Buckner Rd.
Thompson's Station Rd.
Buckner Ln.
Clayton Arnold Rd.
S.R. 840
I-65
Duplex Rd.
US 431
Lewisburg Pk.
93 (100)
135 (186)
181 (125)
81(180)
325(740)
53(202)
(31) 65
(540) 672
(221) 51
(280) 171
(137) 236
(153) 349
185 (381)
1038 (550)
(76) 127
(387) 217
87 (426)
137 (876)
76 (74)
439 (46)
43 (1065)
391 (983)
(111) 213
(349) 1052
161 (93)
54 (107)
175 (507)
950 (469)
(356) 290
(110) 517
94 (117)
114 (143)
720 (1782)
122 (278)
(454) 1357
(197) 328
100 (124)
585 (1422)
(102) 81
(495) 1390
(638) 257
(157) 363
196 (846)
38 (122)
(160) 647
(266) 869
(1202) 238
(79) 55
178 (1111)
210 (79)
5 (11)
287 (791)
(19) 83
(148) 1138
16 (68)
18 (2)
198 (104)
267 (1798)
(290) 830
(165) 1203
0
0.55 mi
1.1 mi
2.2 mi

Figure A8

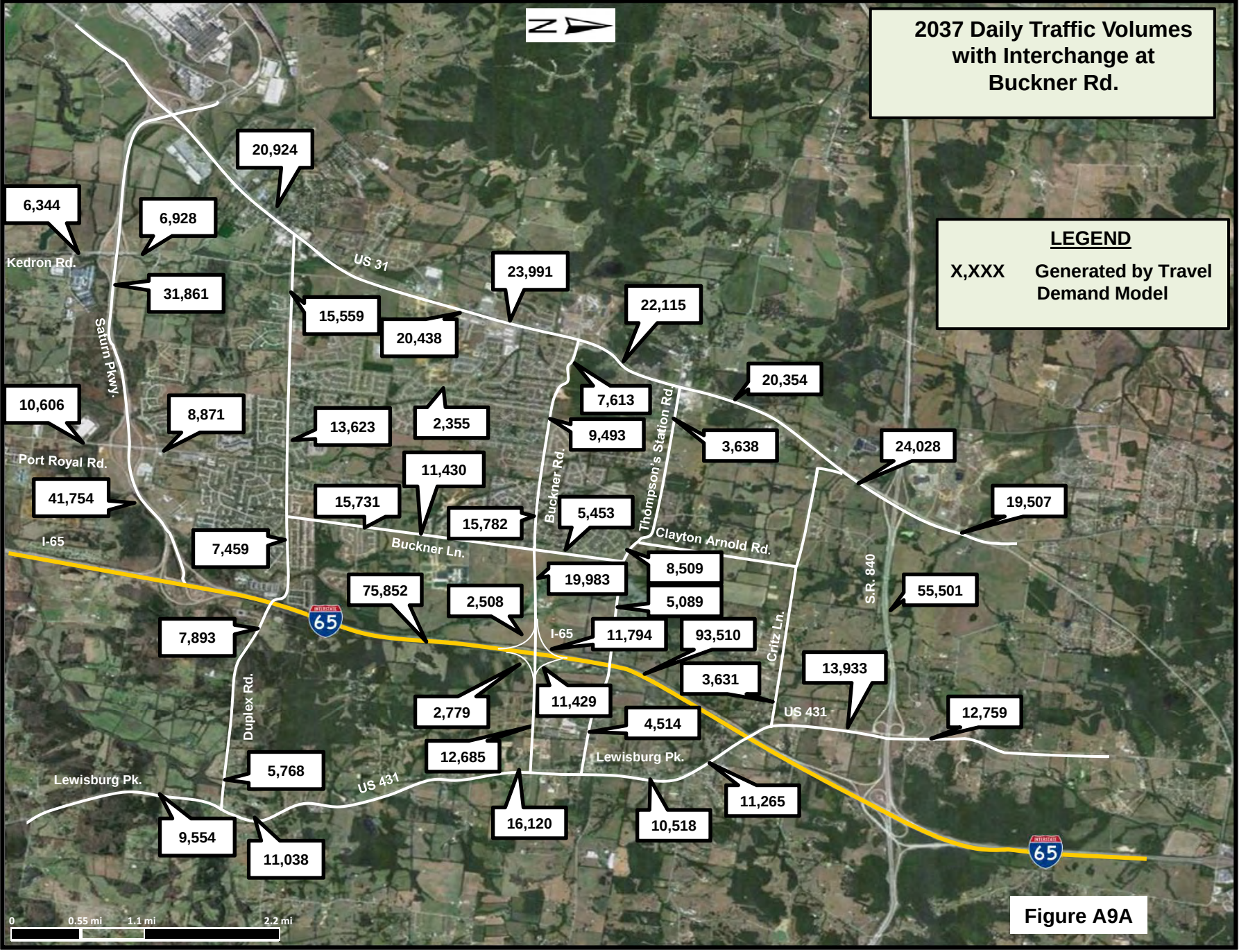

2037 Daily Traffic Volumes with Interchange at Buckner Rd.
LEGEND
X,XXX Generated by Travel Demand Model
N
20,924
6,344
6,928
Kedron Rd.
31,861
US 31
23,991
15,559
20,438
22,115
Saturn Pkwy.
20,354
10,606
8,871
13,623
2,355
7,613
9,493
3,638
24,028
Port Royal Rd.
11,430
Buckner Rd.
Thompson's Station Rd.
41,754
15,731
15,782
5,453
19,507
I-65
7,459
Buckner Ln.
Clayton Arnold Rd.
8,509
19,983
75,852
2,508
5,089
S.R. 840
55,501
7,893
I-65
11,794
93,510
Critz Ln.
13,933
3,631
2,779
11,429
US 431
12,759
Duplex Rd.
4,514
12,685
Lewisburg Pk.
5,768
US 431
Lewisburg Pk.
11,265
16,120
10,518
9,554
11,038
0
0.55 mi
1.1 mi
2.2 mi

Figure A9A

2037 Daily Traffic Volumes
With Interchange at
Buckner Rd.
N
SR 840
State 840
LEWISBURG PK.
I-65
2,317
7,908
2,988
8,154
7,546
9,391
20,082
9,499
12,071
16,853
4,002
25,514
17,489
7,464
0
0.21 mi
0.42 mi
0.84 mi

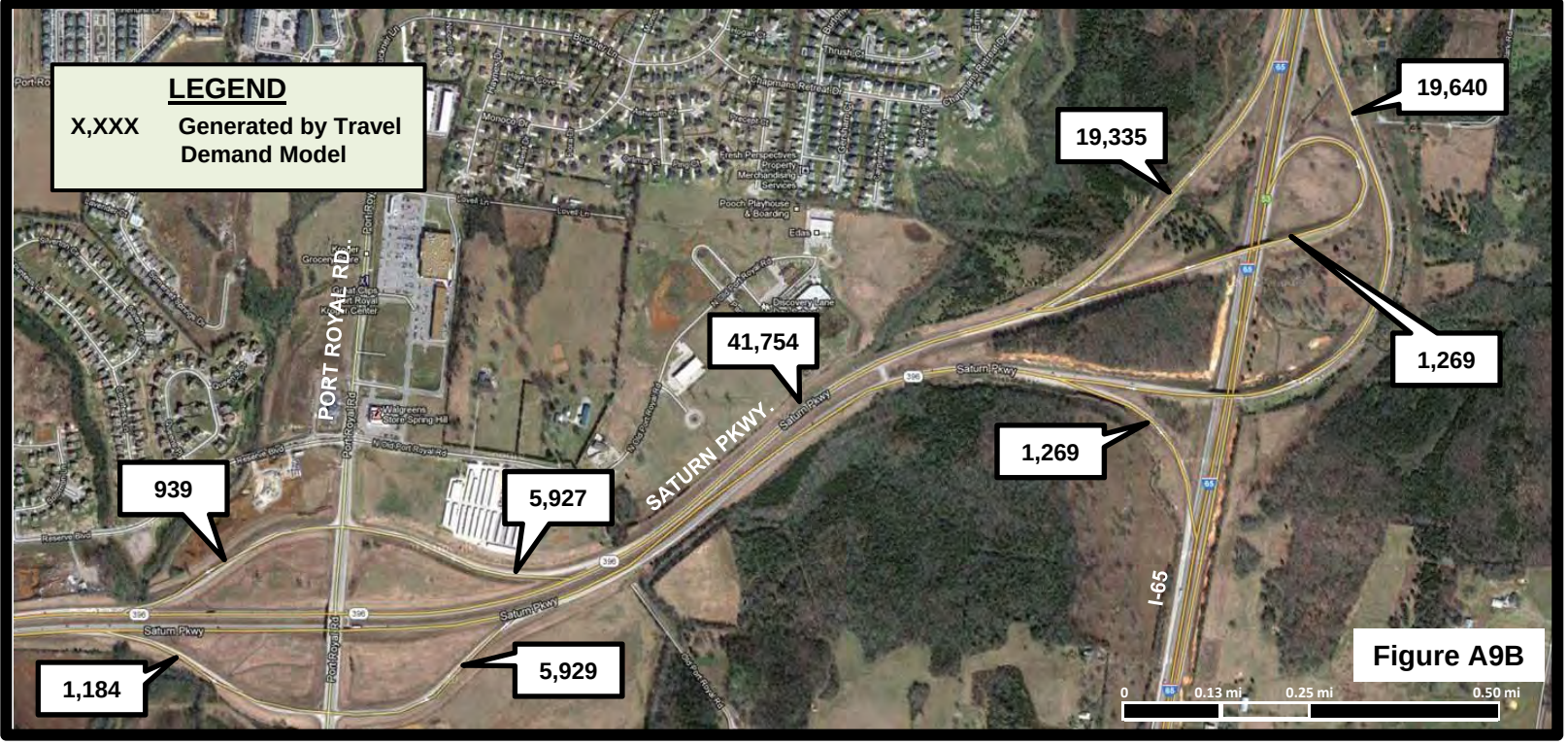

LEGEND
X,XXX Generated by Travel Demand Model
PORT ROYAL RD.
SATURN PKWY.
I-65
939
5,927
1,184
5,929
41,754
1,269
1,269
19,335
19,640
0
0.13 mi
0.25 mi
0.50 mi

Figure A9B

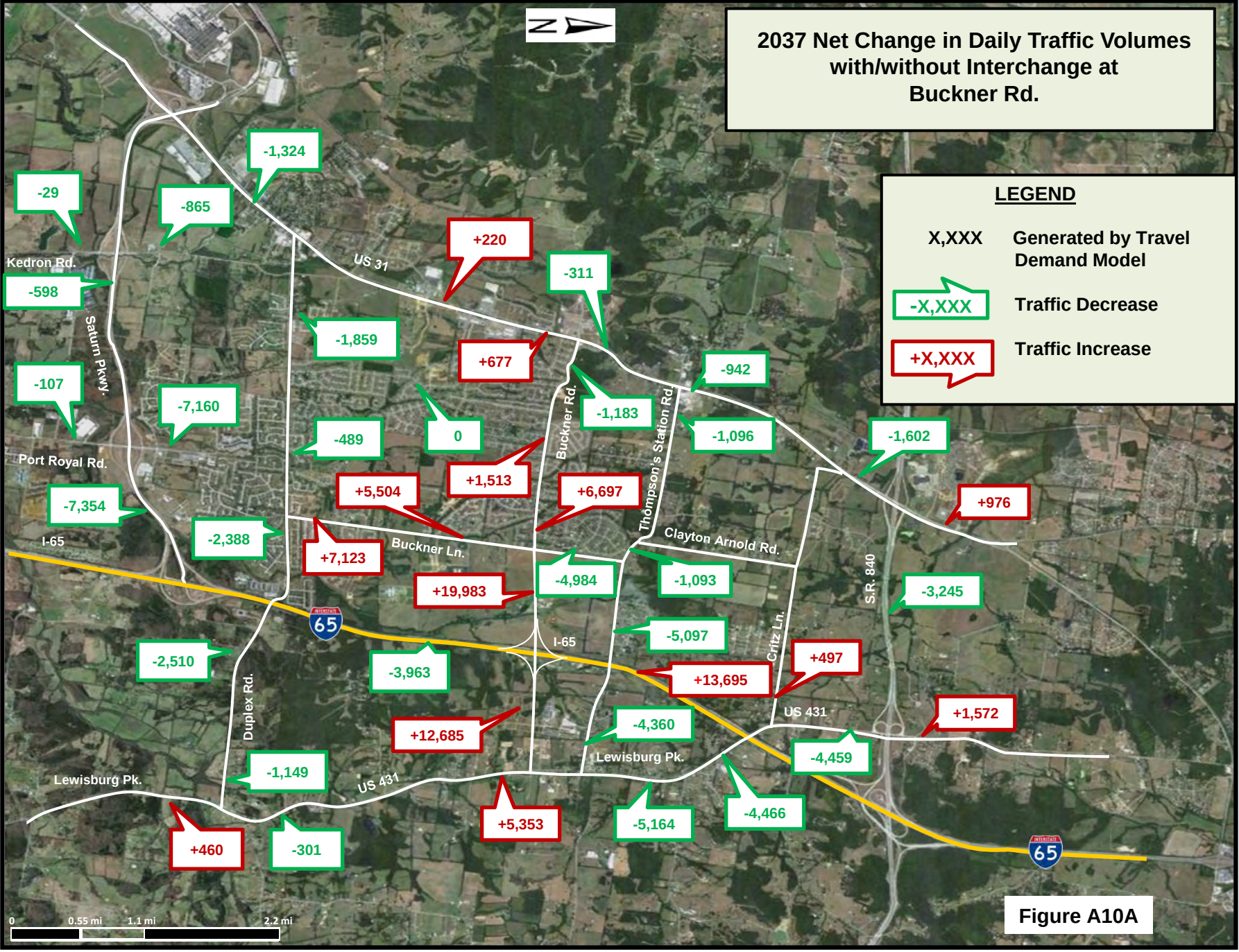

2037 Net Change in Daily Traffic Volumes with/without Interchange at Buckner Rd.
LEGEND
X,XXX Generated by Travel Demand Model
-X,XXX Traffic Decrease
+X,XXX Traffic Increase
-29
-865
-1,324
+220
-311
-598
-1,859
+677
-942
-107
-7,160
-489
0
-1,183
-1,096
-1,602
+1,513
+5,504
+6,697
+976
-7,354
-2,388
+7,123
+19,983
-4,984
-1,093
-3,245
-5,097
+497
+13,695
-2,510
-3,963
+12,685
-4,360
+1,572
-4,459
-1,149
+460
-301
+5,353
-5,164
-4,466
Kedron Rd.
Saturn Pkwy.
Port Royal Rd.
I-65
US 31
Buckner Rd.
Thompson's Station Rd.
Buckner Ln.
Clayton Arnold Rd.
S.R. 840
Critz Ln.
US 431
Duplex Rd.
Lewisburg Pk.
0
0.55 mi
1.1 mi
2.2 mi

Figure A10A

2037 Net Change in Daily Traffic Volumes with/without Interchange at Buckner Rd.

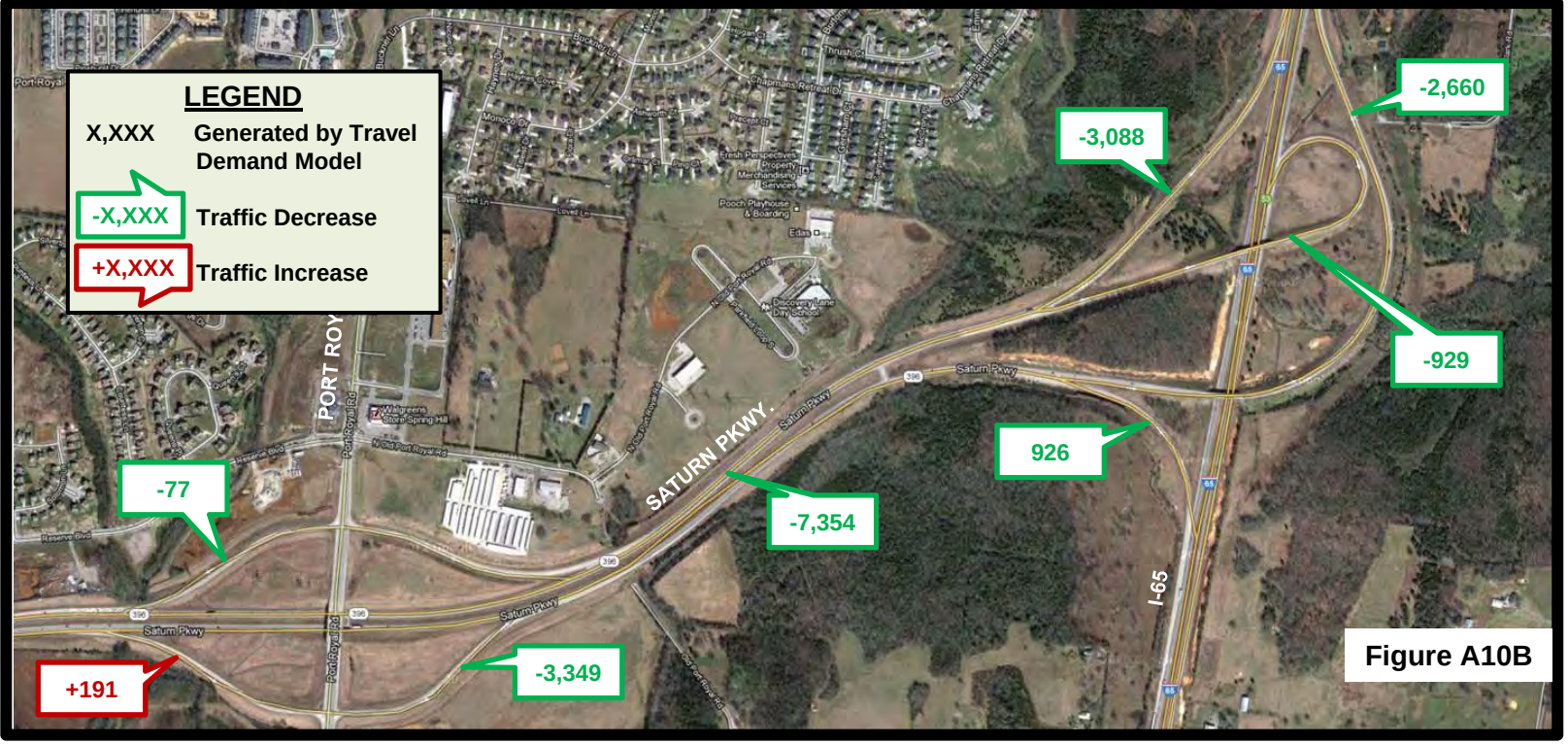


Figure A10B

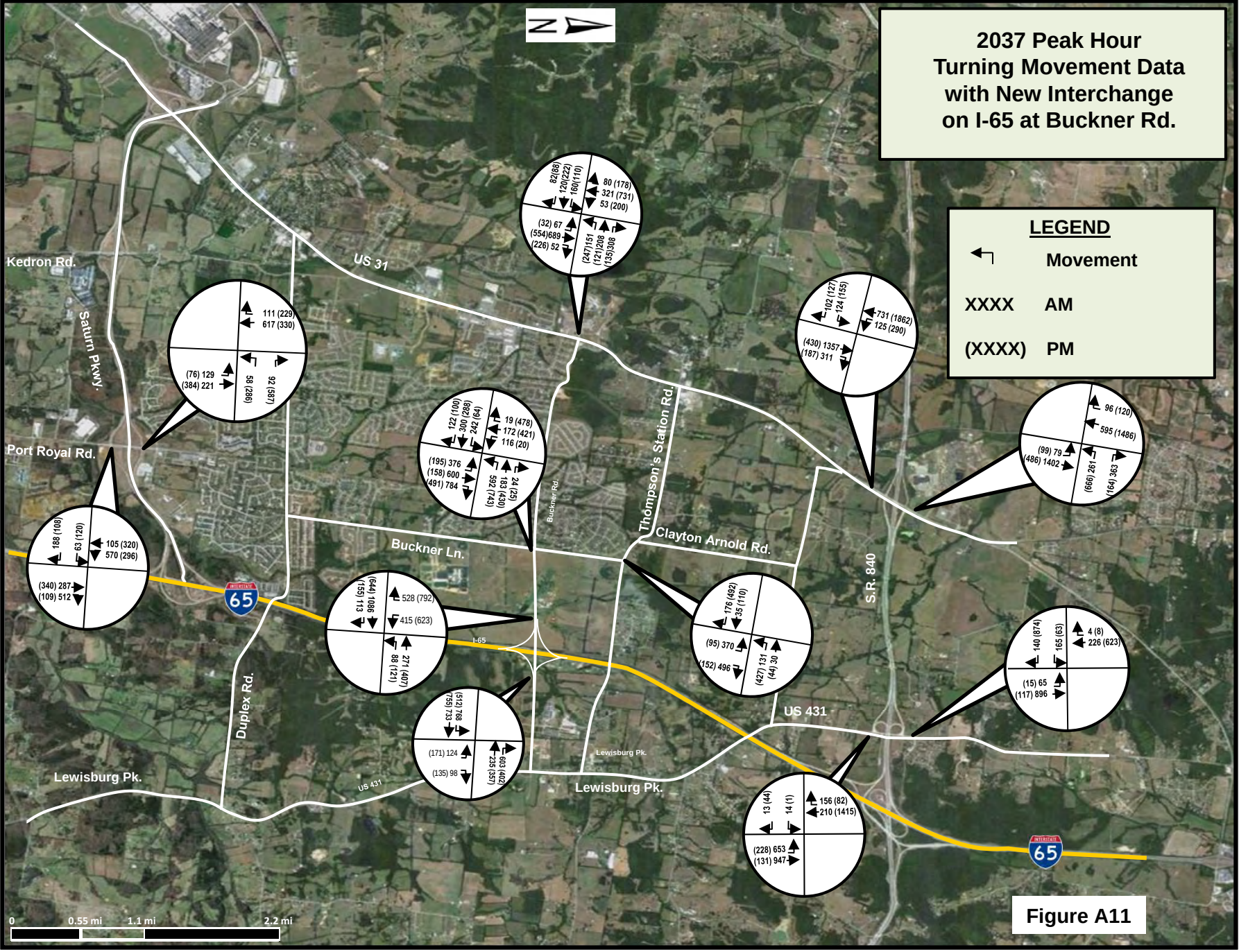
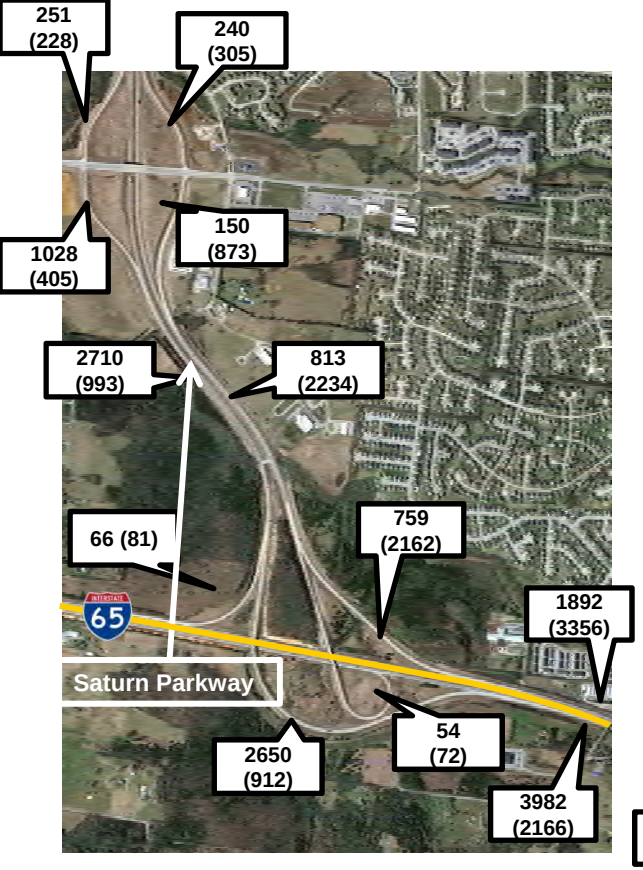

2037 Peak Hour
Turning Movement Data
with New Interchange
on I-65 at Buckner Rd.
LEGEND
Movement
XXXX AM
(XXXX) PM
Kedron Rd.
Saturn Pkwy.
Port Royal Rd.
US 31
Buckner Ln.
Buckner Rd.
Thompson's Station Rd.
Clayton Arnold Rd.
S.R. 840
I-65
Duplex Rd.
Lewisburg Pk.
US 431
0 0.55 mi 1.1 mi 2.2 mi

Figure A11

2037 Peak Hour Traffic with New Interchange at Buckner Rd.

LEGEND

X,XXX	AM Generated by Travel Demand Model
(X,XXX)	PM Generated by Travel Demand Model



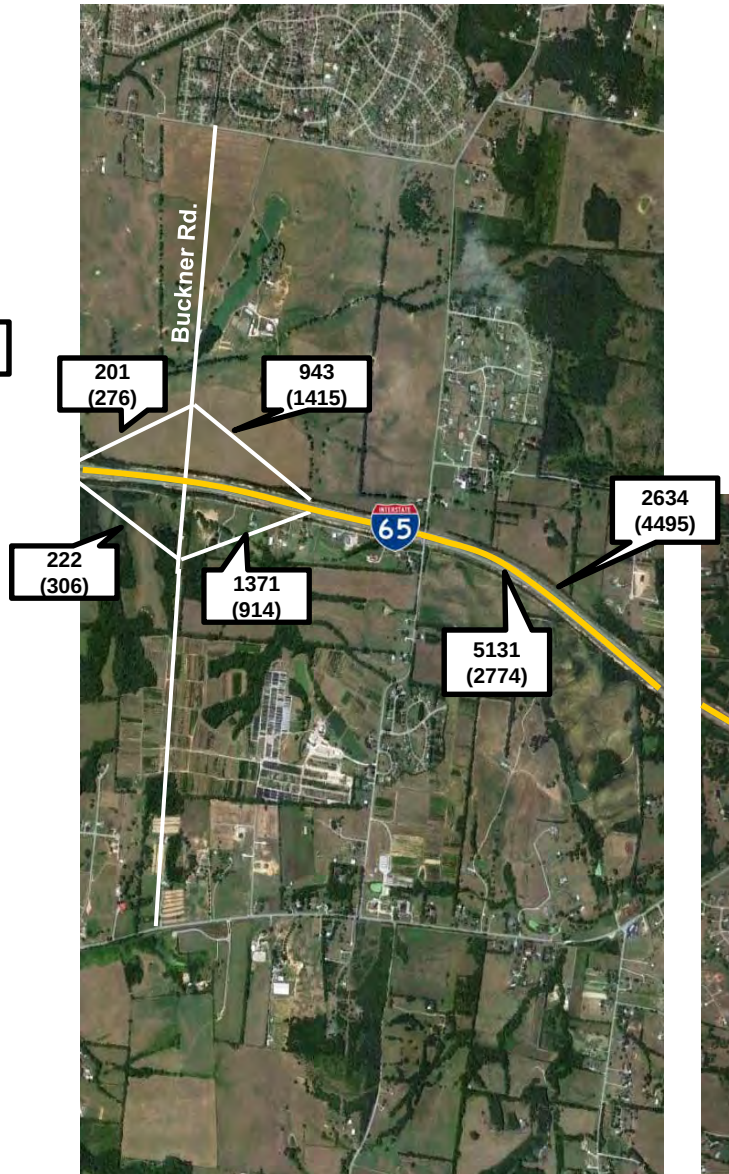
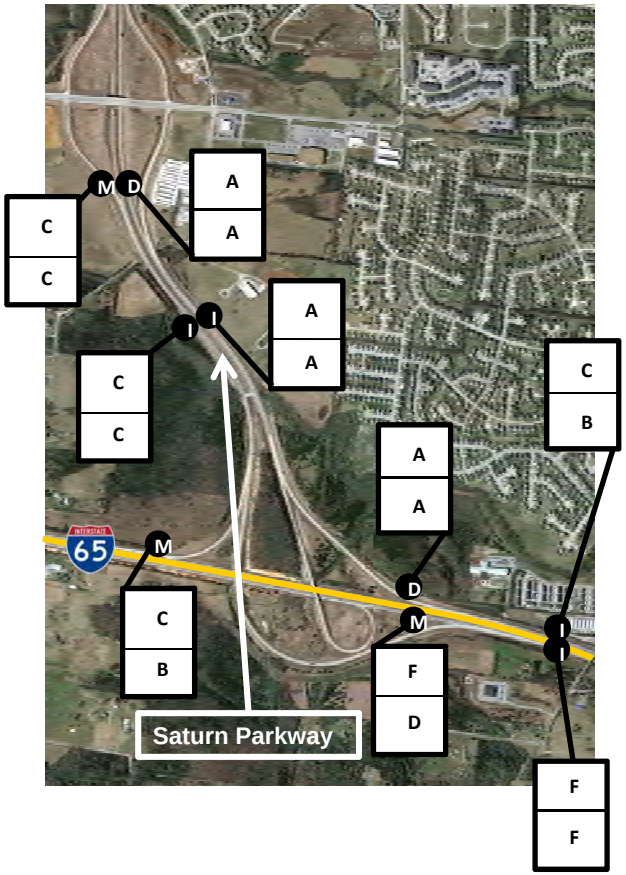
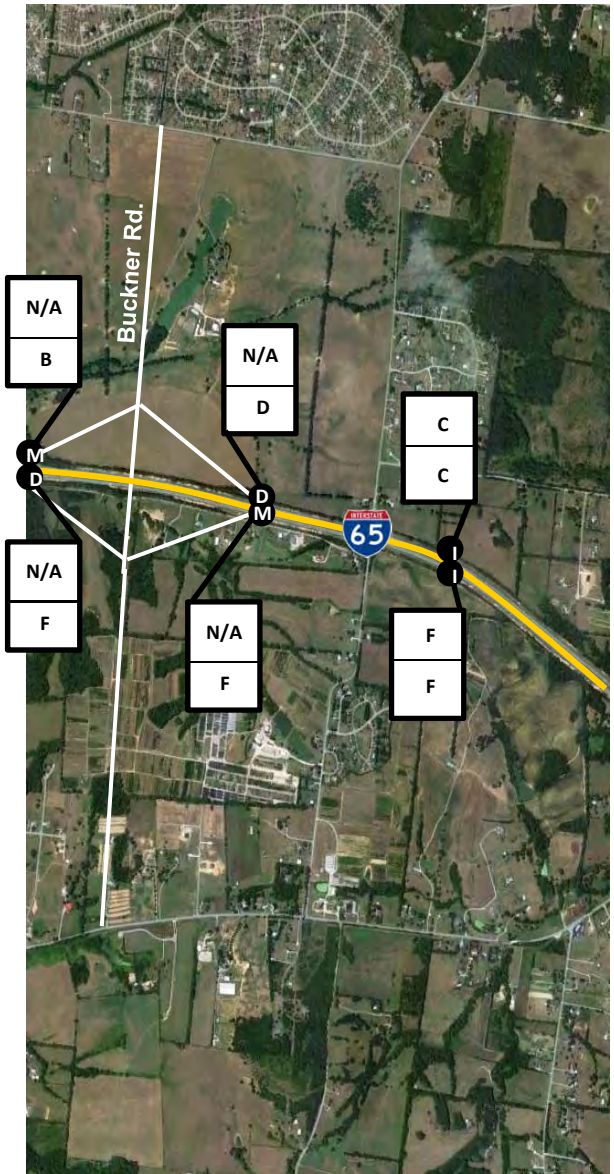
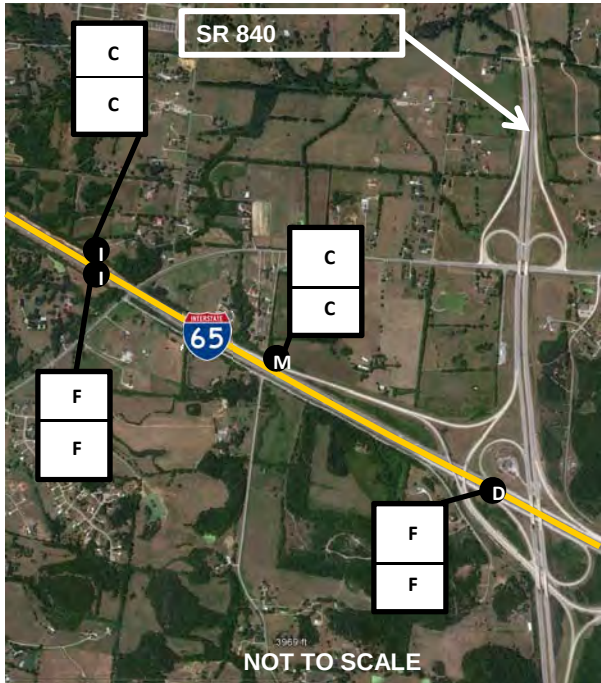


Figure A12

2037 Interchange and Freeway AM LOS with New Interchange at Buckner Rd.





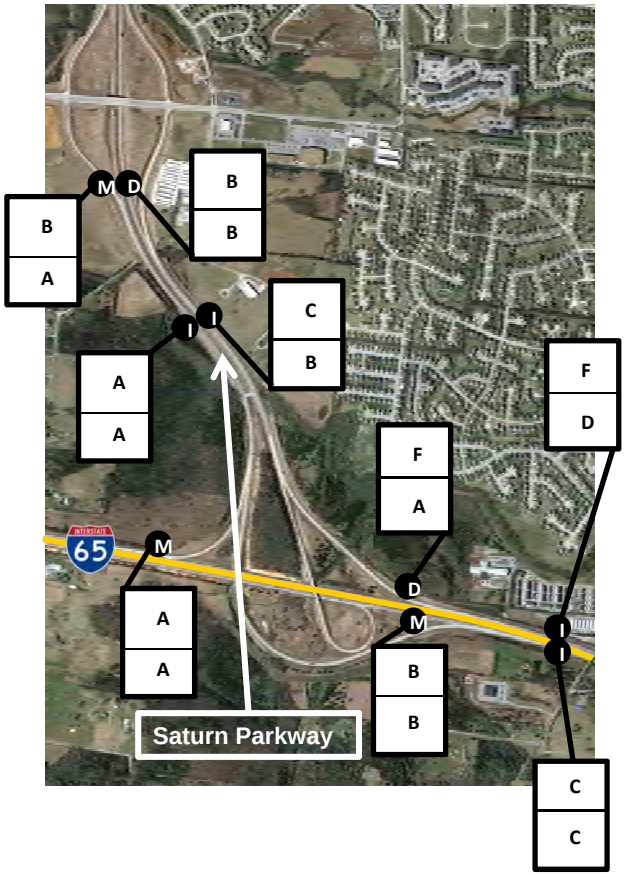


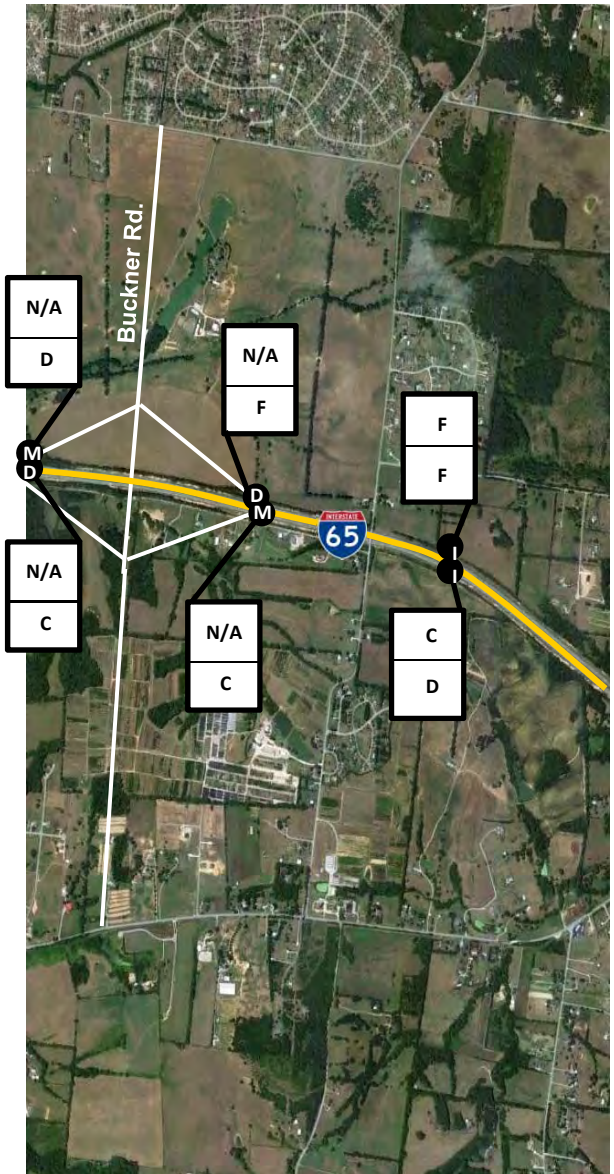
LEGEND

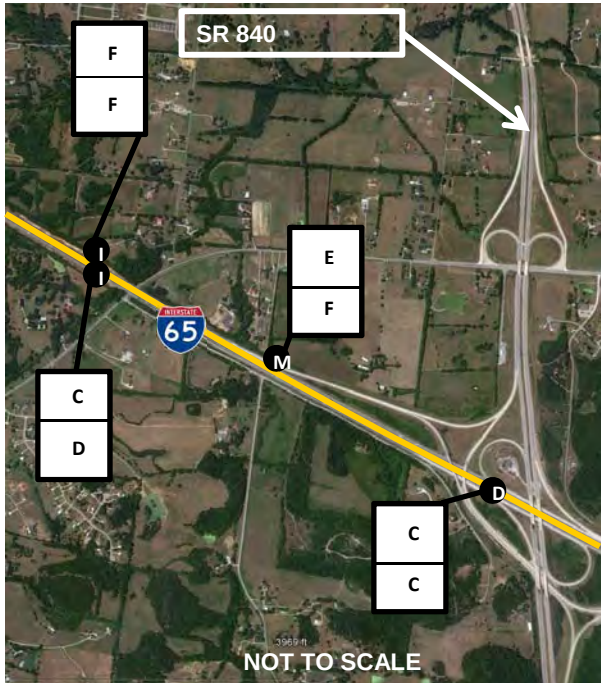
X	2037 LOS with no New Interchange
X	2037 LOS with Interchange at Buckner Rd.
(X)	M-Merge, D-Diverge, I-Interstate/ Parkway Link

Figure A13

2037 Interchange and Freeway PM LOS with New Interchange at Buckner Rd.







LEGEND

X
X
2037 LOS with no New Interchange
2037 LOS with Interchange at Buckner Rd.

X M-Merge, D-Diverge, I-Interstate/ Parkway Link

Figure A14

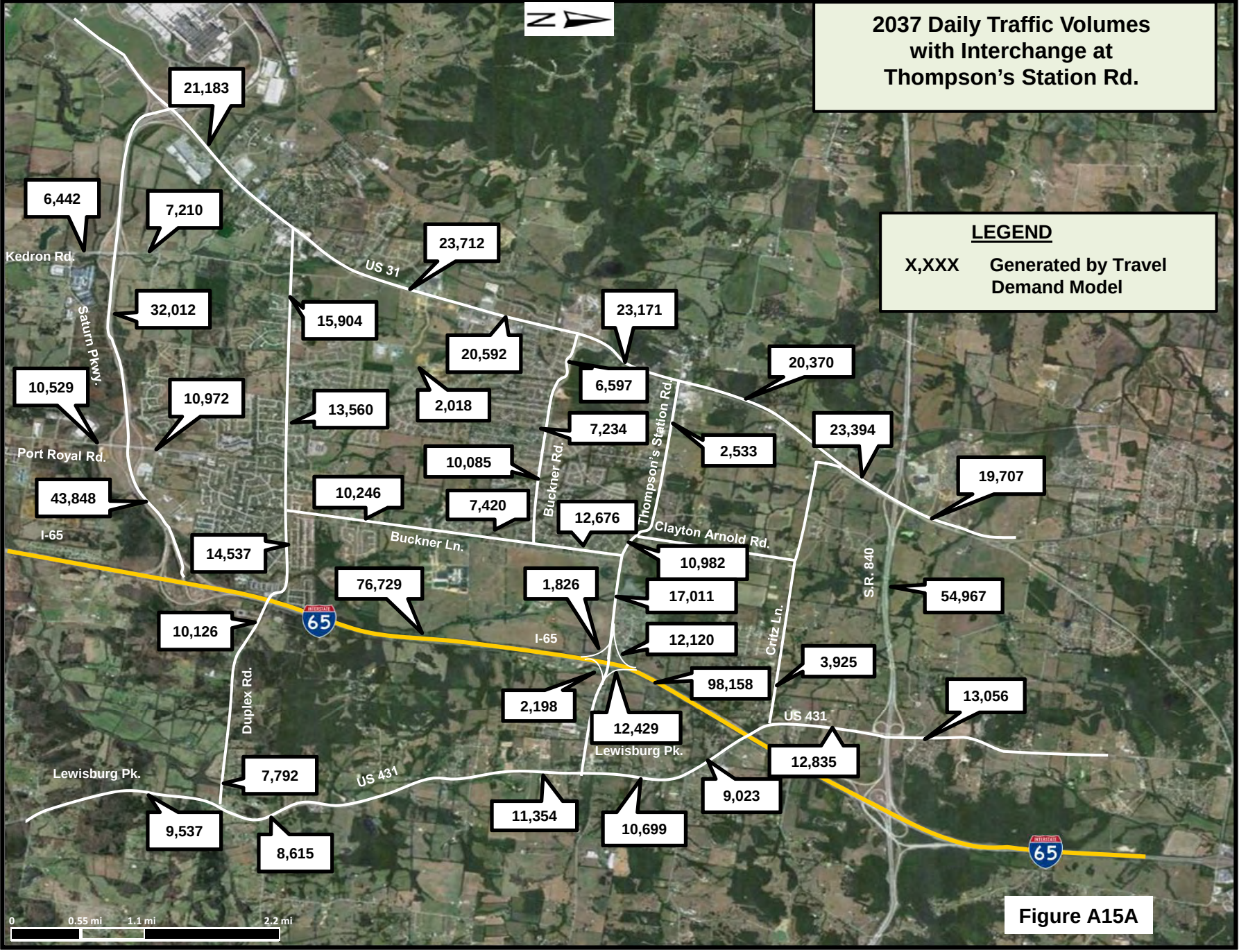

2037 Daily Traffic Volumes with Interchange at Thompson's Station Rd.
LEGEND
X,XXX Generated by Travel Demand Model
N
21,183
6,442
7,210
Kedron Rd.
23,712
US 31
32,012
15,904
23,171
Saturn Pkwy.
20,592
20,370
10,529
10,972
13,560
2,018
6,597
7,234
23,394
Port Royal Rd.
10,085
Buckner Rd.
Thompson's Station Rd.
2,533
19,707
43,848
10,246
7,420
12,676
I-65
Buckner Ln.
Clayton Arnold Rd.
14,537
10,982
76,729
1,826
17,011
S.R. 840
54,967
10,126
I-65
12,120
Critz Ln.
3,925
98,158
Duplex Rd.
2,198
13,056
12,429
US 431
Lewisburg Pk.
12,835
Lewisburg Pk.
7,792
US 431
9,023
11,354
10,699
9,537
8,615
0
0.55 mi
1.1 mi
2.2 mi

Figure A15A

2037 Daily Traffic Volumes With Interchange at Thompson's Station Rd.

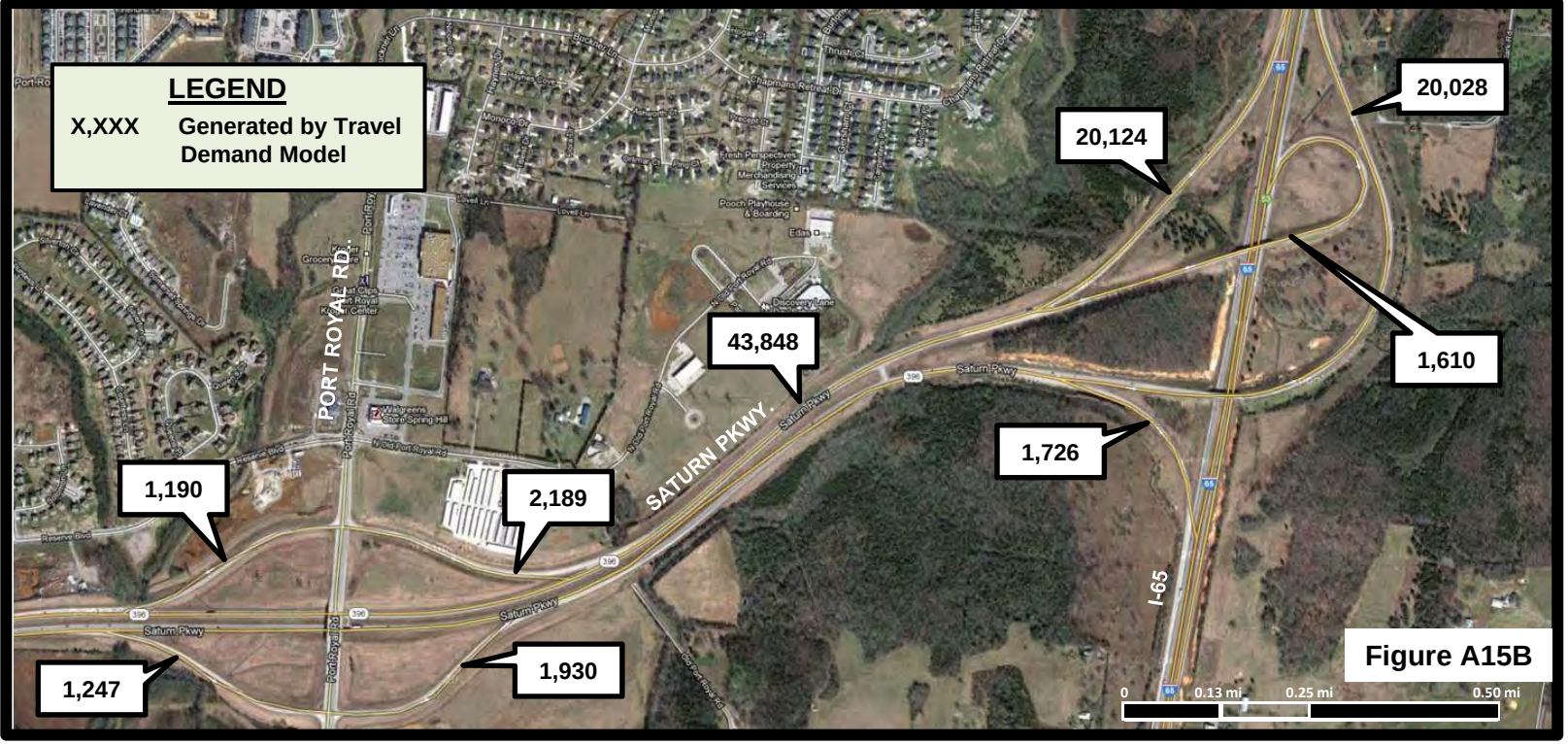


Figure A15B

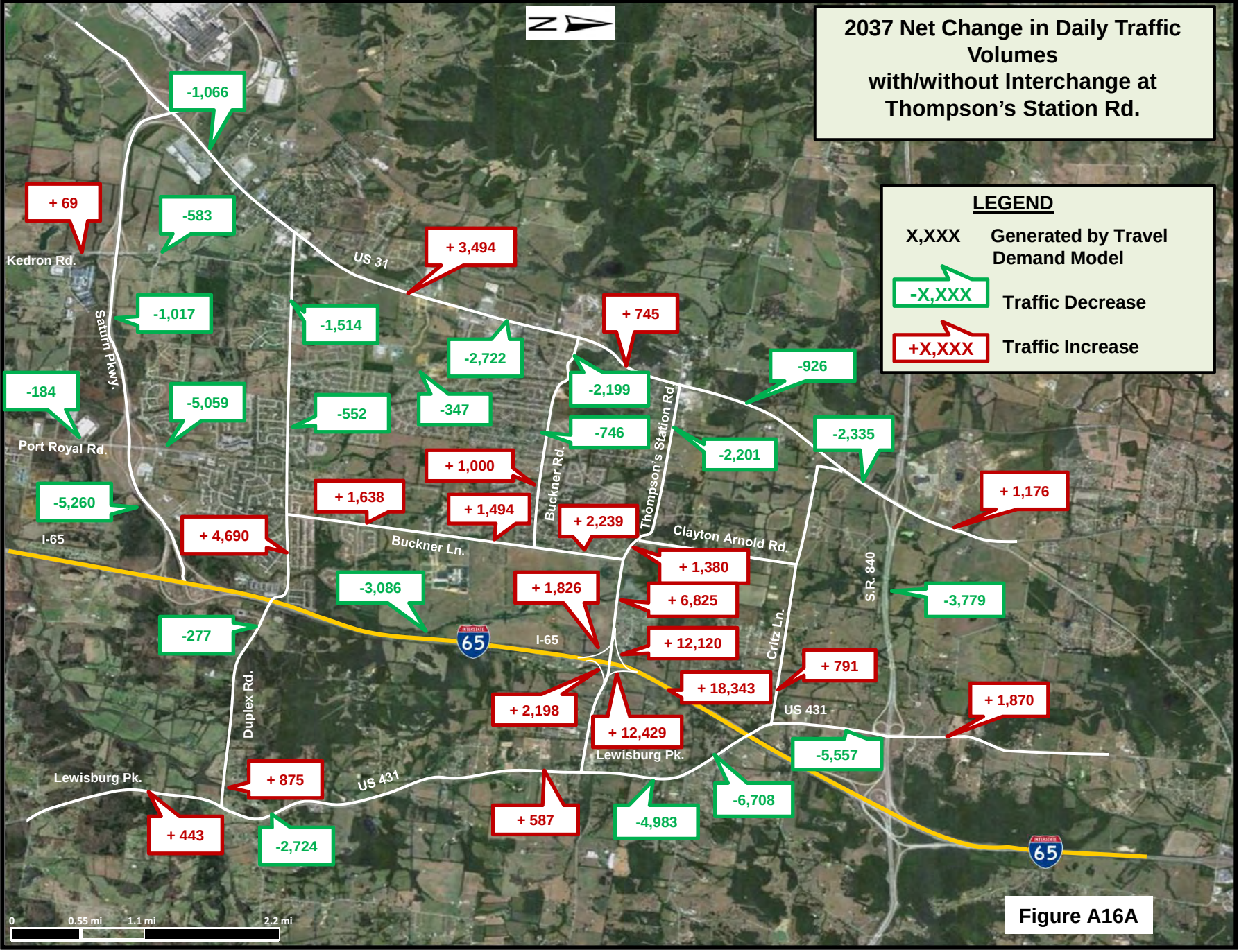

2037 Net Change in Daily Traffic Volumes
with/without Interchange at Thompson's Station Rd.
LEGEND
X,XXX Generated by Travel Demand Model
-X,XXX Traffic Decrease
+X,XXX Traffic Increase
-1,066
+ 69
-583
Kedron Rd.
US 31
+ 3,494
-1,017
-1,514
+ 745
Saturn Pkwy.
-2,722
-926
-184
-5,059
-552
-347
-2,199
Thompson's Station Rd.
Port Royal Rd.
-746
-2,201
-2,335
+ 1,000
Buckner Rd.
-5,260
+ 1,638
+ 1,494
+ 2,239
+ 1,176
I-65
+ 4,690
Buckner Ln.
Clayton Arnold Rd.
+ 1,380
-3,086
+ 1,826
+ 6,825
S.R. 840
-3,779
-277
I-65
+ 12,120
Critz Ln.
+ 791
+ 18,343
+ 2,198
US 431
+ 1,870
Duplex Rd.
+ 12,429
Lewisburg Pk.
-5,557
Lewisburg Pk.
+ 875
US 431
-6,708
+ 587
-4,983
+ 443
-2,724
0
0.55 mi
1.1 mi
2.2 mi

Figure A16A

2037 Daily Traffic Volumes With/without Interchange at Thompson's Station Rd.

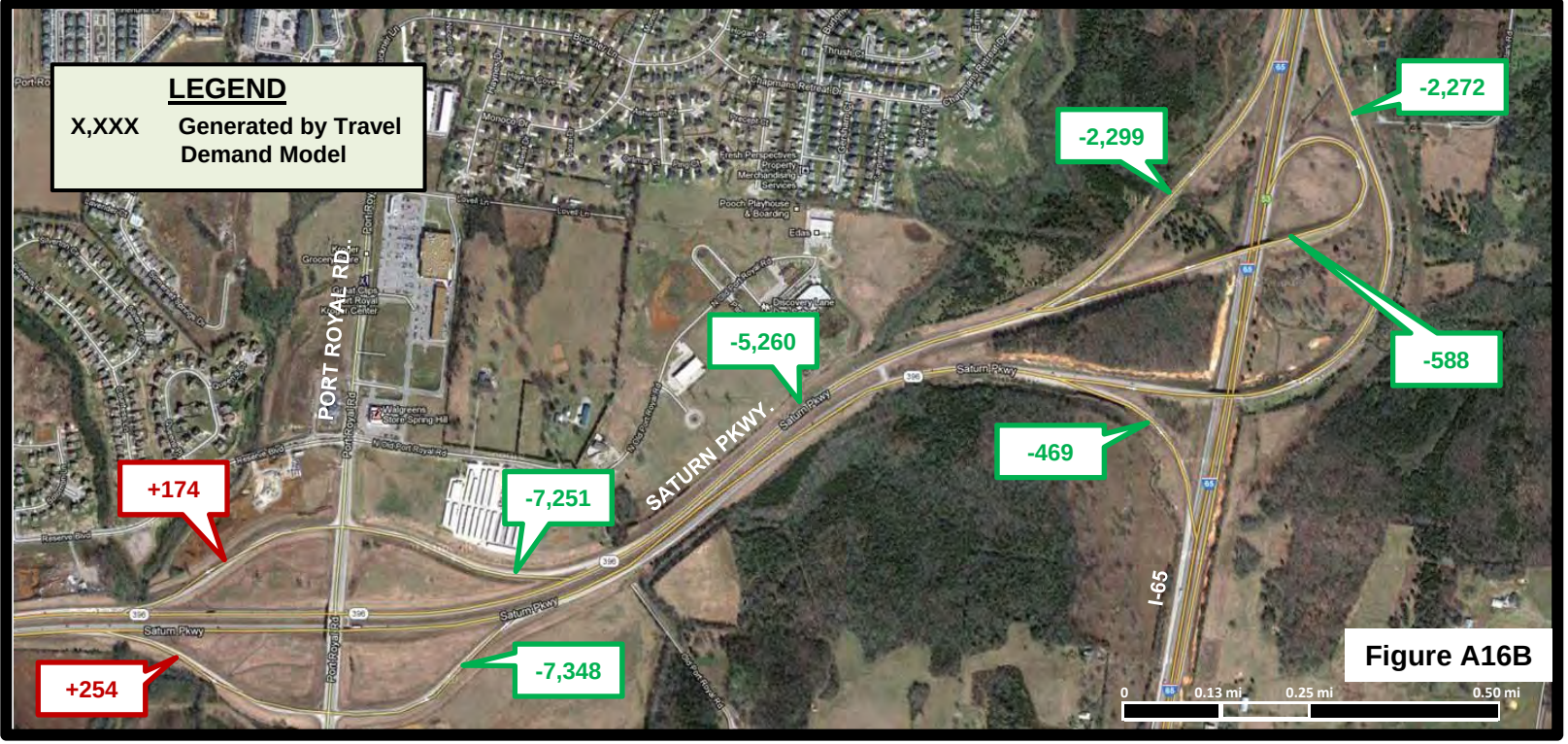


Figure A16B

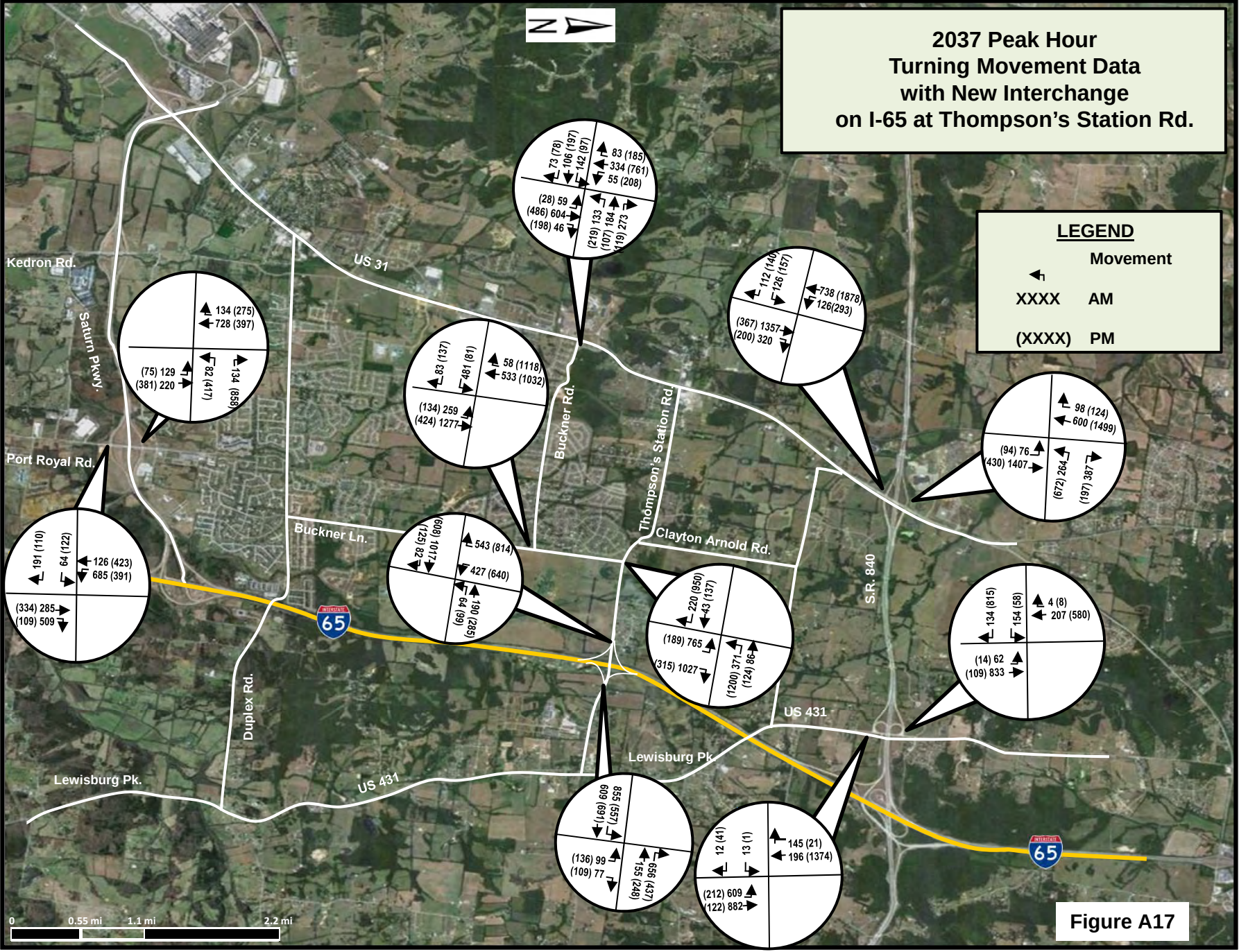
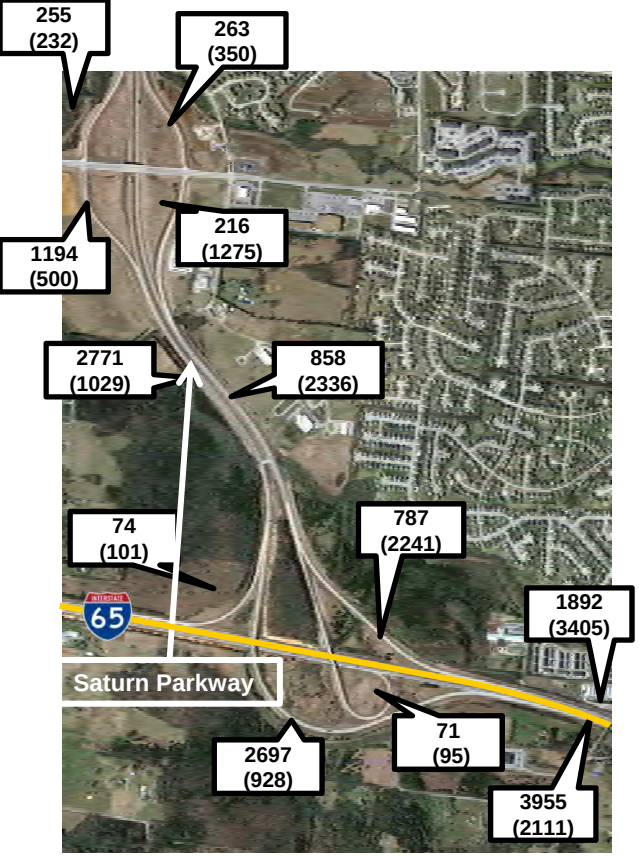

2037 Peak Hour
Turning Movement Data
with New Interchange
on I-65 at Thompson's Station Rd.
LEGEND
Movement
XXXX AM
(XXXX) PM
Kedron Rd.
Saturn Pkwy.
Port Royal Rd.
US 31
Buckner Rd.
Thompson's Station Rd.
Buckner Ln.
Clayton Arnold Rd.
S.R. 840
US 431
Lewisburg Pk.
Duplex Rd.
INTERSTATE 65
0 0.55 mi 1.1 mi 2.2 mi
73 (78)
106 (197)
142 (97)
83 (185)
334 (761)
55 (208)
(28) 59
(486) 604
(198) 46
(219) 133
(107) 184
(419) 273
134 (275)
728 (397)
(75) 129
(381) 220
82 (417)
134 (858)
83 (137)
481 (81)
58 (1118)
533 (1032)
(134) 259
(424) 1277
112 (140)
126 (157)
738 (1878)
126(293)
(367) 1357
(200) 320
98 (124)
600 (1499)
(94) 76
(430) 1407
(672) 264
(197) 387
191 (110)
64 (122)
126 (423)
685 (391)
(334) 285
(109) 509
82 (125)
(608) 1017
543 (814)
427 (640)
94 (99)
190 (285)
220 (950)
43 (137)
(189) 765
(315) 1027
(1200) 371
(124) 86
134 (815)
154 (58)
4 (8)
207 (580)
(14) 62
(109) 833
609 (691)
555 (557)
(136) 99
(109) 77
656 (437)
155 (248)
12 (41)
13 (1)
145 (21)
196 (1374)
(212) 609
(122) 882

Figure A17

2037 Peak Hour Traffic with New Interchange at Thompson's Station Rd.

LEGEND

X,XXX	AM Generated by Travel Demand Model
(X,XXX)	PM Generated by Travel Demand Model



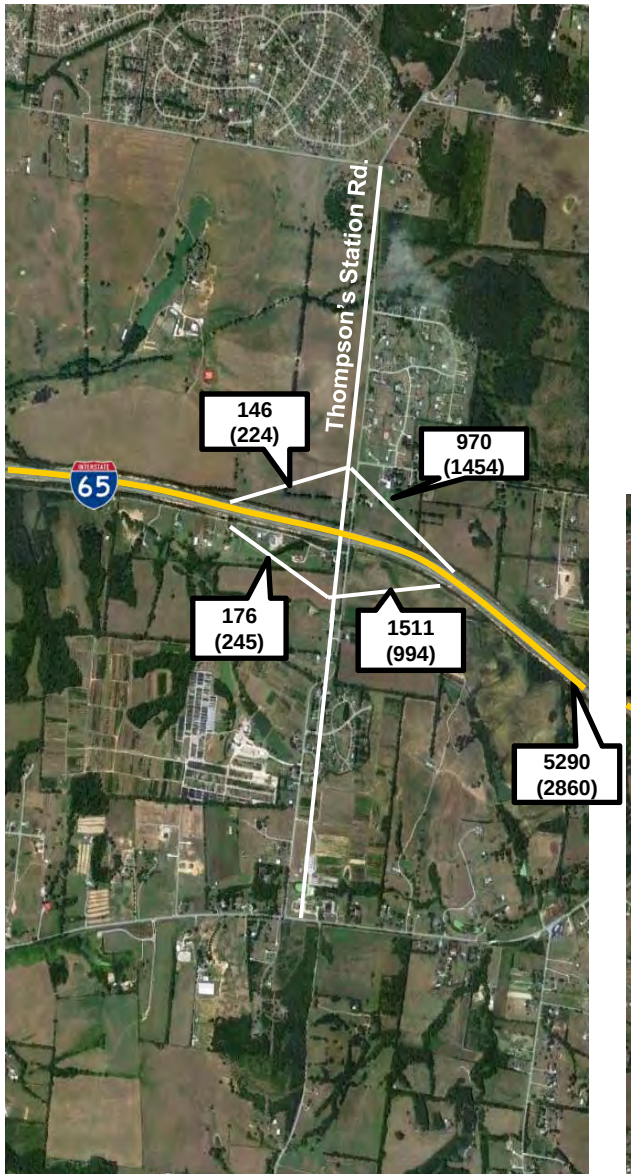
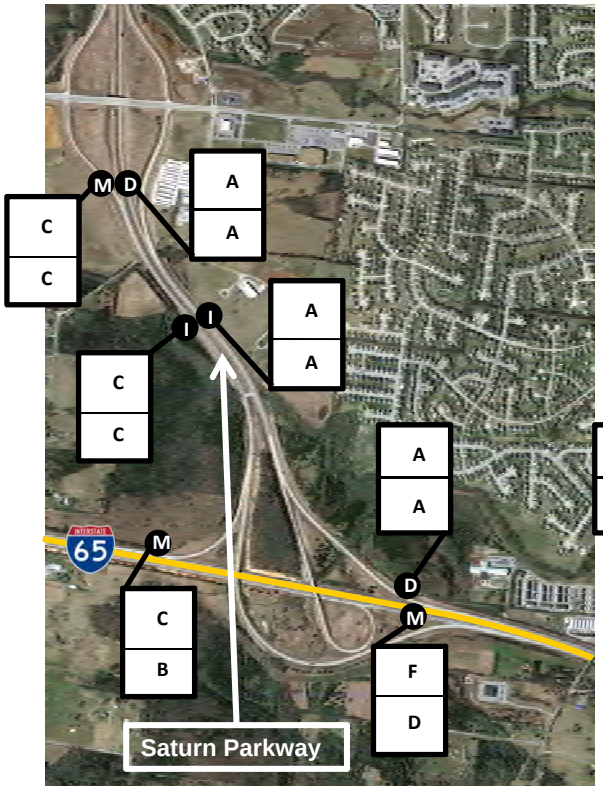
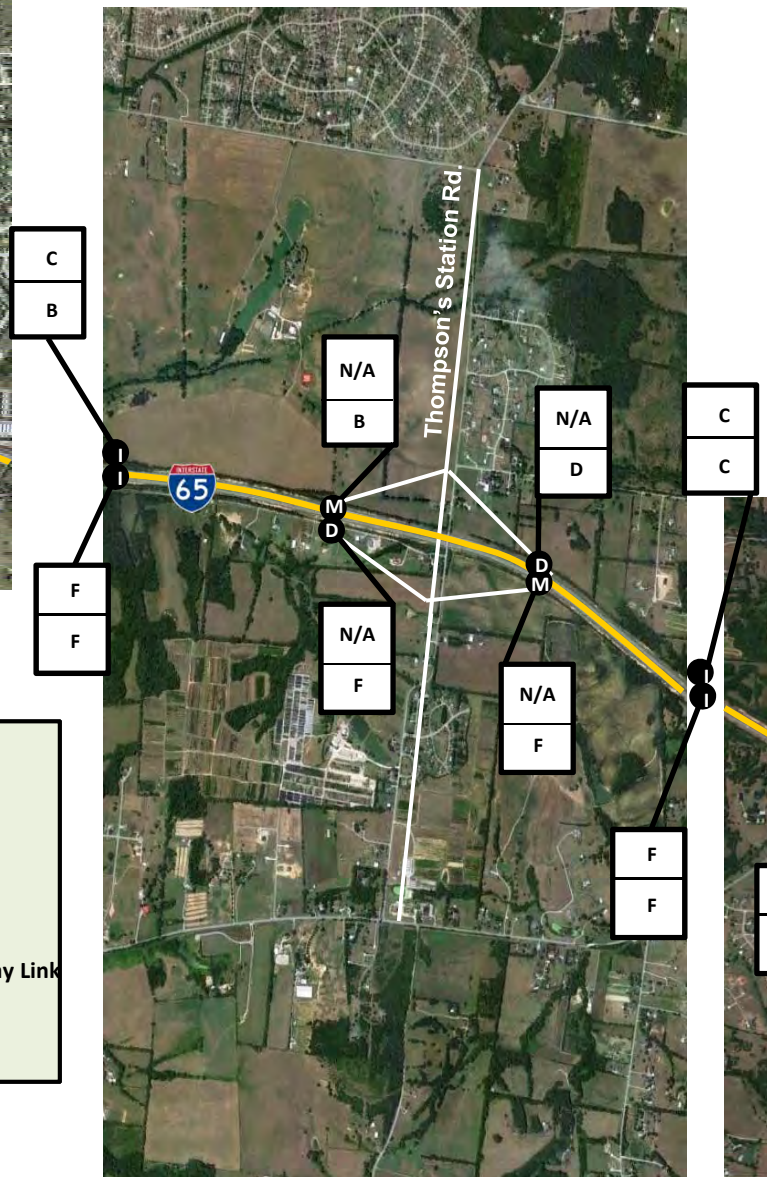
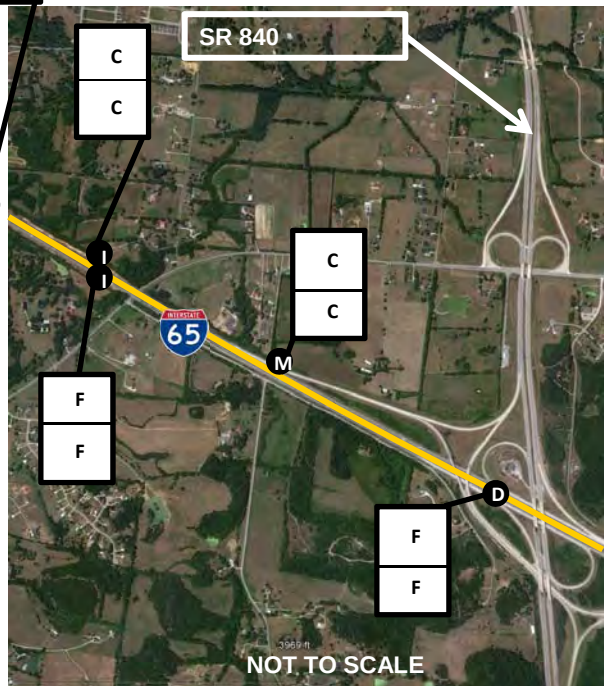


Figure A18

2037 Interchange and Freeway AM LOS with New Interchange at Thompson's Station Rd.





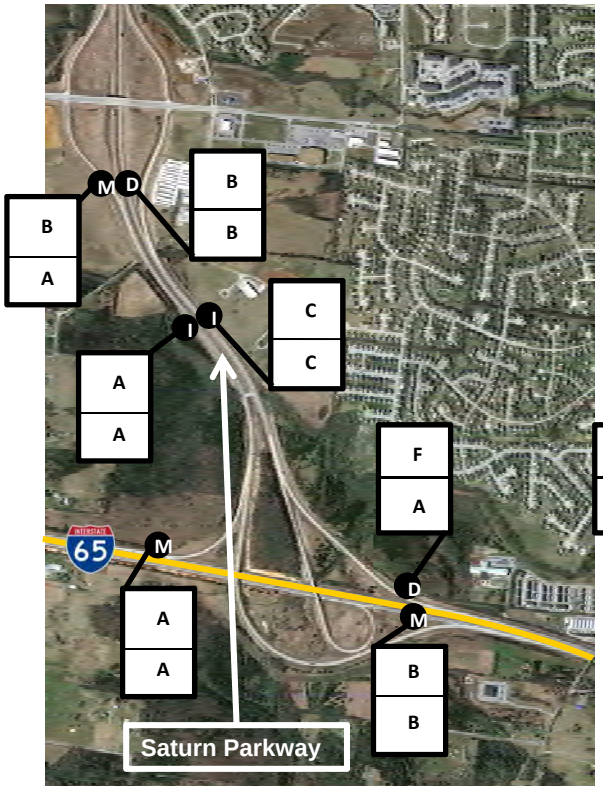


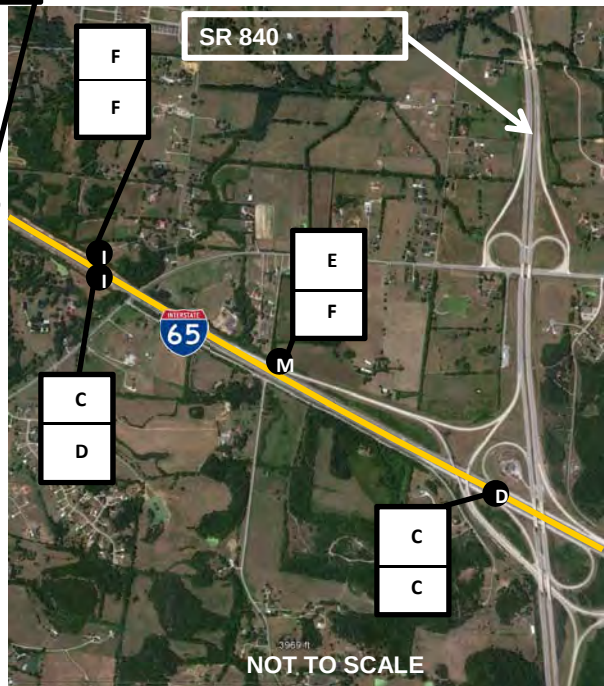
LEGEND

X / X	2037 LOS with no New Interchange
	2037 LOS with Interchange at Thompson Station Rd.
X	M-Merge, D-Diverge, I-Interstate/ Parkway Link

Figure A19

2037 Interchange and Freeway PM LOS with New Interchange at Thompson's Station Rd.





LEGEND

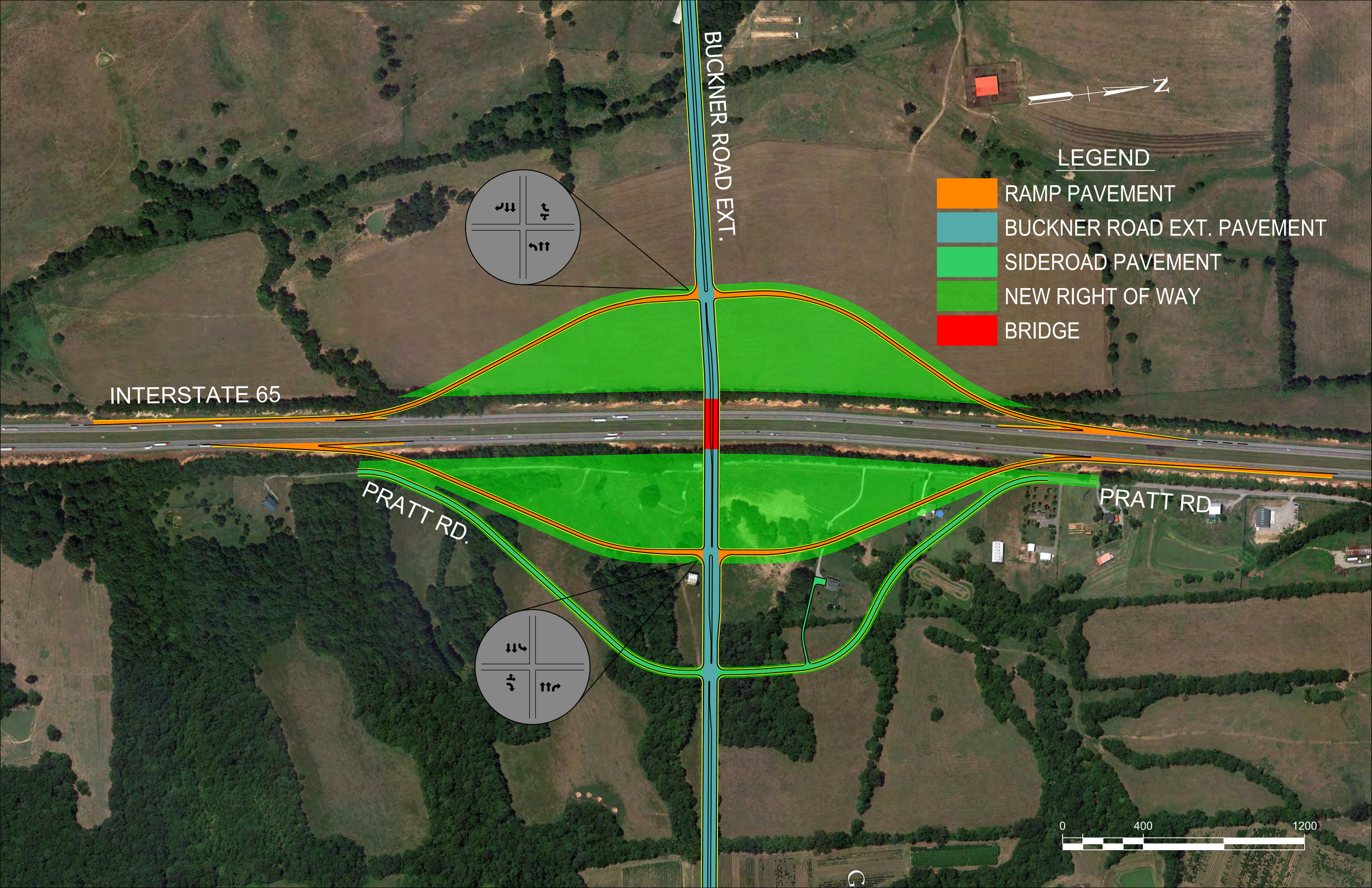
X / X — 2037 LOS with no New Interchange

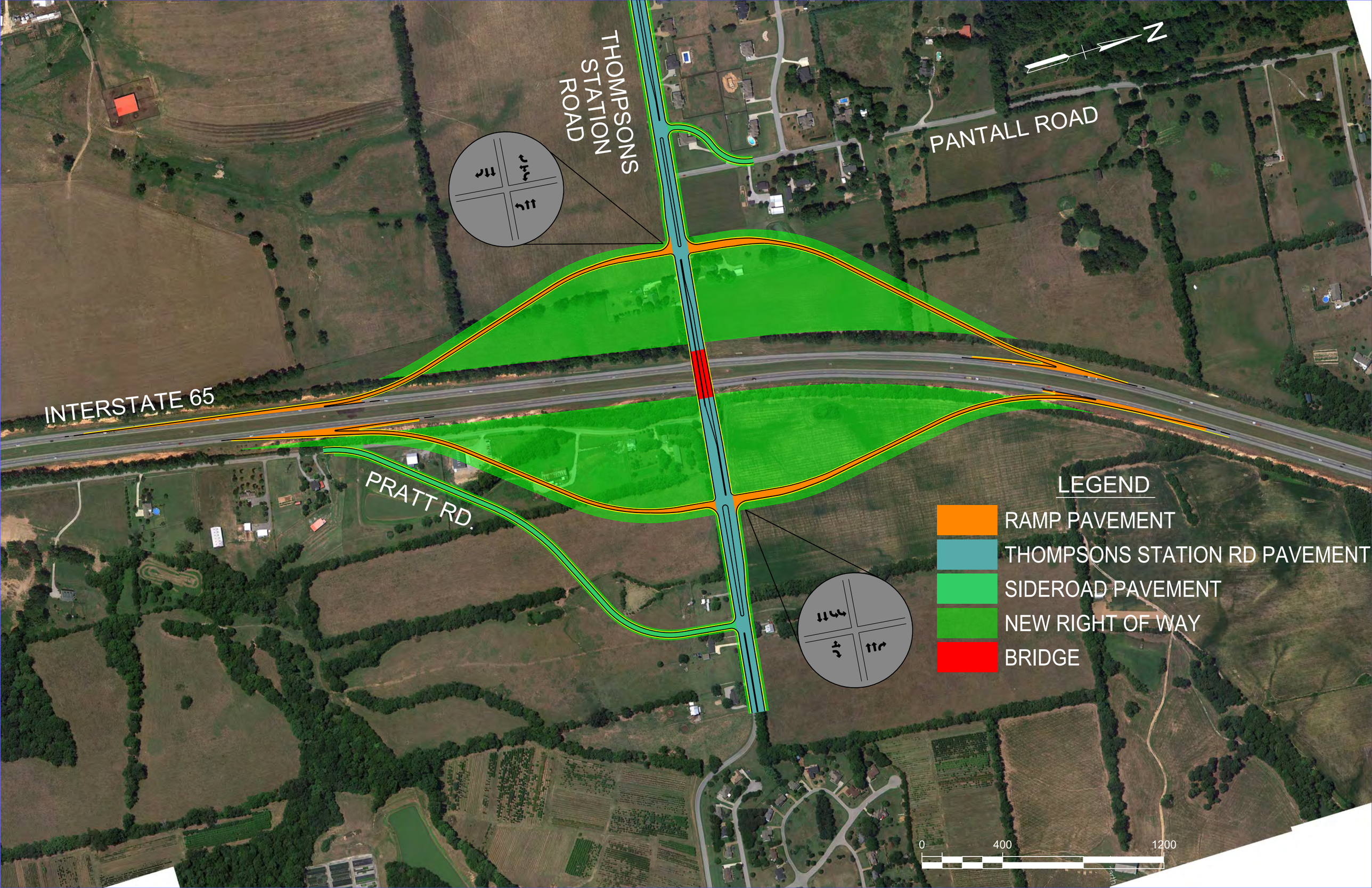
X / X — 2037 LOS with Interchange at Thompson Station Rd.

X — M-Merge, D-Diverge, I-Interstate/ Parkway Link

Figure A20

APPENDIX 2- BUILD ALTERNATIVE MAPS


BUCKNER ROAD EXT.
INTERSTATE 65
PRATT RD.
PRATT RD.
N
LEGEND
RAMP PAVEMENT
BUCKNER ROAD EXT. PAVEMENT
SIDEROAD PAVEMENT
NEW RIGHT OF WAY
BRIDGE
0
400
1200


THOMPSONS STATION ROAD
PANTALL ROAD
INTERSTATE 65
PRATT RD.
N
LEGEND
RAMP PAVEMENT
THOMPSONS STATION RD PAVEMENT
SIDEROAD PAVEMENT
NEW RIGHT OF WAY
BRIDGE
0
400
1200

APPENDIX 3- COST ESTIMATES

Route:	**Buckner Road Interchange at I-65**
Description:	**SUMMARY**
County:	**Williamson Co.**
Length:	
Date:	**April 25, 2013**

DESCRIPTION		Potential 10% State / Local Match	FEDERAL	TOTAL
Right-of-Way	$ -	$ 265,500	$ 2,389,500	$ 2,655,000
Clearing and Grubbing	$ -	$ 19,640	$ 176,760	$ 196,400
Earthwork	$ -	$ 628,320	$ 5,654,880	$ 6,283,200
Railroad Crossing or Separation	$ -	$ -	$ -	$ -
Drainage	$ -	$ 113,090	$ 1,017,810	$ 1,130,900
Utilities	$ -	$ 10,020	$ 90,180	$ 100,200
Structures	$ -	$ 234,000	$ 2,106,000	$ 2,340,000
Pavement Removal	$ -	$ -	$ -	$ -
Paving	$ -	$ 650,880	$ 5,857,920	$ 6,508,800
Roadway and Pavement Appurtenances	$ -	$ 45,230	$ 407,070	$ 452,300
Retaining Walls	$ -	$ -	$ -	$ -
Topsoil	$ -	$ 23,170	$ 208,530	$ 231,700
Seeding	$ -	$ 10,600	$ 95,400	$ 106,000
Sodding	$ -	$ -	$ -	$ -
Rip-Rap or Slope Protection	$ -	$ -	$ -	$ -
Fencing	$ -	$ 11,450	$ 103,050	$ 114,500
Signing [1]			$ 500,000	$ 500,000
Pavement Markings [1]			$ 75,400	$ 75,400
Lighting [1]			$ -	$ -
Signalization [1]			$ 600,000	$ 600,000
Guardrail [1]			$ 452,100	$ 452,100
SUB-TOTAL		$ 2,011,940	$ 19,734,560	$ 21,746,500
Other Construction Items (15%)		$ 301,800	$ 2,960,300	$ 3,262,100
Maintenance of Traffic		$ 13,600	$ 122,000	$ 135,500
SUB-TOTAL		$ 2,327,340	$ 22,816,860	$ 25,144,100
Mobilization (5%)		$ 116,400	$ 1,140,800	$ 1,257,200
CONSTRUCTION COST (rounded)		$ 2,443,740	$ 23,957,660	$ 26,401,300
Engineering and Contingency (10%)		$ 244,500	$ 2,395,800	$ 2,640,200
TOTAL CONSTRUCTION COST (rounded)		$ 2,688,240	$ 26,353,460	$ 29,041,500
Preliminary Engineering (10%)		$ 268,900	$ 2,635,400	$ 2,904,300
PROJECT COST [2](rounded)	**$ -**	**$ 2,957,100**	**$ 28,988,900**	**$ 31,945,800**

[1] ***Indicates safety item 100% eligible and does not require a 10% funding match by the local agency.***

[2] ***For estimating future project costs, a compounded inflation rate of 10% should be applied from the date of this estimate.***

Route:	**Buckner Road Interchange at I-65**
Description:	**New Interchange for Buckner Road at I-65**
	(Includes ramps, turn lanes on Buckner Rd at ramps, and Buckner Rd bridge over I-65)
County:	**Williamson Co.**
Length:	
Date:	**April 25, 2013**

DESCRIPTION		Potential 10% State / Local Match	FEDERAL	TOTAL
Right-of-Way	$ -	$ 196,500	$ 1,768,500	$ 1,965,000
Clearing and Grubbing	$ -	$ 13,880	$ 124,920	$ 138,800
Earthwork	$ -	$ 446,930	$ 4,022,370	$ 4,469,300
Railroad Crossing or Separation	$ -	$ -	$ -	$ -
Drainage	$ -	$ 60,850	$ 547,650	$ 608,500
Utilities	$ -	$ -	$ -	$ -
Structures	$ -	$ 234,000	$ 2,106,000	$ 2,340,000
Pavement Removal	$ -	$ -	$ -	$ -
Paving	$ -	$ 391,670	$ 3,525,030	$ 3,916,700
Roadway and Pavement Appurtenances	$ -	$ 7,340	$ 66,060	$ 73,400
Retaining Walls	$ -	$ -	$ -	$ -
Topsoil	$ -	$ 20,540	$ 184,860	$ 205,400
Seeding	$ -	$ 9,380	$ 84,420	$ 93,800
Sodding	$ -	$ -	$ -	$ -
Rip-Rap or Slope Protection	$ -	$ -	$ -	$ -
Fencing	$ -	$ 11,450	$ 103,050	$ 114,500
Signing [1]			$ 487,500	$ 487,500
Pavement Markings [1]			$ 38,000	$ 38,000
Lighting [1]			$ -	$ -
Signalization [1]			$ 300,000	$ 300,000
Guardrail [1]			$ 244,000	$ 244,000
SUB-TOTAL		$ 1,392,540	$ 13,602,360	$ 14,994,900
Other Construction Items (15%)		$ 208,900	$ 2,040,400	$ 2,249,300
Maintenance of Traffic		$ 9,800	$ 87,800	$ 97,500
SUB-TOTAL		$ 1,611,240	$ 15,730,560	$ 17,341,700
Mobilization (5%)		$ 80,600	$ 786,500	$ 867,100
CONSTRUCTION COST (rounded)		$ 1,691,840	$ 16,517,060	$ 18,208,800
Engineering and Contingency (10%)		$ 169,200	$ 1,651,700	$ 1,820,900
TOTAL CONSTRUCTION COST (rounded)		$ 1,861,040	$ 18,168,760	$ 20,029,700
Preliminary Engineering (10%)		$ 186,100	$ 1,816,900	$ 2,003,000
PROJECT COST [2](rounded)	**$ -**	**$ 2,047,100**	**$ 19,985,700**	**$ 22,032,700**

[1] ***Indicates safety item 100% eligible and does not require a 10% funding match by the local agency.***

[2] ***For estimating future project costs, a compounded inflation rate of 10% should be applied from the date of this estimate.***

Buckner Road at I-65 | **New Buckner Road Interchange** | **Pay Item Summary**

TDOT PAY ITEM	Buckner Road Interchange at I-65	UNIT	QUANTITY	UNIT COST	TOTAL COST
	Residential Relocation (2636 Pratt Road)	LS	1	$ 300,000.00	$ 300,000
	Right - of - way	AC	56	$ 30,000.00	$ 1,665,000
			RIGHT-OF-WAY TOTAL (ROUNDED)		**$ 1,965,000**
201-01	Clearing and Grubbing	LS	56	$ 2,500.00	$ 138,750
			CLEAR AND GRUBBING TOTAL (ROUNDED)		**$ 138,800**
203-01	Excavation (Unclassified)	CY	446928	$ 10.00	$ 4,469,281
			EARTHWORK TOTAL (ROUNDED)		**$ 4,469,300**
607-03.02	18" Conc. Pipe Culvert (Class III)	LF	1459	$ 50.00	$ 72,950
607-05.02	24" Conc. Pipe Culvert (Class III)	LF	1459	$ 60.00	$ 87,540
607-06.02	30" Conc. Pipe Culvert (Class III)	LF	875	$ 70.00	$ 61,250
607-07.02	36" Conc. Pipe Culvert (Class III)	LF	875	$ 90.00	$ 78,750
611-12.02	Catch Basin	EA	88	$ 3,500.00	$ 308,000
			DRAINAGE TOTAL (ROUNDED)		**$ 608,500**
	New Bridge	SF	19,500	$ 120.00	$ 2,340,000
			STRUCTURES TOTAL (ROUNDED)		**$ 2,340,000**
Asphalt					
307-03.01	4" Base (Widening)	TON	6451.9	$ 70.00	$ 451,632
307-03.08	3" Binder (Widening)	TON	4754.8	$ 75.00	$ 356,607
411-03.10	1.25" Surface (Widening)	TON	1855.4	$ 90.00	$ 166,990
402-01	Prime	TON	47.8	$ 550.00	$ 26,298
403-01	Tack	TON	18.2	$ 550.00	$ 10,018
303-01	Stone	TON	12654.4	$ 20.00	$ 253,088
303-01	Shoulder Stone	TON	4591.3	$ 20.00	$ 91,826
303-01	Shoulder Stone (Wedge)	TON	16065.6	$ 20.00	$ 321,311
Ramp					
501-01.02	Portland Cement Concrete Pvmt (Plain) 9"	SY	34728.9	$ 50.00	$ 1,736,444
303-01	Mineral Aggregate, TY A Base, Grading D	TON	7755.0	$ 20.00	$ 155,099
313-03	Treated Permeable Base	SY	34728.9	$ 10.00	$ 347,289
			PAVING TOTAL (ROUNDED)		**$ 3,916,700**
702-01	Conc. Curb	CY	386	$ 190.00	$ 73,392
			ROADWAY AND PAVEMENT APPURTENANCES TOTAL (ROUNDED)		**$ 73,400**
712-01	Traffic Control	LM	1.5	$ 65,000.00	$ 97,500
			MAINTENANCE OF TRAFFIC TOTAL (ROUNDED)		**$ 97,500**
203-07	Furnishing & Spreading Topsoil	CY	34229	$ 6.00	$ 205,376
			TOPSOIL TOTAL (ROUNDED)		**$ 205,400**
801-01	Seeding (With Mulch)	UNIT	2,310	$ 40.00	$ 92,419
801-03	Water	MG	185	$ 7.00	$ 1,294
			SEEDING TOTAL (ROUNDED)		**$ 93,800**
713-99.91	Signs	LM	1.5	$ 5,000.00	$ 7,500
713-30.01	Erect Overhead Sign Truss	EA	6	$ 80,000.00	$ 480,000
			SIGNING TOTAL (ROUNDED)		**$ 487,500**
716-02.04	Plastic Pavement Marking (Channel. Striping)	SY	33	$ 25.00	$ 835

Buckner Road at I-65 | **New Buckner Road Interchange** | **Pay Item Summary**

TDOT PAY ITEM	Buckner Road Interchange at I-65	UNIT	QUANTITY	UNIT COST	TOTAL COST
716-02.05	Plastic Pavement Marking (Stop Line)	LF	168	$ 15.00	$ 2,520
716-02.06	Plastic Pavement Marking (Turn Lane Arrow)	EA	6	$ 125.00	$ 750
716-03.01	Plastic Word Pavement Marking (Only)	EA	2	$ 225.00	$ 450
716-04.01	Plastic Pavement Marking (Straight-Turn Arrow)	EA	2	$ 320.00	$ 640
716-12.01	Enhanced Flatline Thermo Pvmt Mrkng (4" Line)	LM	8.200	$ 4,000.00	$ 32,800
				PAVEMENT MARKINGS TOTAL (ROUNDED)	**$ 38,000**
730-01	Traffic Signal	LS	2	$ 150,000.00	$ 300,000
				SIGNALIZATION TOTAL (ROUNDED)	**$ 300,000**
707-08.01	Fence	LF	11,450	$ 10.00	$ 114,500
				FENCE TOTAL (ROUNDED)	**$ 114,500**
705-02.02	Single Guardrail (Type 2)	LF	12,319	$ 18.00	$ 221,742
705-04.02	Guardrail Terminal (Type 12)			@ 10% of GR	$ 22,174
				GUARDRAIL TOTAL (ROUNDED)	**$ 244,000**

Route:	**Buckner Road Interchange at I-65**
Description:	**Buckner Road, 4-Lane Extension**
	From Buckner Ln to Lewisburg Pk (does not include interchange or turn lanes at ramps)
County:	**Williamson Co.**
Length:	***8000 L.F. +***
Date:	**April 25, 2013**

DESCRIPTION		Potential 10% State / Local Match	FEDERAL	TOTAL
Right-of-Way	$ -	$ 52,500	$ 472,500	$ 525,000
Clearing and Grubbing	$ -	$ 4,380	$ 39,420	$ 43,800
Earthwork	$ -	$ 140,750	$ 1,266,750	$ 1,407,500
Railroad Crossing or Separation	$ -	$ -	$ -	$ -
Drainage	$ -	$ 31,720	$ 285,480	$ 317,200
Utilities	$ -	$ -	$ -	$ -
Structures	$ -	$ -	$ -	$ -
Pavement Removal	$ -	$ -	$ -	$ -
Paving	$ -	$ 186,410	$ 1,677,690	$ 1,864,100
Roadway and Pavement Appurtenances	$ -	$ 37,890	$ 341,010	$ 378,900
Retaining Walls	$ -	$ -	$ -	$ -
Topsoil	$ -	$ 1,600	$ 14,400	$ 16,000
Seeding	$ -	$ 740	$ 6,660	$ 7,400
Sodding	$ -	$ -	$ -	$ -
Rip-Rap or Slope Protection	$ -	$ -	$ -	$ -
Fencing	$ -	$ -	$ -	$ -
Signing [1]			$ 7,600	$ 7,600
Pavement Markings [1]			$ 20,700	$ 20,700
Lighting [1]			$ -	$ -
Signalization [1]			$ 150,000	$ 150,000
Guardrail [1]			$ 126,800	$ 126,800
SUB-TOTAL		$ 456,000	$ 4,409,000	$ 4,865,000
Other Construction Items (15%)		$ 68,400	$ 661,400	$ 729,800
Maintenance of Traffic		$ 2,000	$ 18,000	$ 20,000
SUB-TOTAL		$ 526,400	$ 5,088,400	$ 5,614,800
Mobilization (5%)		$ 26,300	$ 254,400	$ 280,700
CONSTRUCTION COST (rounded)		$ 552,700	$ 5,342,800	$ 5,895,500
Engineering and Contingency (10%)		$ 55,300	$ 534,300	$ 589,600
TOTAL CONSTRUCTION COST (rounded)		$ 608,000	$ 5,877,100	$ 6,485,100
Preliminary Engineering (10%)		$ 60,800	$ 587,700	$ 648,500
PROJECT COST [2](rounded)	**$ -**	**$ 668,800**	**$ 6,464,800**	**$ 7,133,600**

[1] ***Indicates safety item 100% eligible and does not require a 10% funding match by the local agency.***

[2] ***For estimating future project costs, a compounded inflation rate of 10% should be applied from the date of this estimate.***

TDOT PAY ITEM	TDOT DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
	Right - of - way	AC	17.5	$ 30,000.00	$ 525,000
			RIGHT-OF-WAY TOTAL (ROUNDED)		**$ 525,000**
201-01	Clearing and Grubbing	LS	17.5	$ 2,500.00	$ 43,750
			CLEAR AND GRUBBING TOTAL (ROUNDED)		**$ 43,800**
203-01	Excavation (Unclassified)	CY	140741	$ 10.00	$ 1,407,407
			EARTHWORK TOTAL (ROUNDED)		**$ 1,407,500**
607-03.02	18" Conc. Pipe Culvert (Class III)	LF	758	$ 50.00	$ 37,900
607-05.02	24" Conc. Pipe Culvert (Class III)	LF	758	$ 60.00	$ 45,480
607-06.02	30" Conc. Pipe Culvert (Class III)	LF	455	$ 70.00	$ 31,850
607-07.02	36" Conc. Pipe Culvert (Class III)	LF	455	$ 90.00	$ 40,950
611-12.02	Catch Basin	EA	46	$ 3,500.00	$ 161,000
			DRAINAGE TOTAL (ROUNDED)		**$ 317,200**
Asphalt					
307-03.01	4" Base	TON	9307.3	$ 70.00	$ 651,513
307-03.08	3" Binder	TON	6859.1	$ 75.00	$ 514,433
411-03.10	1.25" Surface	TON	2676.6	$ 90.00	$ 240,896
402-01	Prime	TON	69.0	$ 550.00	$ 37,938
403-01	Tack	TON	26.3	$ 550.00	$ 14,452
303-01	Stone	TON	18255.0	$ 20.00	$ 365,099
303-01	Curb Stone	TON	1984.4	$ 20.00	$ 39,689
			PAVING TOTAL (ROUNDED)		**$ 1,864,100**
702-01	Conc. Curb	CY	724	$ 190.00	$ 137,563
702-03	Conc. Curb and Gutter	CY	1149	$ 210.00	$ 241,282
			ROADWAY AND PAVEMENT APPURTENANCES TOTAL (ROUNDED)		**$ 378,900**
712-01	Traffic Control	LS	1	$ 20,000.00	$ 20,000
			MAINTENANCE OF TRAFFIC TOTAL (ROUNDED)		**$ 20,000**
203-07	Furnishing & Spreading Topsoil	CY	2667	$ 6.00	$ 16,000
			TOPSOIL TOTAL (ROUNDED)		**$ 16,000**
801-01	Seeding (With Mulch)	UNIT	180	$ 40.00	$ 7,200
801-03	Water	MG	14	$ 7.00	$ 101
			SEEDING TOTAL (ROUNDED)		**$ 7,400**
713-99.91	Signs	LM	1.5	$ 5,000.00	$ 7,576
			SIGNING TOTAL (ROUNDED)		**$ 7,600**
716-02.04	Plastic Pavement Marking (Channel. Striping)	SY	84	$ 25.00	$ 2,100
716-02.06	Plastic Pavement Marking (Turn Lane Arrow)	EA	3	$ 125.00	$ 375
716-03.01	Plastic Word Pavement Marking (Only)	EA	3	$ 225.00	$ 675
716-04.01	Plastic Pavement Marking (Straight-Turn Arrow)	EA	1	$ 320.00	$ 320
716-12.01	Enhanced Flatline Thermo Pvmt Mrkng (4" Line)	LM	4.288	$ 4,000.00	$ 17,152
			PAVEMENT MARKINGS TOTAL (ROUNDED)		**$ 20,700**
730-01	Traffic Signal	LS	1	$ 150,000.00	$ 150,000
			SIGNALIZATION TOTAL (ROUNDED)		**$ 150,000**
705-02.02	Single Guardrail (Type 2)	LF	6,400	$ 18.00	$ 115,200
705-04.02	Guardrail Terminal (Type 12)			@ 10% of GR	$ 11,520
			GUARDRAIL TOTAL (ROUNDED)		**$ 126,800**

Route:	**Buckner Road Interchange at I-65**
Description:	**Buckner Lane Improvements**
	Turn Lanes at Buckner Rd. and Thompsons Station Rd.
County:	**Williamson Co.**
Length:	***1000 L.F. ±***
Date:	**April 25, 2013**

DESCRIPTION		Potential 10% State / Local Match	FEDERAL	TOTAL
Right-of-Way	$ -	$ 2,400	$ 21,600	$ 24,000
Clearing and Grubbing	$ -	$ 200	$ 1,800	$ 2,000
Earthwork	$ -	$ 2,920	$ 26,280	$ 29,200
Railroad Crossing or Separation	$ -	$ -	$ -	$ -
Drainage	$ -	$ 4,160	$ 37,440	$ 41,600
Utilities	$ -	$ 1,950	$ 17,550	$ 19,500
Structures	$ -	$ -	$ -	$ -
Pavement Removal	$ -	$ -	$ -	$ -
Paving	$ -	$ 10,520	$ 94,680	$ 105,200
Roadway and Pavement Appurtenances	$ -	$ -	$ -	$ -
Retaining Walls	$ -	$ -	$ -	$ -
Topsoil	$ -	$ 210	$ 1,890	$ 2,100
Seeding	$ -	$ 100	$ 900	$ 1,000
Sodding	$ -	$ -	$ -	$ -
Rip-Rap or Slope Protection	$ -	$ -	$ -	$ -
Fencing	$ -	$ -	$ -	$ -
Signing [1]			$ 1,000	$ 1,000
Pavement Markings [1]			$ 3,900	$ 3,900
Lighting [1]			$ -	$ -
Signalization [1]			$ 150,000	$ 150,000
Guardrail [1]			$ 16,700	$ 16,700
SUB-TOTAL		$ 22,500	$ 373,700	$ 396,200
Other Construction Items (15%)		$ 3,400	$ 56,100	$ 59,500
Maintenance of Traffic		$ 1,300	$ 11,700	$ 13,000
SUB-TOTAL		$ 27,200	$ 441,500	$ 468,700
Mobilization (5%)		$ 1,400	$ 22,100	$ 23,500
CONSTRUCTION COST (rounded)		$ 28,600	$ 463,600	$ 492,200
Engineering and Contingency (10%)		$ 2,900	$ 46,400	$ 49,200
TOTAL CONSTRUCTION COST (rounded)		$ 31,500	$ 510,000	$ 541,400
Preliminary Engineering (10%)		$ 3,200	$ 51,000	$ 54,200
PROJECT COST [2](rounded)	**$ -**	**$ 34,700**	**$ 561,000**	**$ 595,600**

[1] ***Indicates safety item 100% eligible and does not require a 10% funding match by the local agency.***

[2] ***For estimating future project costs, a compounded inflation rate of 10% should be applied from the date of this estimate.***

Thompsons Station Rd at I-65 | **Buckner Lane Improvements** | **Pay Item Summary**

TDOT PAY ITEM	TDOT DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
	Right - of - way	AC	0.8	$ 30,000.00	$ 24,000
			RIGHT-OF-WAY TOTAL (ROUNDED)		**$ 24,000**
201-01	Clearing and Grubbing	LS	0.8	$ 2,500.00	$ 2,000
			CLEAR AND GRUBBING TOTAL (ROUNDED)		**$ 2,000**
203-01	Excavation (Unclassified)	CY	2917	$ 10.00	$ 29,167
			EARTHWORK TOTAL (ROUNDED)		**$ 29,200**
607-03.02	18" Conc. Pipe Culvert (Class III)	LF	100	$ 50.00	$ 5,000
607-05.02	24" Conc. Pipe Culvert (Class III)	LF	100	$ 60.00	$ 6,000
607-06.02	30" Conc. Pipe Culvert (Class III)	LF	60	$ 70.00	$ 4,200
607-07.02	36" Conc. Pipe Culvert (Class III)	LF	60	$ 90.00	$ 5,400
611-12.02	Catch Basin	EA	6	$ 3,500.00	$ 21,000
			DRAINAGE TOTAL (ROUNDED)		**$ 41,600**
	5% of Total Construction Cost		389,700	x 5%	$ 19,485
			UTILITIES TOTAL (ROUNDED)		**$ 19,500**
Asphalt					
307-03.01	4" Base (Widening)	TON	536.7	$ 70.00	$ 37,567
307-03.08	3" Binder (Widening)	TON	395.5	$ 75.00	$ 29,663
411-03.10	1.25" Surface (Widening)	TON	154.3	$ 90.00	$ 13,890
402-01	Prime	TON	4.0	$ 550.00	$ 2,188
403-01	Tack	TON	1.5	$ 550.00	$ 833
303-01	Stone	TON	1052.6	$ 20.00	$ 21,052
			PAVING TOTAL (ROUNDED)		**$ 105,200**
			ROADWAY AND PAVEMENT APPURTENANCES TOTAL (ROUNDED)		**$ -**
712-01	Traffic Control	LM	0.2	$ 65,000.00	$ 13,000
			MAINTENANCE OF TRAFFIC TOTAL (ROUNDED)		**$ 13,000**
203-07	Furnishing & Spreading Topsoil	CY	350	$ 6.00	$ 2,100
			TOPSOIL TOTAL (ROUNDED)		**$ 2,100**
801-01	Seeding (With Mulch)	UNIT	24	$ 40.00	$ 945
801-03	Water	MG	2	$ 7.00	$ 13
			SEEDING TOTAL (ROUNDED)		**$ 1,000**
713-99.91	Signs	LM	0.2	$ 5,000.00	$ 994
			SIGNING TOTAL (ROUNDED)		**$ 1,000**
716-03.01	Plastic Word Pavement Marking (Only)	EA	2	$ 225.00	$ 450
716-12.01	Enhanced Flatline Thermo Pvmt Mrkng (4" Line)	LM	0.521	$ 4,000.00	$ 2,083
			PAVEMENT MARKINGS TOTAL (ROUNDED)		**$ 3,900**
730-01	Traffic Signal	LS	1	$ 150,000.00	$ 150,000
			SIGNALIZATION TOTAL (ROUNDED)		**$ 150,000**
705-02.02	Single Guardrail (Type 2)	LF	840	$ 18.00	$ 15,120
705-04.02	Guardrail Terminal (Type 12)			@ 10% of GR	$ 1,512
			GUARDRAIL TOTAL (ROUNDED)		**$ 16,700**

Route:	**Buckner Road Interchange at I-65**
Description:	**Relocated Pratt Rd.**
County:	**Williamson Co.**
Length:	***4100 L.F. +***
Date:	**April 25, 2013**

DESCRIPTION		Potential 10% State / Local Match	FEDERAL	TOTAL
Right-of-Way	$ -	$ 14,100	$ 126,900	$ 141,000
Clearing and Grubbing	$ -	$ 1,180	$ 10,620	$ 11,800
Earthwork	$ -	$ 37,720	$ 339,480	$ 377,200
Railroad Crossing or Separation	$ -	$ -	$ -	$ -
Drainage	$ -	$ 16,360	$ 147,240	$ 163,600
Utilities	$ -	$ 8,070	$ 72,630	$ 80,700
Structures	$ -	$ -	$ -	$ -
Pavement Removal	$ -	$ -	$ -	$ -
Paving	$ -	$ 62,280	$ 560,520	$ 622,800
Roadway and Pavement Appurtenances	$ -	$ -	$ -	$ -
Retaining Walls	$ -	$ -	$ -	$ -
Topsoil	$ -	$ 820	$ 7,380	$ 8,200
Seeding	$ -	$ 380	$ 3,420	$ 3,800
Sodding	$ -	$ -	$ -	$ -
Rip-Rap or Slope Protection	$ -	$ -	$ -	$ -
Fencing	$ -	$ -	$ -	$ -
Signing [1]			$ 3,900	$ 3,900
Pavement Markings [1]			$ 12,800	$ 12,800
Lighting [1]			$ -	$ -
Signalization [1]			$ -	$ -
Guardrail [1]			$ 64,600	$ 64,600
SUB-TOTAL		$ 140,900	$ 1,349,500	$ 1,490,400
Other Construction Items (15%)		$ 21,100	$ 202,400	$ 223,500
Maintenance of Traffic		$ 500	$ 4,500	$ 5,000
SUB-TOTAL		$ 162,500	$ 1,556,400	$ 1,718,900
Mobilization (5%)		$ 8,100	$ 77,800	$ 85,900
CONSTRUCTION COST (rounded)		$ 170,600	$ 1,634,200	$ 1,804,800
Engineering and Contingency (10%)		$ 17,100	$ 163,400	$ 180,500
TOTAL CONSTRUCTION COST (rounded)		$ 187,700	$ 1,797,600	$ 1,985,300
Preliminary Engineering (10%)		$ 18,800	$ 179,800	$ 198,600
PROJECT COST [2](rounded)	**$ -**	**$ 206,500**	**$ 1,977,400**	**$ 2,183,900**

[1] ***Indicates safety item 100% eligible and does not require a 10% funding match by the local agency.***

[2] ***For estimating future project costs, a compounded inflation rate of 10% should be applied from the date of this estimate.***

Buckner Road at I-65 **Relocated Pratt Road** **Pay Item Summary**

TDOT PAY ITEM	TDOT DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
	Right - of - way	AC	4.7	$ 30,000.00	$ 141,000
			RIGHT-OF-WAY TOTAL (ROUNDED)		**$ 141,000**
201-01	Clearing and Grubbing	LS	4.7	$ 2,500.00	$ 11,750
			CLEAR AND GRUBBING TOTAL (ROUNDED)		**$ 11,800**
203-01	Excavation (Unclassified)	CY	37713	$ 10.00	$ 377,130
			EARTHWORK TOTAL (ROUNDED)		**$ 377,200**
607-03.02	18" Conc. Pipe Culvert (Class III)	LF	386	$ 50.00	$ 19,300
607-05.02	24" Conc. Pipe Culvert (Class III)	LF	386	$ 60.00	$ 23,160
607-06.02	30" Conc. Pipe Culvert (Class III)	LF	232	$ 70.00	$ 16,240
607-07.02	36" Conc. Pipe Culvert (Class III)	LF	232	$ 90.00	$ 20,880
611-12.02	Catch Basin	EA	24	$ 3,500.00	$ 84,000
			DRAINAGE TOTAL (ROUNDED)		**$ 163,600**
	5% of Total Construction Cost		1,613,600	x 5%	$ 80,680
			UTILITIES TOTAL (ROUNDED)		**$ 80,700**
Asphalt					
307-03.01	4" Base (Widening)	TON	2498.1	$ 70.00	$ 174,867
307-03.08	3" Binder (Widening)	TON	1841.0	$ 75.00	$ 138,075
411-01.07	2" Shoulder Surface	TON	372.9	$ 85.00	$ 31,697
411-03.10	1.25" Surface (Widening)	TON	718.4	$ 90.00	$ 64,657
402-01	Prime	TON	24.7	$ 550.00	$ 13,577
403-01	Tack	TON	7.1	$ 550.00	$ 3,879
303-01	Stone	TON	4899.7	$ 20.00	$ 97,993
303-01	Shoulder Stone	TON	1633.2	$ 20.00	$ 32,664
303-01	Shoulder Stone (Wedge)	TON	3265.6	$ 20.00	$ 65,313
			PAVING TOTAL (ROUNDED)		**$ 622,800**
712-01	Traffic Control	LS	1	$ 5,000.00	$ 5,000
			MAINTENANCE OF TRAFFIC TOTAL (ROUNDED)		**$ 5,000**
203-07	Furnishing & Spreading Topsoil	CY	1358	$ 6.00	$ 8,146
			TOPSOIL TOTAL (ROUNDED)		**$ 8,200**
801-01	Seeding (With Mulch)	UNIT	92	$ 40.00	$ 3,666
801-03	Water	MG	7	$ 7.00	$ 51
			SEEDING TOTAL (ROUNDED)		**$ 3,800**
713-99.91	Signs	LM	0.8	$ 5,000.00	$ 3,857
			SIGNING TOTAL (ROUNDED)		**$ 3,900**
716-02.05	Plastic Pavement Marking (Stop Line)	LF	24	$ 15.00	$ 360
716-12.01	Enhanced Flatline Thermo Pvmt Mrkng (4" Line)	LM	3.100	$ 4,000.00	$ 12,400
			PAVEMENT MARKINGS TOTAL (ROUNDED)		**$ 12,800**
705-02.02	Single Guardrail (Type 2)	LF	3,259	$ 18.00	$ 58,662
705-04.02	Guardrail Terminal (Type 12)			@ 10% of GR	$ 5,866
			GUARDRAIL TOTAL (ROUNDED)		**$ 64,600**

Route:	**Thompsons Station Road Interchange at I-65**
Description:	**SUMMARY**
County:	**Williamson Co.**
Length:	
Date:	**April 25, 2013**

DESCRIPTION		Potential 10% State / Local Match	FEDERAL	TOTAL
Right-of-Way	$ -	$ 294,100	$ 2,646,900	$ 2,941,000
Clearing and Grubbing	$ -	$ 17,440	$ 156,960	$ 174,400
Earthwork	$ -	$ 527,680	$ 4,749,120	$ 5,276,800
Railroad Crossing or Separation	$ -	$ -	$ -	$ -
Drainage	$ -	$ 115,610	$ 1,040,490	$ 1,156,100
Utilities	$ -	$ 122,980	$ 1,106,820	$ 1,229,800
Structures	$ -	$ 263,350	$ 2,370,150	$ 2,633,500
Pavement Removal	$ -	$ -	$ -	$ -
Paving	$ -	$ 665,410	$ 5,988,690	$ 6,654,100
Roadway and Pavement Appurtenances	$ -	$ 63,010	$ 567,090	$ 630,100
Retaining Walls	$ -	$ -	$ -	$ -
Topsoil	$ -	$ 28,680	$ 258,120	$ 286,800
Seeding	$ -	$ 13,100	$ 117,900	$ 131,000
Sodding	$ -	$ -	$ -	$ -
Rip-Rap or Slope Protection	$ -	$ -	$ -	$ -
Fencing	$ -	$ 11,180	$ 100,620	$ 111,800
Signing [1]			$ 501,700	$ 501,700
Pavement Markings [1]			$ 87,200	$ 87,200
Lighting [1]			$ -	$ -
Signalization [1]			$ 600,000	$ 600,000
Guardrail [1]			$ 460,800	$ 460,800
SUB-TOTAL		$ 2,122,530	$ 20,752,570	$ 22,875,100
Other Construction Items (15%)		$ 318,400	$ 3,112,900	$ 3,431,300
Maintenance of Traffic		$ 22,520	$ 202,680	$ 225,200
SUB-TOTAL		$ 2,463,450	$ 24,068,150	$ 26,531,600
Mobilization (5%)		$ 123,200	$ 1,203,400	$ 1,326,600
CONSTRUCTION COST (rounded)		$ 2,586,650	$ 25,271,550	$ 27,858,200
Engineering and Contingency (10%)		$ 258,700	$ 2,527,200	$ 2,785,900
TOTAL CONSTRUCTION COST (rounded)		$ 2,845,330	$ 27,798,770	$ 30,644,100
Preliminary Engineering (10%)		$ 284,600	$ 2,779,900	$ 3,064,500
PROJECT COST [2](rounded)	**$ -**	**$ 3,129,930**	**$ 30,578,670**	**$ 33,708,600**

[1] ***Indicates safety item 100% eligible and does not require a 10% funding match by the local agency.***

[2] ***For estimating future project costs, a compounded inflation rate of 10% should be applied from the date of this estimate.***

Route:	**Thompsons Station Road Interchange at I-65**
Description:	**New Interchange for Thompsons Station Road at I-65**
	(Includes ramps, Thompsons Station Rd turn lanes, and Thompsons Station bridge over I-65)
County:	**Williamson Co.**
Length:	
Date:	**April 25, 2013**

DESCRIPTION		Potential 10% State / Local Match	FEDERAL	TOTAL
Right-of-Way	$ -	$ 204,300	$ 1,838,700	$ 2,043,000
Clearing and Grubbing	$ -	$ 14,530	$ 130,770	$ 145,300
Earthwork	$ -	$ 468,420	$ 4,215,780	$ 4,684,200
Railroad Crossing or Separation	$ -	$ -	$ -	$ -
Drainage	$ -	$ 56,580	$ 509,220	$ 565,800
Utilities	$ -	$ 80,220	$ 721,980	$ 802,200
Structures	$ -	$ 263,350	$ 2,370,150	$ 2,633,500
Pavement Removal	$ -	$ -	$ -	$ -
Paving	$ -	$ 318,000	$ 2,862,000	$ 3,180,000
Roadway and Pavement Appurtenances	$ -	$ 5,790	$ 52,110	$ 57,900
Retaining Walls	$ -	$ -	$ -	$ -
Topsoil	$ -	$ 25,710	$ 231,390	$ 257,100
Seeding	$ -	$ 11,730	$ 105,570	$ 117,300
Sodding	$ -	$ -	$ -	$ -
Rip-Rap or Slope Protection	$ -	$ -	$ -	$ -
Fencing	$ -	$ 11,180	$ 100,620	$ 111,800
Signing [1]			$ 487,500	$ 487,500
Pavement Markings [1]			$ 35,500	$ 35,500
Lighting [1]			$ -	$ -
Signalization [1]			$ 300,000	$ 300,000
Guardrail [1]			$ 226,300	$ 226,300
SUB-TOTAL		$ 1,459,810	$ 14,187,590	$ 15,647,400
Other Construction Items (15%)		$ 219,000	$ 2,128,100	$ 2,347,100
Maintenance of Traffic		$ 6,500	$ 58,500	$ 65,000
SUB-TOTAL		$ 1,685,310	$ 16,374,190	$ 18,059,500
Mobilization (5%)		$ 84,300	$ 818,700	$ 903,000
CONSTRUCTION COST (rounded)		$ 1,769,610	$ 17,192,890	$ 18,962,500
Engineering and Contingency (10%)		$ 177,000	$ 1,719,300	$ 1,896,300
TOTAL CONSTRUCTION COST (rounded)		$ 1,946,610	$ 18,912,190	$ 20,858,800
Preliminary Engineering (10%)		$ 194,700	$ 1,891,200	$ 2,085,900
PROJECT COST [2](rounded)	**$ -**	**$ 2,141,310**	**$ 20,803,390**	**$ 22,944,700**

[1] ***Indicates safety item 100% eligible and does not require a 10% funding match by the local agency.***

[2] ***For estimating future project costs, a compounded inflation rate of 10% should be applied from the date of this estimate.***

Thompsons Station Road at I-65 | **New Thompsons Station Road Interchange** | **Pay Item Summary**

TDOT PAY ITEM	TDOT DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
	Residential Relocation (2815 Thompsons Station Rd. E)	LS	1	$ 250,000.00	$ 250,000
	Residential Relocation (2616 Pratt Rd.)	LS	1	$ 50,000.00	$ 50,000
	Right - of - way	AC	58.1	$ 30,000.00	$ 1,743,000
			RIGHT-OF-WAY TOTAL (ROUNDED)		**$ 2,043,000**
201-01	Clearing and Grubbing	LS	58.1	$ 2,500.00	$ 145,250
			CLEAR AND GRUBBING TOTAL (ROUNDED)		**$ 145,300**
203-01	Excavation (Unclassified)	CY	468419	$ 10.00	$ 4,684,194
			EARTHWORK TOTAL (ROUNDED)		**$ 4,684,200**
607-03.02	18" Conc. Pipe Culvert (Class III)	LF	1353	$ 50.00	$ 67,650
607-05.02	24" Conc. Pipe Culvert (Class III)	LF	1353	$ 60.00	$ 81,180
607-06.02	30" Conc. Pipe Culvert (Class III)	LF	812	$ 70.00	$ 56,840
607-07.02	36" Conc. Pipe Culvert (Class III)	LF	812	$ 90.00	$ 73,080
611-12.02	Catch Basin	EA	82	$ 3,500.00	$ 287,000
			DRAINAGE TOTAL (ROUNDED)		**$ 565,800**
	5% of Total Construction Cost		16,042,600	x 5%	$ 802,130
			UTILITIES TOTAL (ROUNDED)		**$ 802,200**
	New Bridge	SF	19,734	$ 120.00	$ 2,368,080
	Remove Existing Bridge	SF	6,635	$ 40.00	$ 265,400
			STRUCTURES TOTAL (ROUNDED)		**$ 2,633,500**
Asphalt					
307-03.01	4" Base (Widening)	TON	4574.8	$ 70.00	$ 320,238
307-03.08	3" Binder (Widening)	TON	3371.4	$ 75.00	$ 252,859
411-01.07	2" Shoulder Surface	TON	427.2	$ 85.00	$ 36,316
411-03.10	1.25" Surface (Widening)	TON	1315.6	$ 90.00	$ 118,408
402-01	Prime	TON	41.0	$ 550.00	$ 22,536
403-01	Tack	TON	12.9	$ 550.00	$ 7,104
303-01	Stone	TON	8972.9	$ 20.00	$ 179,457
303-01	Shoulder Stone	TON	1247.5	$ 20.00	$ 24,949
303-01	Shoulder Stone (Wedge)	TON	4988.6	$ 20.00	$ 99,773
Ramp					
501-01.02	Portland Cement Concrete Pvmt (Plain) 9"	SY	32859.0	$ 50.00	$ 1,642,950
303-01	Mineral Aggregate, TY A Base, Grading D	TON	7337.4	$ 20.00	$ 146,748
313-03	Treated Permeable Base	SY	32859.0	$ 10.00	$ 328,590
			PAVING TOTAL (ROUNDED)		**$ 3,180,000**
702-01	Conc. Curb	CY	304	$ 190.00	$ 57,832
			ROADWAY AND PAVEMENT APPURTENANCES TOTAL (ROUNDED)		**$ 57,900**
712-01	Traffic Control	LM	1.5	$ 65,000.00	$ 65,000
			MAINTENANCE OF TRAFFIC TOTAL (ROUNDED)		**$ 65,000**
203-07	Furnishing & Spreading Topsoil	CY	42836	$ 6.00	$ 257,013
			TOPSOIL TOTAL (ROUNDED)		**$ 257,100**
801-01	Seeding (With Mulch)	UNIT	2,891	$ 40.00	$ 115,656
801-03	Water	MG	231	$ 7.00	$ 1,619
			SEEDING TOTAL (ROUNDED)		**$ 117,300**
713-99.91	Signs	LM	1.5	$ 5,000.00	$ 7,500
713-30.01	Erect Overhead Sign Truss	EA	6	$ 80,000.00	$ 480,000

Thompsons Station Road at I-65

New Thompsons Station Road Interchange

Pay Item Summary

TDOT PAY ITEM	TDOT DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
			SIGNING TOTAL (ROUNDED)		**$ 487,500**
716-02.04	Plastic Pavement Marking (Channel. Striping)	SY	33	$ 25.00	$ 835
716-02.05	Plastic Pavement Marking (Stop Line)	LF	192	$ 15.00	$ 2,880
716-02.06	Plastic Pavement Marking (Turn Lane Arrow)	EA	8	$ 125.00	$ 1,000
716-03.01	Plastic Word Pavement Marking (Only)	EA	2	$ 225.00	$ 450
716-04.01	Plastic Pavement Marking (Straight-Turn Arrow)	EA	2	$ 320.00	$ 640
716-12.01	Enhanced Flatline Thermo Pvmt Mrkng (4" Line)	LM	7.400	$ 4,000.00	$ 29,600
			PAVEMENT MARKINGS TOTAL (ROUNDED)		**$ 35,500**
730-01	Traffic Signal	LS	2	$ 150,000.00	$ 300,000
			SIGNALIZATION TOTAL (ROUNDED)		**$ 300,000**
707-08.01	Fence	LF	11,174	$ 10.00	$ 111,740
			FENCE TOTAL (ROUNDED)		**$ 111,800**
705-02.02	Single Guardrail (Type 2)	LF	11,428	$ 18.00	$ 205,704
705-04.02	Guardrail Terminal (Type 12)			@ 10% of GR	$ 20,570
			GUARDRAIL TOTAL (ROUNDED)		**$ 226,300**

Route:	**Thompsons Station Road Interchange at I-65**
Description:	**Thompsons Station Rd. Improvements**
	From Buckner Ln to Lewisburg Pk (does not include interchange or turn lanes at ramps)
County:	**Williamson Co.**
Length:	***8000 L.F. +***
Date:	**April 25, 2013**

DESCRIPTION		Potential 10% State / Local Match	FEDERAL	TOTAL
Right-of-Way	$ -	$ 16,500	$ 148,500	$ 165,000
Clearing and Grubbing	$ -	$ 1,380	$ 12,420	$ 13,800
Earthwork	$ -	$ 22,130	$ 199,170	$ 221,300
Railroad Crossing or Separation	$ -	$ -	$ -	$ -
Drainage	$ -	$ 31,660	$ 284,940	$ 316,600
Utilities	$ -	$ 17,790	$ 160,110	$ 177,900
Structures	$ -	$ -	$ -	$ -
Pavement Removal	$ -	$ -	$ -	$ -
Paving	$ -	$ 197,580	$ 1,778,220	$ 1,975,800
Roadway and Pavement Appurtenances	$ -	$ 38,830	$ 349,470	$ 388,300
Retaining Walls	$ -	$ -	$ -	$ -
Topsoil	$ -	$ 1,600	$ 14,400	$ 16,000
Seeding	$ -	$ 730	$ 6,570	$ 7,300
Sodding	$ -	$ -	$ -	$ -
Rip-Rap or Slope Protection	$ -	$ -	$ -	$ -
Fencing	$ -	$ -	$ -	$ -
Signing [1]			$ 7,600	$ 7,600
Pavement Markings [1]			$ 24,400	$ 24,400
Lighting [1]			$ -	$ -
Signalization [1]			$ 150,000	$ 150,000
Guardrail [1]			$ 126,200	$ 126,200
SUB-TOTAL		$ 328,200	$ 3,262,000	$ 3,590,200
Other Construction Items (15%)		$ 49,200	$ 489,300	$ 538,500
Maintenance of Traffic		$ 9,820	$ 88,380	$ 98,200
SUB-TOTAL		$ 387,220	$ 3,839,680	$ 4,226,900
Mobilization (5%)		$ 19,400	$ 192,000	$ 211,400
CONSTRUCTION COST (rounded)		$ 406,620	$ 4,031,680	$ 4,438,300
Engineering and Contingency (10%)		$ 40,700	$ 403,200	$ 443,900
TOTAL CONSTRUCTION COST (rounded)		$ 447,300	$ 4,434,900	$ 4,882,200
Preliminary Engineering (10%)		$ 44,700	$ 443,500	$ 488,200
PROJECT COST [2](rounded)	**$ -**	**$ 492,000**	**$ 4,878,400**	**$ 5,370,400**

[1] ***Indicates safety item 100% eligible and does not require a 10% funding match by the local agency.***

[2] ***For estimating future project costs, a compounded inflation rate of 10% should be applied from the date of this estimate.***

Thompsons Station Road at I-65

Thompsons Station Road Improvements

Pay Item Summary

TDOT PAY ITEM	TDOT DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
	Right - of - way	AC	5.5	$ 30,000.00	$ 165,000
			RIGHT-OF-WAY TOTAL (ROUNDED)		**$ 165,000**
201-01	Clearing and Grubbing	LS	5.5	$ 2,500.00	$ 13,750
			CLEAR AND GRUBBING TOTAL (ROUNDED)		**$ 13,800**
203-01	Excavation (Unclassified)	CY	22125	$ 10.00	$ 221,250
			EARTHWORK TOTAL (ROUNDED)		**$ 221,300**
607-03.02	18" Conc. Pipe Culvert (Class III)	LF	755	$ 50.00	$ 37,750
607-05.02	24" Conc. Pipe Culvert (Class III)	LF	755	$ 60.00	$ 45,300
607-06.02	30" Conc. Pipe Culvert (Class III)	LF	453	$ 70.00	$ 31,710
607-07.02	36" Conc. Pipe Culvert (Class III)	LF	453	$ 90.00	$ 40,770
611-12.02	Catch Basin	EA	46	$ 3,500.00	$ 161,000
			DRAINAGE TOTAL (ROUNDED)		**$ 316,600**
	5% of Total Construction Cost		3,556,400	x 5%	$ 177,820
			UTILITIES TOTAL (ROUNDED)		**$ 177,900**
Asphalt					
307-03.01	4" Base (Widening)	TON	9672.3	$ 70.00	$ 677,059
307-03.08	3" Binder (Widening)	TON	7128.0	$ 75.00	$ 534,603
411-03.10	1.25" Surface (Widening)	TON	2781.6	$ 90.00	$ 250,342
402-01	Prime	TON	71.7	$ 550.00	$ 39,425
403-01	Tack	TON	27.3	$ 550.00	$ 15,019
303-01	Stone	TON	18970.7	$ 20.00	$ 379,415
303-01	Shoulder Stone (Wedge)	TON	3994.3	$ 20.00	$ 79,887
			PAVING TOTAL (ROUNDED)		**$ 1,975,800**
702-01	Conc. Curb	CY	779	$ 190.00	$ 148,066
702-03	Conc. Curb and Gutter	CY	1144	$ 210.00	$ 240,226
			ROADWAY AND PAVEMENT APPURTENANCES TOTAL (ROUNDED)		**$ 388,300**
712-01	Traffic Control	LM	1.5	$ 65,000.00	$ 98,150
			MAINTENANCE OF TRAFFIC TOTAL (ROUNDED)		**$ 98,200**
203-07	Furnishing & Spreading Topsoil	CY	2655	$ 6.00	$ 15,930
			TOPSOIL TOTAL (ROUNDED)		**$ 16,000**
801-01	Seeding (With Mulch)	UNIT	179	$ 40.00	$ 7,169
801-03	Water	MG	14	$ 7.00	$ 100
			SEEDING TOTAL (ROUNDED)		**$ 7,300**
713-99.91	Signs	LM	1.5	$ 5,000.00	$ 7,543
			SIGNING TOTAL (ROUNDED)		**$ 7,600**
716-03.01	Plastic Word Pavement Marking (Only)	EA	2	$ 225.00	$ 450
716-12.01	Enhanced Flatline Thermo Pvmt Mrkng (4" Line)	LM	3.713	$ 4,000.00	$ 14,850
			PAVEMENT MARKINGS TOTAL (ROUNDED)		**$ 24,400**
730-01	Traffic Signal	LS	1	$ 150,000.00	$ 150,000
			SIGNALIZATION TOTAL (ROUNDED)		**$ 150,000**
705-02.02	Single Guardrail (Type 2)	LF	6,372	$ 18.00	$ 114,696
705-04.02	Guardrail Terminal (Type 12)			@ 10% of GR	$ 11,470
			GUARDRAIL TOTAL (ROUNDED)		**$ 126,200**

Route:	**Thompsons Station Road Interchange at I-65**
Description:	**Buckner Lane Improvements**
	From Buckner Rd. to Thompsons Station Rd.
County:	**Williamson Co.**
Length:	***4000 L.F. ±***
Date:	**April 25, 2013**

DESCRIPTION		Potential 10% State / Local Match	FEDERAL	TOTAL
Right-of-Way	$ -	$ 8,400	$ 75,600	$ 84,000
Clearing and Grubbing	$ -	$ 700	$ 6,300	$ 7,000
Earthwork	$ -	$ 11,120	$ 100,080	$ 111,200
Railroad Crossing or Separation	$ -	$ -	$ -	$ -
Drainage	$ -	$ 15,870	$ 142,830	$ 158,700
Utilities	$ -	$ 19,240	$ 173,160	$ 192,400
Structures	$ -	$ -	$ -	$ -
Pavement Removal	$ -	$ -	$ -	$ -
Paving	$ -	$ 103,020	$ 927,180	$ 1,030,200
Roadway and Pavement Appurtenances	$ -	$ 18,390	$ 165,510	$ 183,900
Retaining Walls	$ -	$ -	$ -	$ -
Topsoil	$ -	$ 800	$ 7,200	$ 8,000
Seeding	$ -	$ 370	$ 3,330	$ 3,700
Sodding	$ -	$ -	$ -	$ -
Rip-Rap or Slope Protection	$ -	$ -	$ -	$ -
Fencing	$ -	$ -	$ -	$ -
Signing [1]			$ 3,800	$ 3,800
Pavement Markings [1]			$ 18,100	$ 18,100
Lighting [1]			$ -	$ -
Signalization [1]			$ 150,000	$ 150,000
Guardrail [1]			$ 63,400	$ 63,400
SUB-TOTAL		$ 177,900	$ 1,836,500	$ 2,014,400
Other Construction Items (15%)		$ 26,700	$ 275,500	$ 302,200
Maintenance of Traffic		$ 5,200	$ 46,800	$ 52,000
SUB-TOTAL		$ 209,800	$ 2,158,800	$ 2,368,600
Mobilization (5%)		$ 10,500	$ 107,900	$ 118,400
CONSTRUCTION COST (rounded)		$ 220,300	$ 2,266,700	$ 2,487,000
Engineering and Contingency (10%)		$ 22,000	$ 226,700	$ 248,700
TOTAL CONSTRUCTION COST (rounded)		$ 242,300	$ 2,493,400	$ 2,735,700
Preliminary Engineering (10%)		$ 24,200	$ 249,300	$ 273,500
PROJECT COST [2](rounded)	**$ -**	**$ 266,500**	**$ 2,742,700**	**$ 3,009,200**

[1] ***Indicates safety item 100% eligible and does not require a 10% funding match by the local agency.***

[2] ***For estimating future project costs, a compounded inflation rate of 10% should be applied from the date of this estimate.***

Thompsons Station Rd at I-65 | **Buckner Lane Improvements** | **Pay Item Summary**

TDOT PAY ITEM	TDOT DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
	Right - of - way	AC	2.8	$ 30,000.00	$ 84,000
			RIGHT-OF-WAY TOTAL (ROUNDED)		**$ 84,000**
201-01	Clearing and Grubbing	LS	2.8	$ 2,500.00	$ 7,000
			CLEAR AND GRUBBING TOTAL (ROUNDED)		**$ 7,000**
203-01	Excavation (Unclassified)	CY	11111	$ 10.00	$ 111,111
			EARTHWORK TOTAL (ROUNDED)		**$ 111,200**
607-03.02	18" Conc. Pipe Culvert (Class III)	LF	379	$ 50.00	$ 18,950
607-05.02	24" Conc. Pipe Culvert (Class III)	LF	379	$ 60.00	$ 22,740
607-06.02	30" Conc. Pipe Culvert (Class III)	LF	228	$ 70.00	$ 15,960
607-07.02	36" Conc. Pipe Culvert (Class III)	LF	228	$ 90.00	$ 20,520
611-12.02	Catch Basin	EA	23	$ 3,500.00	$ 80,500
			DRAINAGE TOTAL (ROUNDED)		**$ 158,700**
	5% of Total Construction Cost		3,846,700	x 5%	$ 192,335
			UTILITIES TOTAL (ROUNDED)		**$ 192,400**
Asphalt					
307-03.01	4" Base (Widening)	TON	5060.0	$ 70.00	$ 354,200
307-03.08	3" Binder (Widening)	TON	3729.0	$ 75.00	$ 279,675
411-03.10	1.25" Surface (Widening)	TON	1455.2	$ 90.00	$ 130,965
402-01	Prime	TON	37.5	$ 550.00	$ 20,625
403-01	Tack	TON	14.3	$ 550.00	$ 7,857
303-01	Stone	TON	9924.4	$ 20.00	$ 198,489
303-01	Shoulder Stone (Wedge)	TON	1915.7	$ 20.00	$ 38,313
			PAVING TOTAL (ROUNDED)		**$ 1,030,200**
702-01	Conc. Curb	CY	333	$ 190.00	$ 63,205
702-03	Conc. Curb and Gutter	CY	574	$ 210.00	$ 120,641
			ROADWAY AND PAVEMENT APPURTENANCES TOTAL (ROUNDED)		**$ 183,900**
712-01	Traffic Control	LM	0.8	$ 65,000.00	$ 52,000
			MAINTENANCE OF TRAFFIC TOTAL (ROUNDED)		**$ 52,000**
203-07	Furnishing & Spreading Topsoil	CY	1333	$ 6.00	$ 8,000
			TOPSOIL TOTAL (ROUNDED)		**$ 8,000**
801-01	Seeding (With Mulch)	UNIT	90	$ 40.00	$ 3,600
801-03	Water	MG	7	$ 7.00	$ 50
			SEEDING TOTAL (ROUNDED)		**$ 3,700**
713-99.91	Signs	LM	0.8	$ 5,000.00	$ 3,788
			SIGNING TOTAL (ROUNDED)		**$ 3,800**
716-03.01	Plastic Word Pavement Marking (Only)	EA	2	$ 225.00	$ 450
716-12.01	Enhanced Flatline Thermo Pvmt Mrkng (4" Line)	LM	4.075	$ 4,000.00	$ 16,302
			PAVEMENT MARKINGS TOTAL (ROUNDED)		**$ 18,100**
730-01	Traffic Signal	LS	1	$ 150,000.00	$ 150,000
			SIGNALIZATION TOTAL (ROUNDED)		**$ 150,000**
705-02.02	Single Guardrail (Type 2)	LF	3,200	$ 18.00	$ 57,600
705-04.02	Guardrail Terminal (Type 12)			@ 10% of GR	$ 5,760
			GUARDRAIL TOTAL (ROUNDED)		**$ 63,400**

Route:	**Thompsons Station Road Interchange at I-65**
Description:	**Relocated Pratt Rd.**
County:	**Williamson Co.**
Length:	***2350 L.F +***
Date:	**April 25, 2013**

DESCRIPTION		Potential 10% State / Local Match	FEDERAL	TOTAL
Right-of-Way	$ -	$ 8,100	$ 72,900	$ 81,000
Clearing and Grubbing	$ -	$ 680	$ 6,120	$ 6,800
Earthwork	$ -	$ 21,700	$ 195,300	$ 217,000
Railroad Crossing or Separation	$ -	$ -	$ -	$ -
Drainage	$ -	$ 9,490	$ 85,410	$ 94,900
Utilities	$ -	$ 4,840	$ 43,560	$ 48,400
Structures	$ -	$ -	$ -	$ -
Pavement Removal	$ -	$ -	$ -	$ -
Paving	$ -	$ 39,580	$ 356,220	$ 395,800
Roadway and Pavement Appurtenances	$ -	$ -	$ -	$ -
Retaining Walls	$ -	$ -	$ -	$ -
Topsoil	$ -	$ 470	$ 4,230	$ 4,700
Seeding	$ -	$ 220	$ 1,980	$ 2,200
Sodding	$ -	$ -	$ -	$ -
Rip-Rap or Slope Protection	$ -	$ -	$ -	$ -
Fencing	$ -	$ -	$ -	$ -
Signing [1]			$ 2,300	$ 2,300
Pavement Markings [1]			$ 7,400	$ 7,400
Lighting [1]			$ -	$ -
Signalization [1]			$ -	$ -
Guardrail [1]			$ 37,200	$ 37,200
SUB-TOTAL		$ 85,080	$ 812,620	$ 897,700
Other Construction Items (15%)		$ 12,800	$ 121,900	$ 134,700
Maintenance of Traffic		$ 500	$ 4,500	$ 5,000
SUB-TOTAL		$ 98,380	$ 939,020	$ 1,037,400
Mobilization (5%)		$ 4,900	$ 47,000	$ 51,900
CONSTRUCTION COST (rounded)		$ 103,280	$ 986,020	$ 1,089,300
Engineering and Contingency (10%)		$ 10,300	$ 98,600	$ 108,900
TOTAL CONSTRUCTION COST (rounded)		$ 113,580	$ 1,084,620	$ 1,198,200
Preliminary Engineering (10%)		$ 11,400	$ 108,500	$ 119,900
PROJECT COST [2](rounded)	**$ -**	**$ 124,980**	**$ 1,193,120**	**$ 1,318,100**

[1] ***Indicates safety item 100% eligible and does not require a 10% funding match by the local agency.***

[2] ***For estimating future project costs, a compounded inflation rate of 10% should be applied from the date of this estimate.***

Thompsons Station Road at I-65 | **Relocated Pratt Road** | **Pay Item Summary**

TDOT PAY ITEM	TDOT DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
	Right - of - way	AC	2.7	$ 30,000.00	$ 81,000
				RIGHT-OF-WAY TOTAL (ROUNDED)	**$ 81,000**
201-01	Clearing and Grubbing	LS	2.7	$ 2,500.00	$ 6,750
				CLEAR AND GRUBBING TOTAL (ROUNDED)	**$ 6,800**
203-01	Excavation (Unclassified)	CY	21694	$ 10.00	$ 216,944
				EARTHWORK TOTAL (ROUNDED)	**$ 217,000**
607-03.02	18" Conc. Pipe Culvert (Class III)	LF	222	$ 50.00	$ 11,100
607-05.02	24" Conc. Pipe Culvert (Class III)	LF	222	$ 60.00	$ 13,320
607-06.02	30" Conc. Pipe Culvert (Class III)	LF	134	$ 70.00	$ 9,380
607-07.02	36" Conc. Pipe Culvert (Class III)	LF	134	$ 90.00	$ 12,060
611-12.02	Catch Basin	EA	14	$ 3,500.00	$ 49,000
				DRAINAGE TOTAL (ROUNDED)	**$ 94,900**
	5% of Total Construction Cost		966,800	x 5%	$ 48,340
				UTILITIES TOTAL (ROUNDED)	**$ 48,400**
Asphalt					
307-03.01	4" Base (Widening)	TON	1437.0	$ 70.00	$ 100,593
307-03.08	3" Binder (Widening)	TON	1059.0	$ 75.00	$ 79,428
411-01.07	2" Shoulder Surface	TON	214.5	$ 85.00	$ 18,234
411-03.10	1.25" Surface (Widening)	TON	413.3	$ 90.00	$ 37,194
402-01	Prime	TON	14.2	$ 550.00	$ 7,810
403-01	Tack	TON	4.1	$ 550.00	$ 2,231
303-01	Stone	TON	2818.5	$ 20.00	$ 56,371
303-01	Shoulder Stone	TON	939.5	$ 20.00	$ 18,790
303-01	Shoulder Stone (Wedge)	TON	3757.1	$ 20.00	$ 75,142
				PAVING TOTAL (ROUNDED)	**$ 395,800**
712-01	Traffic Control	LS		$ 5,000.00	$ 5,000
				MAINTENANCE OF TRAFFIC TOTAL (ROUNDED)	**$ 5,000**
203-07	Furnishing & Spreading Topsoil	CY	781	$ 6.00	$ 4,686
				TOPSOIL TOTAL (ROUNDED)	**$ 4,700**
801-01	Seeding (With Mulch)	UNIT	53	$ 40.00	$ 2,109
801-03	Water	MG	4	$ 7.00	$ 30
				SEEDING TOTAL (ROUNDED)	**$ 2,200**
713-99.91	Signs	LM	0.4	$ 5,000.00	$ 2,219
				SIGNING TOTAL (ROUNDED)	**$ 2,300**
716-02.05	Plastic Pavement Marking (Stop Line)	LF	12	$ 15.00	$ 180
716-12.01	Enhanced Flatline Thermo Pvmt Mrkng (4" Line)	LM	1.800	$ 4,000.00	$ 7,200
				PAVEMENT MARKINGS TOTAL (ROUNDED)	**$ 7,400**
705-02.02	Single Guardrail (Type 2)	LF	1,875	$ 18.00	$ 33,750
705-04.02	Guardrail Terminal (Type 12)			@ 10% of GR	$ 3,375
				GUARDRAIL TOTAL (ROUNDED)	**$ 37,200**

Route:	**Thompsons Station Road Interchange at I-65**
Description:	**Relocated Pantall Rd.**
County:	**Williamson Co.**
Length:	***485 L.F. +***
Date:	**April 25, 2013**

DESCRIPTION		Potential 10% State / Local Match	FEDERAL	TOTAL
Right-of-Way	$ -	$ 56,800	$ 511,200	$ 568,000
Clearing and Grubbing	$ -	$ 150	$ 1,350	$ 1,500
Earthwork	$ -	$ 4,310	$ 38,790	$ 43,100
Railroad Crossing or Separation	$ -	$ -	$ -	$ -
Drainage	$ -	$ 2,010	$ 18,090	$ 20,100
Utilities	$ -	$ 890	$ 8,010	$ 8,900
Structures	$ -	$ -	$ -	$ -
Pavement Removal	$ -	$ -	$ -	$ -
Paving	$ -	$ 7,230	$ 65,070	$ 72,300
Roadway and Pavement Appurtenances	$ -	$ -	$ -	$ -
Retaining Walls	$ -	$ -	$ -	$ -
Topsoil	$ -	$ 100	$ 900	$ 1,000
Seeding	$ -	$ 50	$ 450	$ 500
Sodding	$ -	$ -	$ -	$ -
Rip-Rap or Slope Protection	$ -	$ -	$ -	$ -
Fencing	$ -	$ -	$ -	$ -
Signing [1]			$ 500	$ 500
Pavement Markings [1]			$ 1,800	$ 1,800
Lighting [1]			$ -	$ -
Signalization [1]			$ -	$ -
Guardrail [1]			$ 7,700	$ 7,700
SUB-TOTAL		$ 71,540	$ 653,860	$ 725,400
Other Construction Items (15%)		$ 10,700	$ 98,100	$ 108,800
Maintenance of Traffic		$ 500	$ 4,500	$ 5,000
SUB-TOTAL		$ 82,740	$ 756,460	$ 839,200
Mobilization (5%)		$ 4,100	$ 37,800	$ 41,900
CONSTRUCTION COST (rounded)		$ 86,840	$ 794,260	$ 881,100
Engineering and Contingency (10%)		$ 8,700	$ 79,400	$ 88,100
TOTAL CONSTRUCTION COST (rounded)		$ 95,540	$ 873,660	$ 969,200
Preliminary Engineering (10%)		$ 9,600	$ 87,400	$ 97,000
PROJECT COST [2](rounded)	**$ -**	**$ 105,140**	**$ 961,060**	**$ 1,066,200**

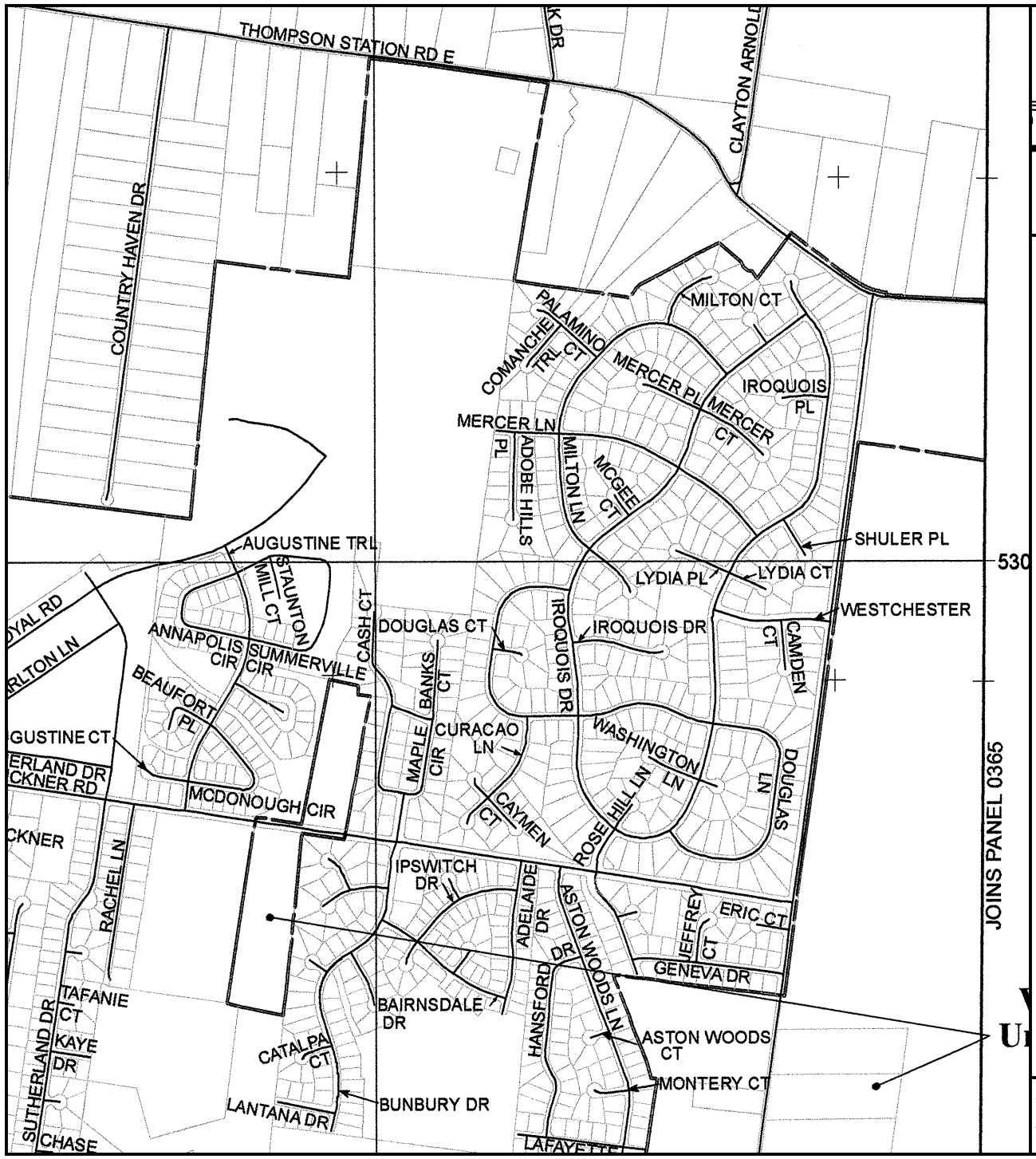
[1] ***Indicates safety item 100% eligible and does not require a 10% funding match by the local agency.***

[2] ***For estimating future project costs, a compounded inflation rate of 10% should be applied from the date of this estimate.***

Thompsons Station Road at I-65 | **Relocated Pantall Road** | **Pay Item Summary**

TDOT PAY ITEM	TDOT DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
	Residential Relocation (2715 Pantall Road)	LS	1		$ 550,000
	Right - of - way	AC	0.6	$ 30,000.00	$ 18,000
			RIGHT-OF-WAY TOTAL (ROUNDED)		**$ 568,000**
201-01	Clearing and Grubbing	LS	0.6	$ 2,500.00	$ 1,500
			CLEAR AND GRUBBING TOTAL (ROUNDED)		**$ 1,500**
203-01	Excavation (Unclassified)	CY	4308	$ 10.00	$ 43,076
			EARTHWORK TOTAL (ROUNDED)		**$ 43,100**
607-03.02	18" Conc. Pipe Culvert (Class III)	LF	46	$ 50.00	$ 2,300
607-05.02	24" Conc. Pipe Culvert (Class III)	LF	46	$ 60.00	$ 2,760
607-06.02	30" Conc. Pipe Culvert (Class III)	LF	28	$ 70.00	$ 1,960
607-07.02	36" Conc. Pipe Culvert (Class III)	LF	28	$ 90.00	$ 2,520
611-12.02	Catch Basin	EA	3	$ 3,500.00	$ 10,500
			DRAINAGE TOTAL (ROUNDED)		**$ 20,100**
	5% of Total Construction Cost		177,500	x 5%	$ 8,875
			UTILITIES TOTAL (ROUNDED)		**$ 8,900**
Asphalt					
307-03.01	4" Base (Widening)	TON	297.5	$ 70.00	$ 20,823
307-03.08	3" Binder (Widening)	TON	219.2	$ 75.00	$ 16,442
411-01.07	2" Shoulder Surface	TON	44.4	$ 85.00	$ 3,774
411-03.10	1.25" Surface (Widening)	TON	85.5	$ 90.00	$ 7,699
402-01	Prime	TON	2.9	$ 550.00	$ 1,617
403-01	Tack	TON	0.8	$ 550.00	$ 462
303-01	Stone	TON	583.4	$ 20.00	$ 11,669
303-01	Shoulder Stone	TON	97.2	$ 20.00	$ 1,945
303-01	Shoulder Stone (Wedge)	TON	388.9	$ 20.00	$ 7,777
			PAVING TOTAL (ROUNDED)		**$ 72,300**
712-01	Traffic Control	LS		$ 5,000.00	$ 5,000
			MAINTENANCE OF TRAFFIC TOTAL (ROUNDED)		**$ 5,000**
203-07	Furnishing & Spreading Topsoil	CY	162	$ 6.00	$ 970
			TOPSOIL TOTAL (ROUNDED)		**$ 1,000**
801-01	Seeding (With Mulch)	UNIT	11	$ 40.00	$ 437
801-03	Water	MG	1	$ 7.00	$ 6
			SEEDING TOTAL (ROUNDED)		**$ 500**
713-99.91	Signs	LM	0.1	$ 5,000.00	$ 459
			SIGNING TOTAL (ROUNDED)		**$ 500**
716-02.05	Plastic Pavement Marking (Stop Line)	LF	12	$ 15.00	$ 180
716-12.01	Enhanced Flatline Thermo Pvmt Mrkng (4" Line)	LM	0.400	$ 4,000.00	$ 1,600
			PAVEMENT MARKINGS TOTAL (ROUNDED)		**$ 1,800**
705-02.02	Single Guardrail (Type 2)	LF	388	$ 18.00	$ 6,984
705-04.02	Guardrail Terminal (Type 12)			@ 10% of GR	$ 698
			GUARDRAIL TOTAL (ROUNDED)		**$ 7,700**

APPENDIX 4- FEMA AND SOIL MAPS



MAP SCALE 1" = 1000'

500 0 500 1,000 1,500 2,000 FEET

0 300 600 METER

PANEL 0345F

FIRM

FLOOD INSURANCE RATE MAP

WILLIAMSON COUNTY, TENNESSEE

AND INCORPORATED AREAS

PANEL 345 OF 485

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
SPRING HILL, CITY OF	470278	0345	F
THOMPSON'S STATION, TOWN OF	470424	0345	F
WILLIAMSON COUNTY	470204	0345	F

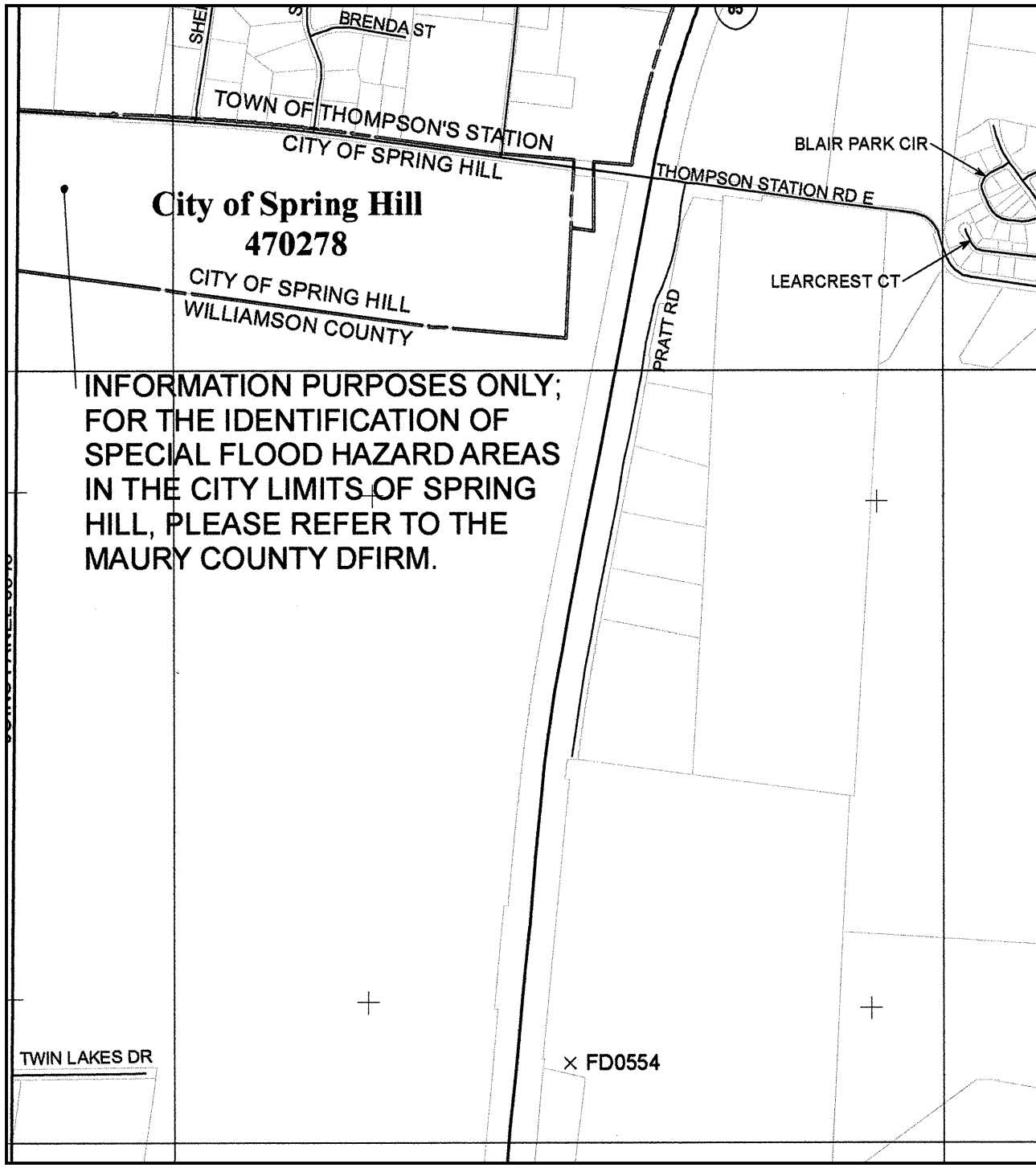
Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
47187C0345F

MAP REVISED
SEPTEMBER 29, 2006

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



MAP SCALE 1" = 1000'

500 0 500 1,000 1,500 2,000 FEET

0 0 300 600 METER

PANEL 0365F

FIRM

FLOOD INSURANCE RATE MAP

WILLIAMSON COUNTY, TENNESSEE

AND INCORPORATED AREAS

PANEL 365 OF 485

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
SPRING HILL, CITY OF	470278	0365	F
THOMPSON'S STATION, TOWN OF	470424	0365	F
WILLIAMSON COUNTY	470204	0365	F

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
47187C0365F

MAP REVISED
SEPTEMBER 29, 2006

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Soil Map--Williamson County, Tennessee

Map Scale: 1:26,000 if printed on A size (8.5" x 11") sheet.

N

Meters: 0, 350, 700, 1,400, 2,100

Feet: 0, 1,000, 2,000, 4,000, 6,000

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Units

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Gully

Short Steep Slope

Other

Political Features

Cities

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

MAP INFORMATION

Map Scale: 1:26,000 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:15,840.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 16N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Williamson County, Tennessee
Survey Area Data: Version 8, Sep 9, 2012

Date(s) aerial images were photographed: 8/16/2006; 8/25/2006

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Williamson County, Tennessee (TN187)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
ArB	Armour silt loam, 2 to 5 percent slopes	110.4	3.6%
ArB2	Armour silt loam, 2 to 5 percent slopes, eroded	162.2	5.2%
ArC	Armour silt loam, 5 to 12 percent slopes	10.7	0.3%
ArC2	Armour silt loam, 5 to 12 percent slopes, eroded	101.7	3.3%
AtC3	Armour silty clay loam, 5 to 12 percent slopes, severely eroded	9.1	0.3%
AwC	Ashwood silty clay loam, 5 to 12 percent slopes	4.0	0.1%
AwD	Ashwood silty clay loam, 12 to 20 percent slopes	0.2	0.0%
BrC2	Braxton cherty silt loam, 5 to 12 percent slopes, eroded	6.8	0.2%
BrD2	Braxton cherty silt loam, 12 to 20 percent slopes, eroded	5.1	0.2%
BsC3	Braxton cherty silty clay loam, 5 to 12 percent slopes, severely eroded	2.9	0.1%
CaA	Captina silt loam, phosphatic, 0 to 2 percent slopes	3.3	0.1%
CaB2	Captina silt loam, phosphatic, 2 to 5 percent slopes, eroded	6.3	0.2%
CfD2	Culleoka flaggy loam, 12 to 20 percent slopes, eroded	11.1	0.4%
CfE2	Culleoka flaggy loam, 20 to 30 percent slopes, eroded	5.2	0.2%
CkC	Culleoka silt loam, 5 to 12 percent slopes	2.0	0.1%
CkD	Culleoka silt loam, 12 to 20 percent slopes	56.7	1.8%
CkD3	Culleoka silt loam, 12 to 20 percent slopes, severely eroded	16.2	0.5%
CkE	Culleoka silt loam, 20 to 35 percent slopes	62.1	2.0%
CkE3	Culleoka silt loam, 20 to 35 percent slopes, severely eroded	4.4	0.1%
DnB2	Donerail silt loam, 2 to 5 percent slopes, eroded	15.7	0.5%
DnC2	Donerail silt loam, 5 to 12 percent slopes, eroded	7.0	0.2%
DoB2	Donerail silt loam, concretionary, 2 to 5 percent slopes, eroded	2.1	0.1%
DoC2	Donerail silt loam, concretionary, 5 to 12 percent slopes, eroded	71.3	2.3%
DsB	Dowellton silt loam, 2 to 5 percent slopes	2.9	0.1%
Du	Dunning silt loam, phosphatic	2.8	0.1%
Eg	Egam silt loam, phosphatic	34.0	1.1%
Gu	Gullied land	14.2	0.5%
HbB2	Hampshire silt loam, 2 to 5 percent slopes, eroded	7.7	0.2%
HbC2	Hampshire silt loam, 5 to 12 percent slopes, eroded	45.9	1.5%
HbD2	Hampshire silt loam, 12 to 20 percent slopes, eroded	3.5	0.1%

Williamson County, Tennessee (TN187)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
HcC3	Hampshire silty clay loam, 5 to 12 percent slopes, severely eroded	42.6	1.4%
HcD3	Hampshire silty clay loam, 12 to 20 percent slopes, severely eroded	18.3	0.6%
HeD2	Hampshire-colbert silt loams, 12 to 20 percent slopes, eroded	4.7	0.2%
HnB2	Hicks silt loam, 2 to 5 percent slopes, eroded	3.4	0.1%
HnC2	Hicks silt loam, 5 to 12 percent slopes, eroded	2.9	0.1%
Hu	Huntington silt loam, phosphatic	236.9	7.6%
ImD	Inman silt loam, 12 to 20 percent slopes	3.9	0.1%
InC3	Inman silty clay loam, 5 to 12 percent slopes, severely eroded	0.2	0.0%
InD3	Inman silty clay loam, 12 to 20 percent slopes, severely eroded	10.1	0.3%
InE3	Inman silty clay loam, 20 to 30 percent slopes, severely eroded	1.4	0.0%
La	Lanton silt loam, phosphatic	25.2	0.8%
Lp	Lindside silt loam, phosphatic	195.2	6.3%
MbB	Maury silt loam, 2 to 5 percent slopes,	39.0	1.3%
MbB2	Maury silt loam, 2 to 5 percent slopes, eroded	199.2	6.4%
MbC2	Maury silt loam, 5 to 12 percent slopes, eroded	108.1	3.5%
McC3	Maury silty clay loam, 5 to 12 percent slopes, severely eroded	19.5	0.6%
Me	Melvin silt loam, phosphatic	24.8	0.8%
MhC2	Mimosa cherty silt loam, 5 to 12 percent slopes, eroded	0.9	0.0%
MhD2	Mimosa cherty silt loam, 12 to 20 percent slopes, eroded	2.2	0.1%
MlB2	Mimosa silt loam, 2 to 5 percent slopes, eroded	9.1	0.3%
MlC2	Mimosa silt loam, 5 to 12 percent slopes, eroded	40.6	1.3%
MlD2	Mimosa silt loam, 12 to 20 percent slopes, eroded	6.0	0.2%
MmD3	Mimosa silty clay, 10 to 20 percent slopes, severely eroded	11.9	0.4%
MnE	Mimosa very rocky soils, 20 to 40 percent slopes	10.9	0.4%
MoD	Mimosa and Ashwood very rocky soils, 5 to 20 percent slopes	40.2	1.3%
Mr	Mine land, reclaimed	53.2	1.7%
Rb	Robertsville silt loam, phosphatic	0.1	0.0%
Rc	Rockland	96.2	3.1%
SrC3	Stiversville clay loam, 5 to 12 percent slopes, severely eroded	133.6	4.3%
SrD3	Stiversville clay loam, 12 to 20 percent slopes, severely eroded	18.1	0.6%
StB2	Stiversville silt loam, 2 to 5 percent slopes, eroded	455.5	14.7%

Williamson County, Tennessee (TN187)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
StC2	Stiversville silt loam, 5 to 12 percent slopes, eroded	440.3	14.2%
StD2	Stiversville silt loam, 12 to 20 percent slopes, eroded	23.4	0.8%
Tb	Taft silt loam, phosphatic	10.6	0.3%
W	Water	30.9	1.0%
Totals for Area of Interest		**3,106.6**	**100.0%**

APPENDIX 5- TRAFFIC ANALYSIS

SYNCHRO ANALYSIS

901: Columbia Pike US31 & SR840 WB Ramp

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	0	0	0	166	0	235	0	1012	0	0	378	0
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	0	0	0	180	0	255	0	1100	0	0	411	0
Shared Lane Traffic (%)				50%								
Lane Group Flow (vph)	0	0	0	90	90	255	0	1100	0	0	411	0

Intersection Summary

Lane Group	WBL	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	90	90	255	1100	411
v/c Ratio	0.25	0.25	0.64	0.49	0.18
Control Delay	17.9	17.9	20.3	7.0	5.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	17.9	17.9	20.3	7.0	5.2
Queue Length 50th (ft)	24	24	49	77	22
Queue Length 95th (ft)	54	54	106	172	55
Internal Link Dist (ft)		2384		933	7506
Turn Bay Length (ft)			150		
Base Capacity (vph)	573	573	590	2267	2267
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.16	0.16	0.43	0.49	0.18

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	0	0	0	0	0	0	0	1000	267	79	463	0
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	0	0	0	0	0	0	0	1087	290	86	503	0
Shared Lane Traffic (%)	0%											
Lane Group Flow (vph)	0	0	0	0	0	0	0	1087	290	86	503	0

Intersection Summary

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Volume (vph)	119	101	47	637	156	3
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Adj. Flow (vph)	129	110	51	692	170	3
Shared Lane Traffic (%)						
Lane Group Flow (vph)	129	110	51	692	173	0

Intersection Summary

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Volume (vph)	10	9	470	681	151	112
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Adj. Flow (vph)	11	10	511	740	164	122
Shared Lane Traffic (%)						
Lane Group Flow (vph)	11	10	511	740	164	122

Intersection Summary

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Volume (vph)	11	56	117	27	335	450
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Adj. Flow (vph)	12	61	127	29	364	489
Shared Lane Traffic (%)						
Lane Group Flow (vph)	73	0	0	156	853	0

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	142	106	73	134	185	274	53	543	41	47	289	72
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	154	115	79	146	201	298	58	590	45	51	314	78
Shared Lane Traffic (%)												
Lane Group Flow (vph)	154	115	79	146	201	298	58	635	0	51	314	78

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	154	115	79	146	201	298	58	635	51	314	78
v/c Ratio	0.62	0.27	0.18	0.49	0.46	0.52	0.09	0.56	0.13	0.27	0.08
Control Delay	29.9	17.8	5.6	23.5	21.0	7.0	5.9	9.3	6.8	6.4	2.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.9	17.8	5.6	23.5	21.0	7.0	5.9	9.3	6.8	6.4	2.0
Queue Length 50th (ft)	44	30	0	40	55	7	6	96	6	38	0
Queue Length 95th (ft)	93	63	24	83	103	54	24	232	24	96	15
Internal Link Dist (ft)		2030			1135			9853		1200	
Turn Bay Length (ft)	175		175	150		300	200		150		150
Base Capacity (vph)	378	662	614	452	662	737	649	1141	381	1150	1007
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.41	0.17	0.13	0.32	0.30	0.40	0.09	0.56	0.13	0.27	0.08

Intersection Summary

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Volume (vph)	243	42	110	542	156	17
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Adj. Flow (vph)	264	46	120	589	170	18
Shared Lane Traffic (%)						
Lane Group Flow (vph)	310	0	0	709	188	0

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	0	0	0	53	0	87	90	154	0	0	633	117
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	0	0	0	58	0	95	98	167	0	0	688	127
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	153	0	98	167	0	0	815	0

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	40	0	120	0	0	0	0	205	366	601	111	0
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	43	0	130	0	0	0	0	223	398	653	121	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	173	0	0	0	0	0	223	398	653	121	0

Intersection Summary

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Volume (vph)	11	56	117	27	335	450
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Adj. Flow (vph)	12	61	127	29	364	489
Shared Lane Traffic (%)						
Lane Group Flow (vph)	12	61	127	29	364	489

Intersection Summary

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	12	61	127	29	364	489
v/c Ratio	0.02	0.11	0.19	0.03	0.55	0.45
Control Delay	20.1	2.6	11.7	10.3	21.1	2.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.1	2.6	11.7	10.3	21.1	2.3
Queue Length 50th (ft)	4	0	32	7	111	8
Queue Length 95th (ft)	16	14	61	19	233	1
Internal Link Dist (ft)	2022			1829	2247	
Turn Bay Length (ft)		150	150			150
Base Capacity (vph)	606	578	705	931	663	1186
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.02	0.11	0.18	0.03	0.55	0.41

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	142	106	73	134	185	274	53	543	41	47	289	72
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	154	115	79	146	201	298	58	590	45	51	314	78
Shared Lane Traffic (%)												
Lane Group Flow (vph)	154	115	79	146	201	298	58	635	0	51	314	78

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	154	115	79	146	201	298	58	635	51	314	78
v/c Ratio	0.53	0.39	0.20	0.43	0.65	0.58	0.10	0.70	0.17	0.35	0.09
Control Delay	29.0	32.8	1.2	26.5	42.0	9.8	9.1	24.2	9.9	16.2	0.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.0	32.8	1.2	26.5	42.0	9.8	9.1	24.2	9.9	16.2	0.2
Queue Length 50th (ft)	58	51	0	53	89	2	12	269	11	106	0
Queue Length 95th (ft)	101	95	0	106	162	75	30	#478	27	178	0
Internal Link Dist (ft)		2030			1135			9853		1200	
Turn Bay Length (ft)	175		175	150		300	200		150		150
Base Capacity (vph)	293	372	447	341	372	555	563	902	307	909	856
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.53	0.31	0.18	0.43	0.54	0.54	0.10	0.70	0.17	0.35	0.09

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Volume (vph)	243	42	110	542	156	17
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Adj. Flow (vph)	264	46	120	589	170	18
Shared Lane Traffic (%)						
Lane Group Flow (vph)	264	46	120	589	170	18

Intersection Summary

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	264	46	120	589	170	18
v/c Ratio	0.70	0.11	0.15	0.48	0.17	0.02
Control Delay	34.6	0.6	6.4	9.2	7.6	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.6	0.6	6.4	9.2	7.6	0.5
Queue Length 50th (ft)	88	0	19	127	25	0
Queue Length 95th (ft)	m183	m0	47	248	89	0
Internal Link Dist (ft)	7444			1245	1600	
Turn Bay Length (ft)		150	150			150
Base Capacity (vph)	531	541	787	1232	992	888
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.50	0.09	0.15	0.48	0.17	0.02

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Volume (vph)	35	242	591	39	83	138
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Adj. Flow (vph)	38	263	642	42	90	150
Shared Lane Traffic (%)						
Lane Group Flow (vph)	38	263	642	42	90	150

Intersection Summary

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	38	263	642	42	90	150
v/c Ratio	0.09	0.47	1.13	0.05	0.12	0.14
Control Delay	23.7	6.6	101.4	12.3	13.6	1.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.7	6.6	101.4	12.3	13.6	1.3
Queue Length 50th (ft)	14	0	~303	11	24	0
Queue Length 95th (ft)	37	55	#546	28	51	17
Internal Link Dist (ft)	2022			1829	2247	
Turn Bay Length (ft)		150	150			150
Base Capacity (vph)	422	562	568	819	755	1067
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.09	0.47	1.13	0.05	0.12	0.14

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	92	186	74	207	101	113	24	414	169	175	640	156
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	100	202	80	225	110	123	26	450	184	190	696	170
Shared Lane Traffic (%)												
Lane Group Flow (vph)	100	202	80	225	110	123	26	634	0	190	696	170

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	100	202	80	225	110	123	26	634	190	696	170
v/c Ratio	0.32	0.71	0.22	0.93	0.33	0.31	0.08	0.73	0.59	0.66	0.18
Control Delay	27.6	49.8	2.0	74.4	37.6	7.8	8.3	24.1	17.8	19.8	3.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.6	49.8	2.0	74.4	37.6	7.8	8.3	24.1	17.8	19.8	3.9
Queue Length 50th (ft)	43	109	0	102	56	0	6	271	44	231	5
Queue Length 95th (ft)	81	179	5	#244	106	38	16	411	#86	#484	41
Internal Link Dist (ft)		2030			1135			9853		1200	
Turn Bay Length (ft)	175		175	150		300	200		150		150
Base Capacity (vph)	314	331	400	242	350	414	326	872	321	1051	956
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.32	0.61	0.20	0.93	0.31	0.30	0.08	0.73	0.59	0.66	0.18

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Volume (vph)	41	69	57	180	400	433
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Adj. Flow (vph)	45	75	62	196	435	471
Shared Lane Traffic (%)						
Lane Group Flow (vph)	45	75	62	196	435	471

Intersection Summary

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	45	75	62	196	435	471
v/c Ratio	0.29	0.35	0.08	0.13	0.32	0.37
Control Delay	38.6	12.4	2.3	2.2	6.7	1.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	38.6	12.4	2.3	2.2	6.7	1.5
Queue Length 50th (ft)	24	4	5	18	90	0
Queue Length 95th (ft)	m37	m15	14	37	158	32
Internal Link Dist (ft)	7444			1245	1600	
Turn Bay Length (ft)		150	150			150
Base Capacity (vph)	472	484	790	1558	1370	1288
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.15	0.08	0.13	0.32	0.37

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	0	0	0	422	0	104	0	350	0	0	941	0
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	0	0	0	459	0	113	0	380	0	0	1023	0
Shared Lane Traffic (%)				50%								
Lane Group Flow (vph)	0	0	0	229	230	113	0	380	0	0	1023	0

Intersection Summary

Lane Group	WBL	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	229	230	113	380	1023
v/c Ratio	0.62	0.62	0.26	0.17	0.45
Control Delay	31.2	31.3	5.9	6.2	8.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	31.2	31.3	5.9	6.2	8.1
Queue Length 50th (ft)	93	94	0	30	103
Queue Length 95th (ft)	144	144	32	61	185
Internal Link Dist (ft)		2384		933	7506
Turn Bay Length (ft)			150		
Base Capacity (vph)	528	528	575	2253	2253
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.43	0.44	0.20	0.17	0.45

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	0	0	0	0	0	0	0	306	152	137	877	0
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	0	0	0	0	0	0	0	333	165	149	953	0
Shared Lane Traffic (%)	0%											
Lane Group Flow (vph)	0	0	0	0	0	0	0	333	165	149	953	0

Intersection Summary

Lane Group	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	333	165	149	953
v/c Ratio	0.09	0.10	0.15	0.27
Control Delay	0.1	0.1	0.3	0.2
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	0.1	0.1	0.3	0.2
Queue Length 50th (ft)	0	0	0	0
Queue Length 95th (ft)	0	0	0	0
Internal Link Dist (ft)	2017			933
Turn Bay Length (ft)		500	175	
Base Capacity (vph)	3539	1583	1026	3539
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.09	0.10	0.15	0.27

Intersection Summary

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Volume (vph)	45	629	11	84	448	6
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Adj. Flow (vph)	49	684	12	91	487	7
Shared Lane Traffic (%)						
Lane Group Flow (vph)	49	684	12	91	494	0

Intersection Summary

Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	49	684	12	91	494
v/c Ratio	0.44	0.43	0.02	0.05	0.31
Control Delay	78.8	0.9	1.3	1.1	3.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	78.8	0.9	1.3	1.1	3.7
Queue Length 50th (ft)	47	0	1	7	63
Queue Length 95th (ft)	91	0	3	11	176
Internal Link Dist (ft)	446			1125	3526
Turn Bay Length (ft)		300	100		
Base Capacity (vph)	306	1583	774	1660	1602
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.16	0.43	0.02	0.05	0.31

Intersection Summary

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Volume (vph)	1	32	164	90	1017	59
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Adj. Flow (vph)	1	35	178	98	1105	64
Shared Lane Traffic (%)						
Lane Group Flow (vph)	1	35	178	98	1105	64

Intersection Summary

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	1	35	178	98	1105	64
v/c Ratio	0.01	0.30	0.46	0.06	0.74	0.05
Control Delay	69.0	14.8	4.9	1.0	11.8	1.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	69.0	14.8	4.9	1.0	11.8	1.6
Queue Length 50th (ft)	1	0	14	7	479	2
Queue Length 95th (ft)	8	23	24	14	895	13
Internal Link Dist (ft)	411			3238	1125	
Turn Bay Length (ft)		200	100			
Base Capacity (vph)	188	214	959	1700	1487	1273
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.16	0.19	0.06	0.74	0.05

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	0	0	0	270	0	555	54	274	0	0	348	241
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	0	0	0	293	0	603	59	298	0	0	378	262
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	293	603	59	298	0	0	640	0

Intersection Summary

Lane Group	WBT	WBR	NBL	NBT	SBT
Lane Group Flow (vph)	293	603	59	298	640
v/c Ratio	1.06	0.80	0.10	0.21	0.27
Control Delay	117.1	12.5	3.7	4.3	4.8
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	117.1	12.5	3.7	4.3	4.8
Queue Length 50th (ft)	~238	0	9	51	52
Queue Length 95th (ft)	#413	124	18	75	78
Internal Link Dist (ft)	1680			1224	528
Turn Bay Length (ft)		300			
Base Capacity (vph)	277	756	647	1409	2329
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	1.06	0.80	0.09	0.21	0.27

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	18	0	69	0	0	0	0	57	78	178	193	0
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	20	0	75	0	0	0	0	62	85	193	210	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	20	75	0	0	0	0	62	85	193	210	0

Intersection Summary

Lane Group	EBT	EBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	20	75	62	85	193	210
v/c Ratio	0.18	0.44	0.02	0.07	0.17	0.13
Control Delay	53.9	19.8	4.4	1.2	3.2	3.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	53.9	19.8	4.4	1.2	3.2	3.1
Queue Length 50th (ft)	14	0	5	0	33	36
Queue Length 95th (ft)	39	47	13	14	m42	m45
Internal Link Dist (ft)	1642		1468			1224
Turn Bay Length (ft)				150		
Base Capacity (vph)	246	284	2687	1222	1333	1635
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.08	0.26	0.02	0.07	0.14	0.13

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

901: Columbia Pike US31 & SR840 WB Ramp

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	0	0	0	422	0	104	0	350	0	0	941	0
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	0	0	0	459	0	113	0	380	0	0	1023	0
Shared Lane Traffic (%)				50%								
Lane Group Flow (vph)	0	0	0	229	230	113	0	380	0	0	1023	0

Intersection Summary

Lane Group	WBL	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	229	230	113	380	1023
v/c Ratio	0.58	0.58	0.25	0.17	0.47
Control Delay	24.2	24.2	5.4	5.5	7.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	24.2	24.2	5.4	5.5	7.3
Queue Length 50th (ft)	68	68	0	23	80
Queue Length 95th (ft)	125	126	29	51	155
Internal Link Dist (ft)		2384		933	7506
Turn Bay Length (ft)			150		
Base Capacity (vph)	580	580	620	2187	2187
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.39	0.40	0.18	0.17	0.47

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	0	0	0	0	0	0	0	306	152	137	877	0
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	0	0	0	0	0	0	0	333	165	149	953	0
Shared Lane Traffic (%)	0%											
Lane Group Flow (vph)	0	0	0	0	0	0	0	333	165	149	953	0

Intersection Summary

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Volume (vph)	45	629	11	84	448	6
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Adj. Flow (vph)	49	684	12	91	487	7
Shared Lane Traffic (%)						
Lane Group Flow (vph)	49	684	12	91	494	0

Intersection Summary

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Volume (vph)	1	32	164	90	1017	59
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Adj. Flow (vph)	1	35	178	98	1105	64
Shared Lane Traffic (%)						
Lane Group Flow (vph)	1	35	178	98	1105	64

Intersection Summary

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Volume (vph)	35	242	591	39	83	138
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Adj. Flow (vph)	38	263	642	42	90	150
Shared Lane Traffic (%)						
Lane Group Flow (vph)	301	0	0	684	240	0

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	92	186	74	207	101	113	24	414	169	175	640	156
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	100	202	80	225	110	123	26	450	184	190	696	170
Shared Lane Traffic (%)												
Lane Group Flow (vph)	100	202	80	225	110	123	26	634	0	190	696	170

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	100	202	80	225	110	123	26	634	190	696	170
v/c Ratio	0.29	0.40	0.17	0.78	0.22	0.24	0.09	0.59	0.55	0.63	0.17
Control Delay	18.3	19.3	5.3	39.3	16.6	4.9	7.2	10.3	16.2	11.8	1.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.3	19.3	5.3	39.3	16.6	4.9	7.2	10.3	16.2	11.8	1.8
Queue Length 50th (ft)	26	55	0	69	28	0	4	115	37	147	0
Queue Length 95th (ft)	59	103	25	#159	61	30	14	223	#114	271	21
Internal Link Dist (ft)		2030			1135			9853		1200	
Turn Bay Length (ft)	175		175	150		300	200		150		150
Base Capacity (vph)	421	613	575	354	613	604	302	1078	347	1104	1007
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.33	0.14	0.64	0.18	0.20	0.09	0.59	0.55	0.63	0.17

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Volume (vph)	41	69	57	180	400	433
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Adj. Flow (vph)	45	75	62	196	435	471
Shared Lane Traffic (%)						
Lane Group Flow (vph)	120	0	0	258	906	0

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	0	0	0	270	0	555	54	274	0	0	348	241
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	0	0	0	293	0	603	59	298	0	0	378	262
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	896	0	59	298	0	0	640	0

Intersection Summary

911: Port Royal Rd & Saturn Pkwy EB Ramp

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	18	0	69	0	0	0	0	57	78	178	193	0
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	20	0	75	0	0	0	0	62	85	193	210	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	95	0	0	0	0	0	62	85	193	210	0

Intersection Summary

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	41	213	259	60	415	558
v/c Ratio	0.09	0.40	0.46	0.07	0.55	0.46
Control Delay	23.7	6.4	16.8	12.5	19.5	1.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.7	6.4	16.8	12.5	19.5	1.9
Queue Length 50th (ft)	15	0	76	16	139	0
Queue Length 95th (ft)	39	50	129	36	223	31
Internal Link Dist (ft)	2022			1829	2247	
Turn Bay Length (ft)		150	150			150
Base Capacity (vph)	436	533	570	819	755	1214
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.09	0.40	0.45	0.07	0.55	0.46

Intersection Summary

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	38	196	238	55	382	513
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.57	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	1059	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	41	213	259	60	415	558
RTOR Reduction (vph)	0	163	0	0	0	243
Lane Group Flow (vph)	41	50	259	60	415	315
Turn Type	NA	Perm	pm+pt	NA	NA	pm+ov
Protected Phases	2		1	6	8	1
Permitted Phases		2	6			8
Actuated Green, G (s)	17.6	17.6	33.0	33.0	32.0	42.4
Effective Green, g (s)	17.6	17.6	33.0	33.0	32.0	42.4
Actuated g/C Ratio	0.23	0.23	0.44	0.44	0.43	0.57
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	437	371	564	819	755	1000
v/s Ratio Prot	0.02		c0.06	0.03	c0.23	0.04
v/s Ratio Perm		0.03	c0.14			0.16
v/c Ratio	0.09	0.13	0.46	0.07	0.55	0.32
Uniform Delay, d1	22.5	22.7	14.0	12.2	16.1	8.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.8	0.6	0.2	2.9	0.2
Delay (s)	22.9	23.4	14.6	12.3	19.0	8.8
Level of Service	C	C	B	B	B	A
Approach Delay (s)	23.3			14.2	13.1	
Approach LOS	C			B	B	

Intersection Summary			
HCM 2000 Control Delay	15.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	49.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	197	147	101	186	257	379	58	635	51	314	78
v/c Ratio	0.92	0.47	0.26	0.61	0.82	0.74	0.10	0.66	0.15	0.34	0.09
Control Delay	74.8	38.8	3.9	38.4	59.2	20.1	8.5	21.1	9.0	15.9	0.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	74.8	38.8	3.9	38.4	59.2	20.1	8.5	21.1	9.0	15.9	0.4
Queue Length 50th (ft)	88	75	0	89	145	49	13	280	11	110	0
Queue Length 95th (ft)	#175	134	19	147	#263	148	28	416	26	172	2
Internal Link Dist (ft)		2030			1135			9853		1200	
Turn Bay Length (ft)	175		175	150		300	200		150		150
Base Capacity (vph)	214	331	400	304	331	526	576	968	342	931	864
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.92	0.44	0.25	0.61	0.78	0.72	0.10	0.66	0.15	0.34	0.09

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	181	135	93	171	236	349	53	543	41	47	289	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1843		1770	1863	1583
Flt Permitted	0.31	1.00	1.00	0.59	1.00	1.00	0.50	1.00		0.25	1.00	1.00
Satd. Flow (perm)	569	1863	1583	1101	1863	1583	922	1843		463	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	197	147	101	186	257	379	58	590	45	51	314	78
RTOR Reduction (vph)	0	0	84	0	0	248	0	3	0	0	0	40
Lane Group Flow (vph)	197	147	17	186	257	131	58	632	0	51	314	38
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	21.2	15.2	15.2	21.2	15.2	15.2	50.0	45.2		47.6	44.0	44.0
Effective Green, g (s)	21.2	15.2	15.2	21.2	15.2	15.2	50.0	45.2		47.6	44.0	44.0
Actuated g/C Ratio	0.24	0.17	0.17	0.24	0.17	0.17	0.56	0.50		0.53	0.49	0.49
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	214	314	267	303	314	267	557	925		297	910	773
v/s Ratio Prot	c0.06	0.08		0.04	0.14		0.01	c0.34		c0.01	0.17	
v/s Ratio Perm	c0.16		0.01	0.10		0.08	0.05			0.08		0.02
v/c Ratio	0.92	0.47	0.06	0.61	0.82	0.49	0.10	0.68		0.17	0.35	0.05
Uniform Delay, d1	32.3	33.8	31.4	29.9	36.1	33.9	9.4	17.0		12.3	14.1	12.0
Progression Factor	1.00	1.00	1.00	1.08	1.05	1.22	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	40.1	1.1	0.1	3.7	15.2	1.4	0.1	4.1		0.3	1.0	0.1
Delay (s)	72.4	34.9	31.5	35.8	53.2	42.9	9.5	21.1		12.5	15.2	12.2
Level of Service	E	C	C	D	D	D	A	C		B	B	B
Approach Delay (s)		50.7			44.5			20.1			14.3	
Approach LOS		D			D			C			B	

Intersection Summary			
HCM 2000 Control Delay	33.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	75.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	477	83	137	673	191	21
v/c Ratio	0.80	0.14	0.22	0.65	0.26	0.03
Control Delay	44.4	12.0	10.5	17.7	19.3	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.4	12.0	10.5	17.7	19.3	0.1
Queue Length 50th (ft)	254	1	37	263	74	0
Queue Length 95th (ft)	#471	m40	55	319	111	0
Internal Link Dist (ft)	7444			1245	1600	
Turn Bay Length (ft)		150	150			150
Base Capacity (vph)	595	588	639	1159	848	767
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.80	0.14	0.21	0.58	0.23	0.03

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	439	76	126	619	176	19
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.95	1.00	0.54	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1002	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	477	83	137	673	191	21
RTOR Reduction (vph)	0	55	0	0	0	13
Lane Group Flow (vph)	477	28	137	673	191	8
Turn Type	NA	Perm	pm+pt	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	30.3	30.3	49.7	49.7	36.0	36.0
Effective Green, g (s)	30.3	30.3	49.7	49.7	36.0	36.0
Actuated g/C Ratio	0.34	0.34	0.55	0.55	0.40	0.40
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	595	532	627	1028	745	633
v/s Ratio Prot	c0.27		0.02	c0.36	0.10	
v/s Ratio Perm		0.02	0.10			0.01
v/c Ratio	0.80	0.05	0.22	0.65	0.26	0.01
Uniform Delay, d1	27.1	20.2	10.0	14.1	18.1	16.3
Progression Factor	1.18	2.09	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.6	0.0	0.2	3.3	0.8	0.0
Delay (s)	39.6	42.2	10.2	17.4	18.9	16.3
Level of Service	D	D	B	B	B	B
Approach Delay (s)	40.0			16.2	18.6	
Approach LOS	D			B	B	

Intersection Summary			
HCM 2000 Control Delay	24.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	65.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	139	140	395	1166	448
v/c Ratio	0.30	0.31	0.83	0.56	0.22
Control Delay	21.0	21.0	35.6	8.7	7.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	21.0	21.0	35.6	8.7	7.9
Queue Length 50th (ft)	47	47	128	125	47
Queue Length 95th (ft)	90	91	#252	151	72
Internal Link Dist (ft)		2384		933	7506
Turn Bay Length (ft)			150		
Base Capacity (vph)	528	528	540	2067	2067
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.26	0.27	0.73	0.56	0.22

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	257	0	363	0	1073	0	0	412	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				5.0	5.0	5.0		5.0			5.0	
Lane Util. Factor				0.95	0.95	1.00		0.95			0.95	
Frt				1.00	1.00	0.85		1.00			1.00	
Flt Protected				0.95	0.95	1.00		1.00			1.00	
Satd. Flow (prot)				1681	1681	1583		3539			3539	
Flt Permitted				0.95	0.95	1.00		1.00			1.00	
Satd. Flow (perm)				1681	1681	1583		3539			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	279	0	395	0	1166	0	0	448	0
RTOR Reduction (vph)	0	0	0	0	0	45	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	139	140	350	0	1166	0	0	448	0
Turn Type				Perm	NA	Perm	Perm	NA			NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8	2					6
Actuated Green, G (s)				19.1	19.1	19.1		40.9			40.9	
Effective Green, g (s)				19.1	19.1	19.1		40.9			40.9	
Actuated g/C Ratio				0.27	0.27	0.27		0.58			0.58	
Clearance Time (s)				5.0	5.0	5.0		5.0			5.0	
Vehicle Extension (s)				3.0	3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)				458	458	431		2067			2067	
v/s Ratio Prot								c0.33			0.13	
v/s Ratio Perm				0.08	0.08	c0.22						
v/c Ratio				0.30	0.31	0.81		0.56			0.22	
Uniform Delay, d1				20.2	20.2	23.8		9.0			6.9	
Progression Factor				1.00	1.00	1.00		0.77			1.00	
Incremental Delay, d2				0.4	0.4	11.1		1.1			0.2	
Delay (s)				20.6	20.6	34.9		8.0			7.2	
Level of Service				C	C	C		A			A	
Approach Delay (s)		0.0			28.9			8.0			7.2	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	14.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	60.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	62	62	102	1146	290	93	547
v/c Ratio	0.32	0.32	0.37	0.41	0.22	0.28	0.20
Control Delay	32.2	32.2	10.8	3.9	0.9	6.5	3.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.2	32.2	10.8	3.9	0.9	6.5	3.1
Queue Length 50th (ft)	26	26	0	74	0	16	47
Queue Length 95th (ft)	58	58	38	124	17	36	68
Internal Link Dist (ft)		1478		2017			933
Turn Bay Length (ft)			250		500	175	
Base Capacity (vph)	384	384	440	2785	1307	338	2785
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.16	0.23	0.41	0.22	0.28	0.20

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	114	0	94	0	0	0	0	1054	267	86	503	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0					5.0	5.0	5.0	5.0	
Lane Util. Factor	0.95	0.95	1.00					0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1681	1681	1583					3539	1583	1770	3539	
Flt Permitted	0.95	0.95	1.00					1.00	1.00	0.23	1.00	
Satd. Flow (perm)	1681	1681	1583					3539	1583	431	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	124	0	102	0	0	0	0	1146	290	93	547	0
RTOR Reduction (vph)	0	0	92	0	0	0	0	0	70	0	0	0
Lane Group Flow (vph)	62	62	10	0	0	0	0	1146	220	93	547	0
Turn Type	Perm	NA	Perm					NA	Perm	custom	NA	
Protected Phases		4						2				
Permitted Phases	4		4						2	6	6	
Actuated Green, G (s)	6.9	6.9	6.9					53.1	53.1	53.1	53.1	
Effective Green, g (s)	6.9	6.9	6.9					53.1	53.1	53.1	53.1	
Actuated g/C Ratio	0.10	0.10	0.10					0.76	0.76	0.76	0.76	
Clearance Time (s)	5.0	5.0	5.0					5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	165	165	156					2684	1200	326	2684	
v/s Ratio Prot								c0.32				
v/s Ratio Perm	c0.04	0.04	0.01						0.14	0.22	0.15	
v/c Ratio	0.38	0.38	0.06					0.43	0.18	0.29	0.20	
Uniform Delay, d1	29.5	29.5	28.6					3.0	2.4	2.6	2.4	
Progression Factor	1.00	1.00	1.00					1.00	1.00	1.13	1.08	
Incremental Delay, d2	1.4	1.4	0.2					0.5	0.3	2.2	0.2	
Delay (s)	31.0	31.0	28.8					3.5	2.7	5.1	2.8	
Level of Service	C	C	C					A	A	A	A	
Approach Delay (s)		30.0			0.0			3.4			3.1	
Approach LOS		C			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	5.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	60.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	228	193	58	776	193
v/c Ratio	0.84	0.12	0.06	0.53	0.14
Control Delay	87.0	0.2	3.2	7.3	7.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	87.0	0.2	3.2	7.3	7.7
Queue Length 50th (ft)	217	0	7	289	60
Queue Length 95th (ft)	#328	0	12	390	92
Internal Link Dist (ft)	446			1125	3526
Turn Bay Length (ft)		300	100		
Base Capacity (vph)	306	1583	907	1452	1338
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.75	0.12	0.06	0.53	0.14

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	210	178	53	714	175	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	4.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	1863	1859	
Flt Permitted	0.95	1.00	0.61	1.00	1.00	
Satd. Flow (perm)	1770	1583	1130	1863	1859	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	228	193	58	776	190	3
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	228	193	58	776	193	0
Turn Type	NA	Free	pm+pt	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		Free	2			
Actuated Green, G (s)	23.1	150.0	116.9	116.9	107.0	
Effective Green, g (s)	23.1	150.0	116.9	116.9	107.0	
Actuated g/C Ratio	0.15	1.00	0.78	0.78	0.71	
Clearance Time (s)	5.0		5.0	5.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	272	1583	901	1451	1326	
v/s Ratio Prot	c0.13		0.00	c0.42	0.10	
v/s Ratio Perm		0.12	0.05			
v/c Ratio	0.84	0.12	0.06	0.53	0.15	
Uniform Delay, d1	61.6	0.0	3.9	6.3	6.9	
Progression Factor	1.00	1.00	0.72	0.89	1.00	
Incremental Delay, d2	19.7	0.2	0.0	1.3	0.2	
Delay (s)	81.3	0.2	2.8	6.8	7.1	
Level of Service	F	A	A	A	A	
Approach Delay (s)	44.1			6.6	7.1	
Approach LOS	D			A	A	

Intersection Summary			
HCM 2000 Control Delay	17.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	57.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	20	17	573	829	184	136
v/c Ratio	0.23	0.13	0.52	0.48	0.12	0.11
Control Delay	74.5	2.2	3.0	2.4	4.4	0.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	74.5	2.2	3.0	2.4	4.4	0.9
Queue Length 50th (ft)	19	0	65	116	38	0
Queue Length 95th (ft)	48	0	106	183	63	10
Internal Link Dist (ft)	411			3238	1125	
Turn Bay Length (ft)		200	100			
Base Capacity (vph)	188	214	1338	1727	1491	1294
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.11	0.08	0.43	0.48	0.12	0.11

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	18	16	527	763	169	125
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.95	1.00	0.62	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1146	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	20	17	573	829	184	136
RTOR Reduction (vph)	0	16	0	0	0	29
Lane Group Flow (vph)	20	1	573	829	184	107
Turn Type	NA	Perm	pm+pt	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	4.9	4.9	135.1	135.1	118.1	118.1
Effective Green, g (s)	4.9	4.9	135.1	135.1	118.1	118.1
Actuated g/C Ratio	0.03	0.03	0.90	0.90	0.79	0.79
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	57	51	1082	1677	1466	1246
v/s Ratio Prot	c0.01		c0.04	0.45	0.10	
v/s Ratio Perm		0.00	c0.43			0.07
v/c Ratio	0.35	0.01	0.53	0.49	0.13	0.09
Uniform Delay, d1	71.0	70.2	1.3	1.3	3.8	3.6
Progression Factor	1.00	1.00	1.00	1.00	0.91	0.75
Incremental Delay, d2	3.7	0.1	0.5	1.0	0.2	0.1
Delay (s)	74.7	70.3	1.7	2.4	3.6	2.9
Level of Service	E	E	A	A	A	A
Approach Delay (s)	72.7			2.1	3.3	
Approach LOS	E			A	A	

Intersection Summary			
HCM 2000 Control Delay	3.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	55.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBT	WBR	NBL	NBT	SBT
Lane Group Flow (vph)	95	149	104	179	893
v/c Ratio	0.54	0.51	0.21	0.12	0.36
Control Delay	59.9	13.9	7.7	5.3	7.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	59.9	13.9	7.7	5.3	7.2
Queue Length 50th (ft)	68	0	10	17	115
Queue Length 95th (ft)	119	59	81	116	176
Internal Link Dist (ft)	1680			1224	528
Turn Bay Length (ft)		300			
Base Capacity (vph)	277	373	569	1515	2462
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.34	0.40	0.18	0.12	0.36

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	87	0	137	96	165	0	0	694	128
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0	5.0	5.0	5.0			5.0	
Lane Util. Factor					1.00	1.00	1.00	1.00			0.95	
Frt					1.00	0.85	1.00	1.00			0.98	
Flt Protected					0.95	1.00	0.95	1.00			1.00	
Satd. Flow (prot)					1770	1583	1770	1863			3457	
Flt Permitted					0.95	1.00	0.28	1.00			1.00	
Satd. Flow (perm)					1770	1583	512	1863			3457	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	95	0	149	104	179	0	0	754	139
RTOR Reduction (vph)	0	0	0	0	0	134	0	0	0	0	9	0
Lane Group Flow (vph)	0	0	0	0	95	15	104	179	0	0	884	0
Turn Type				Perm	NA	Perm	pm+pt	NA			NA	
Protected Phases					8		5	2			6	
Permitted Phases				8		8	2					
Actuated Green, G (s)					11.5	11.5	93.5	93.5			81.5	
Effective Green, g (s)					11.5	11.5	93.5	93.5			81.5	
Actuated g/C Ratio					0.10	0.10	0.81	0.81			0.71	
Clearance Time (s)					5.0	5.0	5.0	5.0			5.0	
Vehicle Extension (s)					3.0	3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)					177	158	492	1514			2449	
v/s Ratio Prot							c0.01	0.10			c0.26	
v/s Ratio Perm					0.05	0.01	0.16					
v/c Ratio					0.54	0.09	0.21	0.12			0.36	
Uniform Delay, d1					49.2	47.0	2.9	2.2			6.6	
Progression Factor					1.00	1.00	2.66	2.02			1.00	
Incremental Delay, d2					3.1	0.3	0.2	0.2			0.4	
Delay (s)					52.3	47.3	7.9	4.7			7.0	
Level of Service					D	D	A	A			A	
Approach Delay (s)		0.0			49.2			5.8			7.0	
Approach LOS		A			D			A			A	

Intersection Summary			
HCM 2000 Control Delay	14.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	78.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	59	175	239	426	716	133
v/c Ratio	0.41	0.61	0.11	0.38	0.72	0.09
Control Delay	58.0	16.5	11.0	2.5	6.1	0.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	58.0	16.5	11.0	2.5	6.1	0.2
Queue Length 50th (ft)	42	0	34	0	3	1
Queue Length 95th (ft)	84	65	73	51	84	2
Internal Link Dist (ft)	1642		1468			1224
Turn Bay Length (ft)				150		
Base Capacity (vph)	246	370	2174	1136	1211	1549
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.47	0.11	0.38	0.59	0.09

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	54	0	161	0	0	0	0	220	392	659	122	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0					5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00	1.00					0.95	1.00	1.00	1.00	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1770	1583					3539	1583	1770	1863	
Flt Permitted		0.95	1.00					1.00	1.00	0.56	1.00	
Satd. Flow (perm)		1770	1583					3539	1583	1049	1863	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	59	0	175	0	0	0	0	239	426	716	133	0
RTOR Reduction (vph)	0	0	161	0	0	0	0	0	164	0	0	0
Lane Group Flow (vph)	0	59	14	0	0	0	0	239	262	716	133	0
Turn Type	Perm	NA	Perm					NA	Perm	pm+pt	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2	6		
Actuated Green, G (s)		9.3	9.3					70.7	70.7	95.7	95.7	
Effective Green, g (s)		9.3	9.3					70.7	70.7	95.7	95.7	
Actuated g/C Ratio		0.08	0.08					0.61	0.61	0.83	0.83	
Clearance Time (s)		5.0	5.0					5.0	5.0	5.0	5.0	
Vehicle Extension (s)		3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		143	128					2175	973	998	1550	
v/s Ratio Prot								0.07		c0.12	0.07	
v/s Ratio Perm		0.03	0.01						0.17	c0.47		
v/c Ratio		0.41	0.11					0.11	0.27	0.72	0.09	
Uniform Delay, d1		50.3	49.0					9.2	10.2	3.0	1.7	
Progression Factor		1.00	1.00					1.00	1.00	0.60	0.07	
Incremental Delay, d2		1.9	0.4					0.1	0.7	2.4	0.1	
Delay (s)		52.2	49.4					9.3	10.9	4.2	0.2	
Level of Service		D	D					A	B	A	A	
Approach Delay (s)		50.1			0.0			10.3			3.6	
Approach LOS		D			A			B			A	

Intersection Summary			
HCM 2000 Control Delay	12.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	78.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	139	140	395	1166	448
v/c Ratio	0.29	0.30	0.80	0.57	0.22
Control Delay	17.5	17.6	30.0	9.6	6.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	17.5	17.6	30.0	9.6	6.7
Queue Length 50th (ft)	38	38	104	133	39
Queue Length 95th (ft)	78	78	#225	186	61
Internal Link Dist (ft)		2384		933	7506
Turn Bay Length (ft)			150		
Base Capacity (vph)	557	557	567	2048	2048
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.25	0.25	0.70	0.57	0.22

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	257	0	363	0	1073	0	0	412	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0			4.0	
Lane Util. Factor				0.95	0.95	1.00		0.95			0.95	
Frt				1.00	1.00	0.85		1.00			1.00	
Flt Protected				0.95	0.95	1.00		1.00			1.00	
Satd. Flow (prot)				1681	1681	1583		3539			3539	
Flt Permitted				0.95	0.95	1.00		1.00			1.00	
Satd. Flow (perm)				1681	1681	1583		3539			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	279	0	395	0	1166	0	0	448	0
RTOR Reduction (vph)	0	0	0	0	0	46	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	139	140	349	0	1166	0	0	448	0
Turn Type				Perm	NA	Perm	Perm	NA			NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8	2					6
Actuated Green, G (s)				16.2	16.2	16.2		33.3			33.3	
Effective Green, g (s)				16.2	16.2	16.2		33.3			33.3	
Actuated g/C Ratio				0.28	0.28	0.28		0.58			0.58	
Clearance Time (s)				4.0	4.0	4.0		4.0			4.0	
Vehicle Extension (s)				3.0	3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)				473	473	445		2049			2049	
v/s Ratio Prot								c0.33			0.13	
v/s Ratio Perm				0.08	0.08	c0.22						
v/c Ratio				0.29	0.30	0.78		0.57			0.22	
Uniform Delay, d1				16.2	16.2	19.0		7.6			5.8	
Progression Factor				1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2				0.3	0.4	8.8		1.2			0.2	
Delay (s)				16.5	16.5	27.8		8.7			6.1	
Level of Service				B	B	C		A			A	
Approach Delay (s)		0.0			23.2			8.7			6.1	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	12.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	57.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	58.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	114	0	94	0	0	0	0	1054	267	86	503	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	124	0	102	0	0	0	0	1146	290	93	547	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			10									
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											1013	
pX, platoon unblocked												
vC, conflicting volume	1307	1879	273	1606	1879	573	547			1146		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1307	1879	273	1606	1879	573	547			1146		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	100	86	100	100	100	100			85		
cM capacity (veh/h)	103	60	724	53	60	463	1019			606		

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	83	143	573	573	290	93	273	273
Volume Left	83	41	0	0	0	93	0	0
Volume Right	0	102	0	0	290	0	0	0
cSH	103	359	1700	1700	1700	606	1700	1700
Volume to Capacity	0.80	0.40	0.34	0.34	0.17	0.15	0.16	0.16
Queue Length 95th (ft)	110	47	0	0	0	14	0	0
Control Delay (s)	115.1	25.3	0.0	0.0	0.0	12.0	0.0	0.0
Lane LOS	F	D				B		
Approach Delay (s)	58.1		0.0			1.8		
Approach LOS	F							

Intersection Summary			
Average Delay	6.2		
Intersection Capacity Utilization	58.8%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	210	178	53	714	175	3
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	228	193	58	776	190	3
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		12				
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1083	192	193			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1083	192	193			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	1	77	96			
cM capacity (veh/h)	230	850	1380			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	422	58	776	193
Volume Left	228	58	0	0
Volume Right	193	0	0	3
cSH	426	1380	1700	1700
Volume to Capacity	0.99	0.04	0.46	0.11
Queue Length 95th (ft)	308	3	0	0
Control Delay (s)	60.1	7.7	0.0	0.0
Lane LOS	F	A		
Approach Delay (s)	60.1	0.5		0.0
Approach LOS	F			

Intersection Summary			
Average Delay	17.8		
Intersection Capacity Utilization	55.9%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	18	16	527	763	169	125
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	20	17	573	829	184	136
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		8				
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2159	184	184			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2159	184	184			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	36	98	59			
cM capacity (veh/h)	31	859	1391			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	37	573	829	184	136
Volume Left	20	573	0	0	0
Volume Right	17	0	0	0	136
cSH	58	1391	1700	1700	1700
Volume to Capacity	0.64	0.41	0.49	0.11	0.08
Queue Length 95th (ft)	66	51	0	0	0
Control Delay (s)	131.8	9.4	0.0	0.0	0.0
Lane LOS	F	A			
Approach Delay (s)	131.8	3.8		0.0	
Approach LOS	F				

Intersection Summary			
Average Delay	5.8		
Intersection Capacity Utilization	51.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	38	196	238	55	382	513
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	41	213	259	60	415	558
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			254		725	148
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			254		725	148
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			80		0	38
cM capacity (veh/h)			1311		315	899

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	254	318	973
Volume Left	0	259	415
Volume Right	213	0	558
cSH	1700	1311	501
Volume to Capacity	0.15	0.20	1.94
Queue Length 95th (ft)	0	18	1614
Control Delay (s)	0.0	7.2	449.5
Lane LOS		A	F
Approach Delay (s)	0.0	7.2	449.5
Approach LOS			F

Intersection Summary			
Average Delay	284.4		
Intersection Capacity Utilization	92.8%	ICU Level of Service	F
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	197	147	101	186	257	379	58	635	51	314	78
v/c Ratio	0.80	0.29	0.20	0.55	0.51	0.60	0.10	0.59	0.15	0.29	0.08
Control Delay	44.1	17.4	5.1	24.2	20.9	10.0	6.8	10.9	7.9	7.5	2.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.1	17.4	5.1	24.2	20.9	10.0	6.8	10.9	7.9	7.5	2.2
Queue Length 50th (ft)	61	39	0	53	73	29	8	129	8	51	0
Queue Length 95th (ft)	#151	77	27	107	130	94	24	232	24	96	15
Internal Link Dist (ft)		2030			1135			9853		1200	
Turn Bay Length (ft)	175		175	150		300	200		150		150
Base Capacity (vph)	307	628	601	416	628	712	603	1083	340	1091	959
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.64	0.23	0.17	0.45	0.41	0.53	0.10	0.59	0.15	0.29	0.08

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	181	135	93	171	236	349	53	543	41	47	289	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1843		1770	1863	1583
Flt Permitted	0.49	1.00	1.00	0.66	1.00	1.00	0.55	1.00		0.31	1.00	1.00
Satd. Flow (perm)	910	1863	1583	1236	1863	1583	1031	1843		581	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	197	147	101	186	257	379	58	590	45	51	314	78
RTOR Reduction (vph)	0	0	74	0	0	197	0	4	0	0	0	32
Lane Group Flow (vph)	197	147	27	186	257	182	58	631	0	51	314	46
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	15.4	15.4	15.4	15.4	15.4	15.4	33.2	33.2		33.2	33.2	33.2
Effective Green, g (s)	15.4	15.4	15.4	15.4	15.4	15.4	33.2	33.2		33.2	33.2	33.2
Actuated g/C Ratio	0.27	0.27	0.27	0.27	0.27	0.27	0.59	0.59		0.59	0.59	0.59
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	247	506	430	336	506	430	604	1081		340	1092	928
v/s Ratio Prot		0.08			0.14			c0.34			0.17	
v/s Ratio Perm	c0.22		0.02	0.15		0.12	0.06			0.09		0.03
v/c Ratio	0.80	0.29	0.06	0.55	0.51	0.42	0.10	0.58		0.15	0.29	0.05
Uniform Delay, d1	19.2	16.3	15.3	17.7	17.4	17.0	5.1	7.4		5.3	5.8	5.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	16.2	0.3	0.1	2.0	0.8	0.7	0.3	2.3		0.9	0.7	0.1
Delay (s)	35.4	16.6	15.3	19.6	18.2	17.6	5.4	9.7		6.2	6.5	5.1
Level of Service	D	B	B	B	B	B	A	A		A	A	A
Approach Delay (s)		24.6			18.3			9.3			6.2	
Approach LOS		C			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	14.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	56.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	72.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	439	76	126	619	176	19
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	477	83	137	673	191	21
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1148	202	212			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1148	202	212			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	90	90			
cM capacity (veh/h)	198	839	1358			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	560	810	212
Volume Left	477	137	0
Volume Right	83	0	21
cSH	223	1358	1700
Volume to Capacity	2.51	0.10	0.12
Queue Length 95th (ft)	1166	8	0
Control Delay (s)	728.5	2.4	0.0
Lane LOS	F	A	
Approach Delay (s)	728.5	2.4	0.0
Approach LOS	F		

Intersection Summary			
Average Delay	259.1		
Intersection Capacity Utilization	88.9%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	87	0	137	96	165	0	0	694	128
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	95	0	149	104	179	0	0	754	139
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								Raised			None	
Median storage veh)								1				
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1212	1212	447	765	1282	179	893			179		
vC1, stage 1 conf vol	824	824		388	388							
vC2, stage 2 conf vol	388	388		377	893							
vCu, unblocked vol	1212	1212	447	765	1282	179	893			179		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)	6.5	5.5		6.5	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	73	100	82	86			100		
cM capacity (veh/h)	217	271	559	356	208	833	755			1394		

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	243	104	179	503	391
Volume Left	95	104	0	0	0
Volume Right	149	0	0	0	139
cSH	547	755	1700	1700	1700
Volume to Capacity	0.44	0.14	0.11	0.30	0.23
Queue Length 95th (ft)	57	12	0	0	0
Control Delay (s)	16.7	10.5	0.0	0.0	0.0
Lane LOS	C	B			
Approach Delay (s)	16.7	3.9		0.0	
Approach LOS	C				

Intersection Summary			
Average Delay	3.6		
Intersection Capacity Utilization	83.7%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	54	0	161	0	0	0	0	220	392	659	122	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	59	0	175	0	0	0	0	239	426	716	133	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								Raised			Raised	
Median storage veh)								1			1	
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1685	1804	133	1804	1804	120	133			239		
vC1, stage 1 conf vol	1565	1565		239	239							
vC2, stage 2 conf vol	120	239		1565	1565							
vCu, unblocked vol	1685	1804	133	1804	1804	120	133			239		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)	6.5	5.5		6.5	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	100	80	100	100	100	100			46		
cM capacity (veh/h)	47	36	892	39	69	909	1450			1325		

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	234	120	120	426	716	133
Volume Left	59	0	0	0	716	0
Volume Right	175	0	0	426	0	0
cSH	160	1700	1700	1700	1325	1700
Volume to Capacity	1.46	0.07	0.07	0.25	0.54	0.08
Queue Length 95th (ft)	375	0	0	0	85	0
Control Delay (s)	289.4	0.0	0.0	0.0	10.9	0.0
Lane LOS	F				B	
Approach Delay (s)	289.4	0.0			9.2	
Approach LOS	F					

Intersection Summary			
Average Delay	43.1		
Intersection Capacity Utilization	83.7%	ICU Level of Service	E
Analysis Period (min)	15		

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	49	338	740	49	103	171
v/c Ratio	0.12	0.55	1.31	0.06	0.14	0.16
Control Delay	24.0	6.8	174.0	12.4	13.7	1.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.0	6.8	174.0	12.4	13.7	1.3
Queue Length 50th (ft)	18	0	~451	13	28	0
Queue Length 95th (ft)	45	62	#654	31	57	19
Internal Link Dist (ft)	2022			1829	2247	
Turn Bay Length (ft)		150	150			150
Base Capacity (vph)	422	620	565	819	755	1074
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.12	0.55	1.31	0.06	0.14	0.16

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	45	311	681	45	95	157
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.56	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	1044	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	49	338	740	49	103	171
RTOR Reduction (vph)	0	261	0	0	0	73
Lane Group Flow (vph)	49	77	740	49	103	98
Turn Type	NA	Perm	pm+pt	NA	NA	pm+ov
Protected Phases	2		1	6	8	1
Permitted Phases		2	6			8
Actuated Green, G (s)	17.0	17.0	33.0	33.0	32.0	43.0
Effective Green, g (s)	17.0	17.0	33.0	33.0	32.0	43.0
Actuated g/C Ratio	0.23	0.23	0.44	0.44	0.43	0.57
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	422	358	565	819	755	1013
v/s Ratio Prot	0.03		c0.19	0.03	c0.06	0.01
v/s Ratio Perm		0.05	c0.38			0.05
v/c Ratio	0.12	0.21	1.31	0.06	0.14	0.10
Uniform Delay, d1	23.0	23.6	20.3	12.1	13.1	7.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	1.4	151.8	0.1	0.4	0.0
Delay (s)	23.6	24.9	172.0	12.2	13.5	7.3
Level of Service	C	C	F	B	B	A
Approach Delay (s)	24.8			162.1	9.6	
Approach LOS	C			F	A	

Intersection Summary			
HCM 2000 Control Delay	96.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	65.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	107	215	86	239	116	130	27	668	196	716	175
v/c Ratio	0.34	0.73	0.23	1.01	0.34	0.32	0.09	0.77	0.67	0.69	0.18
Control Delay	27.8	51.2	2.6	92.5	37.4	8.3	8.5	26.4	23.2	20.8	4.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.8	51.2	2.6	92.5	37.4	8.3	8.5	26.4	23.2	20.8	4.0
Queue Length 50th (ft)	46	116	0	108	58	0	6	296	47	246	7
Queue Length 95th (ft)	86	190	9	#274	112	45	16	448	#111	#550	44
Internal Link Dist (ft)		2030			1135			9853		1200	
Turn Bay Length (ft)	175		175	150		300	200		150		150
Base Capacity (vph)	317	331	400	237	352	416	306	866	291	1044	950
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.34	0.65	0.21	1.01	0.33	0.31	0.09	0.77	0.67	0.69	0.18

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	98	198	79	220	107	120	25	437	178	180	659	161
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1782		1770	1863	1583
Flt Permitted	0.68	1.00	1.00	0.38	1.00	1.00	0.21	1.00		0.16	1.00	1.00
Satd. Flow (perm)	1271	1863	1583	712	1863	1583	395	1782		305	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	107	215	86	239	116	130	27	475	193	196	716	175
RTOR Reduction (vph)	0	0	71	0	0	106	0	16	0	0	0	70
Lane Group Flow (vph)	107	215	15	239	116	24	27	652	0	196	716	105
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	20.0	15.2	15.2	22.4	16.4	16.4	44.3	41.9		53.3	46.4	46.4
Effective Green, g (s)	20.0	15.2	15.2	22.4	16.4	16.4	44.3	41.9		53.3	46.4	46.4
Actuated g/C Ratio	0.22	0.17	0.17	0.25	0.18	0.18	0.49	0.47		0.59	0.52	0.52
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	309	314	267	247	339	288	231	829		292	960	816
v/s Ratio Prot	0.02	0.12		c0.06	0.06		0.00	0.37		c0.05	c0.38	
v/s Ratio Perm	0.06		0.01	c0.18		0.01	0.05			0.34		0.07
v/c Ratio	0.35	0.68	0.05	0.97	0.34	0.08	0.12	0.79		0.67	0.75	0.13
Uniform Delay, d1	29.0	35.1	31.4	32.7	32.1	30.6	13.9	20.3		14.2	17.2	11.3
Progression Factor	1.00	1.00	1.00	1.04	1.05	1.30	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.7	6.1	0.1	46.2	0.6	0.1	0.2	7.4		6.0	5.3	0.3
Delay (s)	29.7	41.2	31.5	80.0	34.2	39.8	14.2	27.7		20.2	22.4	11.6
Level of Service	C	D	C	F	C	D	B	C		C	C	B
Approach Delay (s)		36.1			58.3			27.2			20.3	
Approach LOS		D			E			C			C	

Intersection Summary			
HCM 2000 Control Delay	31.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	83.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	50	85	71	224	496	537
v/c Ratio	0.31	0.39	0.10	0.14	0.36	0.41
Control Delay	38.3	14.6	2.5	2.4	7.3	1.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	38.3	14.6	2.5	2.4	7.3	1.6
Queue Length 50th (ft)	27	5	6	21	109	0
Queue Length 95th (ft)	m38	m21	16	43	189	34
Internal Link Dist (ft)	7444			1245	1600	
Turn Bay Length (ft)		150	150			150
Base Capacity (vph)	472	484	739	1554	1363	1302
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.11	0.18	0.10	0.14	0.36	0.41

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	46	78	65	206	456	494
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.95	1.00	0.41	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	761	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	50	85	71	224	496	537
RTOR Reduction (vph)	0	78	0	0	0	162
Lane Group Flow (vph)	50	7	71	224	496	375
Turn Type	NA	Perm	pm+pt	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	6.9	6.9	73.1	73.1	62.9	62.9
Effective Green, g (s)	6.9	6.9	73.1	73.1	62.9	62.9
Actuated g/C Ratio	0.08	0.08	0.81	0.81	0.70	0.70
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	135	121	676	1513	1302	1106
v/s Ratio Prot	c0.03		0.01	c0.12	c0.27	
v/s Ratio Perm		0.00	0.08			0.24
v/c Ratio	0.37	0.05	0.11	0.15	0.38	0.34
Uniform Delay, d1	39.5	38.5	2.3	1.8	5.6	5.3
Progression Factor	0.92	1.19	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.2	0.1	0.1	0.2	0.8	0.8
Delay (s)	37.5	46.0	2.4	2.0	6.4	6.2
Level of Service	D	D	A	A	A	A
Approach Delay (s)	42.9			2.1	6.3	
Approach LOS	D			A	A	

Intersection Summary			
HCM 2000 Control Delay	8.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	46.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	249	249	123	401	1111
v/c Ratio	0.64	0.64	0.27	0.18	0.50
Control Delay	31.4	31.4	5.6	6.6	9.0
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	31.4	31.4	5.6	6.6	9.0
Queue Length 50th (ft)	102	102	0	33	121
Queue Length 95th (ft)	156	156	33	65	208
Internal Link Dist (ft)		2384		933	7506
Turn Bay Length (ft)			150		
Base Capacity (vph)	528	528	581	2216	2216
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.47	0.47	0.21	0.18	0.50

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	458	0	113	0	369	0	0	1022	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				5.0	5.0	5.0		5.0			5.0	
Lane Util. Factor				0.95	0.95	1.00		0.95			0.95	
Frt				1.00	1.00	0.85		1.00			1.00	
Flt Protected				0.95	0.95	1.00		1.00			1.00	
Satd. Flow (prot)				1681	1681	1583		3539			3539	
Flt Permitted				0.95	0.95	1.00		1.00			1.00	
Satd. Flow (perm)				1681	1681	1583		3539			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	498	0	123	0	401	0	0	1111	0
RTOR Reduction (vph)	0	0	0	0	0	95	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	249	249	28	0	401	0	0	1111	0
Turn Type				Perm	NA	Perm	Perm	NA			NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8	2					6
Actuated Green, G (s)				16.2	16.2	16.2		43.8			43.8	
Effective Green, g (s)				16.2	16.2	16.2		43.8			43.8	
Actuated g/C Ratio				0.23	0.23	0.23		0.63			0.63	
Clearance Time (s)				5.0	5.0	5.0		5.0			5.0	
Vehicle Extension (s)				3.0	3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)				389	389	366		2214			2214	
v/s Ratio Prot								0.11			c0.31	
v/s Ratio Perm				c0.15	0.15	0.02						
v/c Ratio				0.64	0.64	0.08		0.18			0.50	
Uniform Delay, d1				24.3	24.3	21.1		5.5			7.1	
Progression Factor				1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2				3.6	3.6	0.1		0.2			0.8	
Delay (s)				27.8	27.8	21.1		5.7			8.0	
Level of Service				C	C	C		A			A	
Approach Delay (s)		0.0			26.5			5.7			8.0	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	12.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	58.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	350	174	162	1035
v/c Ratio	0.10	0.11	0.16	0.29
Control Delay	0.1	0.1	0.3	0.2
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	0.1	0.1	0.3	0.2
Queue Length 50th (ft)	0	0	0	0
Queue Length 95th (ft)	0	0	0	0
Internal Link Dist (ft)	2017			933
Turn Bay Length (ft)		500	175	
Base Capacity (vph)	3539	1583	1010	3539
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.10	0.11	0.16	0.29

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	0	0	0	322	160	149	952	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)								5.0	5.0	5.0	5.0	
Lane Util. Factor								0.95	1.00	1.00	0.95	
Frt								1.00	0.85	1.00	1.00	
Flt Protected								1.00	1.00	0.95	1.00	
Satd. Flow (prot)								3539	1583	1770	3539	
Flt Permitted								1.00	1.00	0.54	1.00	
Satd. Flow (perm)								3539	1583	1010	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	350	174	162	1035	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0	0	350	174	162	1035	0
Turn Type	Perm		Perm					NA	Perm	custom	NA	
Protected Phases		4						2				
Permitted Phases	4		4						2	6	6	
Actuated Green, G (s)								70.0	70.0	70.0	70.0	
Effective Green, g (s)								70.0	70.0	70.0	70.0	
Actuated g/C Ratio								1.00	1.00	1.00	1.00	
Clearance Time (s)								5.0	5.0	5.0	5.0	
Vehicle Extension (s)								3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)								3539	1583	1010	3539	
v/s Ratio Prot								0.10				
v/s Ratio Perm									0.11	0.16	c0.29	
v/c Ratio								0.10	0.11	0.16	0.29	
Uniform Delay, d1								0.0	0.0	0.0	0.0	
Progression Factor								1.00	1.00	1.00	1.00	
Incremental Delay, d2								0.1	0.1	0.3	0.2	
Delay (s)								0.1	0.1	0.3	0.2	
Level of Service								A	A	A	A	
Approach Delay (s)		0.0			0.0			0.1			0.2	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	0.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	58.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	54	766	13	102	554
v/c Ratio	0.46	0.48	0.02	0.06	0.35
Control Delay	79.2	1.1	1.3	1.1	4.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	79.2	1.1	1.3	1.1	4.1
Queue Length 50th (ft)	52	0	1	7	77
Queue Length 95th (ft)	98	0	3	12	209
Internal Link Dist (ft)	446			1125	3526
Turn Bay Length (ft)		300	100		
Base Capacity (vph)	306	1583	722	1655	1597
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.18	0.48	0.02	0.06	0.35

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	50	705	12	94	502	7
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	4.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	1863	1859	
Flt Permitted	0.95	1.00	0.42	1.00	1.00	
Satd. Flow (perm)	1770	1583	774	1863	1859	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	766	13	102	546	8
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	54	766	13	102	554	0
Turn Type	NA	Free	pm+pt	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		Free	2			
Actuated Green, G (s)	8.7	150.0	131.3	131.3	123.9	
Effective Green, g (s)	8.7	150.0	131.3	131.3	123.9	
Actuated g/C Ratio	0.06	1.00	0.88	0.88	0.83	
Clearance Time (s)	5.0		5.0	5.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	102	1583	693	1630	1535	
v/s Ratio Prot	0.03		0.00	0.05	0.30	
v/s Ratio Perm		c0.48	0.02			
v/c Ratio	0.53	0.48	0.02	0.06	0.36	
Uniform Delay, d1	68.7	0.0	1.6	1.2	3.2	
Progression Factor	1.00	1.00	0.76	0.70	1.00	
Incremental Delay, d2	4.9	1.1	0.0	0.1	0.7	
Delay (s)	73.6	1.1	1.3	0.9	3.9	
Level of Service	E	A	A	A	A	
Approach Delay (s)	5.8			1.0	3.9	
Approach LOS	A			A	A	

Intersection Summary			
HCM 2000 Control Delay	4.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	40.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	1	39	200	110	1239	72
v/c Ratio	0.01	0.34	0.67	0.06	0.85	0.06
Control Delay	68.0	18.6	23.8	1.0	18.0	2.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	68.0	18.6	23.8	1.0	18.0	2.0
Queue Length 50th (ft)	1	0	36	8	708	3
Queue Length 95th (ft)	8	28	123	16	#1448	16
Internal Link Dist (ft)	411			3238	1125	
Turn Bay Length (ft)		200	100			
Base Capacity (vph)	188	214	904	1699	1463	1254
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.18	0.22	0.06	0.85	0.06

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	1	36	184	101	1140	66
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.95	1.00	0.10	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	179	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	39	200	110	1239	72
RTOR Reduction (vph)	0	38	0	0	0	11
Lane Group Flow (vph)	1	1	200	110	1239	61
Turn Type	NA	Perm	pm+pt	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	5.2	5.2	134.8	134.8	116.9	116.9
Effective Green, g (s)	5.2	5.2	134.8	134.8	116.9	116.9
Actuated g/C Ratio	0.03	0.03	0.90	0.90	0.78	0.78
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	61	54	297	1674	1451	1233
v/s Ratio Prot	0.00		c0.06	0.06	c0.67	
v/s Ratio Perm		c0.00	0.55			0.04
v/c Ratio	0.02	0.03	0.67	0.07	0.85	0.05
Uniform Delay, d1	69.9	70.0	34.2	0.8	10.9	3.8
Progression Factor	1.00	1.00	1.00	1.00	0.89	0.90
Incremental Delay, d2	0.1	0.2	5.9	0.1	6.1	0.1
Delay (s)	70.0	70.1	40.1	0.9	15.8	3.5
Level of Service	E	E	D	A	B	A
Approach Delay (s)	70.1			26.2	15.2	
Approach LOS	E			C	B	

Intersection Summary			
HCM 2000 Control Delay	18.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	87.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBT	WBR	NBL	NBT	SBT
Lane Group Flow (vph)	322	661	63	320	701
v/c Ratio	1.16	0.84	0.12	0.23	0.30
Control Delay	148.7	15.8	3.8	4.4	5.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	148.7	15.8	3.8	4.4	5.1
Queue Length 50th (ft)	~283	17	10	56	61
Queue Length 95th (ft)	#462	#215	19	82	91
Internal Link Dist (ft)	1680			1224	528
Turn Bay Length (ft)		300			
Base Capacity (vph)	277	783	615	1409	2329
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	1.16	0.84	0.10	0.23	0.30

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	296	0	608	58	294	0	0	381	264
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0	5.0	5.0	5.0			5.0	
Lane Util. Factor					1.00	1.00	1.00	1.00			0.95	
Frt					1.00	0.85	1.00	1.00			0.94	
Flt Protected					0.95	1.00	0.95	1.00			1.00	
Satd. Flow (prot)					1770	1583	1770	1863			3322	
Flt Permitted					0.95	1.00	0.34	1.00			1.00	
Satd. Flow (perm)					1770	1583	630	1863			3322	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	322	0	661	63	320	0	0	414	287
RTOR Reduction (vph)	0	0	0	0	0	536	0	0	0	0	89	0
Lane Group Flow (vph)	0	0	0	0	322	125	63	320	0	0	612	0
Turn Type				Perm	NA	Perm	pm+pt	NA			NA	
Protected Phases					8		5	2			6	
Permitted Phases				8		8	2					
Actuated Green, G (s)					18.0	18.0	87.0	87.0			76.6	
Effective Green, g (s)					18.0	18.0	87.0	87.0			76.6	
Actuated g/C Ratio					0.16	0.16	0.76	0.76			0.67	
Clearance Time (s)					5.0	5.0	5.0	5.0			5.0	
Vehicle Extension (s)					3.0	3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)					277	247	530	1409			2212	
v/s Ratio Prot							0.01	c0.17			c0.18	
v/s Ratio Perm					0.18	0.08	0.08					
v/c Ratio					1.16	0.51	0.12	0.23			0.28	
Uniform Delay, d1					48.5	44.4	4.0	4.1			7.9	
Progression Factor					1.00	1.00	0.95	0.95			1.00	
Incremental Delay, d2					105.4	1.6	0.1	0.4			0.3	
Delay (s)					153.9	46.1	3.9	4.3			8.2	
Level of Service					F	D	A	A			A	
Approach Delay (s)		0.0			81.4			4.2			8.2	
Approach LOS		A			F			A			A	

Intersection Summary			
HCM 2000 Control Delay	42.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	61.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	21	79	66	91	212	229
v/c Ratio	0.19	0.45	0.02	0.07	0.19	0.14
Control Delay	54.0	19.7	4.5	1.2	3.3	3.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	54.0	19.7	4.5	1.2	3.3	3.1
Queue Length 50th (ft)	15	0	5	0	36	39
Queue Length 95th (ft)	40	47	14	15	m44	m47
Internal Link Dist (ft)	1642		1468			1224
Turn Bay Length (ft)				150		
Base Capacity (vph)	246	288	2679	1220	1331	1634
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.09	0.27	0.02	0.07	0.16	0.14

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	19	0	73	0	0	0	0	61	84	195	211	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0					5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00	1.00					0.95	1.00	1.00	1.00	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1770	1583					3539	1583	1770	1863	
Flt Permitted		0.95	1.00					1.00	1.00	0.67	1.00	
Satd. Flow (perm)		1770	1583					3539	1583	1253	1863	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	21	0	79	0	0	0	0	66	91	212	229	0
RTOR Reduction (vph)	0	0	75	0	0	0	0	0	23	0	0	0
Lane Group Flow (vph)	0	21	4	0	0	0	0	66	68	212	229	0
Turn Type	Perm	NA	Perm					NA	Perm	pm+pt	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2	6		
Actuated Green, G (s)		6.1	6.1					86.1	86.1	98.9	98.9	
Effective Green, g (s)		6.1	6.1					86.1	86.1	98.9	98.9	
Actuated g/C Ratio		0.05	0.05					0.75	0.75	0.86	0.86	
Clearance Time (s)		5.0	5.0					5.0	5.0	5.0	5.0	
Vehicle Extension (s)		3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		93	83					2649	1185	1112	1602	
v/s Ratio Prot								0.02		c0.01	0.12	
v/s Ratio Perm		0.01	0.00						0.04	c0.15		
v/c Ratio		0.23	0.05					0.02	0.06	0.19	0.14	
Uniform Delay, d1		52.2	51.7					3.7	3.8	1.4	1.3	
Progression Factor		1.00	1.00					1.00	1.00	2.02	2.01	
Incremental Delay, d2		1.2	0.3					0.0	0.1	0.1	0.1	
Delay (s)		53.4	52.0					3.7	3.9	2.9	2.7	
Level of Service		D	D					A	A	A	A	
Approach Delay (s)		52.3			0.0			3.8			2.8	
Approach LOS		D			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	10.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.20		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	61.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	249	249	123	401	1111
v/c Ratio	0.60	0.60	0.25	0.19	0.52
Control Delay	24.5	24.5	5.2	5.8	8.0
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	24.5	24.5	5.2	5.8	8.0
Queue Length 50th (ft)	74	74	0	26	94
Queue Length 95th (ft)	136	136	30	54	174
Internal Link Dist (ft)		2384		933	7506
Turn Bay Length (ft)			150		
Base Capacity (vph)	578	578	625	2152	2152
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.43	0.43	0.20	0.19	0.52

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	458	0	113	0	369	0	0	1022	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0			4.0	
Lane Util. Factor				0.95	0.95	1.00		0.95			0.95	
Frt				1.00	1.00	0.85		1.00			1.00	
Flt Protected				0.95	0.95	1.00		1.00			1.00	
Satd. Flow (prot)				1681	1681	1583		3539			3539	
Flt Permitted				0.95	0.95	1.00		1.00			1.00	
Satd. Flow (perm)				1681	1681	1583		3539			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	498	0	123	0	401	0	0	1111	0
RTOR Reduction (vph)	0	0	0	0	0	93	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	249	249	30	0	401	0	0	1111	0
Turn Type				Perm	NA	Perm	Perm	NA			NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8	2					6
Actuated Green, G (s)				13.7	13.7	13.7		33.7			33.7	
Effective Green, g (s)				13.7	13.7	13.7		33.7			33.7	
Actuated g/C Ratio				0.25	0.25	0.25		0.61			0.61	
Clearance Time (s)				4.0	4.0	4.0		4.0			4.0	
Vehicle Extension (s)				3.0	3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)				415	415	391		2152			2152	
v/s Ratio Prot								0.11			c0.31	
v/s Ratio Perm				c0.15	0.15	0.02						
v/c Ratio				0.60	0.60	0.08		0.19			0.52	
Uniform Delay, d1				18.4	18.4	16.0		4.8			6.2	
Progression Factor				1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2				2.3	2.3	0.1		0.2			0.9	
Delay (s)				20.8	20.8	16.1		5.0			7.1	
Level of Service				C	C	B		A			A	
Approach Delay (s)		0.0			19.8			5.0			7.1	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	10.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	55.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	54.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	0	0	322	160	149	952	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	350	174	162	1035	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			10									
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											1013	
pX, platoon unblocked												
vC, conflicting volume	1534	1709	517	1191	1709	175	1035			350		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1534	1709	517	1191	1709	175	1035			350		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			87		
cM capacity (veh/h)	71	78	503	128	78	838	667			1206		

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	0	0	175	175	174	162	517	517
Volume Left	0	0	0	0	0	162	0	0
Volume Right	0	0	0	0	174	0	0	0
cSH	1700	1700	1700	1700	1700	1206	1700	1700
Volume to Capacity	0.00	0.00	0.10	0.10	0.10	0.13	0.30	0.30
Queue Length 95th (ft)	0	0	0	0	0	12	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	8.4	0.0	0.0
Lane LOS	A	A				A		
Approach Delay (s)	0.0		0.0			1.1		
Approach LOS	A							

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	54.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	50	705	12	94	502	7
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	54	766	13	102	546	8
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		12				
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	678	549	553			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	678	549	553			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	87	0	99			
cM capacity (veh/h)	412	535	1017			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	821	13	102	553
Volume Left	54	13	0	0
Volume Right	766	0	0	8
cSH	573	1017	1700	1700
Volume to Capacity	1.43	0.01	0.06	0.33
Queue Length 95th (ft)	972	1	0	0
Control Delay (s)	212.3	8.6	0.0	0.0
Lane LOS	F	A		
Approach Delay (s)	212.3	1.0		0.0
Approach LOS	F			

Intersection Summary			
Average Delay	117.1		
Intersection Capacity Utilization	77.2%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	1	36	184	101	1140	66
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	39	200	110	1239	72
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		8				
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1749	1239	1239			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1749	1239	1239			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	82	64			
cM capacity (veh/h)	61	214	562			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	40	200	110	1239	72
Volume Left	1	200	0	0	0
Volume Right	39	0	0	0	72
cSH	220	562	1700	1700	1700
Volume to Capacity	0.18	0.36	0.06	0.73	0.04
Queue Length 95th (ft)	16	40	0	0	0
Control Delay (s)	26.6	14.9	0.0	0.0	0.0
Lane LOS	D	B			
Approach Delay (s)	26.6	9.6		0.0	
Approach LOS	D				

Intersection Summary			
Average Delay	2.4		
Intersection Capacity Utilization	83.5%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	45	311	681	45	95	157
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	338	740	49	103	171
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			387		1747	218
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			387		1747	218
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			37		0	79
cM capacity (veh/h)			1172		35	822

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	387	789	274
Volume Left	0	740	103
Volume Right	338	0	171
cSH	1700	1172	86
Volume to Capacity	0.23	0.63	3.17
Queue Length 95th (ft)	0	118	Err
Control Delay (s)	0.0	12.9	Err
Lane LOS		B	F
Approach Delay (s)	0.0	12.9	Err
Approach LOS			F

Intersection Summary			
Average Delay	1895.9		
Intersection Capacity Utilization	86.6%	ICU Level of Service	E
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	107	215	86	239	116	130	27	668	196	716	175
v/c Ratio	0.30	0.41	0.17	0.82	0.22	0.24	0.10	0.63	0.64	0.66	0.18
Control Delay	18.2	19.1	5.1	43.0	16.5	4.8	7.6	11.5	22.4	12.9	1.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.2	19.1	5.1	43.0	16.5	4.8	7.6	11.5	22.4	12.9	1.8
Queue Length 50th (ft)	28	59	0	75	30	0	4	140	45	170	0
Queue Length 95th (ft)	63	109	25	#177	63	31	15	243	#149	284	22
Internal Link Dist (ft)		2030			1135			9853		1200	
Turn Bay Length (ft)	175		175	150		300	200		150		150
Base Capacity (vph)	415	609	576	341	609	605	272	1057	308	1081	992
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.26	0.35	0.15	0.70	0.19	0.21	0.10	0.63	0.64	0.66	0.18

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	98	198	79	220	107	120	25	437	178	180	659	161
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1782		1770	1863	1583
Flt Permitted	0.68	1.00	1.00	0.56	1.00	1.00	0.25	1.00		0.28	1.00	1.00
Satd. Flow (perm)	1271	1863	1583	1043	1863	1583	470	1782		530	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	107	215	86	239	116	130	27	475	193	196	716	175
RTOR Reduction (vph)	0	0	62	0	0	93	0	23	0	0	0	73
Lane Group Flow (vph)	107	215	24	239	116	37	27	645	0	196	716	102
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	16.4	16.4	16.4	16.4	16.4	16.4	33.8	33.8		33.8	33.8	33.8
Effective Green, g (s)	16.4	16.4	16.4	16.4	16.4	16.4	33.8	33.8		33.8	33.8	33.8
Actuated g/C Ratio	0.28	0.28	0.28	0.28	0.28	0.28	0.58	0.58		0.58	0.58	0.58
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	358	524	446	293	524	446	272	1034		307	1081	919
v/s Ratio Prot		0.12			0.06			0.36			c0.38	
v/s Ratio Perm	0.08		0.02	c0.23		0.02	0.06			0.37		0.06
v/c Ratio	0.30	0.41	0.05	0.82	0.22	0.08	0.10	0.62		0.64	0.66	0.11
Uniform Delay, d1	16.4	17.0	15.2	19.5	16.0	15.4	5.4	8.0		8.1	8.3	5.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.5	0.5	0.1	15.9	0.2	0.1	0.7	2.8		9.8	3.2	0.2
Delay (s)	16.9	17.5	15.3	35.4	16.2	15.4	6.2	10.9		17.9	11.5	5.7
Level of Service	B	B	B	D	B	B	A	B		B	B	A
Approach Delay (s)		16.9			25.5			10.7			11.7	
Approach LOS		B			C			B			B	

Intersection Summary			
HCM 2000 Control Delay	14.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	58.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	79.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	46	78	65	206	456	494
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	50	85	71	224	496	537
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1129	764	1033			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1129	764	1033			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	75	79	90			
cM capacity (veh/h)	202	404	673			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	135	295	1033
Volume Left	50	71	0
Volume Right	85	0	537
cSH	294	673	1700
Volume to Capacity	0.46	0.10	0.61
Queue Length 95th (ft)	57	9	0
Control Delay (s)	27.1	3.6	0.0
Lane LOS	D	A	
Approach Delay (s)	27.1	3.6	0.0
Approach LOS	D		

Intersection Summary			
Average Delay	3.2		
Intersection Capacity Utilization	81.5%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	296	0	608	58	294	0	0	381	264
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	322	0	661	63	320	0	0	414	287
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								Raised			None	
Median storage veh)								1				
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1003	1003	351	653	1147	320	701			320		
vC1, stage 1 conf vol	558	558		446	446							
vC2, stage 2 conf vol	446	446		207	701							
vCu, unblocked vol	1003	1003	351	653	1147	320	701			320		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)	6.5	5.5		6.5	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	23	100	2	93			100		
cM capacity (veh/h)	11	340	646	419	281	676	892			1237		

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	983	63	320	276	425
Volume Left	322	63	0	0	0
Volume Right	661	0	0	0	287
cSH	563	892	1700	1700	1700
Volume to Capacity	1.74	0.07	0.19	0.16	0.25
Queue Length 95th (ft)	1468	6	0	0	0
Control Delay (s)	360.9	9.3	0.0	0.0	0.0
Lane LOS	F	A			
Approach Delay (s)	360.9	1.5		0.0	
Approach LOS	F				

Intersection Summary			
Average Delay	171.9		
Intersection Capacity Utilization	86.1%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	19	0	73	0	0	0	0	61	84	195	211	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	21	0	79	0	0	0	0	66	91	212	229	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								Raised			Raised	
Median storage veh)								1			1	
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	686	720	229	720	720	33	229			66		
vC1, stage 1 conf vol	653	653		66	66							
vC2, stage 2 conf vol	33	66		653	653							
vCu, unblocked vol	686	720	229	720	720	33	229			66		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)	6.5	5.5		6.5	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	94	100	90	100	100	100	100			86		
cM capacity (veh/h)	325	344	773	292	350	1033	1336			1533		

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	100	33	33	91	212	229
Volume Left	21	0	0	0	212	0
Volume Right	79	0	0	91	0	0
cSH	602	1700	1700	1700	1533	1700
Volume to Capacity	0.17	0.02	0.02	0.05	0.14	0.13
Queue Length 95th (ft)	15	0	0	0	12	0
Control Delay (s)	12.2	0.0	0.0	0.0	7.7	0.0
Lane LOS	B				A	
Approach Delay (s)	12.2	0.0			3.7	
Approach LOS	B					

Intersection Summary				
Average Delay	4.1			
Intersection Capacity Utilization	86.1%	ICU Level of Service	E	
Analysis Period (min)	15			

Lane Group	WBL	WBT	WBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	142	142	395	86	1524	647	104
v/c Ratio	0.30	0.30	0.85	0.21	0.75	0.32	0.11
Control Delay	20.6	20.6	39.9	8.3	11.0	8.8	2.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.6	20.6	39.9	8.3	11.0	8.8	2.2
Queue Length 50th (ft)	47	47	143	14	162	75	0
Queue Length 95th (ft)	92	92	#277	m27	189	106	19
Internal Link Dist (ft)		2384			933	7506	
Turn Bay Length (ft)			150	300			
Base Capacity (vph)	528	528	514	412	2027	2027	951
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.27	0.27	0.77	0.21	0.75	0.32	0.11

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	261	0	363	79	1402	0	0	595	96
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				5.0	5.0	5.0	5.0	5.0			5.0	5.0
Lane Util. Factor				0.95	0.95	1.00	1.00	0.95			0.95	1.00
Frt				1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	0.95	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)				1681	1681	1583	1770	3539			3539	1583
Flt Permitted				0.95	0.95	1.00	0.39	1.00			1.00	1.00
Satd. Flow (perm)				1681	1681	1583	719	3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	284	0	395	86	1524	0	0	647	104
RTOR Reduction (vph)	0	0	0	0	0	17	0	0	0	0	0	44
Lane Group Flow (vph)	0	0	0	142	142	378	86	1524	0	0	647	60
Turn Type				Perm		Perm	Perm					Perm
Protected Phases					8			2			6	
Permitted Phases				8		8	2					6
Actuated Green, G (s)				19.9	19.9	19.9	40.1	40.1			40.1	40.1
Effective Green, g (s)				19.9	19.9	19.9	40.1	40.1			40.1	40.1
Actuated g/C Ratio				0.28	0.28	0.28	0.57	0.57			0.57	0.57
Clearance Time (s)				5.0	5.0	5.0	5.0	5.0			5.0	5.0
Vehicle Extension (s)				3.0	3.0	3.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)				478	478	450	412	2027			2027	907
v/s Ratio Prot								c0.43			0.18	
v/s Ratio Perm				0.08	0.08	c0.24	0.12					0.04
v/c Ratio				0.30	0.30	0.84	0.21	0.75			0.32	0.07
Uniform Delay, d1				19.6	19.6	23.5	7.3	11.2			7.8	6.6
Progression Factor				1.00	1.00	1.00	0.83	0.71			1.00	1.00
Incremental Delay, d2				0.3	0.3	12.9	1.0	2.3			0.4	0.1
Delay (s)				19.9	19.9	36.5	7.1	10.3			8.2	6.8
Level of Service				B	B	D	A	B			A	A
Approach Delay (s)		0.0			29.6			10.1			8.0	
Approach LOS		A			C			B			A	

Intersection Summary			
HCM Average Control Delay	13.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	69.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	67	68	111	1475	338	136	795
v/c Ratio	0.34	0.34	0.39	0.53	0.26	0.62	0.29
Control Delay	32.2	32.3	10.5	4.9	1.0	22.4	3.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.2	32.3	10.5	4.9	1.0	22.4	3.0
Queue Length 50th (ft)	28	29	0	113	0	21	58
Queue Length 95th (ft)	63	63	40	189	19	#141	80
Internal Link Dist (ft)		1478		2017			933
Turn Bay Length (ft)			250		500	175	
Base Capacity (vph)	384	384	447	2774	1314	220	2774
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.18	0.25	0.53	0.26	0.62	0.29

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	124	0	102	0	0	0	0	1357	311	125	731	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0					5.0	5.0	5.0	5.0	
Lane Util. Factor	0.95	0.95	1.00					0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1681	1681	1583					3539	1583	1770	3539	
Flt Permitted	0.95	0.95	1.00					1.00	1.00	0.15	1.00	
Satd. Flow (perm)	1681	1681	1583					3539	1583	281	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	135	0	111	0	0	0	0	1475	338	136	795	0
RTOR Reduction (vph)	0	0	100	0	0	0	0	0	83	0	0	0
Lane Group Flow (vph)	67	68	11	0	0	0	0	1475	255	136	795	0
Turn Type	Perm		Perm						Perm	custom		
Protected Phases		4						2				
Permitted Phases	4		4						2	6	6	
Actuated Green, G (s)	7.1	7.1	7.1					52.9	52.9	52.9	52.9	
Effective Green, g (s)	7.1	7.1	7.1					52.9	52.9	52.9	52.9	
Actuated g/C Ratio	0.10	0.10	0.10					0.76	0.76	0.76	0.76	
Clearance Time (s)	5.0	5.0	5.0					5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	171	171	161					2674	1196	212	2674	
v/s Ratio Prot								0.42				
v/s Ratio Perm	0.04	0.04	0.01						0.16	c0.48	0.22	
v/c Ratio	0.39	0.40	0.07					0.55	0.21	0.64	0.30	
Uniform Delay, d1	29.4	29.4	28.5					3.6	2.5	4.1	2.7	
Progression Factor	1.00	1.00	1.00					1.00	1.00	0.98	0.90	
Incremental Delay, d2	1.5	1.5	0.2					0.8	0.4	13.6	0.3	
Delay (s)	30.9	31.0	28.6					4.4	2.9	17.6	2.7	
Level of Service	C	C	C					A	A	B	A	
Approach Delay (s)		29.9			0.0			4.1			4.9	
Approach LOS		C			A			A			A	

Intersection Summary			
HCM Average Control Delay	6.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	69.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	179	152	71	974	250
v/c Ratio	0.68	0.10	0.09	0.71	0.21
Control Delay	48.8	0.1	3.7	7.9	8.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	48.8	0.1	3.7	7.9	8.3
Queue Length 50th (ft)	96	0	9	270	59
Queue Length 95th (ft)	161	0	m17	173	100
Internal Link Dist (ft)	446			1125	3526
Turn Bay Length (ft)		300	100		
Base Capacity (vph)	315	1583	809	1377	1191
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.57	0.10	0.09	0.71	0.21

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	165	140	65	896	226	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	4.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	1863	1859	
Flt Permitted	0.95	1.00	0.55	1.00	1.00	
Satd. Flow (perm)	1770	1583	1027	1863	1859	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	179	152	71	974	246	4
RTOR Reduction (vph)	0	0	0	0	1	0
Lane Group Flow (vph)	179	152	71	974	249	0
Turn Type		Free	pm+pt			
Protected Phases	4		5	2	6	
Permitted Phases		Free	2			
Actuated Green, G (s)	13.5	90.0	66.5	66.5	56.6	
Effective Green, g (s)	13.5	90.0	66.5	66.5	56.6	
Actuated g/C Ratio	0.15	1.00	0.74	0.74	0.63	
Clearance Time (s)	5.0		5.0	5.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	266	1583	799	1377	1169	
v/s Ratio Prot	c0.10		0.00	c0.52	0.13	
v/s Ratio Perm		0.10	0.06			
v/c Ratio	0.67	0.10	0.09	0.71	0.21	
Uniform Delay, d1	36.2	0.0	3.4	6.4	7.2	
Progression Factor	1.00	1.00	0.93	0.72	1.00	
Incremental Delay, d2	6.6	0.1	0.0	2.5	0.4	
Delay (s)	42.7	0.1	3.2	7.1	7.6	
Level of Service	D	A	A	A	A	
Approach Delay (s)	23.2			6.9	7.6	
Approach LOS	C			A	A	

Intersection Summary			
HCM Average Control Delay	10.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	64.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	15	14	710	1029	228	170
v/c Ratio	0.12	0.11	0.67	0.60	0.18	0.15
Control Delay	40.7	20.5	5.1	3.8	8.3	1.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.7	20.5	5.1	3.8	8.3	1.1
Queue Length 50th (ft)	8	0	0	0	18	0
Queue Length 95th (ft)	27	18	145	293	152	8
Internal Link Dist (ft)	411			3238	1125	
Turn Bay Length (ft)		200	100			
Base Capacity (vph)	315	293	1225	1720	1243	1112
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.05	0.05	0.58	0.60	0.18	0.15

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	14	13	653	947	210	156
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.95	1.00	0.57	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1055	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	15	14	710	1029	228	170
RTOR Reduction (vph)	0	14	0	0	0	62
Lane Group Flow (vph)	15	0	710	1029	228	108
Turn Type		Perm	pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	2.9	2.9	77.1	77.1	57.0	57.0
Effective Green, g (s)	2.9	2.9	77.1	77.1	57.0	57.0
Actuated g/C Ratio	0.03	0.03	0.86	0.86	0.63	0.63
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	57	51	1024	1596	1180	1003
v/s Ratio Prot	c0.01		c0.12	0.55	0.12	
v/s Ratio Perm		0.00	c0.48			0.07
v/c Ratio	0.26	0.01	0.69	0.64	0.19	0.11
Uniform Delay, d1	42.5	42.2	1.9	2.1	6.9	6.5
Progression Factor	1.00	1.00	1.00	1.00	0.74	0.26
Incremental Delay, d2	2.5	0.1	2.1	2.0	0.4	0.2
Delay (s)	45.0	42.2	4.0	4.1	5.5	1.9
Level of Service	D	D	A	A	A	A
Approach Delay (s)	43.6			4.0	3.9	
Approach LOS	D			A	A	

Intersection Summary			
HCM Average Control Delay	4.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	64.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	38	191	142	33	402	539
v/c Ratio	0.07	0.32	0.23	0.04	0.68	0.49
Control Delay	16.2	4.8	9.3	7.8	24.4	2.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.2	4.8	9.3	7.8	24.4	2.4
Queue Length 50th (ft)	10	0	26	6	123	0
Queue Length 95th (ft)	29	39	52	17	#210	36
Internal Link Dist (ft)	2022			1829	3927	
Turn Bay Length (ft)		150	150			
Base Capacity (vph)	546	599	625	932	590	1113
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.07	0.32	0.23	0.04	0.68	0.48

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	35	176	131	30	370	496
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.57	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	1062	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	191	142	33	402	539
RTOR Reduction (vph)	0	135	0	0	0	293
Lane Group Flow (vph)	38	56	142	33	402	246
Turn Type		Perm	pm+pt			pm+ov
Protected Phases	2		1	6	8	1
Permitted Phases		2	6			8
Actuated Green, G (s)	17.6	17.6	30.0	30.0	20.0	27.4
Effective Green, g (s)	17.6	17.6	30.0	30.0	20.0	27.4
Actuated g/C Ratio	0.29	0.29	0.50	0.50	0.33	0.46
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	546	464	618	932	590	855
v/s Ratio Prot	0.02		0.03	0.02	c0.23	c0.04
v/s Ratio Perm		0.04	c0.09			0.12
v/c Ratio	0.07	0.12	0.23	0.04	0.68	0.29
Uniform Delay, d1	15.3	15.5	8.4	7.6	17.3	10.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.5	0.2	0.1	6.3	0.2
Delay (s)	15.5	16.1	8.6	7.7	23.5	10.4
Level of Service	B	B	A	A	C	B
Approach Delay (s)	16.0			8.4	16.0	
Approach LOS	B			A	B	

Intersection Summary			
HCM Average Control Delay	15.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	5.0
Intersection Capacity Utilization	44.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	174	130	89	164	226	335	73	806	58	349	87
v/c Ratio	0.76	0.43	0.27	0.53	0.75	0.73	0.13	0.86	0.27	0.37	0.10
Control Delay	49.9	38.4	9.6	33.2	52.4	20.2	8.6	32.4	11.2	16.1	3.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.9	38.4	9.6	33.2	52.4	20.2	8.6	32.4	11.2	16.1	3.5
Queue Length 50th (ft)	76	66	0	72	122	45	16	415	13	125	0
Queue Length 95th (ft)	#159	120	39	125	#213	139	34	#670	28	193	24
Internal Link Dist (ft)		2030			1135			9853		1200	
Turn Bay Length (ft)	175		175	150		300	200		150		150
Base Capacity (vph)	228	331	355	308	331	484	559	938	215	945	845
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.76	0.39	0.25	0.53	0.68	0.69	0.13	0.86	0.27	0.37	0.10

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	160	120	82	151	208	308	67	689	52	53	321	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1843		1770	1863	1583
Flt Permitted	0.37	1.00	1.00	0.63	1.00	1.00	0.48	1.00		0.11	1.00	1.00
Satd. Flow (perm)	687	1863	1583	1179	1863	1583	889	1843		196	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	174	130	89	164	226	335	73	749	57	58	349	87
RTOR Reduction (vph)	0	0	75	0	0	206	0	3	0	0	0	44
Lane Group Flow (vph)	174	130	14	164	226	129	73	803	0	58	349	43
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	20.5	14.5	14.5	20.5	14.5	14.5	49.6	44.7		49.4	44.6	44.6
Effective Green, g (s)	20.5	14.5	14.5	20.5	14.5	14.5	49.6	44.7		49.4	44.6	44.6
Actuated g/C Ratio	0.23	0.16	0.16	0.23	0.16	0.16	0.55	0.50		0.55	0.50	0.50
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	229	300	255	308	300	255	538	915		192	923	784
v/s Ratio Prot	c0.05	0.07		0.04	0.12		0.01	c0.44		c0.02	0.19	
v/s Ratio Perm	c0.12		0.01	0.09		0.08	0.07			0.15		0.03
v/c Ratio	0.76	0.43	0.06	0.53	0.75	0.50	0.14	0.88		0.30	0.38	0.05
Uniform Delay, d1	31.2	34.0	32.0	29.7	36.0	34.5	9.7	20.2		15.6	14.1	11.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	13.5	1.0	0.1	1.8	10.2	1.6	0.1	11.6		0.9	1.2	0.1
Delay (s)	44.7	35.1	32.1	31.5	46.3	36.0	9.8	31.9		16.4	15.3	11.9
Level of Service	D	D	C	C	D	D	A	C		B	B	B
Approach Delay (s)		38.6			38.2			30.0			14.8	
Approach LOS		D			D			C			B	

Intersection Summary			
HCM Average Control Delay	30.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	80.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	263	326	133	643	225	409	652	852	126	187	21
v/c Ratio	0.53	0.80	0.17	0.89	0.42	0.89	0.65	0.54	0.48	0.65	0.04
Control Delay	18.5	48.0	3.3	49.9	27.1	45.1	31.7	1.3	25.4	45.4	7.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.5	48.0	3.3	49.9	27.1	45.1	31.7	1.3	25.4	45.4	7.8
Queue Length 50th (ft)	82	167	0	180	96	176	174	0	45	98	0
Queue Length 95th (ft)	138	#294	30	#291	166	#296	236	0	83	166	15
Internal Link Dist (ft)		7444			4401		1245			3927	
Turn Bay Length (ft)	150		150	150		150		350	150		
Base Capacity (vph)	525	467	795	737	572	462	1056	1583	264	355	597
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.50	0.70	0.17	0.87	0.39	0.89	0.62	0.54	0.48	0.53	0.04

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	242	300	122	592	183	24	376	600	784	116	172	19
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	4.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00		1.00	0.95	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	3433	1830		1770	3539	1583	1770	1863	1583
Flt Permitted	0.62	1.00	1.00	0.95	1.00		0.36	1.00	1.00	0.40	1.00	1.00
Satd. Flow (perm)	1151	1863	1583	3433	1830		679	3539	1583	753	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	263	326	133	643	199	26	409	652	852	126	187	21
RTOR Reduction (vph)	0	0	81	0	5	0	0	0	0	0	0	15
Lane Group Flow (vph)	263	326	52	643	220	0	409	652	852	126	187	6
Turn Type	pm+pt		pm+ov	Prot			pm+pt		Free	pm+pt		pm+ov
Protected Phases	7	4	5	3	8		5	2		1	6	7
Permitted Phases	4		4				2		Free	6		6
Actuated Green, G (s)	30.1	18.4	33.5	17.8	24.5		34.3	23.9	85.5	19.6	14.2	25.9
Effective Green, g (s)	30.1	18.4	33.5	17.8	24.5		34.3	23.9	85.5	19.6	14.2	25.9
Actuated g/C Ratio	0.35	0.22	0.39	0.21	0.29		0.40	0.28	1.00	0.23	0.17	0.30
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	490	401	713	715	524		465	989	1583	237	309	572
v/s Ratio Prot	0.07	c0.18	0.01	c0.19	0.12		c0.16	0.18		0.03	0.10	0.00
v/s Ratio Perm	0.12		0.02				c0.20		c0.54	0.09		0.00
v/c Ratio	0.54	0.81	0.07	0.90	0.42		0.88	0.66	0.54	0.53	0.61	0.01
Uniform Delay, d1	21.1	31.9	16.3	33.0	24.7		20.7	27.2	0.0	27.3	33.1	20.8
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1	11.9	0.0	14.1	0.5		17.0	1.6	1.3	2.3	3.3	0.0
Delay (s)	22.2	43.8	16.3	47.1	25.3		37.7	28.8	1.3	29.6	36.4	20.9
Level of Service	C	D	B	D	C		D	C	A	C	D	C
Approach Delay (s)		30.9			41.4			18.5			32.9	
Approach LOS		C			D			B			C	

Intersection Summary			
HCM Average Control Delay	27.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	85.5	Sum of lost time (s)	15.0
Intersection Capacity Utilization	79.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBT	WBR	NBL	NBT	SBT
Lane Group Flow (vph)	63	100	140	240	792
v/c Ratio	0.42	0.44	0.26	0.16	0.28
Control Delay	55.4	15.5	4.7	2.2	2.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	55.4	15.5	4.7	2.2	2.5
Queue Length 50th (ft)	43	0	13	20	46
Queue Length 95th (ft)	85	50	53	40	75
Internal Link Dist (ft)	1680			1224	528
Turn Bay Length (ft)		300			
Base Capacity (vph)	370	410	536	1536	2859
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.17	0.24	0.26	0.16	0.28

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	58	0	92	129	221	0	0	617	111
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0	5.0	5.0	5.0			5.0	
Lane Util. Factor					1.00	1.00	1.00	1.00			0.95	
Frt					1.00	0.85	1.00	1.00			0.98	
Flt Protected					0.95	1.00	0.95	1.00			1.00	
Satd. Flow (prot)					1770	1583	1770	1863			3458	
Flt Permitted					0.95	1.00	0.35	1.00			1.00	
Satd. Flow (perm)					1770	1583	650	1863			3458	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	63	0	100	140	240	0	0	671	121
RTOR Reduction (vph)	0	0	0	0	0	92	0	0	0	0	8	0
Lane Group Flow (vph)	0	0	0	0	63	8	140	240	0	0	784	0
Turn Type				Perm		Perm	Perm					
Protected Phases					8			2			6	
Permitted Phases				8		8	2					
Actuated Green, G (s)					9.3	9.3	90.7	90.7			90.7	
Effective Green, g (s)					9.3	9.3	90.7	90.7			90.7	
Actuated g/C Ratio					0.08	0.08	0.82	0.82			0.82	
Clearance Time (s)					5.0	5.0	5.0	5.0			5.0	
Vehicle Extension (s)					3.0	3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)					150	134	536	1536			2851	
v/s Ratio Prot								0.13			c0.23	
v/s Ratio Perm					0.04	0.01	0.22					
v/c Ratio					0.42	0.06	0.26	0.16			0.28	
Uniform Delay, d1					47.8	46.3	2.2	1.9			2.2	
Progression Factor					1.00	1.00	1.33	0.91			1.00	
Incremental Delay, d2					1.9	0.2	1.2	0.2			0.2	
Delay (s)					49.7	46.5	4.1	2.0			2.4	
Level of Service					D	D	A	A			A	
Approach Delay (s)		0.0			47.8			2.8			2.4	
Approach LOS		A			D			A			A	

Intersection Summary			
HCM Average Control Delay	8.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.29		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	80.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	68	204	312	557	620	114
v/c Ratio	0.44	0.63	0.14	0.47	0.67	0.07
Control Delay	55.4	15.5	10.2	3.2	6.2	1.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	55.4	15.5	10.2	3.2	6.2	1.8
Queue Length 50th (ft)	46	0	43	10	69	10
Queue Length 95th (ft)	89	67	86	75	87	21
Internal Link Dist (ft)	1642		1468			1224
Turn Bay Length (ft)				150		
Base Capacity (vph)	257	405	2196	1178	1068	1530
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.26	0.50	0.14	0.47	0.58	0.07

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	63	0	188	0	0	0	0	287	512	570	105	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0					5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00	1.00					0.95	1.00	1.00	1.00	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1770	1583					3539	1583	1770	1863	
Flt Permitted		0.95	1.00					1.00	1.00	0.52	1.00	
Satd. Flow (perm)		1770	1583					3539	1583	976	1863	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	68	0	204	0	0	0	0	312	557	620	114	0
RTOR Reduction (vph)	0	0	186	0	0	0	0	0	196	0	0	0
Lane Group Flow (vph)	0	68	18	0	0	0	0	312	361	620	114	0
Turn Type	Perm		Perm						Perm	pm+pt		
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2	6		
Actuated Green, G (s)		9.7	9.7					68.2	68.2	90.3	90.3	
Effective Green, g (s)		9.7	9.7					68.2	68.2	90.3	90.3	
Actuated g/C Ratio		0.09	0.09					0.62	0.62	0.82	0.82	
Clearance Time (s)		5.0	5.0					5.0	5.0	5.0	5.0	
Vehicle Extension (s)		3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		156	140					2194	981	925	1529	
v/s Ratio Prot								0.09		c0.10	0.06	
v/s Ratio Perm		0.04	0.01						0.23	c0.45		
v/c Ratio		0.44	0.13					0.14	0.37	0.67	0.07	
Uniform Delay, d1		47.6	46.3					8.7	10.3	3.0	1.9	
Progression Factor		1.00	1.00					1.00	1.00	0.79	0.77	
Incremental Delay, d2		1.9	0.4					0.1	1.1	1.9	0.1	
Delay (s)		49.5	46.7					8.8	11.4	4.2	1.5	
Level of Service		D	D					A	B	A	A	
Approach Delay (s)		47.4			0.0			10.5			3.8	
Approach LOS		D			A			B			A	

Intersection Summary			
HCM Average Control Delay	13.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	80.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	SBT	SBR
Lane Group Flow (vph)	1180	123	96	295	451	574
v/c Ratio	0.74	0.17	0.50	0.15	0.71	0.63
Control Delay	26.7	11.2	27.5	17.5	34.8	6.3
Queue Delay	0.1	0.0	0.0	0.0	0.0	0.0
Total Delay	26.8	11.2	27.5	17.5	34.8	6.3
Queue Length 50th (ft)	330	27	40	66	244	14
Queue Length 95th (ft)	415	63	75	96	361	99
Internal Link Dist (ft)	4401			468	931	
Turn Bay Length (ft)		75	150			
Base Capacity (vph)	1600	743	192	1911	637	916
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	37	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.75	0.17	0.50	0.15	0.71	0.63

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1086	113	88	271	0	0	0	0	415	0	528
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0	5.0	5.0						5.0	5.0
Lane Util. Factor		0.95	1.00	1.00	0.95						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (prot)		3539	1583	1770	3539						1770	1583
Flt Permitted		1.00	1.00	0.10	1.00						0.95	1.00
Satd. Flow (perm)		3539	1583	180	3539						1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1180	123	96	295	0	0	0	0	451	0	574
RTOR Reduction (vph)	0	0	28	0	0	0	0	0	0	0	0	346
Lane Group Flow (vph)	0	1180	95	96	295	0	0	0	0	0	451	228
Turn Type			Perm	pm+pt						Perm		Perm
Protected Phases		2		1	6						4	
Permitted Phases			2	6						4		4
Actuated Green, G (s)		44.2	44.2	54.0	54.0						36.0	36.0
Effective Green, g (s)		44.2	44.2	54.0	54.0						36.0	36.0
Actuated g/C Ratio		0.44	0.44	0.54	0.54						0.36	0.36
Clearance Time (s)		5.0	5.0	5.0	5.0						5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		1564	700	174	1911						637	570
v/s Ratio Prot		c0.33		c0.03	0.08							
v/s Ratio Perm			0.06	0.27							0.25	0.14
v/c Ratio		0.75	0.14	0.55	0.15						0.71	0.40
Uniform Delay, d1		23.4	16.6	16.7	11.5						27.5	23.9
Progression Factor		1.00	1.00	1.64	1.49						1.00	1.00
Incremental Delay, d2		3.4	0.4	3.7	0.2						6.5	2.1
Delay (s)		26.8	17.0	31.1	17.4						34.0	26.0
Level of Service		C	B	C	B						C	C
Approach Delay (s)		25.9			20.7			0.0			29.5	
Approach LOS		C			C			A			C	

Intersection Summary			
HCM Average Control Delay	26.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	99.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT
Lane Group Flow (vph)	835	797	255	655	135	107
v/c Ratio	0.87	0.30	0.19	0.74	0.48	0.22
Control Delay	10.9	1.6	22.0	14.8	44.5	1.1
Queue Delay	1.8	0.0	0.0	0.0	0.0	0.0
Total Delay	12.7	1.6	22.0	14.8	44.5	1.1
Queue Length 50th (ft)	19	9	56	108	79	0
Queue Length 95th (ft)	58	29	92	287	140	0
Internal Link Dist (ft)		468	5276			578
Turn Bay Length (ft)	300			300		
Base Capacity (vph)	1010	2619	1377	888	283	479
Starvation Cap Reductn	72	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.89	0.30	0.19	0.74	0.48	0.22

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	768	733	0	0	235	603	124	0	98	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0	5.0	5.0				
Lane Util. Factor	1.00	0.95			0.95	1.00	1.00	1.00				
Frt	1.00	1.00			1.00	0.85	1.00	0.85				
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00				
Satd. Flow (prot)	1770	3539			3539	1583	1770	1583				
Flt Permitted	0.53	1.00			1.00	1.00	0.95	1.00				
Satd. Flow (perm)	980	3539			3539	1583	1770	1583				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	835	797	0	0	255	655	135	0	107	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	273	0	90	0	0	0	0
Lane Group Flow (vph)	835	797	0	0	255	382	135	17	0	0	0	0
Turn Type	pm+pt					Perm	pm+pt					
Protected Phases	5	2			6		3	8				
Permitted Phases	2					6	8					
Actuated Green, G (s)	74.0	74.0			38.9	38.9	16.0	16.0				
Effective Green, g (s)	74.0	74.0			38.9	38.9	16.0	16.0				
Actuated g/C Ratio	0.74	0.74			0.39	0.39	0.16	0.16				
Clearance Time (s)	5.0	5.0			5.0	5.0	5.0	5.0				
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0				
Lane Grp Cap (vph)	963	2619			1377	616	283	253				
v/s Ratio Prot	c0.26	0.23			0.07		c0.08	0.01				
v/s Ratio Perm	c0.38					0.24						
v/c Ratio	0.87	0.30			0.19	0.62	0.48	0.07				
Uniform Delay, d1	6.9	4.4			20.1	24.6	38.2	35.7				
Progression Factor	0.43	0.32			1.00	1.00	1.00	1.00				
Incremental Delay, d2	5.8	0.2			0.3	4.7	1.3	0.5				
Delay (s)	8.7	1.6			20.4	29.3	39.5	36.2				
Level of Service	A	A			C	C	D	D				
Approach Delay (s)		5.2			26.8			38.0			0.0	
Approach LOS		A			C			D			A	

Intersection Summary			
HCM Average Control Delay	15.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	99.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	139	140	395	1475	636
v/c Ratio	0.29	0.30	0.85	0.67	0.29
Control Delay	31.1	31.1	50.2	16.3	10.8
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	31.1	31.1	50.2	16.3	10.8
Queue Length 50th (ft)	78	78	237	320	97
Queue Length 95th (ft)	131	132	354	525	171
Internal Link Dist (ft)		2384		933	7506
Turn Bay Length (ft)			150		
Base Capacity (vph)	675	675	654	2214	2214
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.21	0.21	0.60	0.67	0.29

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	257	0	363	0	1357	0	0	585	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				5.0	5.0	5.0		5.0			5.0	
Lane Util. Factor				0.95	0.95	1.00		0.95			0.95	
Frt				1.00	1.00	0.85		1.00			1.00	
Flt Protected				0.95	0.95	1.00		1.00			1.00	
Satd. Flow (prot)				1681	1681	1583		3539			3539	
Flt Permitted				0.95	0.95	1.00		1.00			1.00	
Satd. Flow (perm)				1681	1681	1583		3539			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	279	0	395	0	1475	0	0	636	0
RTOR Reduction (vph)	0	0	0	0	0	22	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	139	140	373	0	1475	0	0	636	0
Turn Type				Perm		Perm	Perm					Perm
Protected Phases					8			2			6	
Permitted Phases				8		8	2					6
Actuated Green, G (s)				30.3	30.3	30.3		67.4			67.4	
Effective Green, g (s)				30.3	30.3	30.3		67.4			67.4	
Actuated g/C Ratio				0.28	0.28	0.28		0.63			0.63	
Clearance Time (s)				5.0	5.0	5.0		5.0			5.0	
Vehicle Extension (s)				3.0	3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)				473	473	445		2215			2215	
v/s Ratio Prot								c0.42			0.18	
v/s Ratio Perm				0.08	0.08	c0.24						
v/c Ratio				0.29	0.30	0.84		0.67			0.29	
Uniform Delay, d1				30.3	30.3	36.4		12.9			9.2	
Progression Factor				1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2				0.3	0.4	12.9		1.6			0.3	
Delay (s)				30.7	30.7	49.3		14.5			9.5	
Level of Service				C	C	D		B			A	
Approach Delay (s)		0.0			41.6			14.5			9.5	
Approach LOS		A			D			B			A	

Intersection Summary			
HCM Average Control Delay	19.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	107.7	Sum of lost time (s)	10.0
Intersection Capacity Utilization	68.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	0	0	1228	311	125	731	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	1335	338	136	795	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			10									
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											1013	
pX, platoon unblocked	0.96	0.96	0.96	0.96	0.96		0.96					
vC, conflicting volume	1734	2401	397	2004	2401	667	795			1335		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1683	2377	294	1964	2377	667	707			1335		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			73		
cM capacity (veh/h)	47	24	676	29	24	401	854			513		

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	0	0	667	667	338	136	397	397
Volume Left	0	0	0	0	0	136	0	0
Volume Right	0	0	0	0	338	0	0	0
cSH	1700	1700	1700	1700	1700	513	1700	1700
Volume to Capacity	0.00	0.00	0.39	0.39	0.20	0.27	0.23	0.23
Queue Length 95th (ft)	0	0	0	0	0	26	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	14.5	0.0	0.0
Lane LOS	A	A				B		
Approach Delay (s)	0.0		0.0			2.1		
Approach LOS	A							

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	68.3%	ICU Level of Service	C
Analysis Period (min)	15		

Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	233	197	71	963	632
v/c Ratio	0.77	0.45	0.14	0.69	0.51
Control Delay	63.8	9.0	3.8	9.9	13.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	63.8	9.0	3.8	9.9	13.2
Queue Length 50th (ft)	173	0	7	366	244
Queue Length 95th (ft)	252	61	m12	602	377
Internal Link Dist (ft)	446			1125	3526
Turn Bay Length (ft)		300	100		
Base Capacity (vph)	384	497	498	1389	1241
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.61	0.40	0.14	0.69	0.51

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	214	181	65	886	570	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	1863	1858	
Flt Permitted	0.95	1.00	0.31	1.00	1.00	
Satd. Flow (perm)	1770	1583	583	1863	1858	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	233	197	71	963	620	12
RTOR Reduction (vph)	0	163	0	0	0	0
Lane Group Flow (vph)	233	34	71	963	632	0
Turn Type		Perm	pm+pt			
Protected Phases	4		5	2	6	
Permitted Phases		4	2			
Actuated Green, G (s)	20.6	20.6	89.4	89.4	79.1	
Effective Green, g (s)	20.6	20.6	89.4	89.4	79.1	
Actuated g/C Ratio	0.17	0.17	0.75	0.75	0.66	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	304	272	487	1388	1225	
v/s Ratio Prot	c0.13		0.01	c0.52	0.34	
v/s Ratio Perm		0.02	0.10			
v/c Ratio	0.77	0.12	0.15	0.69	0.52	
Uniform Delay, d1	47.4	42.1	6.3	8.1	10.6	
Progression Factor	1.00	1.00	0.69	0.81	1.00	
Incremental Delay, d2	11.0	0.2	0.1	2.3	1.6	
Delay (s)	58.4	42.3	4.5	8.9	12.1	
Level of Service	E	D	A	A	B	
Approach Delay (s)	51.0			8.6	12.1	
Approach LOS	D			A	B	

Intersection Summary			
HCM Average Control Delay	18.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	66.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	23	21	710	1029	600	445
v/c Ratio	0.21	0.18	0.82	0.61	0.70	0.47
Control Delay	57.9	23.8	25.9	4.0	27.8	2.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	57.9	23.8	25.9	4.0	27.8	2.8
Queue Length 50th (ft)	17	0	313	176	407	7
Queue Length 95th (ft)	44	26	493	300	#629	20
Internal Link Dist (ft)	411			3238	1125	
Turn Bay Length (ft)		200	100			
Base Capacity (vph)	236	229	883	1695	859	940
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.09	0.80	0.61	0.70	0.47

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	21	19	653	947	552	409
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.95	1.00	0.19	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	349	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	23	21	710	1029	600	445
RTOR Reduction (vph)	0	20	0	0	0	217
Lane Group Flow (vph)	23	1	710	1029	600	228
Turn Type		Perm	pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	4.8	4.8	105.2	105.2	53.3	53.3
Effective Green, g (s)	4.8	4.8	105.2	105.2	53.3	53.3
Actuated g/C Ratio	0.04	0.04	0.88	0.88	0.44	0.44
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	71	63	861	1633	827	703
v/s Ratio Prot	c0.01		c0.32	0.55	0.32	
v/s Ratio Perm		0.00	c0.40			0.14
v/c Ratio	0.32	0.01	0.82	0.63	0.73	0.32
Uniform Delay, d1	56.0	55.3	21.3	2.0	27.4	21.7
Progression Factor	1.00	1.00	1.00	1.00	0.78	0.26
Incremental Delay, d2	2.6	0.1	6.5	1.9	5.2	1.2
Delay (s)	58.7	55.4	27.7	3.9	26.6	6.8
Level of Service	E	E	C	A	C	A
Approach Delay (s)	57.1			13.6	18.2	
Approach LOS	E			B	B	

Intersection Summary			
HCM Average Control Delay	16.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	82.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	38	191	142	33	402	539
v/c Ratio	0.06	0.28	0.22	0.04	0.53	0.48
Control Delay	27.2	5.1	17.9	16.0	22.3	0.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.2	5.1	17.9	16.0	22.3	0.9
Queue Length 50th (ft)	19	0	59	13	210	9
Queue Length 95th (ft)	47	52	98	31	m145	m0
Internal Link Dist (ft)	2022			1829	2247	
Turn Bay Length (ft)		150	150			150
Base Capacity (vph)	663	687	733	916	752	1279
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.06	0.28	0.19	0.04	0.53	0.42

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	35	176	131	30	370	496
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.66	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	1221	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	191	142	33	402	539
RTOR Reduction (vph)	0	123	0	0	0	259
Lane Group Flow (vph)	38	68	142	33	402	280
Turn Type		Perm	pm+pt			pm+ov
Protected Phases	2		1	6	8	1
Permitted Phases		2	6			8
Actuated Green, G (s)	42.7	42.7	59.0	59.0	51.0	62.3
Effective Green, g (s)	42.7	42.7	59.0	59.0	51.0	62.3
Actuated g/C Ratio	0.36	0.36	0.49	0.49	0.42	0.52
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	663	563	652	916	752	888
v/s Ratio Prot	0.02		0.02	0.02	c0.23	c0.03
v/s Ratio Perm		0.04	c0.09			0.15
v/c Ratio	0.06	0.12	0.22	0.04	0.53	0.32
Uniform Delay, d1	25.4	26.0	17.0	15.8	25.7	16.6
Progression Factor	1.00	1.00	1.00	1.00	0.84	0.80
Incremental Delay, d2	0.2	0.4	0.2	0.1	0.2	0.0
Delay (s)	25.6	26.5	17.1	15.9	21.8	13.3
Level of Service	C	C	B	B	C	B
Approach Delay (s)	26.3			16.9	17.0	
Approach LOS	C			B	B	

Intersection Summary			
HCM Average Control Delay	18.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	5.0
Intersection Capacity Utilization	44.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	174	130	89	164	226	335	73	806	58	349	87
v/c Ratio	0.78	0.46	0.28	0.54	0.77	0.74	0.12	0.77	0.23	0.33	0.09
Control Delay	60.2	51.5	11.1	35.1	58.8	23.9	9.4	27.8	11.1	16.3	3.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	60.2	51.5	11.1	35.1	58.8	23.9	9.4	27.8	11.1	16.3	3.2
Queue Length 50th (ft)	107	92	0	100	167	97	20	500	16	152	0
Queue Length 95th (ft)	#192	153	46	159	252	185	41	700	34	219	25
Internal Link Dist (ft)		2030			1135			9853		1200	
Turn Bay Length (ft)	175		175	150		300	200		150		150
Base Capacity (vph)	223	326	350	305	342	488	599	1046	255	1054	933
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.78	0.40	0.25	0.54	0.66	0.69	0.12	0.77	0.23	0.33	0.09

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	160	120	82	151	208	308	67	689	52	53	321	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1843		1770	1863	1583
Flt Permitted	0.32	1.00	1.00	0.54	1.00	1.00	0.49	1.00		0.16	1.00	1.00
Satd. Flow (perm)	600	1863	1583	1000	1863	1583	907	1843		292	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	174	130	89	164	226	335	73	749	57	58	349	87
RTOR Reduction (vph)	0	0	76	0	0	204	0	2	0	0	0	38
Lane Group Flow (vph)	174	130	13	164	226	131	73	804	0	58	349	49
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	27.0	18.0	18.0	28.8	18.9	18.9	72.2	67.0		72.0	66.9	66.9
Effective Green, g (s)	27.0	18.0	18.0	28.8	18.9	18.9	72.2	67.0		72.0	66.9	66.9
Actuated g/C Ratio	0.22	0.15	0.15	0.24	0.16	0.16	0.60	0.56		0.60	0.56	0.56
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	223	279	237	304	293	249	583	1029		238	1039	883
v/s Ratio Prot	c0.06	0.07		0.04	c0.12		0.01	c0.44		c0.01	0.19	
v/s Ratio Perm	0.12		0.01	0.09		0.08	0.07			0.14		0.03
v/c Ratio	0.78	0.47	0.06	0.54	0.77	0.53	0.13	0.78		0.24	0.34	0.05
Uniform Delay, d1	41.2	46.6	43.7	38.3	48.5	46.4	10.2	20.8		16.5	14.5	12.1
Progression Factor	1.00	1.00	1.00	0.82	0.87	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	16.1	1.2	0.1	1.8	11.5	1.9	0.1	5.9		0.5	0.9	0.1
Delay (s)	57.3	47.8	43.8	33.1	53.6	48.5	10.3	26.6		17.0	15.3	12.2
Level of Service	E	D	D	C	D	D	B	C		B	B	B
Approach Delay (s)		51.1			46.6			25.3			15.0	
Approach LOS		D			D			C			B	

Intersection Summary			
HCM Average Control Delay	33.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	80.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	650	141	409	1599	184	21
v/c Ratio	1.29	0.29	0.54	1.36	0.22	0.03
Control Delay	180.4	16.1	13.4	189.0	19.4	6.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	180.4	16.1	13.4	189.0	19.4	6.3
Queue Length 50th (ft)	~651	32	141	~1626	100	4
Queue Length 95th (ft)	#872	m74	201	#1891	166	16
Internal Link Dist (ft)	7444			1245	1600	
Turn Bay Length (ft)		150	150			150
Base Capacity (vph)	502	494	775	1180	834	721
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.29	0.29	0.53	1.36	0.22	0.03

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	598	130	376	1471	169	19
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.95	1.00	0.56	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1041	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	650	141	409	1599	184	21
RTOR Reduction (vph)	0	46	0	0	0	12
Lane Group Flow (vph)	650	95	409	1599	184	9
Turn Type		Perm	pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	34.0	34.0	76.0	76.0	53.7	53.7
Effective Green, g (s)	34.0	34.0	76.0	76.0	53.7	53.7
Actuated g/C Ratio	0.28	0.28	0.63	0.63	0.45	0.45
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	502	449	764	1180	834	708
v/s Ratio Prot	c0.37		0.08	c0.86	0.10	
v/s Ratio Perm		0.06	0.26			0.01
v/c Ratio	1.29	0.21	0.54	1.36	0.22	0.01
Uniform Delay, d1	43.0	32.8	10.9	22.0	20.3	18.4
Progression Factor	0.89	0.79	1.00	1.00	0.89	0.81
Incremental Delay, d2	146.8	0.2	0.7	165.4	0.6	0.0
Delay (s)	185.3	26.2	11.6	187.4	18.7	15.0
Level of Service	F	C	B	F	B	B
Approach Delay (s)	156.9			151.6	18.3	
Approach LOS	F			F	B	

Intersection Summary			
HCM Average Control Delay	143.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.34		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	118.9%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBT	WBR	NBL	NBT	SBT
Lane Group Flow (vph)	61	100	137	235	774
v/c Ratio	0.43	0.46	0.25	0.15	0.27
Control Delay	61.3	16.7	4.1	2.0	2.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	61.3	16.7	4.1	2.0	2.3
Queue Length 50th (ft)	46	0	13	20	45
Queue Length 95th (ft)	89	52	48	39	74
Internal Link Dist (ft)	1680			1224	528
Turn Bay Length (ft)		300			
Base Capacity (vph)	369	409	555	1560	2902
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.17	0.24	0.25	0.15	0.27

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	56	0	92	126	216	0	0	601	111
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0	5.0	5.0	5.0			5.0	
Lane Util. Factor					1.00	1.00	1.00	1.00			0.95	
Frt					1.00	0.85	1.00	1.00			0.98	
Flt Protected					0.95	1.00	0.95	1.00			1.00	
Satd. Flow (prot)					1770	1583	1770	1863			3456	
Flt Permitted					0.95	1.00	0.36	1.00			1.00	
Satd. Flow (perm)					1770	1583	663	1863			3456	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	61	0	100	137	235	0	0	653	121
RTOR Reduction (vph)	0	0	0	0	0	92	0	0	0	0	7	0
Lane Group Flow (vph)	0	0	0	0	61	8	137	235	0	0	767	0
Turn Type				Perm		Perm	Perm					
Protected Phases					8			2			6	
Permitted Phases				8		8	2					
Actuated Green, G (s)					9.5	9.5	100.5	100.5			100.5	
Effective Green, g (s)					9.5	9.5	100.5	100.5			100.5	
Actuated g/C Ratio					0.08	0.08	0.84	0.84			0.84	
Clearance Time (s)					5.0	5.0	5.0	5.0			5.0	
Vehicle Extension (s)					3.0	3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)					140	125	555	1560			2894	
v/s Ratio Prot								0.13			c0.22	
v/s Ratio Perm					0.03	0.01	0.21					
v/c Ratio					0.44	0.06	0.25	0.15			0.26	
Uniform Delay, d1					52.7	51.1	2.0	1.8			2.0	
Progression Factor					1.00	1.00	1.28	0.89			1.00	
Incremental Delay, d2					2.2	0.2	1.1	0.2			0.2	
Delay (s)					54.9	51.3	3.6	1.8			2.3	
Level of Service					D	D	A	A			A	
Approach Delay (s)		0.0			52.7			2.5			2.3	
Approach LOS		A			D			A			A	

Intersection Summary			
HCM Average Control Delay	8.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.28		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	80.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	70	204	312	557	620	114
v/c Ratio	0.47	0.64	0.14	0.46	0.67	0.07
Control Delay	61.8	16.3	9.6	2.9	6.1	1.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	61.8	16.3	9.6	2.9	6.1	1.7
Queue Length 50th (ft)	53	0	44	10	74	12
Queue Length 95th (ft)	98	72	86	68	92	22
Internal Link Dist (ft)	1642		1468			1224
Turn Bay Length (ft)				150		
Base Capacity (vph)	267	411	2290	1207	1081	1551
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.26	0.50	0.14	0.46	0.57	0.07

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	63	2	188	0	0	0	0	287	512	570	105	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0					5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00	1.00					0.95	1.00	1.00	1.00	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1776	1583					3539	1583	1770	1863	
Flt Permitted		0.95	1.00					1.00	1.00	0.53	1.00	
Satd. Flow (perm)		1776	1583					3539	1583	984	1863	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	68	2	204	0	0	0	0	312	557	620	114	0
RTOR Reduction (vph)	0	0	187	0	0	0	0	0	183	0	0	0
Lane Group Flow (vph)	0	70	17	0	0	0	0	312	374	620	114	0
Turn Type	Perm		Perm						Perm	pm+pt		
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2	6		
Actuated Green, G (s)		10.1	10.1					77.6	77.6	99.9	99.9	
Effective Green, g (s)		10.1	10.1					77.6	77.6	99.9	99.9	
Actuated g/C Ratio		0.08	0.08					0.65	0.65	0.83	0.83	
Clearance Time (s)		5.0	5.0					5.0	5.0	5.0	5.0	
Vehicle Extension (s)		3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		149	133					2289	1024	932	1551	
v/s Ratio Prot								0.09		c0.10	0.06	
v/s Ratio Perm		0.04	0.01						0.24	c0.46		
v/c Ratio		0.47	0.13					0.14	0.37	0.67	0.07	
Uniform Delay, d1		52.4	50.9					8.2	9.8	2.8	1.8	
Progression Factor		1.00	1.00					1.00	1.00	0.83	0.79	
Incremental Delay, d2		2.3	0.4					0.1	1.0	1.8	0.1	
Delay (s)		54.7	51.3					8.3	10.8	4.1	1.5	
Level of Service		D	D					A	B	A	A	
Approach Delay (s)		52.2			0.0			9.9			3.7	
Approach LOS		D			A			A			A	

Intersection Summary			
HCM Average Control Delay	13.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	80.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	47	239	403	93	832	1116
v/c Ratio	0.08	0.37	0.36	0.10	0.69	0.70
Control Delay	15.7	4.6	10.1	8.9	18.6	4.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.7	4.6	10.1	8.9	18.6	4.4
Queue Length 50th (ft)	12	0	40	17	155	68
Queue Length 95th (ft)	32	42	64	38	m209	m110
Internal Link Dist (ft)	2022			3439	3927	
Turn Bay Length (ft)		150	250			600
Base Capacity (vph)	558	642	1130	900	1201	1583
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.08	0.37	0.36	0.10	0.69	0.70

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	43	220	371	86	765	1027
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	4.0
Lane Util. Factor	1.00	1.00	0.97	1.00	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	3433	1863	3433	1583
Flt Permitted	1.00	1.00	0.57	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	2054	1863	3433	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	47	239	403	93	832	1116
RTOR Reduction (vph)	0	167	0	0	0	0
Lane Group Flow (vph)	47	72	403	93	832	1116
Turn Type	NA	Perm	pm+pt	NA	NA	Free
Protected Phases	2		1	6	8	
Permitted Phases		2	6			Free
Actuated Green, G (s)	18.0	18.0	29.0	29.0	21.0	60.0
Effective Green, g (s)	18.0	18.0	29.0	29.0	21.0	60.0
Actuated g/C Ratio	0.30	0.30	0.48	0.48	0.35	1.00
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	558	474	1130	900	1201	1583
v/s Ratio Prot	0.03		0.04	0.05	0.24	
v/s Ratio Perm		0.05	0.14			c0.70
v/c Ratio	0.08	0.15	0.36	0.10	0.69	0.70
Uniform Delay, d1	15.1	15.4	9.3	8.4	16.7	0.0
Progression Factor	1.00	1.00	1.00	1.00	0.97	1.00
Incremental Delay, d2	0.3	0.7	0.2	0.2	2.0	1.6
Delay (s)	15.4	16.1	9.5	8.7	18.2	1.6
Level of Service	B	B	A	A	B	A
Approach Delay (s)	16.0			9.4	8.7	
Approach LOS	B			A	A	

Intersection Summary			
HCM 2000 Control Delay	9.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	47.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	154	115	79	145	200	297	64	707	60	363	90
v/c Ratio	0.52	0.39	0.20	0.43	0.65	0.58	0.13	0.78	0.23	0.42	0.11
Control Delay	28.9	32.8	1.2	25.3	41.0	9.0	9.3	28.2	11.0	18.2	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.9	32.8	1.2	25.3	41.0	9.0	9.3	28.2	11.0	18.2	0.5
Queue Length 50th (ft)	58	51	0	54	94	1	13	320	12	127	0
Queue Length 95th (ft)	101	95	0	95	156	63	32	#562	30	208	4
Internal Link Dist (ft)		2030			1135			9853		1200	
Turn Bay Length (ft)	175		175	150		300	200		150		150
Base Capacity (vph)	294	372	447	341	372	552	501	901	256	856	816
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.52	0.31	0.18	0.43	0.54	0.54	0.13	0.78	0.23	0.42	0.11

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	142	106	73	133	184	273	59	604	46	55	334	83
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1843		1770	1863	1583
Flt Permitted	0.60	1.00	1.00	0.55	1.00	1.00	0.43	1.00		0.14	1.00	1.00
Satd. Flow (perm)	1124	1863	1583	1030	1863	1583	798	1843		270	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	154	115	79	145	200	297	64	657	50	60	363	90
RTOR Reduction (vph)	0	0	68	0	0	243	0	3	0	0	0	51
Lane Group Flow (vph)	154	115	11	145	200	54	64	704	0	60	363	39
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	17.5	11.5	11.5	22.9	14.2	14.2	41.1	36.1		38.5	34.8	34.8
Effective Green, g (s)	17.5	11.5	11.5	22.9	14.2	14.2	41.1	36.1		38.5	34.8	34.8
Actuated g/C Ratio	0.22	0.14	0.14	0.29	0.18	0.18	0.51	0.45		0.48	0.43	0.43
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	294	267	227	375	330	280	470	831		199	810	688
v/s Ratio Prot	0.04	0.06		c0.04	c0.11		0.01	c0.38		c0.01	0.19	
v/s Ratio Perm	0.08		0.01	0.07		0.03	0.06			0.13		0.02
v/c Ratio	0.52	0.43	0.05	0.39	0.61	0.19	0.14	0.85		0.30	0.45	0.06
Uniform Delay, d1	26.7	31.3	29.5	22.2	30.3	28.0	10.2	19.5		14.5	15.9	13.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.7	1.1	0.1	0.7	3.1	0.3	0.1	10.4		0.9	1.8	0.2
Delay (s)	28.4	32.4	29.6	22.9	33.5	28.4	10.3	29.9		15.3	17.7	13.3
Level of Service	C	C	C	C	C	C	B	C		B	B	B
Approach Delay (s)		30.0			28.7			28.3			16.6	
Approach LOS		C			C			C			B	

Intersection Summary			
HCM 2000 Control Delay	26.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	73.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	523	90	282	1388	579	63
v/c Ratio	0.87	0.14	0.70	0.80	0.58	0.06
Control Delay	35.2	2.1	22.8	18.0	18.1	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.2	2.1	22.8	18.0	18.1	0.1
Queue Length 50th (ft)	165	0	61	217	60	0
Queue Length 95th (ft)	#318	15	#139	#312	92	0
Internal Link Dist (ft)	7444			1245	3927	
Turn Bay Length (ft)		150	150			150
Base Capacity (vph)	649	660	400	1741	1001	1177
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.81	0.14	0.70	0.80	0.58	0.05

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	481	83	259	1277	533	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.26	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	486	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	523	90	282	1388	579	63
RTOR Reduction (vph)	0	59	0	0	0	24
Lane Group Flow (vph)	523	31	282	1388	579	39
Turn Type	NA	Perm	pm+pt	NA	NA	pm+ov
Protected Phases	4		5	2	6	4
Permitted Phases		4	2			6
Actuated Green, G (s)	20.5	20.5	29.5	29.5	17.0	37.5
Effective Green, g (s)	20.5	20.5	29.5	29.5	17.0	37.5
Actuated g/C Ratio	0.34	0.34	0.49	0.49	0.28	0.62
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	604	540	399	1740	1002	1121
v/s Ratio Prot	c0.30		0.09	c0.39	0.16	0.01
v/s Ratio Perm		0.02	0.26			0.01
v/c Ratio	0.87	0.06	0.71	0.80	0.58	0.04
Uniform Delay, d1	18.5	13.3	10.2	12.8	18.4	4.3
Progression Factor	1.00	1.00	1.00	1.00	0.82	0.00
Incremental Delay, d2	12.4	0.0	5.6	3.9	2.3	0.0
Delay (s)	30.9	13.3	15.8	16.7	17.4	0.0
Level of Service	C	B	B	B	B	A
Approach Delay (s)	28.3			16.5	15.7	
Approach LOS	C			B	B	

Intersection Summary			
HCM 2000 Control Delay	18.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	70.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBT	WBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	143	144	421	83	1529	652	107
v/c Ratio	0.29	0.29	0.86	0.21	0.78	0.33	0.12
Control Delay	18.6	18.7	38.4	8.2	11.9	9.1	2.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.6	18.7	38.4	8.2	11.9	9.1	2.3
Queue Length 50th (ft)	43	44	137	13	140	73	0
Queue Length 95th (ft)	85	86	#278	m25	165	105	19
Internal Link Dist (ft)		2384			933	7506	
Turn Bay Length (ft)			150	300			
Base Capacity (vph)	543	543	534	392	1950	1950	920
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.26	0.27	0.79	0.21	0.78	0.33	0.12

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	264	0	387	76	1407	0	0	600	98
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				5.0	5.0	5.0	5.0	5.0			5.0	5.0
Lane Util. Factor				0.95	0.95	1.00	1.00	0.95			0.95	1.00
Frt				1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	0.95	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)				1681	1681	1583	1770	3539			3539	1583
Flt Permitted				0.95	0.95	1.00	0.38	1.00			1.00	1.00
Satd. Flow (perm)				1681	1681	1583	713	3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	287	0	421	83	1529	0	0	652	107
RTOR Reduction (vph)	0	0	0	0	0	24	0	0	0	0	0	48
Lane Group Flow (vph)	0	0	0	143	144	397	83	1529	0	0	652	59
Turn Type				Perm	NA	Perm	Perm	NA			NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8	2					6
Actuated Green, G (s)				19.2	19.2	19.2	35.8	35.8			35.8	35.8
Effective Green, g (s)				19.2	19.2	19.2	35.8	35.8			35.8	35.8
Actuated g/C Ratio				0.30	0.30	0.30	0.55	0.55			0.55	0.55
Clearance Time (s)				5.0	5.0	5.0	5.0	5.0			5.0	5.0
Vehicle Extension (s)				3.0	3.0	3.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)				496	496	467	392	1949			1949	871
v/s Ratio Prot								c0.43			0.18	
v/s Ratio Perm				0.09	0.09	c0.25	0.12					0.04
v/c Ratio				0.29	0.29	0.85	0.21	0.78			0.33	0.07
Uniform Delay, d1				17.6	17.6	21.5	7.4	11.5			8.0	6.8
Progression Factor				1.00	1.00	1.00	0.80	0.70			1.00	1.00
Incremental Delay, d2				0.3	0.3	13.8	1.1	2.8			0.5	0.1
Delay (s)				18.0	18.0	35.3	7.0	10.9			8.5	7.0
Level of Service				B	B	D	A	B			A	A
Approach Delay (s)		0.0			28.3			10.7			8.3	
Approach LOS		A			C			B			A	

Intersection Summary			
HCM 2000 Control Delay	14.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	71.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	68	69	122	1475	348	137	802
v/c Ratio	0.32	0.33	0.40	0.54	0.27	0.64	0.29
Control Delay	29.3	29.4	9.8	5.2	1.0	25.2	2.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.3	29.4	9.8	5.2	1.0	25.2	2.8
Queue Length 50th (ft)	26	26	0	111	0	21	18
Queue Length 95th (ft)	58	60	39	190	20	#136	72
Internal Link Dist (ft)		1478		2017			933
Turn Bay Length (ft)			250		500	175	
Base Capacity (vph)	413	413	481	2722	1298	214	2722
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.17	0.25	0.54	0.27	0.64	0.29

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	126	0	112	0	0	0	0	1357	320	126	738	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0					5.0	5.0	5.0	5.0	
Lane Util. Factor	0.95	0.95	1.00					0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1681	1681	1583					3539	1583	1770	3539	
Flt Permitted	0.95	0.95	1.00					1.00	1.00	0.15	1.00	
Satd. Flow (perm)	1681	1681	1583					3539	1583	277	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	137	0	122	0	0	0	0	1475	348	137	802	0
RTOR Reduction (vph)	0	0	109	0	0	0	0	0	91	0	0	0
Lane Group Flow (vph)	68	69	13	0	0	0	0	1475	257	137	802	0
Turn Type	Perm	NA	Perm					NA	Perm	custom	NA	
Protected Phases		4						2				
Permitted Phases	4		4						2	6	6	
Actuated Green, G (s)	7.0	7.0	7.0					48.0	48.0	48.0	48.0	
Effective Green, g (s)	7.0	7.0	7.0					48.0	48.0	48.0	48.0	
Actuated g/C Ratio	0.11	0.11	0.11					0.74	0.74	0.74	0.74	
Clearance Time (s)	5.0	5.0	5.0					5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	181	181	170					2613	1168	204	2613	
v/s Ratio Prot								0.42				
v/s Ratio Perm	0.04	0.04	0.01						0.16	c0.49	0.23	
v/c Ratio	0.38	0.38	0.08					0.56	0.22	0.67	0.31	
Uniform Delay, d1	27.0	27.0	26.1					3.8	2.7	4.4	2.9	
Progression Factor	1.00	1.00	1.00					1.00	1.00	0.98	0.77	
Incremental Delay, d2	1.3	1.3	0.2					0.9	0.4	15.7	0.3	
Delay (s)	28.3	28.3	26.3					4.7	3.1	20.1	2.5	
Level of Service	C	C	C					A	A	C	A	
Approach Delay (s)		27.4			0.0			4.4			5.1	
Approach LOS		C			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	6.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	71.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	167	146	67	905	229
v/c Ratio	0.67	0.09	0.08	0.64	0.19
Control Delay	51.8	0.1	3.5	6.8	7.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	51.8	0.1	3.5	6.8	7.7
Queue Length 50th (ft)	96	0	9	234	53
Queue Length 95th (ft)	160	0	m18	169	90
Internal Link Dist (ft)	446			1125	3526
Turn Bay Length (ft)		300	100		
Base Capacity (vph)	298	1583	845	1404	1227
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.56	0.09	0.08	0.64	0.19

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	154	134	62	833	207	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	4.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	1863	1858	
Flt Permitted	0.95	1.00	0.57	1.00	1.00	
Satd. Flow (perm)	1770	1583	1061	1863	1858	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	167	146	67	905	225	4
RTOR Reduction (vph)	0	0	0	0	1	0
Lane Group Flow (vph)	167	146	67	905	228	0
Turn Type	NA	Free	pm+pt	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		Free	2			
Actuated Green, G (s)	13.4	95.0	71.6	71.6	61.7	
Effective Green, g (s)	13.4	95.0	71.6	71.6	61.7	
Actuated g/C Ratio	0.14	1.00	0.75	0.75	0.65	
Clearance Time (s)	5.0		5.0	5.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	249	1583	836	1404	1206	
v/s Ratio Prot	c0.09		0.00	c0.49	0.12	
v/s Ratio Perm		0.09	0.06			
v/c Ratio	0.67	0.09	0.08	0.64	0.19	
Uniform Delay, d1	38.7	0.0	3.1	5.6	6.7	
Progression Factor	1.00	1.00	0.95	0.75	1.00	
Incremental Delay, d2	6.9	0.1	0.0	1.9	0.3	
Delay (s)	45.6	0.1	3.0	6.1	7.0	
Level of Service	D	A	A	A	A	
Approach Delay (s)	24.4			5.9	7.0	
Approach LOS	C			A	A	

Intersection Summary			
HCM 2000 Control Delay	9.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	60.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	14	13	662	959	213	158
v/c Ratio	0.12	0.07	0.63	0.56	0.16	0.13
Control Delay	43.3	0.8	4.4	3.2	5.4	0.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.3	0.8	4.4	3.2	5.4	0.8
Queue Length 50th (ft)	8	0	0	0	17	0
Queue Length 95th (ft)	27	0	128	243	62	7
Internal Link Dist (ft)	411			3238	1125	
Turn Bay Length (ft)		200	100			
Base Capacity (vph)	298	333	1228	1727	1335	1179
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.05	0.04	0.54	0.56	0.16	0.13

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	13	12	609	882	196	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.95	1.00	0.58	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1081	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	14	13	662	959	213	158
RTOR Reduction (vph)	0	13	0	0	0	50
Lane Group Flow (vph)	14	0	662	959	213	108
Turn Type	NA	Perm	pm+pt	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	2.9	2.9	82.1	82.1	65.1	65.1
Effective Green, g (s)	2.9	2.9	82.1	82.1	65.1	65.1
Actuated g/C Ratio	0.03	0.03	0.86	0.86	0.69	0.69
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	54	48	1021	1610	1276	1084
v/s Ratio Prot	c0.01		c0.08	0.51	0.11	
v/s Ratio Perm		0.00	c0.48			0.07
v/c Ratio	0.26	0.01	0.65	0.60	0.17	0.10
Uniform Delay, d1	45.0	44.7	1.7	1.8	5.3	5.1
Progression Factor	1.00	1.00	1.00	1.00	0.71	0.27
Incremental Delay, d2	2.5	0.1	1.4	1.6	0.3	0.2
Delay (s)	47.5	44.7	3.1	3.4	4.0	1.5
Level of Service	D	D	A	A	A	A
Approach Delay (s)	46.2			3.3	3.0	
Approach LOS	D			A	A	

Intersection Summary			
HCM 2000 Control Delay	3.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	61.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

910: Port Royal Rd & Saturn Pkwy WB Ramp

Lane Group	WBT	WBR	NBL	NBT	SBT
Lane Group Flow (vph)	89	146	140	239	937
v/c Ratio	0.55	0.53	0.29	0.15	0.37
Control Delay	68.6	15.3	8.1	2.5	6.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	68.6	15.3	8.1	2.5	6.9
Queue Length 50th (ft)	73	0	14	24	128
Queue Length 95th (ft)	126	63	78	48	194
Internal Link Dist (ft)	1680			1224	528
Turn Bay Length (ft)		300			
Base Capacity (vph)	367	444	607	1549	2550
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.24	0.33	0.23	0.15	0.37

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	82	0	134	129	220	0	0	728	134
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0	5.0	5.0	5.0			5.0	
Lane Util. Factor					1.00	1.00	1.00	1.00			0.95	
Frt					1.00	0.85	1.00	1.00			0.98	
Flt Protected					0.95	1.00	0.95	1.00			1.00	
Satd. Flow (prot)					1770	1583	1770	1863			3456	
Flt Permitted					0.95	1.00	0.27	1.00			1.00	
Satd. Flow (perm)					1770	1583	495	1863			3456	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	89	0	146	140	239	0	0	791	146
RTOR Reduction (vph)	0	0	0	0	0	133	0	0	0	0	6	0
Lane Group Flow (vph)	0	0	0	0	89	13	140	239	0	0	931	0
Turn Type				Perm	NA	Perm	pm+pt	NA			NA	
Protected Phases					8		5	2			6	
Permitted Phases				8		8	2					
Actuated Green, G (s)					11.9	11.9	108.1	108.1			95.6	
Effective Green, g (s)					11.9	11.9	108.1	108.1			95.6	
Actuated g/C Ratio					0.09	0.09	0.83	0.83			0.74	
Clearance Time (s)					5.0	5.0	5.0	5.0			5.0	
Vehicle Extension (s)					3.0	3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)					162	144	485	1549			2541	
v/s Ratio Prot							c0.02	0.13			c0.27	
v/s Ratio Perm					0.05	0.01	0.22					
v/c Ratio					0.55	0.09	0.29	0.15			0.37	
Uniform Delay, d1					56.5	54.1	2.9	2.1			6.2	
Progression Factor					1.00	1.00	2.88	0.97			1.00	
Incremental Delay, d2					3.8	0.3	0.3	0.2			0.4	
Delay (s)					60.3	54.4	8.6	2.3			6.6	
Level of Service					E	D	A	A			A	
Approach Delay (s)		0.0			56.6			4.6			6.6	
Approach LOS		A			E			A			A	

Intersection Summary			
HCM 2000 Control Delay	13.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	87.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	70	208	310	553	745	137
v/c Ratio	0.49	0.65	0.14	0.48	0.77	0.09
Control Delay	68.2	17.3	11.8	4.9	7.7	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	68.2	17.3	11.8	4.9	7.7	0.5
Queue Length 50th (ft)	57	0	49	33	22	1
Queue Length 95th (ft)	105	76	105	146	96	8
Internal Link Dist (ft)	1642		1468			1224
Turn Bay Length (ft)				150		
Base Capacity (vph)	231	387	2228	1160	1139	1569
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.30	0.54	0.14	0.48	0.65	0.09

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	64	0	191	0	0	0	0	285	509	685	126	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0					5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00	1.00					0.95	1.00	1.00	1.00	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1770	1583					3539	1583	1770	1863	
Flt Permitted		0.95	1.00					1.00	1.00	0.53	1.00	
Satd. Flow (perm)		1770	1583					3539	1583	989	1863	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	70	0	208	0	0	0	0	310	553	745	137	0
RTOR Reduction (vph)	0	0	191	0	0	0	0	0	164	0	0	0
Lane Group Flow (vph)	0	70	17	0	0	0	0	310	389	745	137	0
Turn Type	Perm	NA	Perm					NA	Perm	pm+pt	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2	6		
Actuated Green, G (s)		10.5	10.5					81.8	81.8	109.5	109.5	
Effective Green, g (s)		10.5	10.5					81.8	81.8	109.5	109.5	
Actuated g/C Ratio		0.08	0.08					0.63	0.63	0.84	0.84	
Clearance Time (s)		5.0	5.0					5.0	5.0	5.0	5.0	
Vehicle Extension (s)		3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		142	127					2226	996	969	1569	
v/s Ratio Prot								0.09		c0.13	0.07	
v/s Ratio Perm		0.04	0.01						0.25	c0.51		
v/c Ratio		0.49	0.13					0.14	0.39	0.77	0.09	
Uniform Delay, d1		57.2	55.5					9.8	11.9	3.1	1.7	
Progression Factor		1.00	1.00					1.00	1.00	0.68	0.20	
Incremental Delay, d2		2.7	0.5					0.1	1.2	3.5	0.1	
Delay (s)		59.9	56.0					9.9	13.0	5.7	0.4	
Level of Service		E	E					A	B	A	A	
Approach Delay (s)		57.0			0.0			11.9			4.9	
Approach LOS		E			A			B			A	

Intersection Summary			
HCM 2000 Control Delay	15.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	87.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	1105	89	70	207	367	351	336
v/c Ratio	0.69	0.11	0.28	0.10	0.74	0.62	0.50
Control Delay	19.6	3.0	7.6	4.0	35.1	16.6	5.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	19.6	3.0	7.6	4.0	35.1	16.6	5.5
Queue Length 50th (ft)	217	0	17	26	161	70	0
Queue Length 95th (ft)	290	20	37	43	#291	168	58
Internal Link Dist (ft)	980			565		443	
Turn Bay Length (ft)		100	100		300		
Base Capacity (vph)	1613	777	254	2029	493	562	678
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.69	0.11	0.28	0.10	0.74	0.62	0.50

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1017	82	64	190	0	0	0	0	427	0	543
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0	5.0	5.0					5.0	5.0	5.0
Lane Util. Factor		0.95	1.00	1.00	0.95					0.95	0.91	0.95
Frt		1.00	0.85	1.00	1.00					1.00	0.89	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.99	1.00
Satd. Flow (prot)		3539	1583	1770	3539					1681	1491	1504
Flt Permitted		1.00	1.00	0.12	1.00					0.95	0.99	1.00
Satd. Flow (perm)		3539	1583	230	3539					1681	1491	1504
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1105	89	70	207	0	0	0	0	464	0	590
RTOR Reduction (vph)	0	0	50	0	0	0	0	0	0	0	126	237
Lane Group Flow (vph)	0	1105	39	70	207	0	0	0	0	367	225	99
Turn Type		NA	Perm	pm+pt	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases			2	6						4		4
Actuated Green, G (s)		33.2	33.2	43.0	43.0					22.0	22.0	22.0
Effective Green, g (s)		33.2	33.2	43.0	43.0					22.0	22.0	22.0
Actuated g/C Ratio		0.44	0.44	0.57	0.57					0.29	0.29	0.29
Clearance Time (s)		5.0	5.0	5.0	5.0					5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		1566	700	230	2029					493	437	441
v/s Ratio Prot		c0.31		c0.02	0.06							
v/s Ratio Perm			0.02	0.15						c0.22	0.15	0.07
v/c Ratio		0.71	0.06	0.30	0.10					0.74	0.52	0.22
Uniform Delay, d1		16.9	11.9	10.2	7.3					24.0	22.1	20.0
Progression Factor		1.00	1.00	0.68	0.53					1.00	1.00	1.00
Incremental Delay, d2		2.7	0.2	0.7	0.1					9.8	4.3	1.2
Delay (s)		19.6	12.1	7.7	4.0					33.8	26.4	21.2
Level of Service		B	B	A	A					C	C	C
Approach Delay (s)		19.1			4.9			0.0			27.3	
Approach LOS		B			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	21.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	83.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	NBT	NBR
Lane Group Flow (vph)	929	662	168	713	108	84
v/c Ratio	0.93	0.54	0.16	0.89	0.29	0.20
Control Delay	33.3	5.2	20.2	24.8	27.2	5.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.3	5.2	20.2	24.8	27.2	5.6
Queue Length 50th (ft)	178	12	30	110	42	0
Queue Length 95th (ft)	#317	67	53	#342	84	26
Internal Link Dist (ft)		565	1393		410	
Turn Bay Length (ft)	100			200		
Base Capacity (vph)	1007	1217	1047	798	377	417
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.92	0.54	0.16	0.89	0.29	0.20

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	855	609	0	0	155	656	99	0	77	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0		5.0	5.0			
Lane Util. Factor	0.97	1.00			0.95	1.00		1.00	1.00			
Frt	1.00	1.00			1.00	0.85		1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (prot)	3433	1863			3539	1583		1770	1583			
Flt Permitted	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (perm)	3433	1863			3539	1583		1770	1583			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	929	662	0	0	168	713	108	0	84	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	329	0	0	66	0	0	0
Lane Group Flow (vph)	929	662	0	0	168	384	0	108	18	0	0	0
Turn Type	Prot	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	5	2			6			8				
Permitted Phases						6	8		8			
Actuated Green, G (s)	21.8	49.0			22.2	22.2		16.0	16.0			
Effective Green, g (s)	21.8	49.0			22.2	22.2		16.0	16.0			
Actuated g/C Ratio	0.29	0.65			0.30	0.30		0.21	0.21			
Clearance Time (s)	5.0	5.0			5.0	5.0		5.0	5.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0	3.0			
Lane Grp Cap (vph)	997	1217			1047	468		377	337			
v/s Ratio Prot	c0.27	0.36			0.05							
v/s Ratio Perm						c0.24		0.06	0.01			
v/c Ratio	0.93	0.54			0.16	0.82		0.29	0.05			
Uniform Delay, d1	25.9	7.0			19.5	24.5		24.7	23.5			
Progression Factor	0.73	0.54			1.00	1.00		1.00	1.00			
Incremental Delay, d2	11.5	1.3			0.3	14.8		1.9	0.3			
Delay (s)	30.4	5.0			19.8	39.3		26.6	23.8			
Level of Service	C	A			B	D		C	C			
Approach Delay (s)		19.9			35.6			25.4			0.0	
Approach LOS		B			D			C			A	

Intersection Summary			
HCM 2000 Control Delay	25.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	83.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBT	WBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	139	140	395	88	1511	636	109
v/c Ratio	0.29	0.29	0.84	0.21	0.75	0.31	0.11
Control Delay	20.5	20.6	39.7	8.3	10.9	8.8	2.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.5	20.6	39.7	8.3	10.9	8.8	2.2
Queue Length 50th (ft)	46	47	142	14	159	73	0
Queue Length 95th (ft)	90	91	#276	m29	186	104	19
Internal Link Dist (ft)		2384			933	7506	
Turn Bay Length (ft)			150	300			
Base Capacity (vph)	528	528	515	418	2028	2028	954
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.26	0.27	0.77	0.21	0.75	0.31	0.11

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	257	0	363	81	1390	0	0	585	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				5.0	5.0	5.0	5.0	5.0			5.0	5.0
Lane Util. Factor				0.95	0.95	1.00	1.00	0.95			0.95	1.00
Frt				1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	0.95	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)				1681	1681	1583	1770	3539			3539	1583
Flt Permitted				0.95	0.95	1.00	0.39	1.00			1.00	1.00
Satd. Flow (perm)				1681	1681	1583	730	3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	279	0	395	88	1511	0	0	636	109
RTOR Reduction (vph)	0	0	0	0	0	18	0	0	0	0	0	47
Lane Group Flow (vph)	0	0	0	139	140	377	88	1511	0	0	636	62
Turn Type				Perm		Perm	Perm					Perm
Protected Phases					8			2			6	
Permitted Phases				8		8	2					6
Actuated Green, G (s)				19.9	19.9	19.9	40.1	40.1			40.1	40.1
Effective Green, g (s)				19.9	19.9	19.9	40.1	40.1			40.1	40.1
Actuated g/C Ratio				0.28	0.28	0.28	0.57	0.57			0.57	0.57
Clearance Time (s)				5.0	5.0	5.0	5.0	5.0			5.0	5.0
Vehicle Extension (s)				3.0	3.0	3.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)				478	478	450	418	2027			2027	907
v/s Ratio Prot								c0.43			0.18	
v/s Ratio Perm				0.08	0.08	c0.24	0.12					0.04
v/c Ratio				0.29	0.29	0.84	0.21	0.75			0.31	0.07
Uniform Delay, d1				19.5	19.6	23.5	7.3	11.1			7.8	6.6
Progression Factor				1.00	1.00	1.00	0.84	0.72			1.00	1.00
Incremental Delay, d2				0.3	0.3	12.8	1.0	2.2			0.4	0.1
Delay (s)				19.9	19.9	36.3	7.1	10.2			8.2	6.8
Level of Service				B	B	D	A	B			A	A
Approach Delay (s)		0.0			29.5			10.1			8.0	
Approach LOS		A			C			B			A	

Intersection Summary			
HCM Average Control Delay	13.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	69.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	62	62	102	1475	357	133	783
v/c Ratio	0.32	0.32	0.37	0.53	0.27	0.60	0.28
Control Delay	32.2	32.2	10.8	4.7	1.0	20.7	2.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.2	32.2	10.8	4.7	1.0	20.7	2.9
Queue Length 50th (ft)	26	26	0	110	0	20	57
Queue Length 95th (ft)	58	58	38	184	19	#134	78
Internal Link Dist (ft)		1478		2017			933
Turn Bay Length (ft)			250		500	175	
Base Capacity (vph)	384	384	441	2786	1322	223	2786
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.16	0.23	0.53	0.27	0.60	0.28

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	114	0	94	0	0	0	0	1357	328	122	720	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0					5.0	5.0	5.0	5.0	
Lane Util. Factor	0.95	0.95	1.00					0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1681	1681	1583					3539	1583	1770	3539	
Flt Permitted	0.95	0.95	1.00					1.00	1.00	0.15	1.00	
Satd. Flow (perm)	1681	1681	1583					3539	1583	283	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	124	0	102	0	0	0	0	1475	357	133	783	0
RTOR Reduction (vph)	0	0	92	0	0	0	0	0	86	0	0	0
Lane Group Flow (vph)	62	62	10	0	0	0	0	1475	271	133	783	0
Turn Type	Perm		Perm						Perm	custom		
Protected Phases		4						2				
Permitted Phases	4		4						2	6	6	
Actuated Green, G (s)	6.9	6.9	6.9					53.1	53.1	53.1	53.1	
Effective Green, g (s)	6.9	6.9	6.9					53.1	53.1	53.1	53.1	
Actuated g/C Ratio	0.10	0.10	0.10					0.76	0.76	0.76	0.76	
Clearance Time (s)	5.0	5.0	5.0					5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	166	166	156					2685	1201	215	2685	
v/s Ratio Prot								0.42				
v/s Ratio Perm	c0.04	0.04	0.01						0.17	c0.47	0.22	
v/c Ratio	0.37	0.37	0.06					0.55	0.23	0.62	0.29	
Uniform Delay, d1	29.5	29.5	28.6					3.5	2.5	3.8	2.6	
Progression Factor	1.00	1.00	1.00					1.00	1.00	1.00	0.91	
Incremental Delay, d2	1.4	1.4	0.2					0.8	0.4	12.3	0.3	
Delay (s)	30.9	30.9	28.8					4.3	2.9	16.1	2.6	
Level of Service	C	C	C					A	A	B	A	
Approach Delay (s)		30.0			0.0			4.0			4.6	
Approach LOS		C			A			A			A	

Intersection Summary			
HCM Average Control Delay	6.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	69.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	228	193	90	1237	317
v/c Ratio	0.84	0.12	0.11	0.85	0.24
Control Delay	86.7	0.2	3.0	14.4	8.8
Queue Delay	0.0	0.0	0.0	0.3	0.0
Total Delay	86.7	0.2	3.0	14.7	8.8
Queue Length 50th (ft)	217	0	10	759	109
Queue Length 95th (ft)	#328	0	m11	994	151
Internal Link Dist (ft)	446			1125	3526
Turn Bay Length (ft)		300	100		
Base Capacity (vph)	307	1583	788	1453	1309
Starvation Cap Reductn	0	0	0	23	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.74	0.12	0.11	0.87	0.24

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	210	178	83	1138	287	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	4.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	1863	1859	
Flt Permitted	0.95	1.00	0.52	1.00	1.00	
Satd. Flow (perm)	1770	1583	967	1863	1859	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	228	193	90	1237	312	5
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	228	193	90	1237	317	0
Turn Type		Free	pm+pt			
Protected Phases	4		5	2	6	
Permitted Phases		Free	2			
Actuated Green, G (s)	23.0	150.0	117.0	117.0	105.6	
Effective Green, g (s)	23.0	150.0	117.0	117.0	105.6	
Actuated g/C Ratio	0.15	1.00	0.78	0.78	0.70	
Clearance Time (s)	5.0		5.0	5.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	271	1583	789	1453	1309	
v/s Ratio Prot	c0.13		0.00	c0.66	0.17	
v/s Ratio Perm		0.12	0.08			
v/c Ratio	0.84	0.12	0.11	0.85	0.24	
Uniform Delay, d1	61.7	0.0	4.2	10.8	7.9	
Progression Factor	1.00	1.00	0.66	0.79	1.00	
Incremental Delay, d2	20.4	0.2	0.0	4.3	0.4	
Delay (s)	82.1	0.2	2.8	12.9	8.4	
Level of Service	F	A	A	B	A	
Approach Delay (s)	44.5			12.2	8.4	
Approach LOS	D			B	A	

Intersection Summary			
HCM Average Control Delay	18.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	79.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	20	17	902	1308	290	215
v/c Ratio	0.23	0.18	0.82	0.76	0.26	0.21
Control Delay	74.3	30.6	10.2	6.4	18.4	2.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	74.3	30.6	10.2	6.4	18.4	2.6
Queue Length 50th (ft)	19	0	143	340	87	0
Queue Length 95th (ft)	48	27	313	590	305	76
Internal Link Dist (ft)	411			3238	1125	
Turn Bay Length (ft)		200	100			
Base Capacity (vph)	189	184	1251	1727	1114	1033
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.11	0.09	0.72	0.76	0.26	0.21

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	18	16	830	1203	267	198
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.95	1.00	0.51	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	945	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	20	17	902	1308	290	215
RTOR Reduction (vph)	0	16	0	0	0	89
Lane Group Flow (vph)	20	1	902	1308	290	126
Turn Type		Perm	pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	4.9	4.9	135.1	135.1	87.7	87.7
Effective Green, g (s)	4.9	4.9	135.1	135.1	87.7	87.7
Actuated g/C Ratio	0.03	0.03	0.90	0.90	0.58	0.58
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	58	52	1084	1678	1089	926
v/s Ratio Prot	c0.01		c0.24	0.70	0.16	
v/s Ratio Perm		0.00	c0.51			0.08
v/c Ratio	0.34	0.01	0.83	0.78	0.27	0.14
Uniform Delay, d1	71.0	70.2	4.3	2.5	15.3	14.1
Progression Factor	1.00	1.00	1.00	1.00	0.82	0.58
Incremental Delay, d2	3.6	0.1	5.6	3.7	0.6	0.3
Delay (s)	74.5	70.3	9.9	6.1	13.1	8.4
Level of Service	E	E	A	A	B	A
Approach Delay (s)	72.6			7.7	11.1	
Approach LOS	E			A	B	

Intersection Summary			
HCM Average Control Delay	9.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	77.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	41	213	259	60	703	945
v/c Ratio	0.10	0.40	0.46	0.07	0.93	0.71
Control Delay	23.7	6.4	16.8	12.5	42.4	4.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.7	6.4	16.8	12.5	42.4	4.4
Queue Length 50th (ft)	15	0	76	16	300	12
Queue Length 95th (ft)	39	50	129	36	#520	54
Internal Link Dist (ft)	2022			1829	2247	
Turn Bay Length (ft)		150	150			150
Base Capacity (vph)	430	530	569	820	755	1325
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.40	0.46	0.07	0.93	0.71

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	38	196	238	55	647	869
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.57	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	1055	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	41	213	259	60	703	945
RTOR Reduction (vph)	0	164	0	0	0	373
Lane Group Flow (vph)	41	49	259	60	703	572
Turn Type		Perm	pm+pt			pm+ov
Protected Phases	2		1	6	8	1
Permitted Phases		2	6			8
Actuated Green, G (s)	17.3	17.3	33.0	33.0	32.0	42.7
Effective Green, g (s)	17.3	17.3	33.0	33.0	32.0	42.7
Actuated g/C Ratio	0.23	0.23	0.44	0.44	0.43	0.57
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	430	365	566	820	755	1007
v/s Ratio Prot	0.02		0.07	0.03	c0.40	c0.08
v/s Ratio Perm		0.03	c0.14			0.28
v/c Ratio	0.10	0.13	0.46	0.07	0.93	0.57
Uniform Delay, d1	22.7	22.9	14.0	12.2	20.5	10.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.8	0.6	0.2	19.7	0.7
Delay (s)	23.1	23.7	14.6	12.3	40.2	11.0
Level of Service	C	C	B	B	D	B
Approach Delay (s)	23.6			14.1	23.4	
Approach LOS	C			B	C	

Intersection Summary			
HCM Average Control Delay	22.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	5.0
Intersection Capacity Utilization	67.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	197	147	101	186	257	379	71	785	58	353	88
v/c Ratio	0.92	0.47	0.29	0.61	0.82	0.81	0.13	0.85	0.26	0.38	0.11
Control Delay	74.6	38.8	9.2	38.2	59.4	29.9	8.7	31.8	11.2	16.5	3.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	74.6	38.8	9.2	38.2	59.4	29.9	8.7	31.8	11.2	16.5	3.5
Queue Length 50th (ft)	88	75	0	89	147	84	16	396	13	127	0
Queue Length 95th (ft)	#175	134	42	152	#263	#218	34	#642	28	196	24
Internal Link Dist (ft)		2030			1135			9853		1200	
Turn Bay Length (ft)	175		175	150		300	200		150		150
Base Capacity (vph)	214	331	364	304	331	482	545	924	220	931	835
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.92	0.44	0.28	0.61	0.78	0.79	0.13	0.85	0.26	0.38	0.11

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	181	135	93	171	236	349	65	672	51	53	325	81
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1843		1770	1863	1583
Flt Permitted	0.31	1.00	1.00	0.59	1.00	1.00	0.47	1.00		0.11	1.00	1.00
Satd. Flow (perm)	569	1863	1583	1101	1863	1583	879	1843		209	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	197	147	101	186	257	379	71	730	55	58	353	88
RTOR Reduction (vph)	0	0	84	0	0	203	0	3	0	0	0	45
Lane Group Flow (vph)	197	147	17	186	257	176	71	782	0	58	353	43
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	21.2	15.2	15.2	21.2	15.2	15.2	48.8	44.0		48.8	44.0	44.0
Effective Green, g (s)	21.2	15.2	15.2	21.2	15.2	15.2	48.8	44.0		48.8	44.0	44.0
Actuated g/C Ratio	0.24	0.17	0.17	0.24	0.17	0.17	0.54	0.49		0.54	0.49	0.49
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	214	315	267	304	315	267	524	901		197	911	774
v/s Ratio Prot	c0.06	0.08		0.04	0.14		0.01	c0.42		c0.02	0.19	
v/s Ratio Perm	c0.16		0.01	0.10		0.11	0.07			0.14		0.03
v/c Ratio	0.92	0.47	0.06	0.61	0.82	0.66	0.14	0.87		0.29	0.39	0.06
Uniform Delay, d1	32.3	33.7	31.4	29.9	36.1	35.0	10.1	20.4		15.4	14.5	12.1
Progression Factor	1.00	1.00	1.00	1.07	1.06	1.21	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	40.1	1.1	0.1	3.6	14.9	5.8	0.1	11.1		0.8	1.2	0.1
Delay (s)	72.4	34.8	31.5	35.6	53.1	48.0	10.2	31.5		16.3	15.7	12.2
Level of Service	E	C	C	D	D	D	B	C		B	B	B
Approach Delay (s)		50.7			46.8			29.7			15.2	
Approach LOS		D			D			C			B	

Intersection Summary			
HCM Average Control Delay	35.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	82.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	477	83	232	1143	425	47
v/c Ratio	1.01	0.18	0.45	0.99	0.49	0.06
Control Delay	86.1	17.1	10.3	41.7	19.5	4.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	86.1	17.1	10.3	41.7	19.5	4.6
Queue Length 50th (ft)	~290	13	52	576	165	0
Queue Length 95th (ft)	m#479	m47	85	#916	248	18
Internal Link Dist (ft)	7444			1245	1600	
Turn Bay Length (ft)		150	150			150
Base Capacity (vph)	472	471	529	1159	861	757
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.01	0.18	0.44	0.99	0.49	0.06

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	439	76	213	1052	391	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.95	1.00	0.35	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	651	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	477	83	232	1143	425	47
RTOR Reduction (vph)	0	48	0	0	0	25
Lane Group Flow (vph)	477	35	232	1143	425	22
Turn Type		Perm	pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	24.0	24.0	56.0	56.0	41.6	41.6
Effective Green, g (s)	24.0	24.0	56.0	56.0	41.6	41.6
Actuated g/C Ratio	0.27	0.27	0.62	0.62	0.46	0.46
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	472	422	522	1159	861	732
v/s Ratio Prot	c0.27		0.05	c0.61	0.23	
v/s Ratio Perm		0.02	0.23			0.01
v/c Ratio	1.01	0.08	0.44	0.99	0.49	0.03
Uniform Delay, d1	33.0	24.7	9.0	16.6	16.9	13.2
Progression Factor	1.26	1.72	1.00	1.00	1.00	1.00
Incremental Delay, d2	43.8	0.1	0.6	23.3	2.0	0.1
Delay (s)	85.5	42.5	9.6	40.0	18.9	13.3
Level of Service	F	D	A	D	B	B
Approach Delay (s)	79.1			34.8	18.3	
Approach LOS	E			C	B	

Intersection Summary			
HCM Average Control Delay	41.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	88.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBT	WBR	NBL	NBT	SBT
Lane Group Flow (vph)	95	149	149	236	1329
v/c Ratio	0.54	0.51	0.45	0.16	0.54
Control Delay	59.7	13.9	6.8	1.9	9.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	59.7	13.9	6.8	1.9	9.6
Queue Length 50th (ft)	68	0	1	6	214
Queue Length 95th (ft)	119	59	2	1	329
Internal Link Dist (ft)	1680			1224	528
Turn Bay Length (ft)		300			
Base Capacity (vph)	277	373	414	1515	2440
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.34	0.40	0.36	0.16	0.54

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	87	0	137	137	217	0	0	1038	185
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0	5.0	5.0	5.0			5.0	
Lane Util. Factor					1.00	1.00	1.00	1.00			0.95	
Frt					1.00	0.85	1.00	1.00			0.98	
Flt Protected					0.95	1.00	0.95	1.00			1.00	
Satd. Flow (prot)					1770	1583	1770	1863			3459	
Flt Permitted					0.95	1.00	0.15	1.00			1.00	
Satd. Flow (perm)					1770	1583	287	1863			3459	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	95	0	149	149	236	0	0	1128	201
RTOR Reduction (vph)	0	0	0	0	0	134	0	0	0	0	9	0
Lane Group Flow (vph)	0	0	0	0	95	15	149	236	0	0	1320	0
Turn Type				Perm		Perm	pm+pt					
Protected Phases					8		5	2			6	
Permitted Phases				8		8	2					
Actuated Green, G (s)					11.5	11.5	93.5	93.5			80.8	
Effective Green, g (s)					11.5	11.5	93.5	93.5			80.8	
Actuated g/C Ratio					0.10	0.10	0.81	0.81			0.70	
Clearance Time (s)					5.0	5.0	5.0	5.0			5.0	
Vehicle Extension (s)					3.0	3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)					177	158	333	1515			2430	
v/s Ratio Prot							c0.03	0.13			c0.38	
v/s Ratio Perm					0.05	0.01	0.33					
v/c Ratio					0.54	0.09	0.45	0.16			0.54	
Uniform Delay, d1					49.2	47.0	5.6	2.3			8.2	
Progression Factor					1.00	1.00	1.01	0.63			1.00	
Incremental Delay, d2					3.1	0.3	0.9	0.2			0.9	
Delay (s)					52.3	47.3	6.5	1.7			9.1	
Level of Service					D	D	A	A			A	
Approach Delay (s)		0.0			49.2			3.6			9.1	
Approach LOS		A			D			A			A	

Intersection Summary			
HCM Average Control Delay	13.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	102.1%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	59	175	315	562	1033	190
v/c Ratio	0.41	0.61	0.26	0.74	0.92	0.12
Control Delay	57.9	16.5	31.2	21.4	17.0	0.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	57.9	16.5	31.2	21.4	17.0	0.2
Queue Length 50th (ft)	42	0	97	161	412	0
Queue Length 95th (ft)	84	65	141	#368	#762	2
Internal Link Dist (ft)	1642		1468			1224
Turn Bay Length (ft)				150		
Base Capacity (vph)	246	371	1195	761	1164	1550
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.47	0.26	0.74	0.89	0.12

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	54	0	161	0	0	0	0	290	517	950	175	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0					5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00	1.00					0.95	1.00	1.00	1.00	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1770	1583					3539	1583	1770	1863	
Flt Permitted		0.95	1.00					1.00	1.00	0.46	1.00	
Satd. Flow (perm)		1770	1583					3539	1583	861	1863	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	59	0	175	0	0	0	0	315	562	1033	190	0
RTOR Reduction (vph)	0	0	161	0	0	0	0	0	226	0	0	0
Lane Group Flow (vph)	0	59	14	0	0	0	0	315	336	1033	190	0
Turn Type	Perm		Perm						Perm	pm+pt		
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2	6		
Actuated Green, G (s)		9.3	9.3					38.9	38.9	95.7	95.7	
Effective Green, g (s)		9.3	9.3					38.9	38.9	95.7	95.7	
Actuated g/C Ratio		0.08	0.08					0.34	0.34	0.83	0.83	
Clearance Time (s)		5.0	5.0					5.0	5.0	5.0	5.0	
Vehicle Extension (s)		3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		143	128					1197	535	1126	1550	
v/s Ratio Prot								0.09		c0.41	0.10	
v/s Ratio Perm		0.03	0.01						0.21	c0.35		
v/c Ratio		0.41	0.11					0.26	0.63	0.92	0.12	
Uniform Delay, d1		50.3	49.0					27.6	32.0	9.8	1.8	
Progression Factor		1.00	1.00					1.00	1.00	0.49	0.05	
Incremental Delay, d2		1.9	0.4					0.5	5.5	10.2	0.1	
Delay (s)		52.2	49.4					28.2	37.4	15.0	0.2	
Level of Service		D	D					C	D	B	A	
Approach Delay (s)		50.1			0.0			34.1			12.7	
Approach LOS		D			A			C			B	

Intersection Summary			
HCM Average Control Delay	24.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	102.1%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBT	WBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	139	140	395	88	1511	636	109
v/c Ratio	0.28	0.29	0.83	0.21	0.75	0.31	0.11
Control Delay	17.4	17.4	34.5	8.5	12.8	7.4	2.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.4	17.4	34.5	8.5	12.8	7.4	2.0
Queue Length 50th (ft)	38	38	118	15	203	59	0
Queue Length 95th (ft)	78	78	#246	37	283	87	17
Internal Link Dist (ft)		2384			933	7506	
Turn Bay Length (ft)			150	300			
Base Capacity (vph)	550	550	536	415	2023	2023	952
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.25	0.74	0.21	0.75	0.31	0.11

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	257	0	363	81	1390	0	0	585	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor				0.95	0.95	1.00	1.00	0.95			0.95	1.00
Frt				1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	0.95	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)				1681	1681	1583	1770	3539			3539	1583
Flt Permitted				0.95	0.95	1.00	0.39	1.00			1.00	1.00
Satd. Flow (perm)				1681	1681	1583	726	3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	279	0	395	88	1511	0	0	636	109
RTOR Reduction (vph)	0	0	0	0	0	18	0	0	0	0	0	47
Lane Group Flow (vph)	0	0	0	139	140	377	88	1511	0	0	636	62
Turn Type				Perm		Perm	Perm					Perm
Protected Phases					8			2			6	
Permitted Phases				8		8	2					6
Actuated Green, G (s)				16.9	16.9	16.9	33.2	33.2			33.2	33.2
Effective Green, g (s)				16.9	16.9	16.9	33.2	33.2			33.2	33.2
Actuated g/C Ratio				0.29	0.29	0.29	0.57	0.57			0.57	0.57
Clearance Time (s)				4.0	4.0	4.0	4.0	4.0			4.0	4.0
Vehicle Extension (s)				3.0	3.0	3.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)				489	489	460	415	2022			2022	905
v/s Ratio Prot								c0.43			0.18	
v/s Ratio Perm				0.08	0.08	c0.24	0.12					0.04
v/c Ratio				0.28	0.29	0.82	0.21	0.75			0.31	0.07
Uniform Delay, d1				15.9	15.9	19.2	6.1	9.3			6.5	5.6
Progression Factor				1.00	1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2				0.3	0.3	10.8	1.2	2.6			0.4	0.1
Delay (s)				16.2	16.3	30.0	7.2	11.9			6.9	5.7
Level of Service				B	B	C	A	B			A	A
Approach Delay (s)		0.0			24.3			11.6			6.7	
Approach LOS		A			C			B			A	

Intersection Summary			
HCM Average Control Delay	13.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	58.1	Sum of lost time (s)	8.0
Intersection Capacity Utilization	67.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	114	0	94	0	0	0	0	1357	328	122	720	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	124	0	102	0	0	0	0	1475	357	133	783	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			10									
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											1013	
pX, platoon unblocked												
vC, conflicting volume	1785	2523	391	2132	2523	738	783			1475		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1785	2523	391	2132	2523	738	783			1475		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	100	83	100	100	100	100			71		
cM capacity (veh/h)	40	19	608	18	19	361	831			453		

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	83	143	738	738	357	133	391	391
Volume Left	83	41	0	0	0	133	0	0
Volume Right	0	102	0	0	357	0	0	0
cSH	40	138	1700	1700	1700	453	1700	1700
Volume to Capacity	2.08	1.04	0.43	0.43	0.21	0.29	0.23	0.23
Queue Length 95th (ft)	221	192	0	0	0	30	0	0
Control Delay (s)	716.6	97.9	0.0	0.0	0.0	16.2	0.0	0.0
Lane LOS	F	F				C		
Approach Delay (s)	324.0		0.0			2.3		
Approach LOS	F							

Intersection Summary			
Average Delay	25.4		
Intersection Capacity Utilization	67.6%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	210	178	83	1138	287	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	228	193	90	1237	312	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		12				
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1732	315	317			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1732	315	317			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	73	93			
cM capacity (veh/h)	90	726	1243			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	422	90	1237	317
Volume Left	228	90	0	0
Volume Right	193	0	0	5
cSH	154	1243	1700	1700
Volume to Capacity	2.75	0.07	0.73	0.19
Queue Length 95th (ft)	943	6	0	0
Control Delay (s)	849.2	8.1	0.0	0.0
Lane LOS	F	A		
Approach Delay (s)	849.2	0.6		0.0
Approach LOS	F			

Intersection Summary			
Average Delay	173.7		
Intersection Capacity Utilization	78.2%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	18	16	830	1203	267	198
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	20	17	902	1308	290	215
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		8				
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	3402	290	290			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	3402	290	290			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	98	29			
cM capacity (veh/h)	2	749	1272			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	37	902	1308	290	215
Volume Left	20	902	0	0	0
Volume Right	17	0	0	0	215
cSH	4	1272	1700	1700	1700
Volume to Capacity	8.25	0.71	0.77	0.17	0.13
Queue Length 95th (ft)	Err	161	0	0	0
Control Delay (s)	Err	14.4	0.0	0.0	0.0
Lane LOS	F	B			
Approach Delay (s)	Err	5.9		0.0	
Approach LOS	F				

Intersection Summary			
Average Delay	139.0		
Intersection Capacity Utilization	73.4%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	38	196	238	55	647	869
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	41	213	259	60	703	945
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			254		725	148
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			254		725	148
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			80		0	0
cM capacity (veh/h)			1311		315	899

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	254	318	1648
Volume Left	0	259	703
Volume Right	213	0	945
cSH	1700	1311	501
Volume to Capacity	0.15	0.20	3.29
Queue Length 95th (ft)	0	18	Err
Control Delay (s)	0.0	7.2	Err
Lane LOS		A	F
Approach Delay (s)	0.0	7.2	Err
Approach LOS			F

Intersection Summary			
Average Delay	7420.7		
Intersection Capacity Utilization	129.4%	ICU Level of Service	H
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	197	147	101	186	257	379	71	785	58	353	88
v/c Ratio	0.79	0.29	0.20	0.55	0.51	0.66	0.12	0.72	0.25	0.32	0.09
Control Delay	44.0	17.4	5.1	24.2	20.9	15.0	7.0	14.6	10.5	7.8	2.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.0	17.4	5.1	24.2	20.9	15.0	7.0	14.6	10.5	7.8	2.1
Queue Length 50th (ft)	61	39	0	53	73	52	10	182	9	59	0
Queue Length 95th (ft)	#151	77	27	107	130	128	28	#346	32	109	15
Internal Link Dist (ft)		2030			1135			9853		1200	
Turn Bay Length (ft)	175		175	150		300	200		150		150
Base Capacity (vph)	307	628	601	417	628	661	568	1084	231	1092	964
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.64	0.23	0.17	0.45	0.41	0.57	0.13	0.72	0.25	0.32	0.09

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	181	135	93	171	236	349	65	672	51	53	325	81
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1843		1770	1863	1583
Flt Permitted	0.49	1.00	1.00	0.66	1.00	1.00	0.52	1.00		0.21	1.00	1.00
Satd. Flow (perm)	910	1863	1583	1236	1863	1583	971	1843		395	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	197	147	101	186	257	379	71	730	55	58	353	88
RTOR Reduction (vph)	0	0	74	0	0	140	0	4	0	0	0	36
Lane Group Flow (vph)	197	147	27	186	257	239	71	781	0	58	353	52
Turn Type	Perm		Perm	Perm		Perm	Perm			Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	15.4	15.4	15.4	15.4	15.4	15.4	33.2	33.2		33.2	33.2	33.2
Effective Green, g (s)	15.4	15.4	15.4	15.4	15.4	15.4	33.2	33.2		33.2	33.2	33.2
Actuated g/C Ratio	0.27	0.27	0.27	0.27	0.27	0.27	0.59	0.59		0.59	0.59	0.59
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	248	507	431	336	507	431	570	1081		232	1093	929
v/s Ratio Prot		0.08			0.14			c0.42			0.19	
v/s Ratio Perm	c0.22		0.02	0.15		0.15	0.07			0.15		0.03
v/c Ratio	0.79	0.29	0.06	0.55	0.51	0.56	0.12	0.72		0.25	0.32	0.06
Uniform Delay, d1	19.1	16.3	15.3	17.7	17.4	17.7	5.2	8.4		5.7	6.0	5.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	15.9	0.3	0.1	2.0	0.8	1.6	0.4	4.2		2.6	0.8	0.1
Delay (s)	35.1	16.6	15.3	19.6	18.2	19.2	5.7	12.6		8.2	6.8	5.1
Level of Service	D	B	B	B	B	B	A	B		A	A	A
Approach Delay (s)		24.5			19.0			12.0			6.6	
Approach LOS		C			B			B			A	

Intersection Summary			
HCM Average Control Delay	15.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	56.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	80.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	439	76	213	1052	391	43
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	477	83	232	1143	425	47
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2055	448	472			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2055	448	472			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	86	79			
cM capacity (veh/h)	48	610	1090			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	560	1375	472
Volume Left	477	232	0
Volume Right	83	0	47
cSH	55	1090	1700
Volume to Capacity	10.10	0.21	0.28
Queue Length 95th (ft)	Err	20	0
Control Delay (s)	Err	6.5	0.0
Lane LOS	F	A	
Approach Delay (s)	Err	6.5	0.0
Approach LOS	F		

Intersection Summary			
Average Delay	2329.6		
Intersection Capacity Utilization	129.3%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	87	0	137	127	217	0	0	1038	185
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	95	0	149	138	236	0	0	1128	201
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								Raised			None	
Median storage veh)								1				
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1741	1741	665	1076	1841	236	1329			236		
vC1, stage 1 conf vol	1229	1229		512	512							
vC2, stage 2 conf vol	512	512		564	1329							
vCu, unblocked vol	1741	1741	665	1076	1841	236	1329			236		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)	6.5	5.5		6.5	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	58	100	81	73			100		
cM capacity (veh/h)	121	166	403	225	75	766	515			1328		

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	243	138	236	752	577
Volume Left	95	138	0	0	0
Volume Right	149	0	0	0	201
cSH	396	515	1700	1700	1700
Volume to Capacity	0.61	0.27	0.14	0.44	0.34
Queue Length 95th (ft)	99	27	0	0	0
Control Delay (s)	27.5	14.5	0.0	0.0	0.0
Lane LOS	D	B			
Approach Delay (s)	27.5	5.4		0.0	
Approach LOS	D				

Intersection Summary			
Average Delay	4.5		
Intersection Capacity Utilization	106.3%	ICU Level of Service	G
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	54	0	161	0	0	0	0	290	517	950	175	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	59	0	175	0	0	0	0	315	562	1033	190	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								Raised			Raised	
Median storage veh)								1			1	
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2413	2571	190	2571	2571	158	190			315		
vC1, stage 1 conf vol	2255	2255		315	315							
vC2, stage 2 conf vol	158	315		2255	2255							
vCu, unblocked vol	2413	2571	190	2571	2571	158	190			315		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)	6.5	5.5		6.5	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	100	79	100	100	100	100			17		
cM capacity (veh/h)	5	4	819	5	12	860	1381			1242		

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	234	158	158	562	1033	190
Volume Left	59	0	0	0	1033	0
Volume Right	175	0	0	562	0	0
cSH	20	1700	1700	1700	1242	1700
Volume to Capacity	11.62	0.09	0.09	0.33	0.83	0.11
Queue Length 95th (ft)	Err	0	0	0	264	0
Control Delay (s)	Err	0.0	0.0	0.0	20.2	0.0
Lane LOS	F				C	
Approach Delay (s)	Err	0.0			17.1	
Approach LOS	F					

Intersection Summary			
Average Delay	1010.2		
Intersection Capacity Utilization	106.3%	ICU Level of Service	G
Analysis Period (min)	15		

Lane Group	WBL	WBT	WBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	362	362	178	108	528	1615	130
v/c Ratio	0.85	0.85	0.33	0.87	0.26	0.79	0.13
Control Delay	41.5	41.5	5.3	73.7	4.9	13.7	1.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.5	41.5	5.3	73.7	4.9	13.7	1.8
Queue Length 50th (ft)	128	128	0	25	32	217	0
Queue Length 95th (ft)	#262	#262	39	#126	47	306	18
Internal Link Dist (ft)		2384			933	7506	
Turn Bay Length (ft)			150	300			
Base Capacity (vph)	448	448	553	124	2046	2046	970
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.81	0.81	0.32	0.87	0.26	0.79	0.13

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	666	0	164	99	486	0	0	1486	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				5.0	5.0	5.0	5.0	5.0			5.0	5.0
Lane Util. Factor				0.95	0.95	1.00	1.00	0.95			0.95	1.00
Frt				1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	0.95	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)				1681	1681	1583	1770	3539			3539	1583
Flt Permitted				0.95	0.95	1.00	0.12	1.00			1.00	1.00
Satd. Flow (perm)				1681	1681	1583	215	3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	724	0	178	108	528	0	0	1615	130
RTOR Reduction (vph)	0	0	0	0	0	133	0	0	0	0	0	55
Lane Group Flow (vph)	0	0	0	362	362	45	108	528	0	0	1615	75
Turn Type				Perm		Perm	Perm					Perm
Protected Phases					8			2			6	
Permitted Phases				8		8	2					6
Actuated Green, G (s)				15.3	15.3	15.3	34.7	34.7			34.7	34.7
Effective Green, g (s)				15.3	15.3	15.3	34.7	34.7			34.7	34.7
Actuated g/C Ratio				0.26	0.26	0.26	0.58	0.58			0.58	0.58
Clearance Time (s)				5.0	5.0	5.0	5.0	5.0			5.0	5.0
Vehicle Extension (s)				3.0	3.0	3.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)				429	429	404	124	2047			2047	916
v/s Ratio Prot								0.15			0.46	
v/s Ratio Perm				c0.22	0.22	0.03	c0.50					0.05
v/c Ratio				0.84	0.84	0.11	0.87	0.26			0.79	0.08
Uniform Delay, d1				21.2	21.2	17.1	10.7	6.3			9.8	5.6
Progression Factor				1.00	1.00	1.00	0.92	0.70			1.00	1.00
Incremental Delay, d2				14.1	14.1	0.1	51.5	0.3			3.2	0.2
Delay (s)				35.3	35.3	17.3	61.4	4.7			13.0	5.8
Level of Service				D	D	B	E	A			B	A
Approach Delay (s)		0.0			31.7			14.3			12.5	
Approach LOS		A			C			B			B	

Intersection Summary			
HCM Average Control Delay	18.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	77.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	84	84	138	467	203	315	2024
v/c Ratio	0.29	0.29	0.49	0.18	0.17	0.49	0.80
Control Delay	22.7	22.7	26.2	4.5	1.4	6.6	9.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.7	22.7	26.2	4.5	1.4	6.6	9.3
Queue Length 50th (ft)	28	28	43	27	0	38	170
Queue Length 95th (ft)	57	57	80	57	21	m72	#535
Internal Link Dist (ft)		1478		2017			933
Turn Bay Length (ft)			250		500	175	
Base Capacity (vph)	448	448	428	2526	1188	644	2526
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.19	0.19	0.32	0.18	0.17	0.49	0.80

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	0	127	0	0	0	0	430	187	290	1862	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0					5.0	5.0	5.0	5.0	
Lane Util. Factor	0.95	0.95	1.00					0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1681	1681	1583					3539	1583	1770	3539	
Flt Permitted	0.95	0.95	1.00					1.00	1.00	0.48	1.00	
Satd. Flow (perm)	1681	1681	1583					3539	1583	901	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	168	0	138	0	0	0	0	467	203	315	2024	0
RTOR Reduction (vph)	0	0	7	0	0	0	0	0	65	0	0	0
Lane Group Flow (vph)	84	84	131	0	0	0	0	467	138	315	2024	0
Turn Type	Perm		Perm						Perm	custom		
Protected Phases		4						2				
Permitted Phases	4		4						2	6	6	
Actuated Green, G (s)	9.2	9.2	9.2					40.8	40.8	40.8	40.8	
Effective Green, g (s)	9.2	9.2	9.2					40.8	40.8	40.8	40.8	
Actuated g/C Ratio	0.15	0.15	0.15					0.68	0.68	0.68	0.68	
Clearance Time (s)	5.0	5.0	5.0					5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	258	258	243					2407	1076	613	2407	
v/s Ratio Prot								0.13				
v/s Ratio Perm	0.05	0.05	c0.08						0.09	0.35	c0.57	
v/c Ratio	0.33	0.33	0.54					0.19	0.13	0.51	0.84	
Uniform Delay, d1	22.6	22.6	23.4					3.5	3.4	4.7	7.2	
Progression Factor	1.00	1.00	1.00					1.00	1.00	0.72	0.68	
Incremental Delay, d2	0.7	0.7	2.4					0.2	0.2	1.8	2.2	
Delay (s)	23.4	23.4	25.9					3.7	3.6	5.2	7.1	
Level of Service	C	C	C					A	A	A	A	
Approach Delay (s)		24.5			0.0			3.7			6.8	
Approach LOS		C			A			A			A	

Intersection Summary			
HCM Average Control Delay	7.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	77.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	68	950	16	127	686
v/c Ratio	0.52	0.60	0.03	0.08	0.43
Control Delay	79.9	1.7	0.8	0.8	5.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	79.9	1.7	0.8	0.8	5.1
Queue Length 50th (ft)	65	0	1	5	114
Queue Length 95th (ft)	116	0	2	7	303
Internal Link Dist (ft)	446			1125	3526
Turn Bay Length (ft)		300	100		
Base Capacity (vph)	260	1583	632	1642	1584
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	17	0	0	12
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.26	0.61	0.03	0.08	0.44

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	63	874	15	117	623	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	4.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	1863	1859	
Flt Permitted	0.95	1.00	0.35	1.00	1.00	
Satd. Flow (perm)	1770	1583	654	1863	1859	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	68	950	16	127	677	9
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	68	950	16	127	686	0
Turn Type		Free	pm+pt			
Protected Phases	4		5	2	6	
Permitted Phases		Free	2			
Actuated Green, G (s)	9.8	150.0	130.2	130.2	122.8	
Effective Green, g (s)	9.8	150.0	130.2	130.2	122.8	
Actuated g/C Ratio	0.07	1.00	0.87	0.87	0.82	
Clearance Time (s)	5.0		5.0	5.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	116	1583	586	1617	1522	
v/s Ratio Prot	0.04		0.00	0.07	0.37	
v/s Ratio Perm		c0.60	0.02			
v/c Ratio	0.59	0.60	0.03	0.08	0.45	
Uniform Delay, d1	68.1	0.0	2.3	1.4	3.9	
Progression Factor	1.00	1.00	0.40	0.42	1.00	
Incremental Delay, d2	7.4	1.7	0.0	0.1	1.0	
Delay (s)	75.5	1.7	0.9	0.7	4.9	
Level of Service	E	A	A	A	A	
Approach Delay (s)	6.6			0.7	4.9	
Approach LOS	A			A	A	

Intersection Summary			
HCM Average Control Delay	5.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	46.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	1	48	248	142	1538	89
v/c Ratio	0.01	0.40	0.79	0.08	1.15	0.08
Control Delay	67.0	27.4	64.2	1.1	95.5	2.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	67.0	27.4	64.2	1.1	95.5	2.6
Queue Length 50th (ft)	1	0	185	11	~1764	6
Queue Length 95th (ft)	8	44	#377	23	#2036	m22
Internal Link Dist (ft)	411			3238	1125	
Turn Bay Length (ft)		200	100			
Base Capacity (vph)	189	212	313	1692	1341	1155
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.23	0.79	0.08	1.15	0.08

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	1	44	228	131	1415	82
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.95	1.00	0.04	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	67	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	48	248	142	1538	89
RTOR Reduction (vph)	0	46	0	0	0	16
Lane Group Flow (vph)	1	2	248	142	1538	73
Turn Type		Perm	pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	5.8	5.8	134.2	134.2	107.0	107.0
Effective Green, g (s)	5.8	5.8	134.2	134.2	107.0	107.0
Actuated g/C Ratio	0.04	0.04	0.89	0.89	0.71	0.71
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	68	61	312	1667	1329	1129
v/s Ratio Prot	0.00		c0.12	0.08	c0.83	
v/s Ratio Perm		c0.00	0.60			0.05
v/c Ratio	0.01	0.03	0.79	0.09	1.16	0.06
Uniform Delay, d1	69.4	69.4	56.1	0.9	21.5	6.5
Progression Factor	1.00	1.00	1.00	1.00	0.92	0.93
Incremental Delay, d2	0.1	0.2	13.0	0.1	78.5	0.1
Delay (s)	69.4	69.6	69.1	1.0	98.3	6.1
Level of Service	E	E	E	A	F	A
Approach Delay (s)	69.6			44.3	93.3	
Approach LOS	E			D	F	

Intersection Summary			
HCM Average Control Delay	83.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	104.6%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	120	535	464	48	103	165
v/c Ratio	0.22	0.64	0.65	0.05	0.22	0.18
Control Delay	17.8	6.0	12.8	6.0	18.7	1.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.8	6.0	12.8	6.0	18.7	1.8
Queue Length 50th (ft)	33	0	88	7	29	0
Queue Length 95th (ft)	69	63	148	18	62	21
Internal Link Dist (ft)	2022			1829	3927	
Turn Bay Length (ft)		150	150			
Base Capacity (vph)	542	840	715	1056	472	945
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.22	0.64	0.65	0.05	0.22	0.17

Intersection Summary

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	110	492	427	44	95	152
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.53	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	985	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	120	535	464	48	103	165
RTOR Reduction (vph)	0	379	0	0	0	89
Lane Group Flow (vph)	120	156	464	48	103	76
Turn Type		Perm	pm+pt			pm+ov
Protected Phases	2		1	6	8	1
Permitted Phases		2	6			8
Actuated Green, G (s)	17.5	17.5	34.0	34.0	16.0	27.5
Effective Green, g (s)	17.5	17.5	34.0	34.0	16.0	27.5
Actuated g/C Ratio	0.29	0.29	0.57	0.57	0.27	0.46
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	543	462	709	1056	472	857
v/s Ratio Prot	0.06		c0.13	0.03	c0.06	0.02
v/s Ratio Perm		0.10	c0.25			0.03
v/c Ratio	0.22	0.34	0.65	0.05	0.22	0.09
Uniform Delay, d1	16.1	16.7	8.0	5.8	17.1	9.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.9	2.0	2.2	0.1	1.1	0.0
Delay (s)	17.0	18.7	10.1	5.9	18.2	9.2
Level of Service	B	B	B	A	B	A
Approach Delay (s)	18.4			9.7	12.7	
Approach LOS	B			A	B	

Intersection Summary			
HCM Average Control Delay	14.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	62.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	120	241	96	268	132	147	35	848	217	795	193
v/c Ratio	0.40	0.84	0.30	1.03	0.37	0.35	0.16	1.03	0.90	0.80	0.22
Control Delay	31.6	66.9	10.4	83.8	34.9	8.5	10.6	68.3	62.6	28.9	6.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.6	66.9	10.4	83.8	34.9	8.5	10.6	68.3	62.6	28.9	6.7
Queue Length 50th (ft)	56	150	0	~124	68	9	9	~577	90	444	25
Queue Length 95th (ft)	101	#275	44	m#257	m96	m28	21	#814	#234	#692	64
Internal Link Dist (ft)		2030			1135			9853		1200	
Turn Bay Length (ft)	175		175	150		300	200		150		150
Base Capacity (vph)	299	298	334	260	373	434	224	820	240	988	895
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.40	0.81	0.29	1.03	0.35	0.34	0.16	1.03	0.90	0.80	0.22

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	110	222	88	247	121	135	32	554	226	200	731	178
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1782		1770	1863	1583
Flt Permitted	0.67	1.00	1.00	0.23	1.00	1.00	0.14	1.00		0.08	1.00	1.00
Satd. Flow (perm)	1253	1863	1583	428	1863	1583	259	1782		148	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	120	241	96	268	132	147	35	602	246	217	795	193
RTOR Reduction (vph)	0	0	81	0	0	118	0	15	0	0	0	58
Lane Group Flow (vph)	120	241	15	268	132	29	35	833	0	217	795	135
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	21.4	15.4	15.4	29.4	19.4	19.4	48.8	45.2		59.6	51.0	51.0
Effective Green, g (s)	21.4	15.4	15.4	29.4	19.4	19.4	48.8	45.2		59.6	51.0	51.0
Actuated g/C Ratio	0.21	0.15	0.15	0.29	0.19	0.19	0.49	0.45		0.60	0.51	0.51
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	299	287	244	260	361	307	181	805		241	950	807
v/s Ratio Prot	0.02	0.13		c0.10	0.07		0.01	c0.47		c0.08	0.43	
v/s Ratio Perm	0.06		0.01	c0.20		0.02	0.09			0.45		0.09
v/c Ratio	0.40	0.84	0.06	1.03	0.37	0.09	0.19	1.04		0.90	0.84	0.17
Uniform Delay, d1	33.1	41.1	36.1	32.2	35.0	33.1	17.5	27.4		28.7	20.9	13.1
Progression Factor	1.00	1.00	1.00	0.92	0.94	1.16	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.9	18.9	0.1	53.7	0.4	0.1	0.5	41.1		32.8	8.7	0.4
Delay (s)	34.0	60.0	36.2	83.4	33.2	38.4	18.0	68.5		61.5	29.6	13.6
Level of Service	C	E	D	F	C	D	B	E		E	C	B
Approach Delay (s)		48.2			59.2			66.5			32.8	
Approach LOS		D			E			E			C	

Intersection Summary			
HCM Average Control Delay	49.4	HCM Level of Service	D
HCM Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	96.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	54	313	109	808	489	212	136	534	22	458	520
v/c Ratio	0.18	0.81	0.19	0.95	0.71	0.94	0.11	0.34	0.05	0.93	0.72
Control Delay	12.8	39.3	7.1	57.9	34.4	73.0	23.7	0.6	18.9	64.3	23.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.8	39.3	7.1	57.9	34.4	73.0	23.7	0.6	18.9	64.3	23.6
Queue Length 50th (ft)	15	172	8	260	258	91	27	0	8	283	199
Queue Length 95th (ft)	m17	m190	m10	#378	#453	#226	57	0	24	#468	295
Internal Link Dist (ft)		7444			4401		1245			3927	
Turn Bay Length (ft)	150		150	150		150		350	150		
Base Capacity (vph)	386	388	583	858	692	225	1235	1583	432	503	786
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.14	0.81	0.19	0.94	0.71	0.94	0.11	0.34	0.05	0.91	0.66

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	288	100	743	430	20	195	125	491	20	421	478
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	4.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00		1.00	0.95	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	3433	1850		1770	3539	1583	1770	1863	1583
Flt Permitted	0.40	1.00	1.00	0.95	1.00		0.15	1.00	1.00	0.67	1.00	1.00
Satd. Flow (perm)	751	1863	1583	3433	1850		276	3539	1583	1240	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	313	109	808	467	22	212	136	534	22	458	520
RTOR Reduction (vph)	0	0	53	0	1	0	0	0	0	0	0	95
Lane Group Flow (vph)	54	313	56	808	488	0	212	136	534	22	458	425
Turn Type	pm+pt		pm+ov	Prot			pm+pt		Free	pm+pt		pm+ov
Protected Phases	7	4	5	3	8		5	2		1	6	7
Permitted Phases	4		4				2		Free	6		6
Actuated Green, G (s)	26.2	17.8	25.8	24.9	34.3		42.3	34.9	100.0	31.7	29.3	37.7
Effective Green, g (s)	26.2	17.8	25.8	24.9	34.3		42.3	34.9	100.0	31.7	29.3	37.7
Actuated g/C Ratio	0.26	0.18	0.26	0.25	0.34		0.42	0.35	1.00	0.32	0.29	0.38
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	282	332	488	855	635		236	1235	1583	406	546	676
v/s Ratio Prot	0.02	c0.17	0.01	c0.24	0.26		c0.07	0.04		0.00	0.25	0.05
v/s Ratio Perm	0.03		0.03				c0.31		0.34	0.02		0.22
v/c Ratio	0.19	0.94	0.11	0.95	0.77		0.90	0.11	0.34	0.05	0.84	0.63
Uniform Delay, d1	28.1	40.6	28.4	36.9	29.3		22.7	22.0	0.0	23.6	33.1	25.4
Progression Factor	0.80	0.81	0.68	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	19.5	0.0	18.7	8.7		32.5	0.0	0.6	0.1	10.9	1.8
Delay (s)	22.7	52.5	19.4	55.5	38.0		55.2	22.1	0.6	23.7	44.0	27.3
Level of Service	C	D	B	E	D		E	C	A	C	D	C
Approach Delay (s)		41.6			48.9			17.0			34.9	
Approach LOS		D			D			B			C	

Intersection Summary			
HCM Average Control Delay	36.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	86.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBT	WBR	NBL	NBT	SBT
Lane Group Flow (vph)	311	638	83	417	608
v/c Ratio	0.47	0.85	0.24	0.48	0.36
Control Delay	16.5	21.8	10.4	11.3	8.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	16.5	21.8	10.4	11.3	8.2
Queue Length 50th (ft)	85	129	20	109	44
Queue Length 95th (ft)	126	231	58	220	90
Internal Link Dist (ft)	1680			1224	528
Turn Bay Length (ft)		300			
Base Capacity (vph)	844	886	340	877	1696
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.37	0.72	0.24	0.48	0.36

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	286	0	587	76	384	0	0	330	229
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0	5.0	5.0	5.0			5.0	
Lane Util. Factor					1.00	1.00	1.00	1.00			0.95	
Frt					1.00	0.85	1.00	1.00			0.94	
Flt Protected					0.95	1.00	0.95	1.00			1.00	
Satd. Flow (prot)					1770	1583	1770	1863			3322	
Flt Permitted					0.95	1.00	0.39	1.00			1.00	
Satd. Flow (perm)					1770	1583	723	1863			3322	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	311	0	638	83	417	0	0	359	249
RTOR Reduction (vph)	0	0	0	0	0	157	0	0	0	0	132	0
Lane Group Flow (vph)	0	0	0	0	311	481	83	417	0	0	476	0
Turn Type				Perm		Perm	Perm					
Protected Phases					8			2			6	
Permitted Phases				8		8	2					
Actuated Green, G (s)					24.4	24.4	30.6	30.6			30.6	
Effective Green, g (s)					24.4	24.4	30.6	30.6			30.6	
Actuated g/C Ratio					0.38	0.38	0.47	0.47			0.47	
Clearance Time (s)					5.0	5.0	5.0	5.0			5.0	
Vehicle Extension (s)					3.0	3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)					664	594	340	877			1564	
v/s Ratio Prot								c0.22			0.14	
v/s Ratio Perm					0.18	c0.30	0.11					
v/c Ratio					0.47	0.81	0.24	0.48			0.30	
Uniform Delay, d1					15.4	18.2	10.3	11.7			10.6	
Progression Factor					1.00	1.00	0.61	0.66			1.00	
Incremental Delay, d2					0.5	8.2	1.7	1.8			0.5	
Delay (s)					15.9	26.4	7.9	9.5			11.1	
Level of Service					B	C	A	A			B	
Approach Delay (s)		0.0			23.0			9.3			11.1	
Approach LOS		A			C			A			B	

Intersection Summary			
HCM Average Control Delay	16.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	64.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	130	117	370	118	322	348
v/c Ratio	0.48	0.34	0.21	0.14	0.42	0.25
Control Delay	30.2	8.1	12.2	3.9	4.9	3.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.2	8.1	12.2	3.9	4.9	3.3
Queue Length 50th (ft)	48	0	43	0	25	27
Queue Length 95th (ft)	88	36	88	30	59	58
Internal Link Dist (ft)	1642		1468			1224
Turn Bay Length (ft)				150		
Base Capacity (vph)	463	500	1746	840	819	1382
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.28	0.23	0.21	0.14	0.39	0.25

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	120	0	108	0	0	0	0	340	109	296	320	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0					5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00	1.00					0.95	1.00	1.00	1.00	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1770	1583					3539	1583	1770	1863	
Flt Permitted		0.95	1.00					1.00	1.00	0.46	1.00	
Satd. Flow (perm)		1770	1583					3539	1583	853	1863	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	130	0	117	0	0	0	0	370	118	322	348	0
RTOR Reduction (vph)	0	0	101	0	0	0	0	0	62	0	0	0
Lane Group Flow (vph)	0	130	16	0	0	0	0	370	56	322	348	0
Turn Type	Perm		Perm						Perm	pm+pt		
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2	6		
Actuated Green, G (s)		8.8	8.8					31.1	31.1	46.2	46.2	
Effective Green, g (s)		8.8	8.8					31.1	31.1	46.2	46.2	
Actuated g/C Ratio		0.14	0.14					0.48	0.48	0.71	0.71	
Clearance Time (s)		5.0	5.0					5.0	5.0	5.0	5.0	
Vehicle Extension (s)		3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		240	214					1693	757	749	1324	
v/s Ratio Prot								0.10		c0.07	0.19	
v/s Ratio Perm		0.07	0.01						0.04	c0.24		
v/c Ratio		0.54	0.07					0.22	0.07	0.43	0.26	
Uniform Delay, d1		26.2	24.5					9.9	9.2	3.6	3.3	
Progression Factor		1.00	1.00					1.00	1.00	0.78	0.68	
Incremental Delay, d2		2.5	0.1					0.3	0.2	0.4	0.5	
Delay (s)		28.7	24.7					10.2	9.4	3.2	2.7	
Level of Service		C	C					B	A	A	A	
Approach Delay (s)		26.8			0.0			10.0			3.0	
Approach LOS		C			A			A			A	

Intersection Summary			
HCM Average Control Delay	9.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	64.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	SBT	SBR
Lane Group Flow (vph)	700	168	132	442	677	861
v/c Ratio	0.73	0.33	0.56	0.32	0.80	0.97
Control Delay	31.8	10.9	18.1	8.9	25.3	39.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.8	10.9	18.1	8.9	25.3	39.6
Queue Length 50th (ft)	162	19	39	71	251	287
Queue Length 95th (ft)	#247	67	#85	102	#446	#562
Internal Link Dist (ft)	4401			468	931	
Turn Bay Length (ft)		75	150			
Base Capacity (vph)	953	510	236	1368	850	888
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.73	0.33	0.56	0.32	0.80	0.97

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	644	155	121	407	0	0	0	0	623	0	792
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0	5.0	5.0						5.0	5.0
Lane Util. Factor		0.95	1.00	1.00	0.95						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (prot)		3539	1583	1770	3539						1770	1583
Flt Permitted		1.00	1.00	0.17	1.00						0.95	1.00
Satd. Flow (perm)		3539	1583	308	3539						1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	700	168	132	442	0	0	0	0	677	0	861
RTOR Reduction (vph)	0	0	86	0	0	0	0	0	0	0	0	128
Lane Group Flow (vph)	0	700	82	132	442	0	0	0	0	0	677	733
Turn Type			Perm	pm+pt						Perm		Perm
Protected Phases		2		1	6						4	
Permitted Phases			2	6						4		4
Actuated Green, G (s)		19.2	19.2	29.0	29.0						36.0	36.0
Effective Green, g (s)		19.2	19.2	29.0	29.0						36.0	36.0
Actuated g/C Ratio		0.26	0.26	0.39	0.39						0.48	0.48
Clearance Time (s)		5.0	5.0	5.0	5.0						5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		906	405	213	1368						850	760
v/s Ratio Prot		c0.20		c0.04	0.12							
v/s Ratio Perm			0.05	0.20							0.38	c0.46
v/c Ratio		0.77	0.20	0.62	0.32						0.80	0.96
Uniform Delay, d1		25.9	21.9	16.9	16.1						16.4	18.9
Progression Factor		1.00	1.00	0.59	0.51						1.00	1.00
Incremental Delay, d2		6.4	1.1	5.0	0.6						7.6	25.1
Delay (s)		32.2	23.0	14.9	8.8						24.1	44.0
Level of Service		C	C	B	A						C	D
Approach Delay (s)		30.5			10.2			0.0			35.2	
Approach LOS		C			B			A			D	

Intersection Summary			
HCM Average Control Delay	29.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	75.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT
Lane Group Flow (vph)	557	821	388	437	186	147
v/c Ratio	0.75	0.36	0.31	0.52	0.49	0.29
Control Delay	8.4	3.2	19.6	4.9	31.1	2.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	8.4	3.2	19.6	4.9	31.1	2.9
Queue Length 50th (ft)	11	8	67	0	77	0
Queue Length 95th (ft)	m90	m23	114	64	137	17
Internal Link Dist (ft)		468	5276			578
Turn Bay Length (ft)	300			300		
Base Capacity (vph)	813	2312	1251	842	378	504
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.69	0.36	0.31	0.52	0.49	0.29

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	512	755	0	0	357	402	171	0	135	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0	5.0	5.0				
Lane Util. Factor	1.00	0.95			0.95	1.00	1.00	1.00				
Frt	1.00	1.00			1.00	0.85	1.00	0.85				
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00				
Satd. Flow (prot)	1770	3539			3539	1583	1770	1583				
Flt Permitted	0.42	1.00			1.00	1.00	0.95	1.00				
Satd. Flow (perm)	781	3539			3539	1583	1770	1583				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	557	821	0	0	388	437	186	0	147	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	283	0	116	0	0	0	0
Lane Group Flow (vph)	557	821	0	0	388	154	186	31	0	0	0	0
Turn Type	pm+pt					Perm	pm+pt					
Protected Phases	5	2			6		3	8				
Permitted Phases	2					6	8					
Actuated Green, G (s)	49.0	49.0			26.5	26.5	16.0	16.0				
Effective Green, g (s)	49.0	49.0			26.5	26.5	16.0	16.0				
Actuated g/C Ratio	0.65	0.65			0.35	0.35	0.21	0.21				
Clearance Time (s)	5.0	5.0			5.0	5.0	5.0	5.0				
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0				
Lane Grp Cap (vph)	741	2312			1250	559	378	338				
v/s Ratio Prot	c0.18	0.23			0.11		c0.11	0.02				
v/s Ratio Perm	c0.32					0.10						
v/c Ratio	0.75	0.36			0.31	0.28	0.49	0.09				
Uniform Delay, d1	7.2	5.9			17.6	17.4	25.9	23.7				
Progression Factor	0.58	0.50			1.00	1.00	1.00	1.00				
Incremental Delay, d2	2.7	0.3			0.6	1.2	1.0	0.5				
Delay (s)	6.9	3.2			18.3	18.6	26.9	24.2				
Level of Service	A	A			B	B	C	C				
Approach Delay (s)		4.7			18.4			25.7			0.0	
Approach LOS		A			B			C			A	

Intersection Summary			
HCM Average Control Delay	11.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	75.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	362	362	178	467	1615
v/c Ratio	0.81	0.81	0.33	0.21	0.71
Control Delay	52.1	52.1	8.7	9.3	16.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	52.1	52.1	8.7	9.3	16.5
Queue Length 50th (ft)	252	252	13	67	374
Queue Length 95th (ft)	368	368	65	112	562
Internal Link Dist (ft)		2384		933	7506
Turn Bay Length (ft)			150		
Base Capacity (vph)	593	593	658	2273	2273
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.61	0.61	0.27	0.21	0.71

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	666	0	164	0	430	0	0	1486	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				5.0	5.0	5.0		5.0			5.0	
Lane Util. Factor				0.95	0.95	1.00		0.95			0.95	
Frt				1.00	1.00	0.85		1.00			1.00	
Flt Protected				0.95	0.95	1.00		1.00			1.00	
Satd. Flow (prot)				1681	1681	1583		3539			3539	
Flt Permitted				0.95	0.95	1.00		1.00			1.00	
Satd. Flow (perm)				1681	1681	1583		3539			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	724	0	178	0	467	0	0	1615	0
RTOR Reduction (vph)	0	0	0	0	0	112	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	362	362	66	0	467	0	0	1615	0
Turn Type				Perm		Perm	Perm					Perm
Protected Phases					8			2			6	
Permitted Phases				8		8	2					6
Actuated Green, G (s)				29.7	29.7	29.7		71.3			71.3	
Effective Green, g (s)				29.7	29.7	29.7		71.3			71.3	
Actuated g/C Ratio				0.27	0.27	0.27		0.64			0.64	
Clearance Time (s)				5.0	5.0	5.0		5.0			5.0	
Vehicle Extension (s)				3.0	3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)				450	450	424		2273			2273	
v/s Ratio Prot								0.13			c0.46	
v/s Ratio Perm				c0.22	0.22	0.04						
v/c Ratio				0.80	0.80	0.16		0.21			0.71	
Uniform Delay, d1				37.9	37.9	31.1		8.2			13.1	
Progression Factor				1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2				10.0	10.0	0.2		0.2			1.9	
Delay (s)				48.0	48.0	31.2		8.4			15.0	
Level of Service				D	D	C		A			B	
Approach Delay (s)		0.0			44.7			8.4			15.0	
Approach LOS		A			D			A			B	

Intersection Summary			
HCM Average Control Delay	22.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	111.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	77.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	0	0	376	187	216	1385	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	409	203	235	1505	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			10									
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											1013	
pX, platoon unblocked	0.79	0.79	0.79	0.79	0.79		0.79					
vC, conflicting volume	2179	2384	753	1631	2384	204	1505			409		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1965	2223	167	1274	2223	204	1116			409		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			80		
cM capacity (veh/h)	25	27	673	83	27	802	493			1147		

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	0	0	204	204	203	235	753	753
Volume Left	0	0	0	0	0	235	0	0
Volume Right	0	0	0	0	203	0	0	0
cSH	1700	1700	1700	1700	1700	1147	1700	1700
Volume to Capacity	0.00	0.00	0.12	0.12	0.12	0.20	0.44	0.44
Queue Length 95th (ft)	0	0	0	0	0	19	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	8.9	0.0	0.0
Lane LOS	A	A				A		
Approach Delay (s)	0.0		0.0			1.2		
Approach LOS	A							

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	77.0%	ICU Level of Service	D
Analysis Period (min)	15		

Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	88	1228	16	127	1803
v/c Ratio	0.14	1.96	0.11	0.12	1.83
Control Delay	27.5	463.3	12.1	11.2	400.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	27.5	463.3	12.1	11.2	400.1
Queue Length 50th (ft)	46	~1433	4	33	~2077
Queue Length 95th (ft)	86	#1699	13	55	#2488
Internal Link Dist (ft)	446			1125	3526
Turn Bay Length (ft)		300	100		
Base Capacity (vph)	620	625	147	1056	986
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.14	1.96	0.11	0.12	1.83

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	81	1130	15	117	1637	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	1863	1859	
Flt Permitted	0.95	1.00	0.06	1.00	1.00	
Satd. Flow (perm)	1770	1583	114	1863	1859	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	88	1228	16	127	1779	24
RTOR Reduction (vph)	0	71	0	0	0	0
Lane Group Flow (vph)	88	1157	16	127	1803	0
Turn Type		Perm	pm+pt			
Protected Phases	4		5	2	6	
Permitted Phases		4	2			
Actuated Green, G (s)	42.0	42.0	68.0	68.0	60.6	
Effective Green, g (s)	42.0	42.0	68.0	68.0	60.6	
Actuated g/C Ratio	0.35	0.35	0.57	0.57	0.51	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	620	554	98	1056	939	
v/s Ratio Prot	0.05		0.00	c0.07	c0.97	
v/s Ratio Perm		c0.73	0.09			
v/c Ratio	0.14	2.09	0.16	0.12	1.92	
Uniform Delay, d1	26.7	39.0	27.3	12.1	29.7	
Progression Factor	1.00	1.00	0.92	0.90	1.00	
Incremental Delay, d2	0.1	496.1	0.8	0.2	417.8	
Delay (s)	26.8	535.1	26.0	11.1	447.5	
Level of Service	C	F	C	B	F	
Approach Delay (s)	501.1			12.8	447.5	
Approach LOS	F			B	F	

Intersection Summary			
HCM Average Control Delay	450.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.95		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	165.8%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	2	74	248	136	4038	235
v/c Ratio	0.02	0.45	0.75	0.08	3.17	0.21
Control Delay	52.0	21.0	48.1	1.4	992.1	4.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	52.0	21.0	48.1	1.4	992.1	4.3
Queue Length 50th (ft)	2	0	132	10	~5548	39
Queue Length 95th (ft)	10	47	#311	24	m#3413	m27
Internal Link Dist (ft)	411			3238	1125	
Turn Bay Length (ft)		200	100			
Base Capacity (vph)	236	275	331	1647	1273	1101
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.27	0.75	0.08	3.17	0.21

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	2	68	228	125	3715	216
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.95	1.00	0.05	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	87	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2	74	248	136	4038	235
RTOR Reduction (vph)	0	70	0	0	0	20
Lane Group Flow (vph)	2	4	248	136	4038	215
Turn Type		Perm	pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	5.9	5.9	104.1	104.1	81.0	81.0
Effective Green, g (s)	5.9	5.9	104.1	104.1	81.0	81.0
Actuated g/C Ratio	0.05	0.05	0.87	0.87	0.68	0.68
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	87	78	329	1616	1258	1069
v/s Ratio Prot	0.00		c0.11	0.07	c2.17	
v/s Ratio Perm		c0.00	0.54			0.14
v/c Ratio	0.02	0.05	0.75	0.08	3.21	0.20
Uniform Delay, d1	54.3	54.4	42.3	1.1	19.5	7.3
Progression Factor	1.00	1.00	1.00	1.00	0.81	0.82
Incremental Delay, d2	0.1	0.2	9.4	0.1	994.6	0.0
Delay (s)	54.4	54.6	51.7	1.2	1010.4	6.1
Level of Service	D	D	D	A	F	A
Approach Delay (s)	54.6			33.8	955.2	
Approach LOS	D			C	F	

Intersection Summary			
HCM Average Control Delay	866.0	HCM Level of Service	F
HCM Volume to Capacity ratio	2.61		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	208.9%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	120	828	718	48	105	175
v/c Ratio	0.12	0.75	0.69	0.03	0.44	0.25
Control Delay	14.8	12.3	8.7	3.0	61.6	3.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.8	12.3	8.7	3.0	61.6	3.0
Queue Length 50th (ft)	44	163	168	7	78	0
Queue Length 95th (ft)	83	376	235	15	136	30
Internal Link Dist (ft)	2022			1829	2247	
Turn Bay Length (ft)		150	150			150
Base Capacity (vph)	1013	1106	1065	1459	236	762
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.12	0.75	0.67	0.03	0.44	0.23

Intersection Summary

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	110	762	661	44	97	161
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.63	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	1176	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	120	828	718	48	105	175
RTOR Reduction (vph)	0	244	0	0	0	117
Lane Group Flow (vph)	120	584	718	48	105	58
Turn Type		Perm	pm+pt			pm+ov
Protected Phases	2		1	6	8	1
Permitted Phases		2	6			8
Actuated Green, G (s)	65.3	65.3	94.0	94.0	16.0	39.7
Effective Green, g (s)	65.3	65.3	94.0	94.0	16.0	39.7
Actuated g/C Ratio	0.54	0.54	0.78	0.78	0.13	0.33
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1014	861	1039	1459	236	590
v/s Ratio Prot	0.06		c0.14	0.03	c0.06	0.02
v/s Ratio Perm		0.37	c0.40			0.02
v/c Ratio	0.12	0.68	0.69	0.03	0.44	0.10
Uniform Delay, d1	13.3	19.8	5.0	2.9	47.9	27.8
Progression Factor	1.00	1.00	1.00	1.00	1.14	0.65
Incremental Delay, d2	0.2	4.3	2.0	0.0	5.9	0.1
Delay (s)	13.6	24.0	7.0	2.9	60.8	18.2
Level of Service	B	C	A	A	E	B
Approach Delay (s)	22.7			6.7	34.2	
Approach LOS	C			A	C	

Intersection Summary			
HCM Average Control Delay	18.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	92.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	120	241	96	268	132	147	35	848	217	795	193
v/c Ratio	0.42	0.97	0.33	1.06	0.40	0.37	0.13	0.95	0.92	0.74	0.20
Control Delay	39.3	102.5	12.4	107.7	46.5	9.5	10.0	50.0	71.3	25.0	6.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.3	102.5	12.4	107.7	46.5	9.5	10.0	50.0	71.3	25.0	6.4
Queue Length 50th (ft)	72	188	0	~176	87	4	9	599	117	472	29
Queue Length 95th (ft)	123	#353	50	#349	151	54	22	#888	#267	651	67
Internal Link Dist (ft)		2030			1135			9853		1200	
Turn Bay Length (ft)	175		175	150		300	200		150		150
Base Capacity (vph)	285	248	294	254	327	399	263	889	238	1077	962
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.42	0.97	0.33	1.06	0.40	0.37	0.13	0.95	0.91	0.74	0.20

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	110	222	88	247	121	135	32	554	226	200	731	178
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1782		1770	1863	1583
Flt Permitted	0.67	1.00	1.00	0.19	1.00	1.00	0.19	1.00		0.06	1.00	1.00
Satd. Flow (perm)	1253	1863	1583	355	1863	1583	354	1782		116	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	120	241	96	268	132	147	35	602	246	217	795	193
RTOR Reduction (vph)	0	0	83	0	0	121	0	12	0	0	0	49
Lane Group Flow (vph)	120	241	13	268	132	26	35	836	0	217	795	144
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	23.9	16.0	16.0	34.0	21.1	21.1	62.7	59.1		76.0	67.4	67.4
Effective Green, g (s)	23.9	16.0	16.0	34.0	21.1	21.1	62.7	59.1		76.0	67.4	67.4
Actuated g/C Ratio	0.20	0.13	0.13	0.28	0.18	0.18	0.52	0.49		0.63	0.56	0.56
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	284	248	211	254	328	278	227	878		237	1046	889
v/s Ratio Prot	0.03	0.13		c0.11	0.07		0.00	0.47		c0.09	0.43	
v/s Ratio Perm	0.06		0.01	c0.18		0.02	0.08			c0.49		0.09
v/c Ratio	0.42	0.97	0.06	1.06	0.40	0.09	0.15	0.95		0.92	0.76	0.16
Uniform Delay, d1	41.3	51.8	45.4	38.6	43.9	41.4	17.5	29.1		37.9	20.1	12.7
Progression Factor	1.00	1.00	1.00	0.95	0.96	0.98	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.0	49.0	0.1	71.6	0.8	0.1	0.3	20.7		36.1	5.2	0.4
Delay (s)	42.3	100.8	45.6	108.3	43.0	40.7	17.8	49.8		74.0	25.3	13.1
Level of Service	D	F	D	F	D	D	B	D		E	C	B
Approach Delay (s)		73.8			74.4			48.6			32.1	
Approach LOS		E			E			D			C	

Intersection Summary			
HCM Average Control Delay	50.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	96.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	61	233	212	290	213	232
v/c Ratio	0.42	0.68	0.22	0.19	0.16	0.19
Control Delay	47.1	8.1	2.7	2.5	4.3	0.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.1	8.1	2.7	2.5	4.3	0.4
Queue Length 50th (ft)	44	33	23	32	30	0
Queue Length 95th (ft)	m41	m37	49	67	m43	m6
Internal Link Dist (ft)	7444			1245	1600	
Turn Bay Length (ft)		150	150			150
Base Capacity (vph)	561	661	1063	1554	1347	1209
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.11	0.35	0.20	0.19	0.16	0.19

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	56	214	195	267	196	213
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.95	1.00	0.59	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1100	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	61	233	212	290	213	232
RTOR Reduction (vph)	0	214	0	0	0	64
Lane Group Flow (vph)	61	19	212	290	213	168
Turn Type		Perm	pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	9.9	9.9	100.1	100.1	86.7	86.7
Effective Green, g (s)	9.9	9.9	100.1	100.1	86.7	86.7
Actuated g/C Ratio	0.08	0.08	0.83	0.83	0.72	0.72
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	146	131	964	1554	1346	1144
v/s Ratio Prot	c0.03		c0.02	0.16	0.11	
v/s Ratio Perm		0.01	c0.17			0.11
v/c Ratio	0.42	0.15	0.22	0.19	0.16	0.15
Uniform Delay, d1	52.3	51.1	2.0	2.0	5.2	5.2
Progression Factor	0.86	0.70	1.00	1.00	0.71	0.21
Incremental Delay, d2	0.6	0.2	0.1	0.3	0.2	0.2
Delay (s)	45.7	36.1	2.1	2.2	3.9	1.3
Level of Service	D	D	A	A	A	A
Approach Delay (s)	38.1			2.2	2.5	
Approach LOS	D			A	A	

Intersection Summary			
HCM Average Control Delay	10.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.24		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	38.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBT	WBR	NBL	NBT	SBT
Lane Group Flow (vph)	314	638	83	417	608
v/c Ratio	0.49	0.86	0.21	0.40	0.32
Control Delay	30.3	30.7	18.6	18.8	12.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	30.3	30.7	18.6	18.8	12.6
Queue Length 50th (ft)	185	284	30	167	90
Queue Length 95th (ft)	208	354	78	338	171
Internal Link Dist (ft)	1680			1224	528
Turn Bay Length (ft)		300			
Base Capacity (vph)	944	968	391	1030	1913
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.33	0.66	0.21	0.40	0.32

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	289	0	587	76	384	0	0	330	229
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0	5.0	5.0	5.0			5.0	
Lane Util. Factor					1.00	1.00	1.00	1.00			0.95	
Frt					1.00	0.85	1.00	1.00			0.94	
Flt Protected					0.95	1.00	0.95	1.00			1.00	
Satd. Flow (prot)					1770	1583	1770	1863			3322	
Flt Permitted					0.95	1.00	0.38	1.00			1.00	
Satd. Flow (perm)					1770	1583	707	1863			3322	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	314	0	638	83	417	0	0	359	249
RTOR Reduction (vph)	0	0	0	0	0	168	0	0	0	0	77	0
Lane Group Flow (vph)	0	0	0	0	314	470	83	417	0	0	531	0
Turn Type				Perm		Perm	Perm					
Protected Phases					8			2			6	
Permitted Phases				8		8	2					
Actuated Green, G (s)					43.7	43.7	66.3	66.3			66.3	
Effective Green, g (s)					43.7	43.7	66.3	66.3			66.3	
Actuated g/C Ratio					0.36	0.36	0.55	0.55			0.55	
Clearance Time (s)					5.0	5.0	5.0	5.0			5.0	
Vehicle Extension (s)					3.0	3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)					645	576	391	1029			1835	
v/s Ratio Prot								c0.22			0.16	
v/s Ratio Perm					0.18	c0.30	0.12					
v/c Ratio					0.49	0.82	0.21	0.41			0.29	
Uniform Delay, d1					29.5	34.5	13.6	15.5			14.3	
Progression Factor					1.00	1.00	0.93	0.94			1.00	
Incremental Delay, d2					0.6	8.7	1.2	1.2			0.4	
Delay (s)					30.1	43.2	13.9	15.7			14.7	
Level of Service					C	D	B	B			B	
Approach Delay (s)		0.0			38.9			15.4			14.7	
Approach LOS		A			D			B			B	

Intersection Summary			
HCM Average Control Delay	26.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	64.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	30	117	87	118	184	199
v/c Ratio	0.25	0.55	0.03	0.10	0.17	0.13
Control Delay	57.5	19.1	4.5	1.1	1.4	1.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	57.5	19.1	4.5	1.1	1.4	1.2
Queue Length 50th (ft)	23	0	7	0	10	10
Queue Length 95th (ft)	53	57	17	17	19	20
Internal Link Dist (ft)	1642		1468			1224
Turn Bay Length (ft)				150		
Base Capacity (vph)	516	545	2635	1209	1186	1584
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.06	0.21	0.03	0.10	0.16	0.13

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	28	0	108	0	0	0	0	80	109	169	183	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0					5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00	1.00					0.95	1.00	1.00	1.00	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1770	1583					3539	1583	1770	1863	
Flt Permitted		0.95	1.00					1.00	1.00	0.66	1.00	
Satd. Flow (perm)		1770	1583					3539	1583	1231	1863	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	30	0	117	0	0	0	0	87	118	184	199	0
RTOR Reduction (vph)	0	0	109	0	0	0	0	0	30	0	0	0
Lane Group Flow (vph)	0	30	8	0	0	0	0	87	88	184	199	0
Turn Type	Perm		Perm						Perm	pm+pt		
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2	6		
Actuated Green, G (s)		8.0	8.0					89.3	89.3	102.0	102.0	
Effective Green, g (s)		8.0	8.0					89.3	89.3	102.0	102.0	
Actuated g/C Ratio		0.07	0.07					0.74	0.74	0.85	0.85	
Clearance Time (s)		5.0	5.0					5.0	5.0	5.0	5.0	
Vehicle Extension (s)		3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		118	106					2634	1178	1081	1584	
v/s Ratio Prot								0.02		c0.01	0.11	
v/s Ratio Perm		0.02	0.00						0.06	c0.13		
v/c Ratio		0.25	0.07					0.03	0.07	0.17	0.13	
Uniform Delay, d1		53.2	52.5					4.0	4.2	1.6	1.5	
Progression Factor		1.00	1.00					1.00	1.00	0.63	0.63	
Incremental Delay, d2		1.1	0.3					0.0	0.1	0.1	0.2	
Delay (s)		54.3	52.8					4.0	4.3	1.1	1.1	
Level of Service		D	D					A	A	A	A	
Approach Delay (s)		53.1			0.0			4.2			1.1	
Approach LOS		D			A			A			A	

Intersection Summary			
HCM Average Control Delay	12.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.18		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	64.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	149	1033	1304	135	205	342
v/c Ratio	0.15	0.91	0.76	0.10	0.34	0.43
Control Delay	11.7	21.3	10.1	4.3	34.1	4.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.7	21.3	10.1	4.3	34.1	4.2
Queue Length 50th (ft)	42	218	151	20	53	0
Queue Length 95th (ft)	74	#607	193	37	85	54
Internal Link Dist (ft)	2022			3439	2247	
Turn Bay Length (ft)		150	250			600
Base Capacity (vph)	972	1131	1708	1324	610	797
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.15	0.91	0.76	0.10	0.34	0.43

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	137	950	1200	124	189	315
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	0.97	1.00	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	3433	1863	3433	1583
Flt Permitted	1.00	1.00	0.60	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	2163	1863	3433	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	149	1033	1304	135	205	342
RTOR Reduction (vph)	0	304	0	0	0	236
Lane Group Flow (vph)	149	729	1304	135	205	106
Turn Type	NA	Perm	pm+pt	NA	NA	pm+ov
Protected Phases	2		1	6	8	1
Permitted Phases		2	6			8
Actuated Green, G (s)	47.0	47.0	64.0	64.0	16.0	28.0
Effective Green, g (s)	47.0	47.0	64.0	64.0	16.0	28.0
Actuated g/C Ratio	0.52	0.52	0.71	0.71	0.18	0.31
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	972	826	1707	1324	610	580
v/s Ratio Prot	0.08		c0.10	0.07	c0.06	0.02
v/s Ratio Perm		c0.46	0.44			0.04
v/c Ratio	0.15	0.88	0.76	0.10	0.34	0.18
Uniform Delay, d1	11.2	19.0	7.3	4.0	32.4	22.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	13.1	2.1	0.2	1.5	0.2
Delay (s)	11.5	32.1	9.4	4.2	33.8	22.8
Level of Service	B	C	A	A	C	C
Approach Delay (s)	29.5			8.9	26.9	
Approach LOS	C			A	C	

Intersection Summary			
HCM 2000 Control Delay	19.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	101.4%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	105	214	85	238	116	129	30	743	226	827	201
v/c Ratio	0.33	0.73	0.23	0.93	0.32	0.31	0.15	0.93	0.86	0.85	0.22
Control Delay	27.0	51.2	2.5	71.8	34.8	6.6	10.1	43.2	50.9	31.1	5.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.0	51.2	2.5	71.8	34.8	6.6	10.1	43.2	50.9	31.1	5.4
Queue Length 50th (ft)	44	115	0	108	58	0	7	381	80	440	17
Queue Length 95th (ft)	83	189	9	#192	107	38	18	#626	#225	#704	57
Internal Link Dist (ft)		2030			1135			9853		1200	
Turn Bay Length (ft)	175		175	150		300	200		150		150
Base Capacity (vph)	317	331	400	256	371	432	204	801	263	978	900
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.33	0.65	0.21	0.93	0.31	0.30	0.15	0.93	0.86	0.85	0.22

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	97	197	78	219	107	119	28	486	198	208	761	185
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1782		1770	1863	1583
Flt Permitted	0.68	1.00	1.00	0.36	1.00	1.00	0.10	1.00		0.09	1.00	1.00
Satd. Flow (perm)	1271	1863	1583	672	1863	1583	193	1782		171	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	105	214	85	238	116	129	30	528	215	226	827	201
RTOR Reduction (vph)	0	0	71	0	0	104	0	17	0	0	0	74
Lane Group Flow (vph)	105	214	14	238	116	25	30	726	0	226	827	127
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	19.9	15.1	15.1	24.3	17.3	17.3	42.2	38.6		52.9	44.3	44.3
Effective Green, g (s)	19.9	15.1	15.1	24.3	17.3	17.3	42.2	38.6		52.9	44.3	44.3
Actuated g/C Ratio	0.22	0.17	0.17	0.27	0.19	0.19	0.47	0.43		0.59	0.49	0.49
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	307	312	265	266	358	304	153	764		265	917	779
v/s Ratio Prot	0.02	0.11		c0.07	0.06		0.01	0.41		c0.09	c0.44	
v/s Ratio Perm	0.06		0.01	c0.17		0.02	0.08			0.41		0.08
v/c Ratio	0.34	0.69	0.05	0.89	0.32	0.08	0.20	0.95		0.85	0.90	0.16
Uniform Delay, d1	29.0	35.2	31.5	30.4	31.3	29.8	17.5	24.8		23.1	20.9	12.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.7	6.1	0.1	29.3	0.5	0.1	0.6	22.6		22.4	13.8	0.5
Delay (s)	29.7	41.4	31.5	59.7	31.8	29.9	18.1	47.3		45.4	34.6	13.1
Level of Service	C	D	C	E	C	C	B	D		D	C	B
Approach Delay (s)		36.3			45.1			46.2			33.1	
Approach LOS		D			D			D			C	

Intersection Summary			
HCM 2000 Control Delay	39.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	88.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	88	149	146	461	1122	1215
v/c Ratio	0.14	0.23	0.57	0.26	0.84	0.90
Control Delay	16.0	4.1	19.4	10.5	29.0	17.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.0	4.1	19.4	10.5	29.0	17.3
Queue Length 50th (ft)	25	0	32	56	240	227
Queue Length 95th (ft)	54	34	#68	83	#366	#724
Internal Link Dist (ft)	7444			1245	1600	
Turn Bay Length (ft)		150	150			150
Base Capacity (vph)	632	661	254	1776	1331	1330
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.14	0.23	0.57	0.26	0.84	0.91

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	81	137	134	424	1032	1118
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.13	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	246	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	88	149	146	461	1122	1215
RTOR Reduction (vph)	0	96	0	0	0	82
Lane Group Flow (vph)	88	53	146	461	1122	1133
Turn Type	NA	Perm	pm+pt	NA	NA	pm+ov
Protected Phases	4		5	2	6	4
Permitted Phases		4	2			6
Actuated Green, G (s)	24.9	24.9	35.1	35.1	25.3	50.2
Effective Green, g (s)	24.9	24.9	35.1	35.1	25.3	50.2
Actuated g/C Ratio	0.36	0.36	0.50	0.50	0.36	0.72
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	629	563	227	1774	1279	1248
v/s Ratio Prot	0.05		c0.04	0.13	0.32	c0.32
v/s Ratio Perm		0.03	0.28			0.39
v/c Ratio	0.14	0.09	0.64	0.26	0.88	0.91
Uniform Delay, d1	15.3	15.0	13.6	10.0	20.9	8.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.1	6.1	0.4	8.7	9.7
Delay (s)	15.4	15.1	19.7	10.4	29.6	17.7
Level of Service	B	B	B	B	C	B
Approach Delay (s)	15.2			12.6	23.4	
Approach LOS	B			B	C	

Intersection Summary			
HCM 2000 Control Delay	20.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	85.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBT	WBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	143	144	421	83	1529	652	107
v/c Ratio	0.29	0.29	0.86	0.21	0.78	0.33	0.12
Control Delay	18.6	18.7	38.4	8.2	11.9	9.1	2.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.6	18.7	38.4	8.2	11.9	9.1	2.3
Queue Length 50th (ft)	43	44	137	13	140	73	0
Queue Length 95th (ft)	85	86	#278	m25	165	105	19
Internal Link Dist (ft)		2384			933	7506	
Turn Bay Length (ft)			150	300			
Base Capacity (vph)	543	543	534	392	1950	1950	920
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.26	0.27	0.79	0.21	0.78	0.33	0.12

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	264	0	387	76	1407	0	0	600	98
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				5.0	5.0	5.0	5.0	5.0			5.0	5.0
Lane Util. Factor				0.95	0.95	1.00	1.00	0.95			0.95	1.00
Frt				1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	0.95	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)				1681	1681	1583	1770	3539			3539	1583
Flt Permitted				0.95	0.95	1.00	0.38	1.00			1.00	1.00
Satd. Flow (perm)				1681	1681	1583	713	3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	287	0	421	83	1529	0	0	652	107
RTOR Reduction (vph)	0	0	0	0	0	24	0	0	0	0	0	48
Lane Group Flow (vph)	0	0	0	143	144	397	83	1529	0	0	652	59
Turn Type				Perm	NA	Perm	Perm	NA			NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8	2					6
Actuated Green, G (s)				19.2	19.2	19.2	35.8	35.8			35.8	35.8
Effective Green, g (s)				19.2	19.2	19.2	35.8	35.8			35.8	35.8
Actuated g/C Ratio				0.30	0.30	0.30	0.55	0.55			0.55	0.55
Clearance Time (s)				5.0	5.0	5.0	5.0	5.0			5.0	5.0
Vehicle Extension (s)				3.0	3.0	3.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)				496	496	467	392	1949			1949	871
v/s Ratio Prot								c0.43			0.18	
v/s Ratio Perm				0.09	0.09	c0.25	0.12					0.04
v/c Ratio				0.29	0.29	0.85	0.21	0.78			0.33	0.07
Uniform Delay, d1				17.6	17.6	21.5	7.4	11.5			8.0	6.8
Progression Factor				1.00	1.00	1.00	0.80	0.70			1.00	1.00
Incremental Delay, d2				0.3	0.3	13.8	1.1	2.8			0.5	0.1
Delay (s)				18.0	18.0	35.3	7.0	10.9			8.5	7.0
Level of Service				B	B	D	A	B			A	A
Approach Delay (s)		0.0			28.3			10.7			8.3	
Approach LOS		A			C			B			A	

Intersection Summary			
HCM 2000 Control Delay	14.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	71.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	68	69	122	1475	348	137	802
v/c Ratio	0.32	0.33	0.40	0.54	0.27	0.64	0.29
Control Delay	29.3	29.4	9.8	5.2	1.0	25.2	2.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.3	29.4	9.8	5.2	1.0	25.2	2.8
Queue Length 50th (ft)	26	26	0	111	0	21	18
Queue Length 95th (ft)	58	60	39	190	20	#136	72
Internal Link Dist (ft)		1478		2017			933
Turn Bay Length (ft)			250		500	175	
Base Capacity (vph)	413	413	481	2722	1298	214	2722
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.17	0.25	0.54	0.27	0.64	0.29

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	126	0	112	0	0	0	0	1357	320	126	738	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0					5.0	5.0	5.0	5.0	
Lane Util. Factor	0.95	0.95	1.00					0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1681	1681	1583					3539	1583	1770	3539	
Flt Permitted	0.95	0.95	1.00					1.00	1.00	0.15	1.00	
Satd. Flow (perm)	1681	1681	1583					3539	1583	277	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	137	0	122	0	0	0	0	1475	348	137	802	0
RTOR Reduction (vph)	0	0	109	0	0	0	0	0	91	0	0	0
Lane Group Flow (vph)	68	69	13	0	0	0	0	1475	257	137	802	0
Turn Type	Perm	NA	Perm					NA	Perm	custom	NA	
Protected Phases		4						2				
Permitted Phases	4		4						2	6	6	
Actuated Green, G (s)	7.0	7.0	7.0					48.0	48.0	48.0	48.0	
Effective Green, g (s)	7.0	7.0	7.0					48.0	48.0	48.0	48.0	
Actuated g/C Ratio	0.11	0.11	0.11					0.74	0.74	0.74	0.74	
Clearance Time (s)	5.0	5.0	5.0					5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	181	181	170					2613	1168	204	2613	
v/s Ratio Prot								0.42				
v/s Ratio Perm	0.04	0.04	0.01						0.16	c0.49	0.23	
v/c Ratio	0.38	0.38	0.08					0.56	0.22	0.67	0.31	
Uniform Delay, d1	27.0	27.0	26.1					3.8	2.7	4.4	2.9	
Progression Factor	1.00	1.00	1.00					1.00	1.00	0.98	0.77	
Incremental Delay, d2	1.3	1.3	0.2					0.9	0.4	15.7	0.3	
Delay (s)	28.3	28.3	26.3					4.7	3.1	20.1	2.5	
Level of Service	C	C	C					A	A	C	A	
Approach Delay (s)		27.4			0.0			4.4			5.1	
Approach LOS		C			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	6.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	71.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	167	146	67	905	229
v/c Ratio	0.67	0.09	0.08	0.64	0.19
Control Delay	51.8	0.1	3.5	6.8	7.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	51.8	0.1	3.5	6.8	7.7
Queue Length 50th (ft)	96	0	9	234	53
Queue Length 95th (ft)	160	0	m18	169	90
Internal Link Dist (ft)	446			1125	3526
Turn Bay Length (ft)		300	100		
Base Capacity (vph)	298	1583	845	1404	1227
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.56	0.09	0.08	0.64	0.19

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	154	134	62	833	207	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	4.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	1863	1858	
Flt Permitted	0.95	1.00	0.57	1.00	1.00	
Satd. Flow (perm)	1770	1583	1061	1863	1858	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	167	146	67	905	225	4
RTOR Reduction (vph)	0	0	0	0	1	0
Lane Group Flow (vph)	167	146	67	905	228	0
Turn Type	NA	Free	pm+pt	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		Free	2			
Actuated Green, G (s)	13.4	95.0	71.6	71.6	61.7	
Effective Green, g (s)	13.4	95.0	71.6	71.6	61.7	
Actuated g/C Ratio	0.14	1.00	0.75	0.75	0.65	
Clearance Time (s)	5.0		5.0	5.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	249	1583	836	1404	1206	
v/s Ratio Prot	c0.09		0.00	c0.49	0.12	
v/s Ratio Perm		0.09	0.06			
v/c Ratio	0.67	0.09	0.08	0.64	0.19	
Uniform Delay, d1	38.7	0.0	3.1	5.6	6.7	
Progression Factor	1.00	1.00	0.95	0.75	1.00	
Incremental Delay, d2	6.9	0.1	0.0	1.9	0.3	
Delay (s)	45.6	0.1	3.0	6.1	7.0	
Level of Service	D	A	A	A	A	
Approach Delay (s)	24.4			5.9	7.0	
Approach LOS	C			A	A	

Intersection Summary			
HCM 2000 Control Delay	9.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	60.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	14	13	662	959	213	158
v/c Ratio	0.12	0.07	0.63	0.56	0.16	0.13
Control Delay	43.3	0.8	4.4	3.2	5.4	0.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.3	0.8	4.4	3.2	5.4	0.8
Queue Length 50th (ft)	8	0	0	0	17	0
Queue Length 95th (ft)	27	0	128	243	62	7
Internal Link Dist (ft)	411			3238	1125	
Turn Bay Length (ft)		200	100			
Base Capacity (vph)	298	333	1228	1727	1335	1179
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.05	0.04	0.54	0.56	0.16	0.13

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	13	12	609	882	196	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.95	1.00	0.58	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1081	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	14	13	662	959	213	158
RTOR Reduction (vph)	0	13	0	0	0	50
Lane Group Flow (vph)	14	0	662	959	213	108
Turn Type	NA	Perm	pm+pt	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	2.9	2.9	82.1	82.1	65.1	65.1
Effective Green, g (s)	2.9	2.9	82.1	82.1	65.1	65.1
Actuated g/C Ratio	0.03	0.03	0.86	0.86	0.69	0.69
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	54	48	1021	1610	1276	1084
v/s Ratio Prot	c0.01		c0.08	0.51	0.11	
v/s Ratio Perm		0.00	c0.48			0.07
v/c Ratio	0.26	0.01	0.65	0.60	0.17	0.10
Uniform Delay, d1	45.0	44.7	1.7	1.8	5.3	5.1
Progression Factor	1.00	1.00	1.00	1.00	0.71	0.27
Incremental Delay, d2	2.5	0.1	1.4	1.6	0.3	0.2
Delay (s)	47.5	44.7	3.1	3.4	4.0	1.5
Level of Service	D	D	A	A	A	A
Approach Delay (s)	46.2			3.3	3.0	
Approach LOS	D			A	A	

Intersection Summary			
HCM 2000 Control Delay	3.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	61.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

910: Port Royal Rd & Saturn Pkwy WB Ramp

Lane Group	WBT	WBR	NBL	NBT	SBT
Lane Group Flow (vph)	89	146	140	239	937
v/c Ratio	0.55	0.53	0.29	0.15	0.37
Control Delay	68.6	15.3	8.1	2.5	6.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	68.6	15.3	8.1	2.5	6.9
Queue Length 50th (ft)	73	0	14	24	128
Queue Length 95th (ft)	126	63	78	48	194
Internal Link Dist (ft)	1680			1224	528
Turn Bay Length (ft)		300			
Base Capacity (vph)	367	444	607	1549	2550
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.24	0.33	0.23	0.15	0.37

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	82	0	134	129	220	0	0	728	134
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0	5.0	5.0	5.0			5.0	
Lane Util. Factor					1.00	1.00	1.00	1.00			0.95	
Frt					1.00	0.85	1.00	1.00			0.98	
Flt Protected					0.95	1.00	0.95	1.00			1.00	
Satd. Flow (prot)					1770	1583	1770	1863			3456	
Flt Permitted					0.95	1.00	0.27	1.00			1.00	
Satd. Flow (perm)					1770	1583	495	1863			3456	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	89	0	146	140	239	0	0	791	146
RTOR Reduction (vph)	0	0	0	0	0	133	0	0	0	0	6	0
Lane Group Flow (vph)	0	0	0	0	89	13	140	239	0	0	931	0
Turn Type				Perm	NA	Perm	pm+pt	NA			NA	
Protected Phases					8		5	2			6	
Permitted Phases				8		8	2					
Actuated Green, G (s)					11.9	11.9	108.1	108.1			95.6	
Effective Green, g (s)					11.9	11.9	108.1	108.1			95.6	
Actuated g/C Ratio					0.09	0.09	0.83	0.83			0.74	
Clearance Time (s)					5.0	5.0	5.0	5.0			5.0	
Vehicle Extension (s)					3.0	3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)					162	144	485	1549			2541	
v/s Ratio Prot							c0.02	0.13			c0.27	
v/s Ratio Perm					0.05	0.01	0.22					
v/c Ratio					0.55	0.09	0.29	0.15			0.37	
Uniform Delay, d1					56.5	54.1	2.9	2.1			6.2	
Progression Factor					1.00	1.00	2.88	0.97			1.00	
Incremental Delay, d2					3.8	0.3	0.3	0.2			0.4	
Delay (s)					60.3	54.4	8.6	2.3			6.6	
Level of Service					E	D	A	A			A	
Approach Delay (s)		0.0			56.6			4.6			6.6	
Approach LOS		A			E			A			A	

Intersection Summary			
HCM 2000 Control Delay	13.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	87.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	70	208	310	553	745	137
v/c Ratio	0.49	0.65	0.14	0.48	0.77	0.09
Control Delay	68.2	17.3	11.8	4.9	7.7	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	68.2	17.3	11.8	4.9	7.7	0.5
Queue Length 50th (ft)	57	0	49	33	22	1
Queue Length 95th (ft)	105	76	105	146	96	8
Internal Link Dist (ft)	1642		1468			1224
Turn Bay Length (ft)				150		
Base Capacity (vph)	231	387	2228	1160	1139	1569
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.30	0.54	0.14	0.48	0.65	0.09

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	64	0	191	0	0	0	0	285	509	685	126	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0					5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00	1.00					0.95	1.00	1.00	1.00	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1770	1583					3539	1583	1770	1863	
Flt Permitted		0.95	1.00					1.00	1.00	0.53	1.00	
Satd. Flow (perm)		1770	1583					3539	1583	989	1863	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	70	0	208	0	0	0	0	310	553	745	137	0
RTOR Reduction (vph)	0	0	191	0	0	0	0	0	164	0	0	0
Lane Group Flow (vph)	0	70	17	0	0	0	0	310	389	745	137	0
Turn Type	Perm	NA	Perm					NA	Perm	pm+pt	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2	6		
Actuated Green, G (s)		10.5	10.5					81.8	81.8	109.5	109.5	
Effective Green, g (s)		10.5	10.5					81.8	81.8	109.5	109.5	
Actuated g/C Ratio		0.08	0.08					0.63	0.63	0.84	0.84	
Clearance Time (s)		5.0	5.0					5.0	5.0	5.0	5.0	
Vehicle Extension (s)		3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		142	127					2226	996	969	1569	
v/s Ratio Prot								0.09		c0.13	0.07	
v/s Ratio Perm		0.04	0.01						0.25	c0.51		
v/c Ratio		0.49	0.13					0.14	0.39	0.77	0.09	
Uniform Delay, d1		57.2	55.5					9.8	11.9	3.1	1.7	
Progression Factor		1.00	1.00					1.00	1.00	0.68	0.20	
Incremental Delay, d2		2.7	0.5					0.1	1.2	3.5	0.1	
Delay (s)		59.9	56.0					9.9	13.0	5.7	0.4	
Level of Service		E	E					A	B	A	A	
Approach Delay (s)		57.0			0.0			11.9			4.9	
Approach LOS		E			A			B			A	

Intersection Summary			
HCM 2000 Control Delay	15.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	87.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	1105	89	70	207	367	351	336
v/c Ratio	0.69	0.11	0.28	0.10	0.74	0.62	0.50
Control Delay	19.6	3.0	7.6	4.0	35.1	16.6	5.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	19.6	3.0	7.6	4.0	35.1	16.6	5.5
Queue Length 50th (ft)	217	0	17	26	161	70	0
Queue Length 95th (ft)	290	20	37	43	#291	168	58
Internal Link Dist (ft)	980			565		443	
Turn Bay Length (ft)		100	100		300		
Base Capacity (vph)	1613	777	254	2029	493	562	678
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.69	0.11	0.28	0.10	0.74	0.62	0.50

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1017	82	64	190	0	0	0	0	427	0	543
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0	5.0	5.0					5.0	5.0	5.0
Lane Util. Factor		0.95	1.00	1.00	0.95					0.95	0.91	0.95
Frt		1.00	0.85	1.00	1.00					1.00	0.89	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.99	1.00
Satd. Flow (prot)		3539	1583	1770	3539					1681	1491	1504
Flt Permitted		1.00	1.00	0.12	1.00					0.95	0.99	1.00
Satd. Flow (perm)		3539	1583	230	3539					1681	1491	1504
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1105	89	70	207	0	0	0	0	464	0	590
RTOR Reduction (vph)	0	0	50	0	0	0	0	0	0	0	126	237
Lane Group Flow (vph)	0	1105	39	70	207	0	0	0	0	367	225	99
Turn Type		NA	Perm	pm+pt	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases			2	6						4		4
Actuated Green, G (s)		33.2	33.2	43.0	43.0					22.0	22.0	22.0
Effective Green, g (s)		33.2	33.2	43.0	43.0					22.0	22.0	22.0
Actuated g/C Ratio		0.44	0.44	0.57	0.57					0.29	0.29	0.29
Clearance Time (s)		5.0	5.0	5.0	5.0					5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		1566	700	230	2029					493	437	441
v/s Ratio Prot		c0.31		c0.02	0.06							
v/s Ratio Perm			0.02	0.15						c0.22	0.15	0.07
v/c Ratio		0.71	0.06	0.30	0.10					0.74	0.52	0.22
Uniform Delay, d1		16.9	11.9	10.2	7.3					24.0	22.1	20.0
Progression Factor		1.00	1.00	0.68	0.53					1.00	1.00	1.00
Incremental Delay, d2		2.7	0.2	0.7	0.1					9.8	4.3	1.2
Delay (s)		19.6	12.1	7.7	4.0					33.8	26.4	21.2
Level of Service		B	B	A	A					C	C	C
Approach Delay (s)		19.1			4.9			0.0			27.3	
Approach LOS		B			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	21.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	83.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	NBT	NBR
Lane Group Flow (vph)	929	662	168	713	108	84
v/c Ratio	0.93	0.54	0.16	0.89	0.29	0.20
Control Delay	33.3	5.2	20.2	24.8	27.2	5.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.3	5.2	20.2	24.8	27.2	5.6
Queue Length 50th (ft)	178	12	30	110	42	0
Queue Length 95th (ft)	#317	67	53	#342	84	26
Internal Link Dist (ft)		565	1393		410	
Turn Bay Length (ft)	100			200		
Base Capacity (vph)	1007	1217	1047	798	377	417
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.92	0.54	0.16	0.89	0.29	0.20

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	855	609	0	0	155	656	99	0	77	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0		5.0	5.0			
Lane Util. Factor	0.97	1.00			0.95	1.00		1.00	1.00			
Frt	1.00	1.00			1.00	0.85		1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (prot)	3433	1863			3539	1583		1770	1583			
Flt Permitted	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (perm)	3433	1863			3539	1583		1770	1583			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	929	662	0	0	168	713	108	0	84	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	329	0	0	66	0	0	0
Lane Group Flow (vph)	929	662	0	0	168	384	0	108	18	0	0	0
Turn Type	Prot	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	5	2			6			8				
Permitted Phases						6	8		8			
Actuated Green, G (s)	21.8	49.0			22.2	22.2		16.0	16.0			
Effective Green, g (s)	21.8	49.0			22.2	22.2		16.0	16.0			
Actuated g/C Ratio	0.29	0.65			0.30	0.30		0.21	0.21			
Clearance Time (s)	5.0	5.0			5.0	5.0		5.0	5.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0	3.0			
Lane Grp Cap (vph)	997	1217			1047	468		377	337			
v/s Ratio Prot	c0.27	0.36			0.05							
v/s Ratio Perm						c0.24		0.06	0.01			
v/c Ratio	0.93	0.54			0.16	0.82		0.29	0.05			
Uniform Delay, d1	25.9	7.0			19.5	24.5		24.7	23.5			
Progression Factor	0.73	0.54			1.00	1.00		1.00	1.00			
Incremental Delay, d2	11.5	1.3			0.3	14.8		1.9	0.3			
Delay (s)	30.4	5.0			19.8	39.3		26.6	23.8			
Level of Service	C	A			B	D		C	C			
Approach Delay (s)		19.9			35.6			25.4			0.0	
Approach LOS		B			D			C			A	

Intersection Summary			
HCM 2000 Control Delay	25.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	83.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBT	WBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	346	347	171	111	538	1546	135
v/c Ratio	0.81	0.82	0.32	0.90	0.26	0.75	0.14
Control Delay	38.6	38.8	5.4	78.8	5.1	12.6	1.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	38.6	38.8	5.4	78.8	5.1	12.6	1.7
Queue Length 50th (ft)	121	122	0	26	34	201	0
Queue Length 95th (ft)	#246	#247	38	#124	50	281	18
Internal Link Dist (ft)		2384			933	7506	
Turn Bay Length (ft)			150	300			
Base Capacity (vph)	448	448	548	124	2055	2055	976
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.77	0.77	0.31	0.90	0.26	0.75	0.14

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	638	0	157	102	495	0	0	1422	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				5.0	5.0	5.0	5.0	5.0			5.0	5.0
Lane Util. Factor				0.95	0.95	1.00	1.00	0.95			0.95	1.00
Frt				1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	0.95	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)				1681	1681	1583	1770	3539			3539	1583
Flt Permitted				0.95	0.95	1.00	0.11	1.00			1.00	1.00
Satd. Flow (perm)				1681	1681	1583	214	3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	693	0	171	111	538	0	0	1546	135
RTOR Reduction (vph)	0	0	0	0	0	128	0	0	0	0	0	57
Lane Group Flow (vph)	0	0	0	346	347	43	111	538	0	0	1546	78
Turn Type				Perm		Perm	Perm					Perm
Protected Phases					8			2			6	
Permitted Phases				8		8	2					6
Actuated Green, G (s)				15.2	15.2	15.2	34.8	34.8			34.8	34.8
Effective Green, g (s)				15.2	15.2	15.2	34.8	34.8			34.8	34.8
Actuated g/C Ratio				0.25	0.25	0.25	0.58	0.58			0.58	0.58
Clearance Time (s)				5.0	5.0	5.0	5.0	5.0			5.0	5.0
Vehicle Extension (s)				3.0	3.0	3.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)				426	426	401	124	2053			2053	918
v/s Ratio Prot								0.15			0.44	
v/s Ratio Perm				0.21	0.21	0.03	c0.52					0.05
v/c Ratio				0.81	0.81	0.11	0.90	0.26			0.75	0.09
Uniform Delay, d1				21.1	21.1	17.2	11.0	6.2			9.4	5.6
Progression Factor				1.00	1.00	1.00	0.98	0.74			1.00	1.00
Incremental Delay, d2				11.2	11.4	0.1	56.1	0.3			2.6	0.2
Delay (s)				32.3	32.4	17.3	66.9	4.9			12.0	5.8
Level of Service				C	C	B	E	A			B	A
Approach Delay (s)		0.0			29.4			15.5			11.5	
Approach LOS		A			C			B			B	

Intersection Summary			
HCM Average Control Delay	17.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	75.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	77	78	127	493	214	302	1937
v/c Ratio	0.28	0.28	0.47	0.19	0.18	0.48	0.76
Control Delay	23.1	23.1	25.6	4.3	1.3	6.1	7.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.1	23.1	25.6	4.3	1.3	6.1	7.9
Queue Length 50th (ft)	26	26	39	28	0	42	152
Queue Length 95th (ft)	54	54	75	59	21	m62	#486
Internal Link Dist (ft)		1478		2017			933
Turn Bay Length (ft)			250		500	175	
Base Capacity (vph)	448	448	429	2552	1201	634	2552
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.17	0.30	0.19	0.18	0.48	0.76

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	143	0	117	0	0	0	0	454	197	278	1782	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0					5.0	5.0	5.0	5.0	
Lane Util. Factor	0.95	0.95	1.00					0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1681	1681	1583					3539	1583	1770	3539	
Flt Permitted	0.95	0.95	1.00					1.00	1.00	0.47	1.00	
Satd. Flow (perm)	1681	1681	1583					3539	1583	879	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	155	0	127	0	0	0	0	493	214	302	1937	0
RTOR Reduction (vph)	0	0	9	0	0	0	0	0	67	0	0	0
Lane Group Flow (vph)	77	78	118	0	0	0	0	493	147	302	1937	0
Turn Type	Perm		Perm						Perm	custom		
Protected Phases		4						2				
Permitted Phases	4		4						2	6	6	
Actuated Green, G (s)	8.7	8.7	8.7					41.3	41.3	41.3	41.3	
Effective Green, g (s)	8.7	8.7	8.7					41.3	41.3	41.3	41.3	
Actuated g/C Ratio	0.14	0.14	0.14					0.69	0.69	0.69	0.69	
Clearance Time (s)	5.0	5.0	5.0					5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	244	244	230					2436	1090	605	2436	
v/s Ratio Prot								0.14				
v/s Ratio Perm	0.05	0.05	c0.07						0.09	0.34	c0.55	
v/c Ratio	0.32	0.32	0.52					0.20	0.14	0.50	0.80	
Uniform Delay, d1	23.0	23.0	23.7					3.4	3.2	4.4	6.4	
Progression Factor	1.00	1.00	1.00					1.00	1.00	0.67	0.67	
Incremental Delay, d2	0.7	0.8	1.9					0.2	0.3	1.9	1.8	
Delay (s)	23.7	23.8	25.6					3.6	3.5	4.8	6.1	
Level of Service	C	C	C					A	A	A	A	
Approach Delay (s)		24.6			0.0			3.5			5.9	
Approach LOS		C			A			A			A	

Intersection Summary			
HCM Average Control Delay	7.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	75.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	86	1208	21	161	872
v/c Ratio	0.58	0.76	0.05	0.10	0.58
Control Delay	80.8	3.5	2.3	2.2	8.4
Queue Delay	0.0	0.8	0.0	0.0	0.1
Total Delay	80.8	4.3	2.3	2.2	8.6
Queue Length 50th (ft)	83	0	2	20	314
Queue Length 95th (ft)	139	0	8	40	489
Internal Link Dist (ft)	446			1125	3526
Turn Bay Length (ft)		300	100		
Base Capacity (vph)	236	1583	461	1582	1497
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	136	0	0	105
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.36	0.83	0.05	0.10	0.63

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	79	1111	19	148	791	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	4.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	1863	1859	
Flt Permitted	0.95	1.00	0.26	1.00	1.00	
Satd. Flow (perm)	1770	1583	483	1863	1859	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	86	1208	21	161	860	12
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	86	1208	21	161	872	0
Turn Type		Free	pm+pt			
Protected Phases	4		5	2	6	
Permitted Phases		Free	2			
Actuated Green, G (s)	12.6	150.0	127.4	127.4	118.8	
Effective Green, g (s)	12.6	150.0	127.4	127.4	118.8	
Actuated g/C Ratio	0.08	1.00	0.85	0.85	0.79	
Clearance Time (s)	5.0		5.0	5.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	149	1583	441	1582	1472	
v/s Ratio Prot	0.05		0.00	0.09	0.47	
v/s Ratio Perm		c0.76	0.04			
v/c Ratio	0.58	0.76	0.05	0.10	0.59	
Uniform Delay, d1	66.1	0.0	4.7	1.9	6.1	
Progression Factor	1.00	1.00	0.98	0.97	1.00	
Incremental Delay, d2	5.3	3.5	0.0	0.1	1.8	
Delay (s)	71.5	3.5	4.6	1.9	7.9	
Level of Service	E	A	A	A	A	
Approach Delay (s)	8.1			2.2	7.9	
Approach LOS	A			A	A	

Intersection Summary			
HCM Average Control Delay	7.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	55.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	2	74	315	179	1954	113
v/c Ratio	0.02	0.50	0.99	0.11	1.50	0.10
Control Delay	67.0	25.7	98.0	1.3	249.4	2.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	67.0	25.7	98.0	1.3	249.4	2.7
Queue Length 50th (ft)	2	0	257	14	~2658	8
Queue Length 95th (ft)	11	53	#507	31	#2915	m18
Internal Link Dist (ft)	411			3238	1125	
Turn Bay Length (ft)		200	100			
Base Capacity (vph)	189	235	317	1648	1304	1123
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.31	0.99	0.11	1.50	0.10

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	2	68	290	165	1798	104
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.95	1.00	0.04	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	68	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2	74	315	179	1954	113
RTOR Reduction (vph)	0	70	0	0	0	15
Lane Group Flow (vph)	2	4	315	179	1954	98
Turn Type		Perm	pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	7.3	7.3	132.7	132.7	105.0	105.0
Effective Green, g (s)	7.3	7.3	132.7	132.7	105.0	105.0
Actuated g/C Ratio	0.05	0.05	0.88	0.88	0.70	0.70
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	86	77	318	1648	1304	1108
v/s Ratio Prot	0.00		c0.15	0.10	c1.05	
v/s Ratio Perm		c0.00	0.73			0.06
v/c Ratio	0.02	0.05	0.99	0.11	1.50	0.09
Uniform Delay, d1	68.0	68.0	58.7	1.1	22.5	7.2
Progression Factor	1.00	1.00	1.00	1.00	0.88	0.64
Incremental Delay, d2	0.1	0.3	47.7	0.1	227.2	0.1
Delay (s)	68.1	68.3	106.5	1.2	247.1	4.7
Level of Service	E	E	F	A	F	A
Approach Delay (s)	68.3			68.3	233.9	
Approach LOS	E			E	F	

Intersection Summary			
HCM Average Control Delay	198.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.34		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	128.2%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	133	920	1307	86	174	289
v/c Ratio	0.18	1.12	1.13	0.06	0.86	0.30
Control Delay	28.0	97.1	83.6	2.6	96.3	2.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.0	97.1	83.6	2.6	96.3	2.0
Queue Length 50th (ft)	78	~785	~1155	13	144	0
Queue Length 95th (ft)	126	#1046	#1644	22	#298	25
Internal Link Dist (ft)	2022			1829	2247	
Turn Bay Length (ft)		150	150			150
Base Capacity (vph)	745	820	1155	1517	202	973
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.18	1.12	1.13	0.06	0.86	0.30

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	122	846	1202	79	160	266
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.60	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	1114	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	133	920	1307	86	174	289
RTOR Reduction (vph)	0	187	0	0	0	147
Lane Group Flow (vph)	133	733	1307	86	174	142
Turn Type		Perm	pm+pt			pm+ov
Protected Phases	2		1	6	8	1
Permitted Phases		2	6			8
Actuated Green, G (s)	56.0	56.0	114.0	114.0	16.0	69.0
Effective Green, g (s)	56.0	56.0	114.0	114.0	16.0	69.0
Actuated g/C Ratio	0.40	0.40	0.81	0.81	0.11	0.49
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	745	633	1155	1517	202	837
v/s Ratio Prot	0.07		c0.43	0.05	c0.10	0.06
v/s Ratio Perm		0.46	c0.49			0.03
v/c Ratio	0.18	1.16	1.13	0.06	0.86	0.17
Uniform Delay, d1	27.1	42.0	10.0	2.5	60.9	19.7
Progression Factor	1.00	1.00	1.00	1.00	1.01	0.70
Incremental Delay, d2	0.5	88.2	70.5	0.1	35.0	0.1
Delay (s)	27.7	130.2	80.5	2.6	96.5	13.8
Level of Service	C	F	F	A	F	B
Approach Delay (s)	117.2			75.7	44.9	
Approach LOS	F			E	D	

Intersection Summary			
HCM Average Control Delay	85.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	127.3%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	136	274	109	304	149	166	34	827	220	804	196
v/c Ratio	0.46	0.98	0.34	1.03	0.36	0.35	0.15	0.97	0.96	0.77	0.21
Control Delay	42.7	108.2	16.0	87.9	43.6	5.7	13.3	60.4	87.9	31.3	9.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	42.7	108.2	16.0	87.9	43.6	5.7	13.3	60.4	87.9	31.3	9.2
Queue Length 50th (ft)	91	252	10	~244	116	6	12	710	151	590	46
Queue Length 95th (ft)	147	#437	66	m#368	m140	m27	27	#1004	#320	786	91
Internal Link Dist (ft)		2030			1135			9853		1200	
Turn Bay Length (ft)	175		175	150		300	200		150		150
Base Capacity (vph)	299	279	319	294	413	480	221	850	230	1043	928
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.45	0.98	0.34	1.03	0.36	0.35	0.15	0.97	0.96	0.77	0.21

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	125	252	100	280	137	153	31	540	221	202	740	180
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1782		1770	1863	1583
Flt Permitted	0.66	1.00	1.00	0.15	1.00	1.00	0.16	1.00		0.06	1.00	1.00
Satd. Flow (perm)	1234	1863	1583	287	1863	1583	307	1782		105	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	136	274	109	304	149	166	34	587	240	220	804	196
RTOR Reduction (vph)	0	0	82	0	0	129	0	11	0	0	0	42
Lane Group Flow (vph)	136	274	27	304	149	37	34	816	0	220	804	154
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	30.0	21.0	21.0	45.0	31.0	31.0	69.6	66.0		85.0	76.4	76.4
Effective Green, g (s)	30.0	21.0	21.0	45.0	31.0	31.0	69.6	66.0		85.0	76.4	76.4
Actuated g/C Ratio	0.21	0.15	0.15	0.32	0.22	0.22	0.50	0.47		0.61	0.55	0.55
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	299	279	237	294	413	351	190	840		230	1017	864
v/s Ratio Prot	0.03	0.15		c0.14	0.08		0.00	0.46		c0.10	0.43	
v/s Ratio Perm	0.07		0.02	c0.19		0.02	0.08			c0.48		0.10
v/c Ratio	0.45	0.98	0.12	1.03	0.36	0.10	0.18	0.97		0.96	0.79	0.18
Uniform Delay, d1	46.8	59.3	51.5	41.2	46.1	43.4	22.9	36.1		46.7	25.4	16.0
Progression Factor	1.00	1.00	1.00	0.96	0.90	0.71	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.1	48.7	0.2	49.5	0.3	0.1	0.5	24.9		46.7	6.3	0.5
Delay (s)	47.9	108.0	51.7	88.9	42.0	30.8	23.4	61.0		93.5	31.7	16.5
Level of Service	D	F	D	F	D	C	C	E		F	C	B
Approach Delay (s)		80.4			62.0			59.6			40.4	
Approach LOS		F			E			E			D	

Intersection Summary			
HCM Average Control Delay	56.1	HCM Level of Service	E
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	98.5%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	50	80	121	379	1068	1158
v/c Ratio	0.42	0.44	0.35	0.24	0.74	0.83
Control Delay	56.7	16.1	4.5	2.2	6.2	4.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	56.7	16.1	4.5	2.2	6.2	4.3
Queue Length 50th (ft)	45	16	12	44	227	122
Queue Length 95th (ft)	m46	m18	25	78	m172	m25
Internal Link Dist (ft)	7444			1245	1600	
Turn Bay Length (ft)		150	150			150
Base Capacity (vph)	202	252	344	1605	1445	1394
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.32	0.35	0.24	0.74	0.83

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	46	74	111	349	983	1065
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.95	1.00	0.17	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	314	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	50	80	121	379	1068	1158
RTOR Reduction (vph)	0	75	0	0	0	166
Lane Group Flow (vph)	50	5	121	379	1068	992
Turn Type		Perm	pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	9.4	9.4	120.6	120.6	108.6	108.6
Effective Green, g (s)	9.4	9.4	120.6	120.6	108.6	108.6
Actuated g/C Ratio	0.07	0.07	0.86	0.86	0.78	0.78
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	119	106	343	1605	1445	1228
v/s Ratio Prot	c0.03		c0.02	0.20	0.57	
v/s Ratio Perm		0.00	0.29			c0.63
v/c Ratio	0.42	0.05	0.35	0.24	0.74	0.81
Uniform Delay, d1	62.7	61.1	11.2	1.7	8.3	9.4
Progression Factor	0.86	1.13	1.00	1.00	0.62	0.95
Incremental Delay, d2	0.7	0.1	0.6	0.3	0.3	0.6
Delay (s)	54.9	69.1	11.8	2.0	5.5	9.5
Level of Service	D	E	B	A	A	A
Approach Delay (s)	63.6			4.4	7.6	
Approach LOS	E			A	A	

Intersection Summary			
HCM Average Control Delay	9.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	80.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBT	WBR	NBL	NBT	SBT
Lane Group Flow (vph)	463	952	83	421	1012
v/c Ratio	0.51	1.01	0.47	0.58	0.90
Control Delay	18.8	52.0	24.9	22.4	40.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	18.8	52.0	24.9	22.4	40.5
Queue Length 50th (ft)	187	~508	32	190	285
Queue Length 95th (ft)	277	#797	73	291	#423
Internal Link Dist (ft)	1680			1224	528
Turn Bay Length (ft)		300			
Base Capacity (vph)	903	939	178	727	1125
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.51	1.01	0.47	0.58	0.90

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	426	0	876	76	387	0	0	550	381
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0	5.0	5.0	5.0			5.0	
Lane Util. Factor					1.00	1.00	1.00	1.00			0.95	
Frt					1.00	0.85	1.00	1.00			0.94	
Flt Protected					0.95	1.00	0.95	1.00			1.00	
Satd. Flow (prot)					1770	1583	1770	1863			3322	
Flt Permitted					0.95	1.00	0.12	1.00			1.00	
Satd. Flow (perm)					1770	1583	218	1863			3322	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	463	0	952	83	421	0	0	598	414
RTOR Reduction (vph)	0	0	0	0	0	131	0	0	0	0	123	0
Lane Group Flow (vph)	0	0	0	0	463	821	83	421	0	0	889	0
Turn Type				Perm		Perm	pm+pt					
Protected Phases					8		5	2			6	
Permitted Phases				8		8	2					
Actuated Green, G (s)					51.0	51.0	39.0	39.0			29.2	
Effective Green, g (s)					51.0	51.0	39.0	39.0			29.2	
Actuated g/C Ratio					0.51	0.51	0.39	0.39			0.29	
Clearance Time (s)					5.0	5.0	5.0	5.0			5.0	
Vehicle Extension (s)					3.0	3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)					903	807	160	727			970	
v/s Ratio Prot							0.02	c0.23			c0.27	
v/s Ratio Perm					0.26	c0.52	0.18					
v/c Ratio					0.51	1.02	0.52	0.58			0.92	
Uniform Delay, d1					16.3	24.5	24.2	24.0			34.2	
Progression Factor					1.00	1.00	0.83	0.78			1.00	
Incremental Delay, d2					0.5	36.0	2.8	3.3			14.6	
Delay (s)					16.7	60.5	22.9	21.9			48.8	
Level of Service					B	E	C	C			D	
Approach Delay (s)		0.0			46.2			22.1			48.8	
Approach LOS		A			D			C			D	

Intersection Summary			
HCM Average Control Delay	43.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	82.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	116	101	387	120	510	551
v/c Ratio	0.56	0.37	0.19	0.12	0.61	0.38
Control Delay	51.0	11.7	11.8	3.1	3.6	1.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	51.0	11.7	11.8	3.1	3.6	1.7
Queue Length 50th (ft)	71	0	55	0	21	23
Queue Length 95th (ft)	121	45	110	31	m27	m29
Internal Link Dist (ft)	1642		1468			1224
Turn Bay Length (ft)				150		
Base Capacity (vph)	336	383	2047	966	1066	1456
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.26	0.19	0.12	0.48	0.38

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	107	0	93	0	0	0	0	356	110	469	507	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0					5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00	1.00					0.95	1.00	1.00	1.00	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1770	1583					3539	1583	1770	1863	
Flt Permitted		0.95	1.00					1.00	1.00	0.48	1.00	
Satd. Flow (perm)		1770	1583					3539	1583	891	1863	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	116	0	101	0	0	0	0	387	120	510	551	0
RTOR Reduction (vph)	0	0	89	0	0	0	0	0	51	0	0	0
Lane Group Flow (vph)	0	116	12	0	0	0	0	387	69	510	551	0
Turn Type	Perm		Perm						Perm	pm+pt		
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2	6		
Actuated Green, G (s)		11.8	11.8					57.9	57.9	78.2	78.2	
Effective Green, g (s)		11.8	11.8					57.9	57.9	78.2	78.2	
Actuated g/C Ratio		0.12	0.12					0.58	0.58	0.78	0.78	
Clearance Time (s)		5.0	5.0					5.0	5.0	5.0	5.0	
Vehicle Extension (s)		3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		209	187					2049	917	831	1457	
v/s Ratio Prot								0.11		c0.09	0.30	
v/s Ratio Perm		0.07	0.01						0.04	c0.39		
v/c Ratio		0.56	0.06					0.19	0.08	0.61	0.38	
Uniform Delay, d1		41.6	39.2					10.0	9.3	3.6	3.4	
Progression Factor		1.00	1.00					1.00	1.00	0.35	0.31	
Incremental Delay, d2		3.2	0.1					0.2	0.2	0.9	0.5	
Delay (s)		44.8	39.3					10.2	9.4	2.2	1.5	
Level of Service		D	D					B	A	A	A	
Approach Delay (s)		42.3			0.0			10.0			1.8	
Approach LOS		D			A			A			A	

Intersection Summary			
HCM Average Control Delay	9.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	82.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBT	WBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	346	347	171	111	538	1546	135
v/c Ratio	0.81	0.81	0.32	0.88	0.25	0.72	0.13
Control Delay	38.0	38.2	5.4	74.4	5.9	10.6	1.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	38.0	38.2	5.4	74.4	5.9	10.6	1.5
Queue Length 50th (ft)	121	122	0	30	41	181	0
Queue Length 95th (ft)	#246	#247	38	#80	62	253	16
Internal Link Dist (ft)		2384			933	7506	
Turn Bay Length (ft)			150	300			
Base Capacity (vph)	456	456	554	126	2160	2160	1019
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.76	0.76	0.31	0.88	0.25	0.72	0.13

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	638	0	157	102	495	0	0	1422	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor				0.95	0.95	1.00	1.00	0.95			0.95	1.00
Frt				1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	0.95	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)				1681	1681	1583	1770	3539			3539	1583
Flt Permitted				0.95	0.95	1.00	0.11	1.00			1.00	1.00
Satd. Flow (perm)				1681	1681	1583	207	3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	693	0	171	111	538	0	0	1546	135
RTOR Reduction (vph)	0	0	0	0	0	128	0	0	0	0	0	53
Lane Group Flow (vph)	0	0	0	346	347	43	111	538	0	0	1546	82
Turn Type				Perm		Perm	Perm					Perm
Protected Phases					8			2			6	
Permitted Phases				8		8	2					6
Actuated Green, G (s)				15.0	15.0	15.0	36.0	36.0			36.0	36.0
Effective Green, g (s)				15.0	15.0	15.0	36.0	36.0			36.0	36.0
Actuated g/C Ratio				0.25	0.25	0.25	0.61	0.61			0.61	0.61
Clearance Time (s)				4.0	4.0	4.0	4.0	4.0			4.0	4.0
Vehicle Extension (s)				3.0	3.0	3.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)				427	427	402	126	2159			2159	966
v/s Ratio Prot								0.15			0.44	
v/s Ratio Perm				0.21	0.21	0.03	c0.54					0.05
v/c Ratio				0.81	0.81	0.11	0.88	0.25			0.72	0.09
Uniform Delay, d1				20.7	20.7	16.9	9.7	5.3			8.0	4.7
Progression Factor				1.00	1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2				11.1	11.2	0.1	53.1	0.3			2.1	0.2
Delay (s)				31.8	31.9	17.0	62.8	5.6			10.0	4.9
Level of Service				C	C	B	E	A			B	A
Approach Delay (s)		0.0			28.9			15.4			9.6	
Approach LOS		A			C			B			A	

Intersection Summary			
HCM Average Control Delay	16.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	59.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	72.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	143	0	117	0	0	0	0	454	197	278	1782	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	155	0	127	0	0	0	0	493	214	302	1937	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			10									
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											1013	
pX, platoon unblocked	0.71	0.71	0.71	0.71	0.71		0.71					
vC, conflicting volume	2788	3035	968	2066	3035	247	1937			493		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2703	3049	157	1693	3049	247	1512			493		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	100	79	100	100	100	100			72		
cM capacity (veh/h)	6	6	615	27	6	753	313			1066		

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	104	179	247	247	214	302	968	968
Volume Left	104	52	0	0	0	302	0	0
Volume Right	0	127	0	0	214	0	0	0
cSH	6	19	1700	1700	1700	1066	1700	1700
Volume to Capacity	18.36	9.36	0.15	0.15	0.13	0.28	0.57	0.57
Queue Length 95th (ft)	Err	Err	0	0	0	29	0	0
Control Delay (s)	Err	Err	0.0	0.0	0.0	9.7	0.0	0.0
Lane LOS	F	F				A		
Approach Delay (s)	9999.0		0.0			1.3		
Approach LOS	F							

Intersection Summary			
Average Delay	875.9		
Intersection Capacity Utilization	72.6%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	79	1111	19	148	791	11
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	86	1208	21	161	860	12
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		12				
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1068	866	872			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1068	866	872			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	64	0	97			
cM capacity (veh/h)	239	353	774			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	1293	21	161	872
Volume Left	86	21	0	0
Volume Right	1208	0	0	12
cSH	357	774	1700	1700
Volume to Capacity	3.62	0.03	0.09	0.51
Queue Length 95th (ft)	Err	2	0	0
Control Delay (s)	Err	9.8	0.0	0.0
Lane LOS	F	A		
Approach Delay (s)	Err	1.1		0.0
Approach LOS	F			

Intersection Summary			
Average Delay	5511.3		
Intersection Capacity Utilization	117.8%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	2	68	290	165	1798	104
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	74	315	179	1954	113
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		8				
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2764	1954	1954			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2764	1954	1954			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	8	0			
cM capacity (veh/h)	0	80	298			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	76	315	179	1954	113
Volume Left	2	315	0	0	0
Volume Right	74	0	0	0	113
cSH	0	298	1700	1700	1700
Volume to Capacity	Err	1.06	0.11	1.15	0.07
Queue Length 95th (ft)	Err	300	0	0	0
Control Delay (s)	Err	106.8	0.0	0.0	0.0
Lane LOS	F	F			
Approach Delay (s)	Err	68.0		0.0	
Approach LOS	F				

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	124.0%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	122	846	1202	79	160	266
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	133	920	1307	86	174	289
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			1052		3291	592
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1052		3291	592
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			0		0	43
cM capacity (veh/h)			662		0	506

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	1052	1392	463
Volume Left	0	1307	174
Volume Right	920	0	289
cSH	1700	662	0
Volume to Capacity	0.62	1.97	Err
Queue Length 95th (ft)	0	2157	Err
Control Delay (s)	0.0	459.9	Err
Lane LOS		F	F
Approach Delay (s)	0.0	459.9	Err
Approach LOS			F

Intersection Summary			
Average Delay		Err	
Intersection Capacity Utilization		164.6%	ICU Level of Service H
Analysis Period (min)		15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	136	274	109	304	149	166	34	827	220	804	196
v/c Ratio	0.37	0.49	0.20	1.19	0.27	0.28	0.16	0.78	1.15	0.74	0.19
Control Delay	23.1	23.7	5.3	145.9	20.2	4.9	9.0	16.8	131.5	15.8	1.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.1	23.7	5.3	145.9	20.2	4.9	9.0	16.8	131.5	15.8	1.6
Queue Length 50th (ft)	46	96	0	~162	48	0	6	227	~114	226	0
Queue Length 95th (ft)	93	163	32	#304	92	39	20	384	#159	365	22
Internal Link Dist (ft)		2030			1135			9853		1200	
Turn Bay Length (ft)	175		175	150		300	200		150		150
Base Capacity (vph)	363	559	551	255	559	591	209	1064	192	1091	1008
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.37	0.49	0.20	1.19	0.27	0.28	0.16	0.78	1.15	0.74	0.19

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	125	252	100	280	137	153	31	540	221	202	740	180
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1782		1770	1863	1583
Flt Permitted	0.65	1.00	1.00	0.46	1.00	1.00	0.19	1.00		0.18	1.00	1.00
Satd. Flow (perm)	1209	1863	1583	849	1863	1583	355	1782		328	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	136	274	109	304	149	166	34	587	240	220	804	196
RTOR Reduction (vph)	0	0	76	0	0	116	0	21	0	0	0	81
Lane Group Flow (vph)	136	274	33	304	149	50	34	806	0	220	804	115
Turn Type	Perm		Perm	Perm		Perm	Perm			Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	21.0	21.0	21.0	21.0	21.0	21.0	41.0	41.0		41.0	41.0	41.0
Effective Green, g (s)	21.0	21.0	21.0	21.0	21.0	21.0	41.0	41.0		41.0	41.0	41.0
Actuated g/C Ratio	0.30	0.30	0.30	0.30	0.30	0.30	0.59	0.59		0.59	0.59	0.59
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	363	559	475	255	559	475	208	1044		192	1091	927
v/s Ratio Prot		0.15			0.08			0.45			0.43	
v/s Ratio Perm	0.11		0.02	c0.36		0.03	0.10			c0.67		0.07
v/c Ratio	0.37	0.49	0.07	1.19	0.27	0.10	0.16	0.77		1.15	0.74	0.12
Uniform Delay, d1	19.3	20.1	17.5	24.5	18.6	17.7	6.6	11.0		14.5	10.6	6.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.7	0.7	0.1	118.4	0.3	0.1	1.7	5.5		109.7	4.5	0.3
Delay (s)	20.0	20.8	17.6	142.9	18.9	17.8	8.3	16.5		124.2	15.0	6.8
Level of Service	B	C	B	F	B	B	A	B		F	B	A
Approach Delay (s)		19.9			79.5			16.2			33.4	
Approach LOS		B			E			B			C	

Intersection Summary			
HCM Average Control Delay	35.5	HCM Level of Service	D
HCM Volume to Capacity ratio	1.16		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	95.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	46	74	111	349	983	1065
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	50	80	121	379	1068	1158
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2268	1647	2226			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2268	1647	2226			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	34	48			
cM capacity (veh/h)	22	122	233			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	130	500	2226
Volume Left	50	121	0
Volume Right	80	0	1158
cSH	44	233	1700
Volume to Capacity	2.98	0.52	1.31
Queue Length 95th (ft)	356	67	0
Control Delay (s)	1087.0	26.7	0.0
Lane LOS	F	D	
Approach Delay (s)	1087.0	26.7	0.0
Approach LOS	F		

Intersection Summary			
Average Delay	54.3		
Intersection Capacity Utilization	130.7%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	426	0	876	76	387	0	0	550	381
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	463	0	952	83	421	0	0	598	414
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								Raised			None	
Median storage veh)								1				
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1391	1391	506	885	1598	421	1012			421		
vC1, stage 1 conf vol	805	805		586	586							
vC2, stage 2 conf vol	586	586		299	1012							
vCu, unblocked vol	1391	1391	506	885	1598	421	1012			421		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)	6.5	5.5		6.5	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	100	100	0	100	0	88			100		
cM capacity (veh/h)	0	245	512	314	175	581	681			1135		

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	1415	83	421	399	613
Volume Left	463	83	0	0	0
Volume Right	952	0	0	0	414
cSH	455	681	1700	1700	1700
Volume to Capacity	3.11	0.12	0.25	0.23	0.36
Queue Length 95th (ft)	Err	10	0	0	0
Control Delay (s)	Err	11.0	0.0	0.0	0.0
Lane LOS	F	B			
Approach Delay (s)	Err	1.8		0.0	
Approach LOS	F				

Intersection Summary			
Average Delay	4829.2		
Intersection Capacity Utilization	119.1%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	107	0	93	0	0	0	0	356	110	469	507	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	116	0	101	0	0	0	0	387	120	510	551	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								Raised			Raised	
Median storage veh)								1			1	
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1764	1958	551	1958	1958	193	551			387		
vC1, stage 1 conf vol	1571	1571		387	387							
vC2, stage 2 conf vol	193	387		1571	1571							
vCu, unblocked vol	1764	1958	551	1958	1958	193	551			387		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)	6.5	5.5		6.5	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	100	79	100	100	100	100			56		
cM capacity (veh/h)	56	60	478	45	82	815	1015			1168		

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	217	193	193	120	510	551
Volume Left	116	0	0	0	510	0
Volume Right	101	0	0	120	0	0
cSH	96	1700	1700	1700	1168	1700
Volume to Capacity	2.27	0.11	0.11	0.07	0.44	0.32
Queue Length 95th (ft)	486	0	0	0	57	0
Control Delay (s)	676.7	0.0	0.0	0.0	10.4	0.0
Lane LOS	F				B	
Approach Delay (s)	676.7	0.0			5.0	
Approach LOS	F					

Intersection Summary			
Average Delay	85.4		
Intersection Capacity Utilization	119.1%	ICU Level of Service	H
Analysis Period (min)	15		

HCM ANALYSIS

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*I-65 NB*
Agency or Company	*CDM Smith*	From/To	*SR-840 to Saturn Parkway*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*AM*	Analysis Year	*2012*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3194*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.870*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1996*	pc/h/ln	Design LOS		
S	*62.7*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
D = v_p / S	*31.9*	pc/mi/ln	S		mph
LOS	*D*		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*I-65 NB*
Agency or Company	*CDM Smith*	From/To	*SR-840 to Saturn Parkway*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*PM*	Analysis Year	*2012*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1727*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.870*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1079*	pc/h/ln	Design LOS		
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S	*70.0*	mph	S		mph
D = v_p / S	*15.4*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*B*		Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*I-65 NB*
Agency or Company	*CDM Smith*	From/To	*SR-840 to Saturn Parkway*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*AM*	Analysis Year	*2017*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3577*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.870*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2236*	pc/h/ln	Design LOS	
S	*57.5*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*38.9*	pc/mi/ln	S	mph
LOS	*E*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*I-65 NB*
Agency or Company	*CDM Smith*	From/To	*SR-840 to Saturn Parkway*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*PM*	Analysis Year	*2017*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1934*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.870*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1209*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*70.0*	mph	S	mph
D = v_p / S	*17.3*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*I-65 SB*
Agency or Company	*CDM Smith*	From/To	*SR-840 to Saturn Parkway*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*AM*	Analysis Year	*2012*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1640*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.870*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1025*	pc/h/ln	Design LOS		
S	*70.0*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
D = v_p / S	*14.6*	pc/mi/ln	S		mph
LOS	*B*		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*I-65 SB*
Agency or Company	*CDM Smith*	From/To	*SR-840 to Saturn Parkway*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*PM*	Analysis Year	*2012*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2798*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.870*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1749*	pc/h/ln	Design LOS	
S	*66.5*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*26.3*	pc/mi/ln	S	mph
LOS	*D*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*I-65 SB*
Agency or Company	*CDM Smith*	From/To	*SR-840 to Saturn Parkway*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*AM*	Analysis Year	*2017*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1836*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.870*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1147*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*70.0*	mph	S	mph
D = v_p / S	*16.4*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*I-65 SB*
Agency or Company	*CDM Smith*	From/To	*SR-840 to Saturn Parkway*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*PM*	Analysis Year	*2017*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3134*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.870*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1959*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*63.3*	mph	S	mph
D = v_p / S	*30.9*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*SATURN PKWY EB*
Agency or Company	*CDM Smith*	From/To	*I-65 to Port Royal Rd*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*AM*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3067*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1717*	pc/h/ln	Design LOS	
S	*66.9*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*25.7*	pc/mi/ln	S	mph
LOS	*C*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*SATURN PKWY EB*
Agency or Company	*CDM Smith*	From/To	*I-65 to Port Royal Rd*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*PM*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1205*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*675*	pc/h/ln
S	*70.0*	mph
D = v_p / S	*9.6*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*I-65 NB*
Agency or Company	*CDM Smith*	From/To	*SR-840 to Saturn Parkway*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*AM*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4430*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.870*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2769*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*41.4*	mph	S	mph
D = v_p / S	*66.8*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*F*		Required Number of Lanes, N	

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*I-65 NB*
Agency or Company	*CDM Smith*	From/To	*SR-840 to Saturn Parkway*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*PM*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2395*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.870*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1497*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*69.0*	mph	S	mph
D = v_p / S	*21.7*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*I-65 SB*
Agency or Company	*CDM Smith*	From/To	*SR-840 to Saturn Parkway*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*AM*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2274*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.870*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1421*	pc/h/ln	Design LOS	
S	*69.4*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*20.5*	pc/mi/ln	S	mph
LOS	*C*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*I-65 SB*
Agency or Company	*CDM Smith*	From/To	*SR-840 to Saturn Parkway*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*PM*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3881*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.870*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2426*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*52.6*	mph	S	mph
D = v_p / S	*46.2*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*F*		Required Number of Lanes, N	

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*SATURN PKWY WB*
Agency or Company	*CDM Smith*	From/To	*I-65 to Port Royal Rd*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*AM*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*956*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*535*	pc/h/ln
S	*70.0*	mph
D = v_p / S	*7.6*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*SATURN PKWY WB*
Agency or Company	*CDM Smith*	From/To	*I-65 to Port Royal Rd*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*PM*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2587*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1448*	pc/h/ln	Design LOS	
S	*69.3*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*20.9*	pc/mi/ln	S	mph
LOS	*C*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 NB
Agency or Company	CDM Smith	Junction	Saturn Pkwy at I-65 NB
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	AM	Analysis Year	2037

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☑ Yes ☐ On	Number of Lanes, N: 2	☐ Yes ☐ On
☐ No ☑ Off	Acceleration Lane Length, L_A: 1500	☑ No ☐ Off
L_{up} = 1400 ft	Deceleration Lane Length L_D:	L_{down} = ft
V_u = 89 veh/h	Freeway Volume, V_F: 1461	V_D = veh/h
	Ramp Volume, V_R: 2969	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1461	0.92	Rolling	10	0	0.870	1.00	1826
Ramp	2969	0.92	Rolling	2	0	0.971	1.00	3324
UpStream	89	0.92	Rolling	2	0	0.971	1.00	100
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1826 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5150	Exhibit 13-8		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5150	Exhibit 13-8	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 34.7 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = 0.858 (Exibit 13-11)

S_R= 46.0 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 46.0 mph (Exhibit 13-13)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	Saturn Parkway EB
Agency or Company	CDM Smith	Junction	Saturn Pkwy at Port Royal Rd
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	AM	Analysis Year	2037

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☑ Yes ☐ On	Number of Lanes, N: 2	☐ Yes ☐ On
☐ No ☑ Off	Acceleration Lane Length, L_A: 900	☑ No ☐ Off
L_{up} = 3000 ft	Deceleration Lane Length L_D:	L_{down} = ft
V_u = 215 veh/h	Freeway Volume, V_F: 1600	V_D = veh/h
	Ramp Volume, V_R: 1467	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1600	0.92	Rolling	2	0	0.971	1.00	1791
Ramp	1467	0.92	Rolling	2	0	0.971	1.00	1642
UpStream	215	0.92	Rolling	2	0	0.971	1.00	241
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1791 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3433	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3433	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 25.9 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.361 (Exibit 13-11)

S_R= 59.9 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 59.9 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 SB
Agency or Company	CDM Smith	Junction	SR 840 at I-65 SB
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	AM	Analysis Year	2037

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Acceleration Lane Length, L_A: 750	☑ No ☐ Off
L_{up} = ft	Deceleration Lane Length L_D:	L_{down} = ft
V_u = veh/h	Freeway Volume, V_F: 1526	V_D = veh/h
	Ramp Volume, V_R: 748	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1526	0.92	Rolling	10	0	0.870	1.00	1907
Ramp	748	0.92	Rolling	2	0	0.971	1.00	837
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1907 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2744	Exhibit 13-8		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2744	Exhibit 13-8	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 21.8 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = 0.314 (Exibit 13-11)

S_R= 61.2 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 61.2 mph (Exhibit 13-13)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 NB
Agency or Company	CDM Smith	Junction	Saturn Pkwy at I-65 NB
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	PM	Analysis Year	2037

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☑ Yes ☐ On	Number of Lanes, N: 2	☐ Yes ☐ On
☐ No ☑ Off	Acceleration Lane Length, L_A: 1500	☑ No ☐ Off
L_{up} = 1400 ft	Deceleration Lane Length L_D:	L_{down} = ft
V_u = 118 veh/h	Freeway Volume, V_F: 1373	V_D = veh/h
	Ramp Volume, V_R: 1022	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1373	0.92	Rolling	10	0	0.870	1.00	1716
Ramp	1022	0.92	Rolling	2	0	0.971	1.00	1144
UpStream	118	0.92	Rolling	1	0	0.985	1.00	130
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1716 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2860	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2860	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 17.9 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.254 (Exibit 13-11)

S_R= 62.9 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 62.9 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	Saturn Parkway EB
Agency or Company	CDM Smith	Junction	Saturn Pkwy at Port Royal Rd
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	PM	Analysis Year	2037

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp

☑ Yes ☐ On

☐ No ☑ Off

L_{up} = 3000 ft

V_u = 200 veh/h

Number of Lanes, N	2
Acceleration Lane Length, L_A	900
Deceleration Lane Length L_D	
Freeway Volume, V_F	626
Ramp Volume, V_R	579
Freeway Free-Flow Speed, S_{FF}	70.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	626	0.92	Rolling	2	0	0.971	1.00	701
Ramp	579	0.92	Rolling	2	0	0.971	1.00	648
UpStream	200	0.92	Rolling	2	0	0.971	1.00	224
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 701 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1349	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1349	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 10.1 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.255 (Exibit 13-11)

S_R= 62.9 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 62.9 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 SB
Agency or Company	CDM Smith	Junction	SR 840 at I-65 SB
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	PM	Analysis Year	2037

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Acceleration Lane Length, L_A: 750	☑ No ☐ Off
L_{up} = ft	Deceleration Lane Length L_D:	L_{down} = ft
V_u = veh/h	Freeway Volume, V_F: 2825	V_D = veh/h
	Ramp Volume, V_R: 1056	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2825	0.92	Rolling	10	0	0.870	1.00	3531
Ramp	1056	0.92	Rolling	2	0	0.971	1.00	1182
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 3531 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4713	Exhibit 13-8		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4713	Exhibit 13-8	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 37.0 (pc/mi/ln)

LOS = E (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = 0.688 (Exibit 13-11)

S_R= 50.7 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 50.7 mph (Exhibit 13-13)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	Saturn Parkway EB
Agency or Company	CDM Smith	Junction	Saturn Parkway EB at I-65 SB
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	AM	Analysis Year	2037

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	1500	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	3067	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	98	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	55.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3067	0.92	Rolling	2	0	0.971	1.00	3434
Ramp	98	0.92	Rolling	2	0	0.971	1.00	110
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 3434 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3434	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	3324	Exhibit 13-8	4500	No
V_R	110	Exhibit 13-10	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3434	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 20.3 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Speed Determination

D_s = 0.438 (Exhibit 13-12)

S_R= 49.3 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 49.3 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 NB
Agency or Company	CDM Smith	Junction	I-65 NB at SR 840
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	AM	Analysis Year	2037

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Acceleration Lane Length, L_A	☑ No ☐ Off
L_{up} = ft	Deceleration Lane Length L_D: 350	L_{down} = ft
V_u = veh/h	Freeway Volume, V_F: 4430	V_D = veh/h
	Ramp Volume, V_R: 3024	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 55.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4430	0.92	Rolling	10	0	0.870	1.00	5537
Ramp	3024	0.92	Rolling	5	0	0.930	1.00	3533
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.459 using Equation (Exhibit 13-7)

V_{12} = 4453 pc/h

V_3 or V_{av34} 1084 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5537	Exhibit 13-8	7200	No
$V_{FO} = V_F - V_R$	2004	Exhibit 13-8	7200	No
V_R	3533	Exhibit 13-10	2200	Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4453	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 39.4 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Speed Determination

D_s = 0.486 (Exhibit 13-12)

S_R= 56.4 mph (Exhibit 13-12)

S_0= 76.5 mph (Exhibit 13-12)

S = 59.4 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 SB
Agency or Company	CDM Smith	Junction	I-65 SB at Saturn Parkway
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	AM	Analysis Year	2037

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	1500	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	2274	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	867	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	55.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2274	0.92	Rolling	10	0	0.870	1.00	2842
Ramp	867	0.92	Rolling	2	0	0.971	1.00	971
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 2842 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2842	Exhibit 13-8	4800	No
$V_{FO} = V_F - V_R$	1871	Exhibit 13-8	4800	No
V_R	971	Exhibit 13-10	4400	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2842	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = -11.8 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Speed Determination

D_s = 0.255 (Exhibit 13-12)

S_R= 62.8 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 62.8 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	Saturn Parkway WB
Agency or Company	CDM Smith	Junction	Saturn Parkway WB at PortRoyal
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	AM	Analysis Year	2037

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Number of Lanes, N: 2	☑ Yes ☑ On
☑ No ☐ Off	Acceleration Lane Length, L_A	☐ No ☐ Off
L_{up} = ft	Deceleration Lane Length L_D: 1500	L_{down} = 3500 ft
V_u = veh/h	Freeway Volume, V_F: 956	V_D = 312 veh/h
	Ramp Volume, V_R: 224	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	956	0.92	Rolling	2	0	0.971	1.00	1070
Ramp	224	0.92	Rolling	2	0	0.971	1.00	251
UpStream								
DownStream	312	0.90	Level	0	0	1.000	1.00	347

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 1070 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1070	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	819	Exhibit 13-8	4500	No
V_R	251	Exhibit 13-10	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1070	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = -0.0 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Speed Determination

D_s = 0.451 (Exhibit 13-12)

S_R= 49.1 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 49.1 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	Saturn Parkway EB
Agency or Company	CDM Smith	Junction	Saturn Parkway EB at I-65 SB
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	PM	Analysis Year	2037

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Acceleration Lane Length, L_A	☑ No ☐ Off
L_{up} = ft	Deceleration Lane Length L_D: 1500	L_{down} = ft
V_u = veh/h	Freeway Volume, V_F: 1205	V_D = veh/h
	Ramp Volume, V_R: 133	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1205	0.92	Rolling	2	0	0.971	1.00	1349
Ramp	133	0.92	Rolling	2	0	0.971	1.00	149
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 1349 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1349	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	1200	Exhibit 13-8	4500	No
V_R	149	Exhibit 13-10	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1349	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 2.4 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Speed Determination

D_s = 0.441 (Exhibit 13-12)

S_R= 49.3 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 49.3 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 NB
Agency or Company	CDM Smith	Junction	I-65 NB at SR 840
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	PM	Analysis Year	2037

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	350	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	2395	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	752	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	55.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2395	0.92	Rolling	10	0	0.870	1.00	2994
Ramp	752	0.92	Rolling	5	0	0.930	1.00	879
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.645 using Equation (Exhibit 13-7)

V_{12} = 2243 pc/h

V_3 or V_{av34} 751 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2994	Exhibit 13-8	7200	No
$V_{FO} = V_F - V_R$	2115	Exhibit 13-8	7200	No
V_R	879	Exhibit 13-10	2200	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2243	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 20.4 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Speed Determination

D_s = 0.247 (Exhibit 13-12)

S_R= 63.1 mph (Exhibit 13-12)

S_0= 76.8 mph (Exhibit 13-12)

S = 66.0 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 SB
Agency or Company	CDM Smith	Junction	I-65 SB at Saturn Parkway
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	PM	Analysis Year	2037

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	1500	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	3881	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	2469	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	55.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3881	0.92	Rolling	10	0	0.870	1.00	4851
Ramp	2469	0.92	Rolling	2	0	0.971	1.00	2764
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 4851 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4851	Exhibit 13-8	4800	Yes
$V_{FO} = V_F - V_R$	2087	Exhibit 13-8	4800	No
V_R	2764	Exhibit 13-10	4400	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4851	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 5.5 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Speed Determination

D_s = 0.417 (Exhibit 13-12)

S_R= 58.3 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 58.3 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	Saturn Parkway WB
Agency or Company	CDM Smith	Junction	Saturn Parkway WB at PortRoyal
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	PM	Analysis Year	2037

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☑ Yes	☑ On
☑ No	☐ Off	Deceleration Lane Length L_D	1500	☐ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	2587	L_{down} =	3500 ft
V_u =	veh/h	Ramp Volume, V_R	1302	V_D =	457 veh/h
		Freeway Free-Flow Speed, S_{FF}	55.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2587	0.92	Rolling	2	0	0.971	1.00	2896
Ramp	1302	0.92	Rolling	2	0	0.971	1.00	1458
UpStream								
DownStream	457	0.90	Level	0	0	1.000	1.00	508

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 2896 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

	Actual	Capacity		LOS F?
V_F	2896	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	1438	Exhibit 13-8	4500	No
V_R	1458	Exhibit 13-10	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2896	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 15.7 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

D_s = 0.559 (Exhibit 13-12)

S_R= 47.7 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 47.7 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*SATURN PKWY EB*
Agency or Company	*CDM Smith*	From/To	*Port Royal Rd to I-65*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*AM*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2710*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1517*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*68.8*	mph	S	mph
D = v_p / S	*22.0*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*SATURN PKWY EB*
Agency or Company	*CDM Smith*	From/To	*Port Royal Rd to I-65*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*PM*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*993*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*556*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*70.0*	mph	S	mph
D = v_p / S	*7.9*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*A*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*I-65 NB*
Agency or Company	*CDM Smith*	From/To	*Buckner Interchange to SR-840*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*AM*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5131*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.870*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*3207*	pc/h/ln
S	*23.3*	mph
D = v_p / S	*137.8*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*I-65 NB*
Agency or Company	*CDM Smith*	From/To	*Saturn Parkway to Buckner Rd*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*AM*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3982*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.870*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2489*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*50.7*	mph	S	mph
D = v_p / S	*49.1*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*F*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*I-65 NB*
Agency or Company	*CDM Smith*	From/To	*Buckner Interchange to SR-840*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*PM*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2774*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.870*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1734*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*66.7*	mph	S	mph
D = v_p / S	*26.0*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*I-65 NB*
Agency or Company	*CDM Smith*	From/To	*Saturn Parkway to Buckner Rd*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*PM*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2166*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.870*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1354*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*69.7*	mph	S	mph
D = v_p / S	*19.4*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*I-65 SB*
Agency or Company	*CDM Smith*	From/To	*SR-840 to Buckner Interchange*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*AM*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2634*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.870*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1646*	pc/h/ln	Design LOS	
S	*67.7*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*24.3*	pc/mi/ln	S	mph
LOS	*C*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*I-65 SB*
Agency or Company	*CDM Smith*	From/To	*Buckner Rd to Saturn Parkway*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*AM*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1892*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.870*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1182*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*70.0*	mph	S	mph
D = v_p / S	*16.9*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*I-65 SB*
Agency or Company	*CDM Smith*	From/To	*SR-840 to Buckner Interchange*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*PM*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4495*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.870*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2809*	pc/h/ln	Design LOS	
S	*40.0*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*70.3*	pc/mi/ln	S	mph
LOS	*F*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*I-65 SB*
Agency or Company	*CDM Smith*	From/To	*Buckner Rd to Saturn Parkway*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*PM*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3356*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.870*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2097*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*60.7*	mph	S	mph
D = v_p / S	*34.6*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*SATURN PKWY WB*
Agency or Company	*CDM Smith*	From/To	*I-65 to Port Royal Rd*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*AM*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*813*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*455*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*70.0*	mph	S	mph
D = v_p / S	*6.5*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*A*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*SATURN PKWY WB*
Agency or Company	*CDM Smith*	From/To	*I-65 to Port Royal Rd*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*PM*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2234*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1251*	pc/h/ln	Design LOS	
S	*70.0*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*17.9*	pc/mi/ln	S	mph
LOS	*B*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 NB
Agency or Company	CDM Smith	Junction	I-65 NB at new Buckner Rd Int
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	AM	Analysis Year	2037 Buckner Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp

☑ Yes ☐ On

☐ No ☑ Off

L_{up} = 2000 ft

V_u = 222 veh/h

Number of Lanes, N	2
Acceleration Lane Length, L_A	900
Deceleration Lane Length L_D	
Freeway Volume, V_F	3760
Ramp Volume, V_R	1371
Freeway Free-Flow Speed, S_{FF}	70.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3760	0.92	Rolling	2	0	0.971	1.00	4210
Ramp	1371	0.92	Rolling	2	0	0.971	1.00	1535
UpStream	222	0.92	Rolling	2	0	0.971	1.00	249
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 4210 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5745	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5745	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 43.9 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = 1.459 (Exibit 13-11)

S_R= 29.1 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 29.1 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 SB
Agency or Company	CDM Smith	Junction	I-65 SB at new Buckner Rd Int
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	AM	Analysis Year	2037 Buckner Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp

☑ Yes ☐ On

☐ No ☑ Off

L_{up} = 2000 ft

V_u = 943 veh/h

Number of Lanes, N	2
Acceleration Lane Length, L_A	900
Deceleration Lane Length L_D	
Freeway Volume, V_F	1691
Ramp Volume, V_R	201
Freeway Free-Flow Speed, S_{FF}	70.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1691	0.92	Rolling	2	0	0.971	1.00	1893
Ramp	201	0.92	Rolling	2	0	0.971	1.00	225
UpStream	943	0.92	Rolling	2	0	0.971	1.00	1056
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1893 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2118	Exhibit 13-8		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2118	Exhibit 13-8	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 16.2 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = 0.272 (Exibit 13-11)

S_R= 62.4 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 62.4 mph (Exhibit 13-13)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 NB
Agency or Company	CDM Smith	Junction	Saturn Pkwy at I-65 NB
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	AM	Analysis Year	2037 Buckner Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☑ Yes ☐ On	Number of Lanes, N: 2	☐ Yes ☐ On
☐ No ☑ Off	Acceleration Lane Length, L_A: 1500	☑ No ☐ Off
L_{up} = 1400 ft	Deceleration Lane Length L_D:	L_{down} = ft
V_u = 54 veh/h	Freeway Volume, V_F: 1332	V_D = veh/h
	Ramp Volume, V_R: 2650	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1332	0.92	Rolling	10	0	0.870	1.00	1665
Ramp	2650	0.92	Rolling	2	0	0.971	1.00	2967
UpStream	54	0.92	Rolling	2	0	0.971	1.00	60
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1665 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4632	Exhibit 13-8		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4632	Exhibit 13-8	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 30.8 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = 0.587 (Exibit 13-11)

S_R= 53.6 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 53.6 mph (Exhibit 13-13)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	Saturn Parkway EB
Agency or Company	CDM Smith	Junction	Saturn Pkwy at Port Royal Rd
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	AM	Analysis Year	2037 Buckner Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☑ Yes ☐ On	Number of Lanes, N: 2	☐ Yes ☐ On
☐ No ☑ Off	Acceleration Lane Length, L_A: 900	☑ No ☐ Off
L_{up} = 3000 ft	Deceleration Lane Length L_D:	L_{down} = ft
V_u = 251 veh/h	Freeway Volume, V_F: 1682	V_D = veh/h
	Ramp Volume, V_R: 1028	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1682	0.92	Rolling	2	0	0.971	1.00	1883
Ramp	1028	0.92	Rolling	2	0	0.971	1.00	1151
UpStream	251	0.92	Rolling	2	0	0.971	1.00	281
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1883 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3034	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3034	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 23.0 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.321 (Exibit 13-11)

S_R= 61.0 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 61.0 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 SB
Agency or Company	CDM Smith	Junction	SR 840 at I-65 SB
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	AM	Analysis Year	2037 Buckner Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Acceleration Lane Length, L_A: 750	☑ No ☐ Off
L_{up} = ft	Deceleration Lane Length L_D:	L_{down} = ft
V_u = veh/h	Freeway Volume, V_F: 1823	V_D = veh/h
	Ramp Volume, V_R: 811	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1823	0.92	Rolling	10	0	0.870	1.00	2279
Ramp	811	0.92	Rolling	2	0	0.971	1.00	908
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2279 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3187	Exhibit 13-8		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3187	Exhibit 13-8	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 25.2 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = 0.348 (Exibit 13-11)

S_R= 60.3 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 60.3 mph (Exhibit 13-13)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 NB
Agency or Company	CDM Smith	Junction	I-65 NB at new Buckner Rd Int
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	PM	Analysis Year	2037 Buckner Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp

☑ Yes ☐ On

☐ No ☑ Off

L_{up} = 2000 ft

V_u = 306 veh/h

Number of Lanes, N	2
Acceleration Lane Length, L_A	900
Deceleration Lane Length L_D	
Freeway Volume, V_F	1860
Ramp Volume, V_R	914
Freeway Free-Flow Speed, S_{FF}	70.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1860	0.92	Rolling	2	0	0.971	1.00	2082
Ramp	914	0.92	Rolling	2	0	0.971	1.00	1023
UpStream	306	0.92	Rolling	2	0	0.971	1.00	343
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2082 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3105	Exhibit 13-8		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3105	Exhibit 13-8	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 23.6 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = 0.327 (Exibit 13-11)

S_R= 60.8 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 60.8 mph (Exhibit 13-13)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 SB
Agency or Company	CDM Smith	Junction	I-65 SB at new Buckner Rd Int
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	PM	Analysis Year	2037 Buckner Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp

☑ Yes ☐ On

☐ No ☑ Off

L_{up} = 2000 ft

V_u = 1415 veh/h

Number of Lanes, N	2
Acceleration Lane Length, L_A	900
Deceleration Lane Length L_D	
Freeway Volume, V_F	3080
Ramp Volume, V_R	276
Freeway Free-Flow Speed, S_{FF}	70.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3080	0.92	Rolling	2	0	0.971	1.00	3448
Ramp	276	0.92	Rolling	2	0	0.971	1.00	309
UpStream	1415	0.92	Rolling	2	0	0.971	1.00	1584
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 3448 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3757	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3757	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 29.0 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.407 (Exibit 13-11)

S_R= 58.6 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 58.6 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 NB
Agency or Company	CDM Smith	Junction	Saturn Pkwy at I-65 NB
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	PM	Analysis Year	2037 Buckner Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☑ Yes ☐ On	Number of Lanes, N: 2	☐ Yes ☐ On
☐ No ☑ Off	Acceleration Lane Length, L_A: 1500	☑ No ☐ Off
L_{up} = 1400 ft	Deceleration Lane Length L_D:	L_{down} = ft
V_u = 72 veh/h	Freeway Volume, V_F: 1254	V_D = veh/h
	Ramp Volume, V_R: 912	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1254	0.92	Rolling	10	0	0.870	1.00	1567
Ramp	912	0.92	Rolling	2	0	0.971	1.00	1021
UpStream	72	0.92	Rolling	2	0	0.971	1.00	81
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1567 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2588	Exhibit 13-8		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2588	Exhibit 13-8	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 15.8 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = 0.238 (Exibit 13-11)

S_R= 63.3 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 63.3 mph (Exhibit 13-13)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	Saturn Parkway EB
Agency or Company	CDM Smith	Junction	Saturn Pkwy at Port Royal Rd
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	PM	Analysis Year	2037 Buckner Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☑ Yes ☐ On	Number of Lanes, N: 2	☐ Yes ☐ On
☐ No ☑ Off	Acceleration Lane Length, L_A: 900	☑ No ☐ Off
L_{up} = 3000 ft	Deceleration Lane Length L_D:	L_{down} = ft
V_u = 228 veh/h	Freeway Volume, V_F: 765	V_D = veh/h
	Ramp Volume, V_R: 405	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	765	0.92	Rolling	2	0	0.971	1.00	856
Ramp	405	0.92	Rolling	2	0	0.971	1.00	453
UpStream	228	0.92	Rolling	2	0	0.971	1.00	255
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 856 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1309	Exhibit 13-8		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1309	Exhibit 13-8	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 9.8 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = 0.254 (Exibit 13-11)

S_R= 62.9 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 62.9 mph (Exhibit 13-13)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 SB
Agency or Company	CDM Smith	Junction	SR 840 at I-65 SB
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	PM	Analysis Year	2037 Buckner Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Acceleration Lane Length, L_A: 750	☑ No ☐ Off
L_{up} = ft	Deceleration Lane Length L_D:	L_{down} = ft
V_u = veh/h	Freeway Volume, V_F: 3341	V_D = veh/h
	Ramp Volume, V_R: 1154	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3341	0.92	Rolling	10	0	0.870	1.00	4176
Ramp	1154	0.92	Rolling	2	0	0.971	1.00	1292
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 4176 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5468	Exhibit 13-8		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5468	Exhibit 13-8	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 42.8 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = 1.178 (Exibit 13-11)

S_R= 37.0 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 37.0 mph (Exhibit 13-13)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	Saturn Parkway EB
Agency or Company	CDM Smith	Junction	Saturn Parkway EB at I-65 SB
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	AM	Analysis Year	2037 Buckner Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	1500	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	2710	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	66	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	55.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2710	0.92	Rolling	2	0	0.971	1.00	3034
Ramp	66	0.92	Rolling	2	0	0.971	1.00	74
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 3034 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3034	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	2960	Exhibit 13-8	4500	No
V_R	74	Exhibit 13-10	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3034	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 16.8 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Speed Determination

D_s = 0.435 (Exhibit 13-12)

S_R= 49.3 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 49.3 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 NB
Agency or Company	CDM Smith	Junction	I-65 NB at new Buckner Rd Int
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	AM	Analysis Year	2037 Buckner Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☑ Yes	☑ On
☑ No	☐ Off	Deceleration Lane Length L_D	350	☐ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	3982	L_{down} =	2000 ft
V_u =	veh/h	Ramp Volume, V_R	222	V_D =	1371 veh/h
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3982	0.92	Rolling	10	0	0.870	1.00	4977
Ramp	222	0.92	Rolling	2	0	0.971	1.00	249
UpStream								
DownStream	1371	0.92	Rolling	2	0	0.971	1.00	1535

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 4977 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4977	Exhibit 13-8	4800	Yes
$V_{FO} = V_F - V_R$	4728	Exhibit 13-8	4800	No
V_R	249	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4977	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 43.9 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.450 (Exhibit 13-12)

S_R= 57.4 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 57.4 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 NB
Agency or Company	CDM Smith	Junction	I-65 NB at SR 840
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	AM	Analysis Year	2037 Buckner Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	350	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	5131	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	3128	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	55.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5131	0.92	Rolling	10	0	0.870	1.00	6414
Ramp	3128	0.92	Rolling	5	0	0.930	1.00	3655
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.432 using Equation (Exhibit 13-7)

V_{12} = 4846 pc/h

V_3 or V_{av34} 1568 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6414	Exhibit 13-8	7200	No
$V_{FO} = V_F - V_R$	2759	Exhibit 13-8	7200	No
V_R	3655	Exhibit 13-10	2200	Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4846	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 42.8 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Speed Determination

D_s = 0.497 (Exhibit 13-12)

S_R= 56.1 mph (Exhibit 13-12)

S_0= 74.6 mph (Exhibit 13-12)

S = 59.7 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 SB
Agency or Company	CDM Smith	Junction	I-65 SB at new Buckner Rd Int
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	AM	Analysis Year	2037 Buckner Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☑ Yes	☑ On
☑ No	☐ Off	Deceleration Lane Length L_D	350	☐ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	2634	L_{down} =	2000 ft
V_u =	veh/h	Ramp Volume, V_R	943	V_D =	201 veh/h
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2634	0.92	Rolling	10	0	0.870	1.00	3292
Ramp	943	0.92	Rolling	2	0	0.971	1.00	1056
UpStream								
DownStream	201	0.92	Rolling	2	0	0.971	1.00	225

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 3292 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3292	Exhibit 13-8	4800	No
$V_{FO} = V_F - V_R$	2236	Exhibit 13-8	4800	No
V_R	1056	Exhibit 13-10	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3292	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 29.4 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Speed Determination

D_s = 0.523 (Exhibit 13-12)

S_R= 55.4 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 55.4 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 SB
Agency or Company	CDM Smith	Junction	I-65 SB at Saturn Parkway
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	AM	Analysis Year	2037 Buckner Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	1500	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	1892	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	759	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	55.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1892	0.92	Rolling	10	0	0.870	1.00	2365
Ramp	759	0.92	Rolling	2	0	0.971	1.00	850
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 2365 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2365	Exhibit 13-8	4800	No
$V_{FO} = V_F - V_R$	1515	Exhibit 13-8	4800	No
V_R	850	Exhibit 13-10	4400	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2365	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = -15.9 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_S = 0.244 (Exhibit 13-12)

S_R= 63.2 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 63.2 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	Saturn Parkway WB
Agency or Company	CDM Smith	Junction	Saturn Parkway WB at PortRoyal
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	AM	Analysis Year	2037 Buckner Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Number of Lanes, N: 2	☑ Yes ☑ On
☑ No ☐ Off	Acceleration Lane Length, L_A	☐ No ☐ Off
L_{up} = ft	Deceleration Lane Length L_D: 1500	L_{down} = 3500 ft
V_u = veh/h	Freeway Volume, V_F: 813	V_D = 240 veh/h
	Ramp Volume, V_R: 150	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	813	0.92	Rolling	2	0	0.971	1.00	910
Ramp	150	0.92	Rolling	2	0	0.971	1.00	168
UpStream								
DownStream	240	0.90	Level	0	0	1.000	1.00	267

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 910 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

	Actual	Capacity		LOS F?
V_F	910	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	742	Exhibit 13-8	4500	No
V_R	168	Exhibit 13-10	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	910	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = -1.4 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

D_s = 0.443 (Exhibit 13-12)

S_R= 49.2 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 49.2 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	Saturn Parkway EB
Agency or Company	CDM Smith	Junction	Saturn Parkway EB at I-65 SB
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	PM	Analysis Year	2037 Buckner Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	1500	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	993	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	81	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	55.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	993	0.92	Rolling	2	0	0.971	1.00	1112
Ramp	81	0.92	Rolling	2	0	0.971	1.00	91
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 1112 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1112	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	1021	Exhibit 13-8	4500	No
V_R	91	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1112	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 0.3 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.436 (Exhibit 13-12)

S_R= 49.3 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 49.3 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 NB
Agency or Company	CDM Smith	Junction	I-65 NB at new Buckner Rd Int
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	PM	Analysis Year	2037 Buckner Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☑ Yes	☑ On
☑ No	☐ Off	Deceleration Lane Length L_D	350	☐ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	2166	L_{down} =	2000 ft
V_u =	veh/h	Ramp Volume, V_R	306	V_D =	914 veh/h
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2166	0.92	Rolling	10	0	0.870	1.00	2707
Ramp	306	0.92	Rolling	2	0	0.971	1.00	343
UpStream								
DownStream	914	0.92	Rolling	2	0	0.971	1.00	1023

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 2707 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2707	Exhibit 13-8	4800	No
$V_{FO} = V_F - V_R$	2364	Exhibit 13-8	4800	No
V_R	343	Exhibit 13-10	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2707	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 24.4 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Speed Determination

D_s = 0.459 (Exhibit 13-12)

S_R= 57.2 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 57.2 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 NB
Agency or Company	CDM Smith	Junction	I-65 NB at SR 840
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	PM	Analysis Year	2037 Buckner Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	350	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	2774	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	801	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	55.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2774	0.92	Rolling	10	0	0.870	1.00	3467
Ramp	801	0.92	Rolling	5	0	0.930	1.00	936
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.630 using Equation (Exhibit 13-7)

V_{12} = 2531 pc/h

V_3 or V_{av34} 936 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3467	Exhibit 13-8	7200	No
$V_{FO} = V_F - V_R$	2531	Exhibit 13-8	7200	No
V_R	936	Exhibit 13-10	2200	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2531	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 22.9 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Speed Determination

D_s = 0.252 (Exhibit 13-12)

S_R= 62.9 mph (Exhibit 13-12)

S_0= 76.8 mph (Exhibit 13-12)

S = 66.2 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 SB
Agency or Company	CDM Smith	Junction	I-65 SB at new Buckner Rd Int
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	PM	Analysis Year	2037 Buckner Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☑ Yes	☑ On
☑ No	☐ Off	Deceleration Lane Length L_D	350	☐ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	4495	L_{down} =	2000 ft
		Ramp Volume, V_R	1415		
		Freeway Free-Flow Speed, S_{FF}	70.0		
V_u =	veh/h	Ramp Free-Flow Speed, S_{FR}	35.0	V_D =	276 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4495	0.92	Rolling	10	0	0.870	1.00	5619
Ramp	1415	0.92	Rolling	2	0	0.971	1.00	1584
UpStream								
DownStream	276	0.92	Rolling	2	0	0.971	1.00	309

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 5619 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

	Actual	Capacity		LOS F?
V_F	5619	Exhibit 13-8	4800	Yes
$V_{FO} = V_F - V_R$	4035	Exhibit 13-8	4800	No
V_R	1584	Exhibit 13-10	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5619	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 49.4 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

D_s = 0.571 (Exhibit 13-12)

S_R= 54.0 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 54.0 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 SB
Agency or Company	CDM Smith	Junction	I-65 SB at Saturn Parkway
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	PM	Analysis Year	2037 Buckner Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	1500	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	3356	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	2162	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	55.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3356	0.92	Rolling	10	0	0.870	1.00	4195
Ramp	2162	0.92	Rolling	2	0	0.971	1.00	2420
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 4195 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4195	Exhibit 13-8	4800	No
$V_{FO} = V_F - V_R$	1775	Exhibit 13-8	4800	No
V_R	2420	Exhibit 13-10	4400	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4195	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = -0.2 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Speed Determination

D_s = 0.386 (Exhibit 13-12)

S_R= 59.2 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 59.2 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	Saturn Parkway WB
Agency or Company	CDM Smith	Junction	Saturn Parkway WB at PortRoyal
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	PM	Analysis Year	2037 Buckner Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☑ Yes	☑ On
☑ No	☐ Off	Deceleration Lane Length L_D	1500	☐ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	2234	L_{down} =	3500 ft
V_u =	veh/h	Ramp Volume, V_R	873	V_D =	305 veh/h
		Freeway Free-Flow Speed, S_{FF}	55.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2234	0.92	Rolling	2	0	0.971	1.00	2501
Ramp	873	0.92	Rolling	2	0	0.971	1.00	977
UpStream								
DownStream	305	0.90	Level	0	0	1.000	1.00	339

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 2501 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2501	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	1524	Exhibit 13-8	4500	No
V_R	977	Exhibit 13-10	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2501	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 12.3 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Speed Determination

D_s = 0.516 (Exhibit 13-12)

S_R= 48.3 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 48.3 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*SATURN PKWY EB*
Agency or Company	*CDM Smith*	From/To	*Port Royal Rd to I-65*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*AM with Thompson Sta. Int.*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2771*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1551*	pc/h/ln
S	*68.6*	mph
D = v_p / S	*22.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*SATURN PKWY EB*
Agency or Company	*CDM Smith*	From/To	*Port Royal Rd to I-65*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*PM with Thompson Sta. Int.*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1029*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*576*	pc/h/ln
S	*70.0*	mph
D = v_p / S	*8.2*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*I-65 NB*
Agency or Company	*CDM Smith*	From/To	*Thompson Interchange to SR 840*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*AM*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5290*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.870*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2204*	pc/h/ln
S	*58.3*	mph
D = v_p / S	*37.8*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*I-65 NB*
Agency or Company	*CDM Smith*	From/To	*Thompson Interchange to SR 840*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*AM*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5290*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.870*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*3306*	pc/h/ln
S	*18.6*	mph
D = v_p / S	*178.2*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*I-65 NB*
Agency or Company	*CDM Smith*	From/To	*Saturn Parkway to Thompson Rd*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*AM*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3955*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
			Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.870*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2472*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*51.2*	mph	S	mph
D = v_p / S	*48.3*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*F*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*I-65 NB*
Agency or Company	*CDM Smith*	From/To	*Thompson Interchange to SR 840*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*PM*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2860*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.870*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1787*	pc/h/ln
S	*66.0*	mph
D = v_p / S	*27.1*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*I-65 NB*
Agency or Company	*CDM Smith*	From/To	*Saturn Parkway to Thompson Rd*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*PM*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2111*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.870*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1319*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*69.8*	mph	S	mph
D = v_p / S	*18.9*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*I-65 SB*
Agency or Company	*CDM Smith*	From/To	*SR-840 to Thompson Interchange*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*AM*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2716*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.870*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1697*	pc/h/ln	Design LOS	
S	*67.1*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*25.3*	pc/mi/ln	S	mph
LOS	*C*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*I-65 SB*
Agency or Company	*CDM Smith*	From/To	*Thompson Rd to Saturn Parkway*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*AM*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1892*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.870*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1182*	pc/h/ln	Design LOS	
S	*70.0*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*16.9*	pc/mi/ln	S	mph
LOS	*B*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*I-65 SB*
Agency or Company	*CDM Smith*	From/To	*SR-840 to Thompson Interchange*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*PM*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4635*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.870*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2897*	pc/h/ln
S	*36.6*	mph
D = v_p / S	*79.2*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*I-65 SB*
Agency or Company	*CDM Smith*	From/To	*Thompson Rd to Saturn Parkway*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*PM*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3405*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.870*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2128*	pc/h/ln
S	*60.0*	mph
D = v_p / S	*35.5*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*SATURN PKWY WB*
Agency or Company	*CDM Smith*	From/To	*I-65 to Port Royal Rd*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*AM w Thompson Sta. Rd Int.*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*858*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*480*	pc/h/ln
S	*70.0*	mph
D = v_p / S	*6.9*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*KCOLE*	Highway/Direction of Travel	*SATURN PKWY WB*
Agency or Company	*CDM Smith*	From/To	*I-65 to Port Royal Rd*
Date Performed	*8/9/2012*	Jurisdiction	*TDOT Williamson County*
Analysis Time Period	*PM w Thompson Sta. Rd Int.*	Analysis Year	*2037*

Project Description *Spring Hill Interchange Justification Study*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2336*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Rolling*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*2.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1308*	pc/h/ln
S	*69.9*	mph
D = v_p / S	*18.7*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 NB
Agency or Company	CDM Smith	Junction	I-65 NB at new Thompson Statio
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	AM	Analysis Year	2037 Thompson Station Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☑ Yes ☐ On	Number of Lanes, N: 2	☐ Yes ☐ On
☐ No ☑ Off	Acceleration Lane Length, L_A: 900	☑ No ☐ Off
L_{up} = 2000 ft	Deceleration Lane Length L_D:	L_{down} = ft
V_u = 176 veh/h	Freeway Volume, V_F: 3779	V_D = veh/h
	Ramp Volume, V_R: 1511	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3779	0.92	Rolling	2	0	0.971	1.00	4231
Ramp	1511	0.92	Rolling	2	0	0.971	1.00	1692
UpStream	176	0.92	Rolling	2	0	0.971	1.00	197
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 4231 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5923	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5923	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 45.3 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = 1.697 (Exibit 13-11)

S_R= 22.5 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 22.5 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 SB
Agency or Company	CDM Smith	Junction	I-65 SB at new Thompson Statio
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	AM	Analysis Year	2037 Thompson Station Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☑ Yes ☐ On	Number of Lanes, N: 2	☐ Yes ☐ On
☐ No ☑ Off	Acceleration Lane Length, L_A: 900	☑ No ☐ Off
L_{up} = 2000 ft	Deceleration Lane Length L_D:	L_{down} = ft
V_u = 970 veh/h	Freeway Volume, V_F: 1746	V_D = veh/h
	Ramp Volume, V_R: 146	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1746	0.92	Rolling	2	0	0.971	1.00	1955
Ramp	146	0.92	Rolling	2	0	0.971	1.00	163
UpStream	970	0.92	Rolling	2	0	0.971	1.00	1086
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1955 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2118	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2118	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 16.3 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.272 (Exibit 13-11)

S_R= 62.4 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 62.4 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 NB
Agency or Company	CDM Smith	Junction	Saturn Pkwy at I-65 NB
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	AM	Analysis Year	2037 Thompson Station Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☑ Yes ☐ On	Number of Lanes, N: 2	☐ Yes ☐ On
☐ No ☑ Off	Acceleration Lane Length, L_A: 1500	☑ No ☐ Off
L_{up} = 1400 ft	Deceleration Lane Length L_D:	L_{down} = ft
V_u = 71 veh/h	Freeway Volume, V_F: 1258	V_D = veh/h
	Ramp Volume, V_R: 2697	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1258	0.92	Rolling	10	0	0.870	1.00	1572
Ramp	2697	0.92	Rolling	2	0	0.971	1.00	3019
UpStream	71	0.92	Rolling	2	0	0.971	1.00	79
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1572 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4591	Exhibit 13-8		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4591	Exhibit 13-8	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 30.5 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = 0.571 (Exibit 13-11)

S_R= 54.0 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 54.0 mph (Exhibit 13-13)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	Saturn Parkway EB
Agency or Company	CDM Smith	Junction	Saturn Pkwy at Port Royal Rd
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	AM	Analysis Year	2037 Thompson Station Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp

☑ Yes ☐ On

☐ No ☑ Off

L_{up} = 3000 ft

V_u = 255 veh/h

Number of Lanes, N	2
Acceleration Lane Length, L_A	900
Deceleration Lane Length L_D	
Freeway Volume, V_F	1577
Ramp Volume, V_R	1194
Freeway Free-Flow Speed, S_{FF}	70.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1577	0.92	Rolling	2	0	0.971	1.00	1766
Ramp	1194	0.92	Rolling	2	0	0.971	1.00	1337
UpStream	255	0.92	Rolling	2	0	0.971	1.00	285
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1766 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3103	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3103	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 23.4 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.327 (Exibit 13-11)

S_R= 60.8 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 60.8 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 SB
Agency or Company	CDM Smith	Junction	SR 840 at I-65 SB
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	AM	Analysis Year	2037 Thompson Station Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Acceleration Lane Length, L_A: 750	☑ No ☐ Off
L_{up} = ft	Deceleration Lane Length L_D:	L_{down} = ft
V_u = veh/h	Freeway Volume, V_F: 1875	V_D = veh/h
	Ramp Volume, V_R: 841	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1875	0.92	Rolling	10	0	0.870	1.00	2344
Ramp	841	0.92	Rolling	2	0	0.971	1.00	942
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2344 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3286	Exhibit 13-8		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3286	Exhibit 13-8	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 26.0 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = 0.358 (Exibit 13-11)

S_R= 60.0 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 60.0 mph (Exhibit 13-13)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 NB
Agency or Company	CDM Smith	Junction	I-65 NB at new Thompson Statio
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	PM	Analysis Year	2037 Thompson Station Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☑ Yes ☐ On	Number of Lanes, N: 2	☐ Yes ☐ On
☐ No ☑ Off	Acceleration Lane Length, L_A: 900	☑ No ☐ Off
L_{up} = 2000 ft	Deceleration Lane Length L_D:	L_{down} = ft
V_u = 245 veh/h	Freeway Volume, V_F: 1866	V_D = veh/h
	Ramp Volume, V_R: 994	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1866	0.92	Rolling	2	0	0.971	1.00	2089
Ramp	994	0.92	Rolling	2	0	0.971	1.00	1113
UpStream	245	0.92	Rolling	2	0	0.971	1.00	274
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2089 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3202	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3202	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 24.3 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.336 (Exibit 13-11)

S_R= 60.6 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 60.6 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 SB
Agency or Company	CDM Smith	Junction	I-65 SB at new Thompson Statio
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	PM	Analysis Year	2037 Thompson Station Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☑ Yes ☐ On	Number of Lanes, N: 2	☐ Yes ☐ On
☐ No ☑ Off	Acceleration Lane Length, L_A: 900	☑ No ☐ Off
L_{up} = 2000 ft	Deceleration Lane Length L_D:	L_{down} = ft
V_u = 1454 veh/h	Freeway Volume, V_F: 3181	V_D = veh/h
	Ramp Volume, V_R: 224	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3181	0.92	Rolling	2	0	0.971	1.00	3561
Ramp	224	0.92	Rolling	2	0	0.971	1.00	251
UpStream	1454	0.92	Rolling	2	0	0.971	1.00	1628
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 3561 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3812	Exhibit 13-8		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3812	Exhibit 13-8	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 29.5 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = 0.416 (Exibit 13-11)

S_R= 58.3 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 58.3 mph (Exhibit 13-13)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 NB
Agency or Company	CDM Smith	Junction	Saturn Pkwy at I-65 NB
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	PM	Analysis Year	2037 Thompson Station Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☑ Yes ☐ On	Number of Lanes, N: 2	☐ Yes ☐ On
☐ No ☑ Off	Acceleration Lane Length, L_A: 1500	☑ No ☐ Off
L_{up} = 1400 ft	Deceleration Lane Length L_D:	L_{down} = ft
V_u = 95 veh/h	Freeway Volume, V_F: 1183	V_D = veh/h
	Ramp Volume, V_R: 928	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1183	0.92	Rolling	10	0	0.870	1.00	1479
Ramp	928	0.92	Rolling	2	0	0.971	1.00	1039
UpStream	95	0.92	Rolling	2	0	0.971	1.00	106
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1479 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2518	Exhibit 13-8		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2518	Exhibit 13-8	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 15.2 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = 0.234 (Exibit 13-11)

S_R= 63.4 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 63.4 mph (Exhibit 13-13)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	Saturn Parkway EB
Agency or Company	CDM Smith	Junction	Saturn Pkwy at Port Royal Rd
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	PM	Analysis Year	2037 Thompson Station Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☑ Yes ☐ On	Number of Lanes, N: 2	☐ Yes ☐ On
☐ No ☑ Off	Acceleration Lane Length, L_A: 900	☑ No ☐ Off
L_{up} = 3000 ft	Deceleration Lane Length L_D:	L_{down} = ft
V_u = 232 veh/h	Freeway Volume, V_F: 529	V_D = veh/h
	Ramp Volume, V_R: 500	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	529	0.92	Rolling	2	0	0.971	1.00	592
Ramp	500	0.92	Rolling	2	0	0.971	1.00	560
UpStream	232	0.92	Rolling	2	0	0.971	1.00	260
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 592 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1152	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1152	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 8.6 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = 0.252 (Exibit 13-11)

S_R= 62.9 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 62.9 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 SB
Agency or Company	CDM Smith	Junction	SR 840 at I-65 SB
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	PM	Analysis Year	2037 Thompson Station Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Acceleration Lane Length, L_A: 750	☑ No ☐ Off
L_{up} = ft	Deceleration Lane Length L_D:	L_{down} = ft
V_u = veh/h	Freeway Volume, V_F: 3334	V_D = veh/h
	Ramp Volume, V_R: 1301	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3334	0.92	Rolling	10	0	0.870	1.00	4167
Ramp	1301	0.92	Rolling	2	0	0.971	1.00	1457
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 4167 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5624	Exhibit 13-8		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5624	Exhibit 13-8	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 44.0 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = 1.334 (Exibit 13-11)

S_R= 32.7 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 32.7 mph (Exhibit 13-13)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	Saturn Parkway EB
Agency or Company	CDM Smith	Junction	Saturn Parkway EB at I-65 SB
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	AM	Analysis Year	2037 Thompson Station Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	1500	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	2771	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	74	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	55.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2771	0.92	Rolling	2	0	0.971	1.00	3102
Ramp	74	0.92	Rolling	2	0	0.971	1.00	83
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 3102 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3102	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	3019	Exhibit 13-8	4500	No
V_R	83	Exhibit 13-10	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3102	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 17.4 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Speed Determination

D_s = 0.435 (Exhibit 13-12)

S_R= 49.3 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 49.3 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 NB
Agency or Company	CDM Smith	Junction	I-65 NB at SR 840
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	AM	Analysis Year	2037 Thompson Station Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	350	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	5290	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	3725	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	55.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5290	0.92	Rolling	10	0	0.870	1.00	6612
Ramp	3725	0.92	Rolling	5	0	0.930	1.00	4353
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.394 using Equation (Exhibit 13-7)

V_{12} = 5244 pc/h

V_3 or V_{av34} 1368 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6612	Exhibit 13-8	7200	No
$V_{FO} = V_F - V_R$	2259	Exhibit 13-8	7200	No
V_R	4353	Exhibit 13-10	2200	Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5244	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 46.2 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Speed Determination

D_s = 0.560 (Exhibit 13-12)

S_R= 54.3 mph (Exhibit 13-12)

S_0= 75.4 mph (Exhibit 13-12)

S = 57.7 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 NB
Agency or Company	CDM Smith	Junction	I-65 NB at new Thompson Statio
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	AM	Analysis Year	2037 Thompson Station Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☑ Yes	☑ On
☑ No	☐ Off	Deceleration Lane Length L_D	350	☐ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	3955	L_{down} =	2000 ft
V_u =	veh/h	Ramp Volume, V_R	176	V_D =	1511 veh/h
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3955	0.92	Rolling	10	0	0.870	1.00	4944
Ramp	176	0.92	Rolling	2	0	0.971	1.00	197
UpStream								
DownStream	1511	0.92	Rolling	2	0	0.971	1.00	1692

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 4944 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4944	Exhibit 13-8	4800	Yes
$V_{FO} = V_F - V_R$	4747	Exhibit 13-8	4800	No
V_R	197	Exhibit 13-10	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4944	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 43.6 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Speed Determination

D_s = 0.446 (Exhibit 13-12)

S_R= 57.5 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 57.5 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 SB
Agency or Company	CDM Smith	Junction	I-65 SB at new Thompson Statio
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	AM	Analysis Year	2037 Thompson Station Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Number of Lanes, N: 2	☑ Yes ☑ On
☑ No ☐ Off	Acceleration Lane Length, L_A	☐ No ☐ Off
L_{up} = ft	Deceleration Lane Length L_D: 350	L_{down} = 2000 ft
V_u = veh/h	Freeway Volume, V_F: 2716	V_D = 146 veh/h
	Ramp Volume, V_R: 970	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2716	0.92	Rolling	10	0	0.870	1.00	3395
Ramp	970	0.92	Rolling	2	0	0.971	1.00	1086
UpStream								
DownStream	146	0.92	Rolling	2	0	0.971	1.00	163

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 3395 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

	Actual	Capacity		LOS F?
V_F	3395	Exhibit 13-8	4800	No
$V_{FO} = V_F - V_R$	2309	Exhibit 13-8	4800	No
V_R	1086	Exhibit 13-10	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3395	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 30.3 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

D_S = 0.526 (Exhibit 13-12)

S_R= 55.3 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 55.3 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 SB
Agency or Company	CDM Smith	Junction	I-65 SB at Saturn Parkway
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	AM	Analysis Year	2037 Thompson Station Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Acceleration Lane Length, L_A	☑ No ☐ Off
L_{up} = ft	Deceleration Lane Length L_D: 1500	L_{down} = ft
V_u = veh/h	Freeway Volume, V_F: 1892	V_D = veh/h
	Ramp Volume, V_R: 787	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 55.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1892	0.92	Rolling	10	0	0.870	1.00	2365
Ramp	787	0.92	Rolling	2	0	0.971	1.00	881
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 2365 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2365	Exhibit 13-8	4800	No
$V_{FO} = V_F - V_R$	1484	Exhibit 13-8	4800	No
V_R	881	Exhibit 13-10	4400	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2365	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = -15.9 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Speed Determination

D_s = 0.247 (Exhibit 13-12)

S_R= 63.1 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 63.1 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	Saturn Parkway WB
Agency or Company	CDM Smith	Junction	Saturn Parkway WB at PortRoyal
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	AM	Analysis Year	2037 Thompson Station Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Number of Lanes, N: 2	☑ Yes ☑ On
☑ No ☐ Off	Acceleration Lane Length, L_A	☐ No ☐ Off
L_{up} = ft	Deceleration Lane Length L_D: 1500	L_{down} = 3500 ft
V_u = veh/h	Freeway Volume, V_F: 858	V_D = 263 veh/h
	Ramp Volume, V_R: 216	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	858	0.92	Rolling	2	0	0.971	1.00	961
Ramp	216	0.92	Rolling	2	0	0.971	1.00	242
UpStream								
DownStream	263	0.90	Level	0	0	1.000	1.00	292

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 961 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	961	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	719	Exhibit 13-8	4500	No
V_R	242	Exhibit 13-10	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	961	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = -1.0 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Speed Determination

D_s = 0.450 (Exhibit 13-12)

S_R= 49.2 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 49.2 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	Saturn Parkway EB
Agency or Company	CDM Smith	Junction	Saturn Parkway EB at I-65 SB
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	PM	Analysis Year	2037 Thompson Station Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	1500	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	1029	L_{down} =	ft
		Ramp Volume, V_R	101		
V_u =	veh/h	Freeway Free-Flow Speed, S_{FF}	55.0	V_D =	veh/h
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1029	0.92	Rolling	2	0	0.971	1.00	1152
Ramp	101	0.92	Rolling	2	0	0.971	1.00	113
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 1152 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1152	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	1039	Exhibit 13-8	4500	No
V_R	113	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1152	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 0.7 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_S = 0.438 (Exhibit 13-12)

S_R= 49.3 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 49.3 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 NB
Agency or Company	CDM Smith	Junction	I-65 NB at SR 840
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	PM	Analysis Year	2037 Thompson Station Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	350	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	2860	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	1069	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	55.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2860	0.92	Rolling	10	0	0.870	1.00	3575
Ramp	1069	0.92	Rolling	5	0	0.930	1.00	1249
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.613 using Equation (Exhibit 13-7)

V_{12} = 2675 pc/h

V_3 or V_{av34} 900 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3575	Exhibit 13-8	7200	No
$V_{FO} = V_F - V_R$	2326	Exhibit 13-8	7200	No
V_R	1249	Exhibit 13-10	2200	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2675	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 24.1 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.280 (Exhibit 13-12)

S_R= 62.1 mph (Exhibit 13-12)

S_0= 76.8 mph (Exhibit 13-12)

S = 65.3 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 NB
Agency or Company	CDM Smith	Junction	I-65 NB at new Thompson Statio
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	PM	Analysis Year	2037 Thompson Station Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Number of Lanes, N: 2	☑ Yes ☑ On
☑ No ☐ Off	Acceleration Lane Length, L_A	☐ No ☐ Off
L_{up} = ft	Deceleration Lane Length L_D: 350	L_{down} = 2000 ft
V_u = veh/h	Freeway Volume, V_F: 2111	V_D = 994 veh/h
	Ramp Volume, V_R: 245	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2111	0.92	Rolling	10	0	0.870	1.00	2639
Ramp	245	0.92	Rolling	2	0	0.971	1.00	274
UpStream								
DownStream	994	0.92	Rolling	2	0	0.971	1.00	1113

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 2639 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2639	Exhibit 13-8	4800	No
$V_{FO} = V_F - V_R$	2365	Exhibit 13-8	4800	No
V_R	274	Exhibit 13-10	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2639	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 23.8 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Speed Determination

D_s = 0.453 (Exhibit 13-12)

S_R= 57.3 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 57.3 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 SB
Agency or Company	CDM Smith	Junction	I-65 SB at new Thompson Statio
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	PM	Analysis Year	2037 Thompson Station Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Number of Lanes, N: 2	☑ Yes ☑ On
☑ No ☐ Off	Acceleration Lane Length, L_A	☐ No ☐ Off
L_{up} = ft	Deceleration Lane Length L_D: 350	L_{down} = 2000 ft
V_u = veh/h	Freeway Volume, V_F: 4635	V_D = 224 veh/h
	Ramp Volume, V_R: 1454	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4635	0.92	Rolling	10	0	0.870	1.00	5794
Ramp	1454	0.92	Rolling	2	0	0.971	1.00	1628
UpStream								
DownStream	224	0.92	Rolling	2	0	0.971	1.00	251

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 5794 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5794	Exhibit 13-8	4800	Yes
$V_{FO} = V_F - V_R$	4166	Exhibit 13-8	4800	No
V_R	1628	Exhibit 13-10	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5794	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 50.9 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Speed Determination

D_s = 0.575 (Exhibit 13-12)

S_R= 53.9 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 53.9 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	I-65 SB
Agency or Company	CDM Smith	Junction	I-65 SB at Saturn Parkway
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	PM	Analysis Year	2037 Thompson Station Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	1500	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	3405	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	2241	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	55.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3405	0.92	Rolling	10	0	0.870	1.00	4256
Ramp	2241	0.92	Rolling	2	0	0.971	1.00	2509
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 4256 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4256	Exhibit 13-8	4800	No
$V_{FO} = V_F - V_R$	1747	Exhibit 13-8	4800	No
V_R	2509	Exhibit 13-10	4400	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4256	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 0.4 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.394 (Exhibit 13-12)

S_R= 59.0 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 59.0 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	KCOLE	Freeway/Dir of Travel	Saturn Parkway WB
Agency or Company	CDM Smith	Junction	Saturn Parkway WB at PortRoyal
Date Performed	8/9/2012	Jurisdiction	TDOT Williamson County
Analysis Time Period	PM	Analysis Year	2037 Thompson Station Int

Project Description Spring Hill Interchange Justification Study

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Number of Lanes, N: 2	☑ Yes ☑ On
☑ No ☐ Off	Acceleration Lane Length, L_A	☐ No ☐ Off
L_{up} = ft	Deceleration Lane Length L_D: 1500	L_{down} = 3500 ft
V_u = veh/h	Freeway Volume, V_F: 2336	V_D = 350 veh/h
	Ramp Volume, V_R: 1275	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2336	0.92	Rolling	2	0	0.971	1.00	2615
Ramp	1275	0.92	Rolling	2	0	0.971	1.00	1427
UpStream								
DownStream	350	0.90	Level	0	0	1.000	1.00	389

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 2615 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

	Actual	Capacity		LOS F?
V_F	2615	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	1188	Exhibit 13-8	4500	No
V_R	1427	Exhibit 13-10	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2615	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 13.2 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

D_s = 0.556 (Exhibit 13-12)

S_R= 47.8 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 47.8 mph (Exhibit 13-13)

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INTERSECTION TURNING MOVEMENT COUNTS

CDM SMITH Inc.
1100 MARION STREET, SUITE 200
KNOXVILLE, TN 37921
865-963-4300

File Name : Site 1
Site Code : 00000001
Start Date : 2/7/2012
Page No : 1

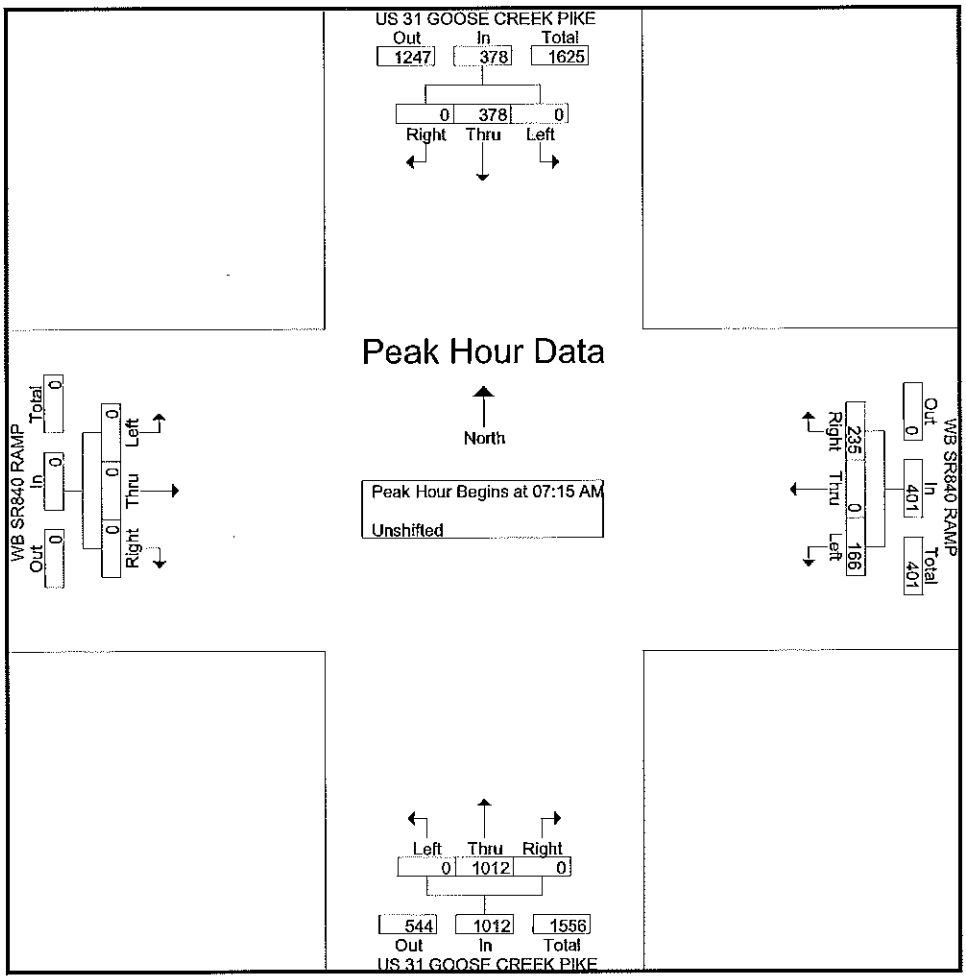
Groups Printed- Unshifted

	US 31 GOOSE CREEK PIKE Southbound				WB SR840 RAMP Westbound				US 31 GOOSE CREEK PIKE Northbound				WB SR840 RAMP Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
07:15 AM	0	138	0	138	38	0	74	112	0	327	0	327	0	0	0	0	577
07:30 AM	0	73	0	73	54	0	70	124	0	272	0	272	0	0	0	0	469
07:45 AM	0	82	0	82	35	0	57	92	0	214	0	214	0	0	0	0	388
Total	0	293	0	293	127	0	201	328	0	813	0	813	0	0	0	0	1434
08:00 AM	0	85	0	85	39	0	34	73	0	199	0	199	0	0	0	0	357
08:15 AM	0	74	0	74	31	0	29	60	0	209	0	209	0	0	0	0	343
08:30 AM	0	71	0	71	31	0	45	76	0	201	0	201	0	0	0	0	348
08:45 AM	0	81	0	81	32	0	26	58	0	182	0	182	0	0	0	0	321
Total	0	311	0	311	133	0	134	267	0	791	0	791	0	0	0	0	1369
*** BREAK ***																	
11:00 AM	0	95	0	95	32	0	15	47	0	79	0	79	0	0	0	0	221
11:15 AM	0	77	0	77	34	0	14	48	0	88	0	88	0	0	0	0	213
11:30 AM	0	88	0	88	32	0	16	48	0	82	0	82	0	0	0	0	218
11:45 AM	0	82	0	82	49	0	11	60	0	103	0	103	0	0	0	0	245
Total	0	342	0	342	147	0	56	203	0	352	0	352	0	0	0	0	897
12:00 PM	0	81	0	81	29	0	12	41	0	70	0	70	0	0	0	0	192
12:15 PM	0	75	0	75	38	0	15	53	0	72	0	72	0	0	0	0	200
12:30 PM	0	107	0	107	43	0	16	59	0	82	0	82	0	0	0	0	248
12:45 PM	0	84	0	84	42	0	10	52	0	92	0	92	0	0	0	0	228
Total	0	347	0	347	152	0	53	205	0	316	0	316	0	0	0	0	868
*** BREAK ***																	
02:00 PM	0	95	0	95	62	0	19	81	0	81	0	81	0	0	0	0	257
02:15 PM	0	141	0	141	72	0	8	80	0	106	0	106	0	0	0	0	327
02:30 PM	0	211	0	211	62	0	20	82	0	110	0	110	0	0	0	0	403
02:45 PM	0	278	0	278	64	0	17	81	0	103	0	103	0	0	0	0	462
Total	0	725	0	725	260	0	64	324	0	400	0	400	0	0	0	0	1449
03:00 PM	0	194	0	194	86	0	21	107	0	96	0	96	0	0	0	0	397
03:15 PM	0	195	0	195	86	0	26	112	0	75	0	75	0	0	0	0	382
03:30 PM	0	159	0	159	88	0	20	108	0	95	0	95	0	0	0	0	362
03:45 PM	0	254	0	254	71	0	23	94	0	100	0	100	0	0	0	0	448
Total	0	802	0	802	331	0	90	421	0	366	0	366	0	0	0	0	1589
04:00 PM	0	199	0	199	83	0	26	109	0	93	0	93	0	0	0	0	401
04:15 PM	0	230	0	230	98	0	17	115	0	95	0	95	0	0	0	0	440
04:30 PM	0	197	0	197	116	0	26	142	0	104	0	104	0	0	0	0	443
04:45 PM	0	234	0	234	90	0	24	114	0	95	0	95	0	0	0	0	443
Total	0	860	0	860	387	0	93	480	0	387	0	387	0	0	0	0	1727
05:00 PM	0	260	0	260	113	0	30	143	0	78	0	78	0	0	0	0	481
05:15 PM	0	223	0	223	91	0	27	118	0	94	0	94	0	0	0	0	435
05:30 PM	0	224	0	224	128	0	23	151	0	83	0	83	0	0	0	0	458
05:45 PM	0	177	0	177	109	1	20	130	0	96	0	96	0	0	0	0	403
Total	0	884	0	884	441	1	100	542	0	351	0	351	0	0	0	0	1777
Grand Total	0	4564	0	4564	1978	1	791	2770	0	3776	0	3776	0	0	0	0	11110
Apprch %	0	100	0		71.4	0	28.6		0	100	0		0	0	0		
Total %	0	41.1	0	41.1	17.8	0	7.1	24.9	0	34	0	34	0	0	0	0	

CDM SMITH Inc.
1100 MARION STREET, SUITE 200
KNOXVILLE, TN 37921
865-963-4300

File Name : Site 1
Site Code : 00000001
Start Date : 2/7/2012
Page No : 2

	US 31 GOOSE CREEK PIKE Southbound				WB SR840 RAMP Westbound				US 31 GOOSE CREEK PIKE Northbound				WB SR840 RAMP Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:15 AM to 09:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15 AM																	
07:15 AM	0	**138**	0	**138**	38	0	74	112	0	**327**	0	**327**	0	0	0	0	**577**
07:30 AM	0	73	0	73	**54**	0	70	**124**	0	272	0	272	0	0	0	0	469
07:45 AM	0	82	0	82	35	0	57	92	0	214	0	214	0	0	0	0	388
08:00 AM	0	85	0	85	39	0	34	73	0	199	0	199	0	0	0	0	357
Total Volume	0	378	0	378	166	0	235	401	0	1012	0	1012	0	0	0	0	1791
% App. Total	0	100	0		41.4	0	58.6		0	100	0		0	0	0		
PHF	.000	.685	.000	.685	.769	.000	.794	.808	.000	.774	.000	.774	.000	.000	.000	.000	.776



CDM SMITH Inc.
1100 MARION STREET, SUITE 200
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865-963-4300

File Name : Site 1
Site Code : 00000001
Start Date : 2/7/2012
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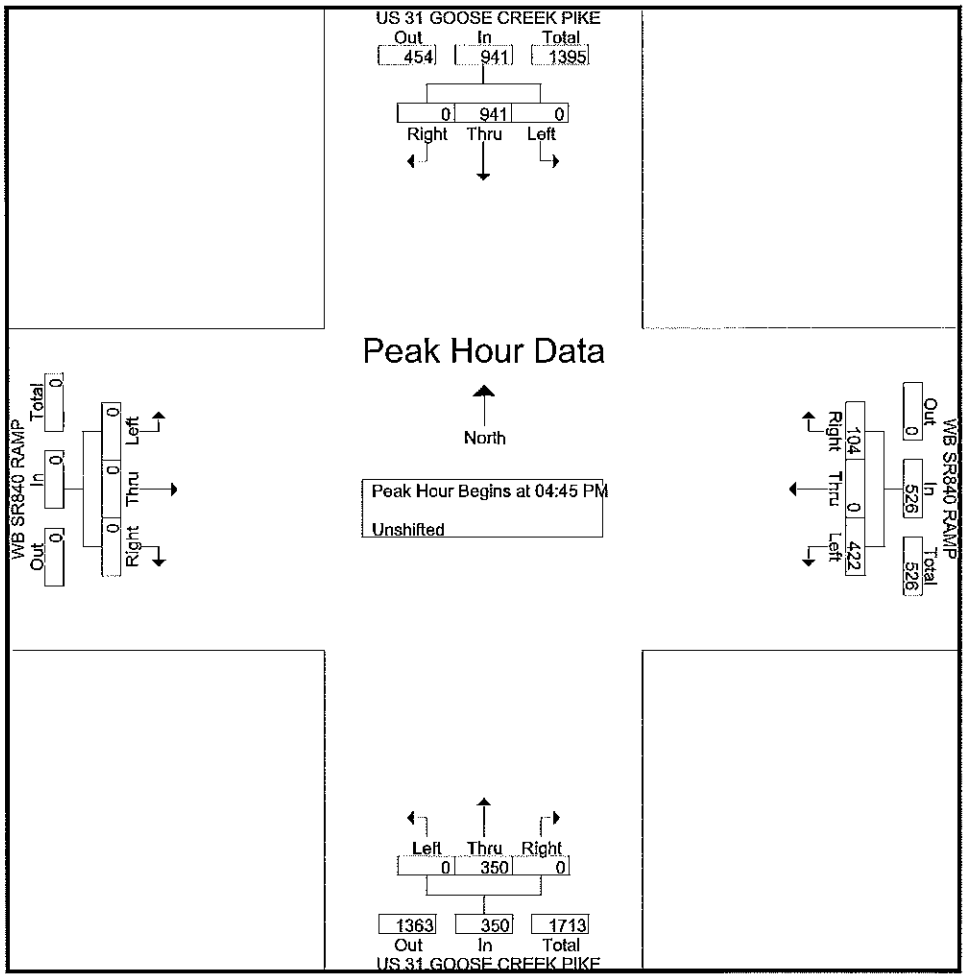
	US 31 GOOSE CREEK PIKE Southbound				WB SR840 RAMP Westbound				US 31 GOOSE CREEK PIKE Northbound				WB SR840 RAMP Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	0	234	0	234	90	0	24	114	0	**95**	0	**95**	0	0	0	0	443
05:00 PM	0	**260**	0	**260**	113	0	**30**	143	0	78	0	78	0	0	0	0	**481**
05:15 PM	0	223	0	223	91	0	27	118	0	94	0	94	0	0	0	0	435
05:30 PM	0	224	0	224	**128**	0	23	**151**	0	83	0	83	0	0	0	0	458
Total Volume	0	941	0	941	422	0	104	526	0	350	0	350	0	0	0	0	1817
% App. Total	0	100	0		80.2	0	19.8		0	100	0		0	0	0		
PHF	.000	.905	.000	.905	.824	.000	.867	.871	.000	.921	.000	.921	.000	.000	.000	.000	.944



CDM SMITH Inc.
1100 MARION STREET, SUITE 200
KNOXVILLE, TN 37921
865-963-4300

File Name : Site 2
Site Code : 00000002
Start Date : 2/7/2012
Page No : 1

Groups Printed- Unshifted

	US 31 GOOSE CRK PIKE Southbound				EB SR840 RAMP Westbound				US 31 GOOSE CRK PIKE Northbound				EB SR840 RAMP Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
07:15 AM	35	143	0	178	0	0	0	0	0	305	55	360	0	0	0	0	538
07:30 AM	19	115	0	134	0	0	0	0	0	279	63	342	0	0	0	0	476
07:45 AM	14	95	0	109	0	0	0	0	0	213	67	280	0	0	0	0	389
Total	68	353	0	421	0	0	0	0	0	797	185	982	0	0	0	0	1403
08:00 AM	11	110	0	121	0	0	0	0	0	203	68	271	0	0	0	0	392
08:15 AM	18	92	0	110	0	0	0	0	0	198	76	274	0	0	0	0	384
08:30 AM	15	87	0	102	0	0	0	0	0	215	72	287	0	0	0	0	389
08:45 AM	12	101	0	113	0	0	0	0	0	180	70	250	0	0	0	0	363
Total	56	390	0	446	0	0	0	0	0	796	286	1082	0	0	0	0	1528
*** BREAK ***																	
03:00 PM	22	253	0	275	0	0	0	0	3	89	49	141	0	0	0	0	416
03:15 PM	36	211	0	247	0	0	0	0	18	60	29	107	0	0	0	0	354
03:30 PM	20	159	0	179	0	0	0	0	1	65	37	103	0	0	0	0	282
03:45 PM	22	120	0	142	0	0	0	0	0	25	18	43	0	0	0	0	185
Total	100	743	0	843	0	0	0	0	22	239	133	394	0	0	0	0	1237
04:00 PM	24	181	0	205	0	0	0	0	0	80	51	131	0	0	0	0	336
04:15 PM	31	262	0	293	0	0	0	0	0	70	50	120	0	0	0	0	413
04:30 PM	21	137	0	158	0	0	0	0	0	51	27	78	0	0	0	0	236
04:45 PM	23	123	0	146	0	0	0	0	0	29	32	61	0	0	0	0	207
Total	99	703	0	802	0	0	0	0	0	230	160	390	0	0	0	0	1192
05:00 PM	42	187	0	229	0	0	0	0	0	44	28	72	0	0	0	0	301
05:15 PM	24	171	0	195	0	0	0	0	12	47	23	82	0	0	0	0	277
05:30 PM	38	276	0	314	0	0	0	0	0	101	49	150	0	0	0	0	464
05:45 PM	33	243	0	276	0	0	0	0	0	114	52	166	0	0	0	0	442
Total	137	877	0	1014	0	0	0	0	12	306	152	470	0	0	0	0	1484
Grand Total	460	3066	0	3526	0	0	0	0	34	2368	916	3318	0	0	0	0	6844
Apprch %	13	87	0		0	0	0		1	71.4	27.6		0	0	0		
Total %	6.7	44.8	0	51.5	0	0	0	0	0.5	34.6	13.4	48.5	0	0	0	0	

CDM SMITH Inc.
1100 MARION STREET, SUITE 200
KNOXVILLE, TN 37921
865-963-4300

File Name : Site 2
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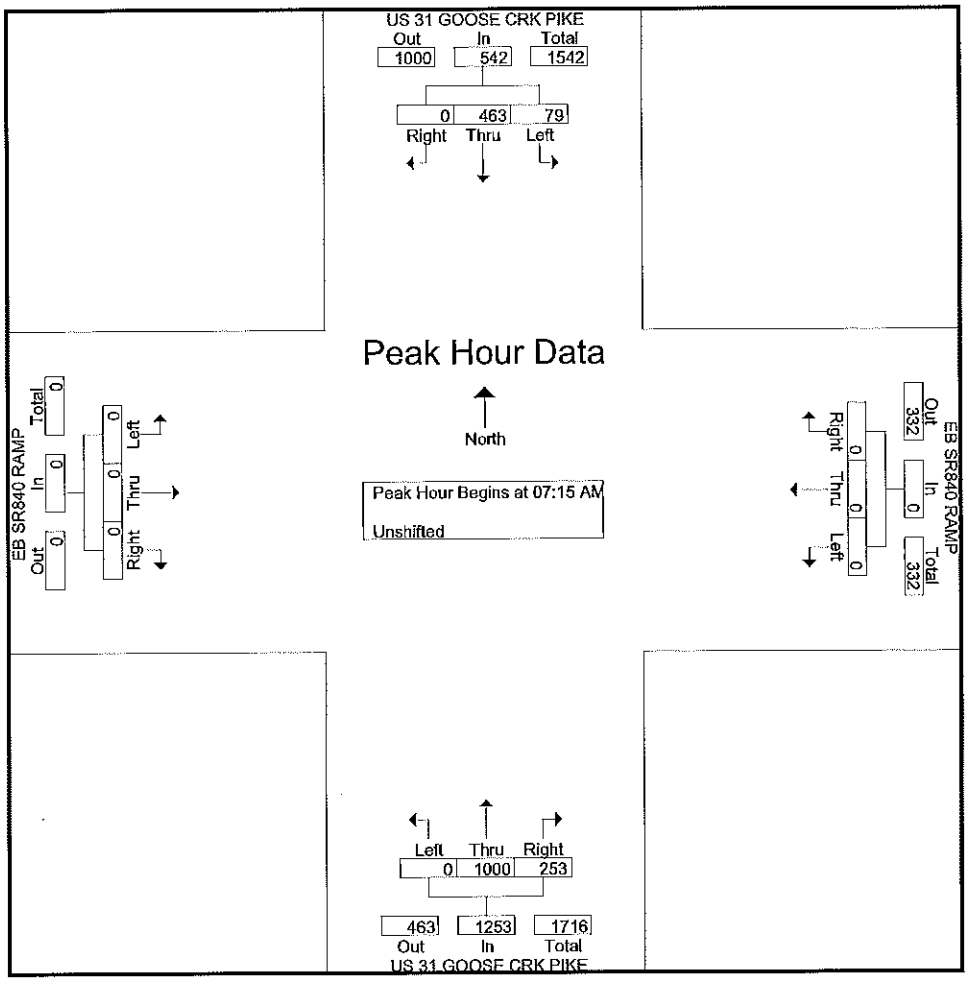
	US 31 GOOSE CRK PIKE Southbound				EB SR840 RAMP Westbound				US 31 GOOSE CRK PIKE Northbound				EB SR840 RAMP Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:15 AM to 09:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15 AM																	
07:15 AM	35	143	0	178	0	0	0	0	0	305	55	360	0	0	0	0	538
07:30 AM	19	115	0	134	0	0	0	0	0	279	63	342	0	0	0	0	476
07:45 AM	14	95	0	109	0	0	0	0	0	213	67	280	0	0	0	0	389
08:00 AM	11	110	0	121	0	0	0	0	0	203	68	271	0	0	0	0	392
Total Volume	79	463	0	542	0	0	0	0	0	1000	253	1253	0	0	0	0	1795
% App. Total	14.6	85.4	0		0	0	0		0	79.8	20.2		0	0	0		
PHF	.564	.809	.000	.761	.000	.000	.000	.000	.000	.820	.930	.870	.000	.000	.000	.000	.834



CDM SMITH Inc.
1100 MARION STREET, SUITE 200
KNOXVILLE, TN 37921
865-963-4300

File Name : Site 2
Site Code : 00000002
Start Date : 2/7/2012
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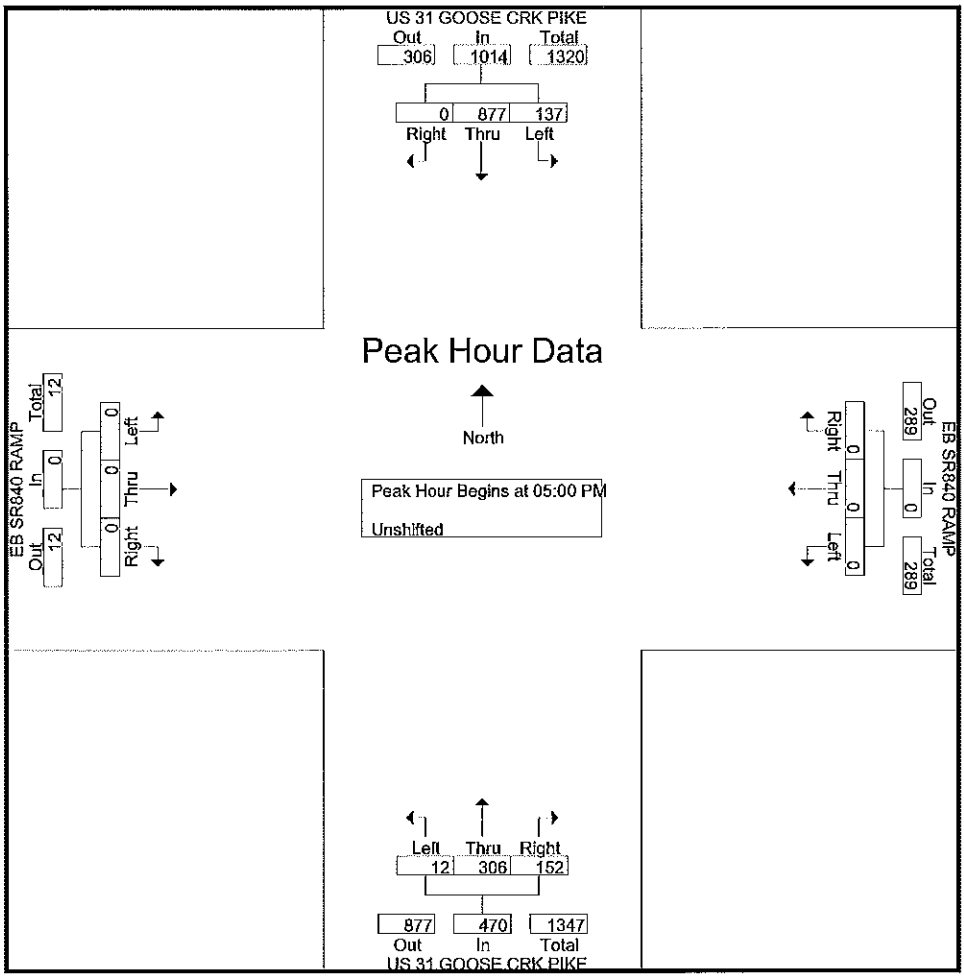
	US 31 GOOSE CRK PIKE Southbound				EB SR840 RAMP Westbound				US 31 GOOSE CRK PIKE Northbound				EB SR840 RAMP Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	**42**	187	0	229	0	0	0	0	0	44	28	72	0	0	0	0	301
05:15 PM	24	171	0	195	0	0	0	0	**12**	47	23	82	0	0	0	0	277
05:30 PM	38	**276**	0	**314**	0	0	0	0	0	101	49	150	0	0	0	0	**464**
05:45 PM	33	243	0	276	0	0	0	0	0	**114**	**52**	**166**	0	0	0	0	442
Total Volume	137	877	0	1014	0	0	0	0	12	306	152	470	0	0	0	0	1484
% App. Total	13.5	86.5	0		0	0	0		2.6	65.1	32.3		0	0	0		
PHF	.815	.794	.000	.807	.000	.000	.000	.000	.250	.671	.731	.708	.000	.000	.000	.000	.800



CDM SMITH Inc.
1100 MARION STREET, SUITE 200
KNOXVILLE, TN 37921
865-963-4300

File Name : Site 3
Site Code : 00000003
Start Date : 2/8/2012
Page No : 1

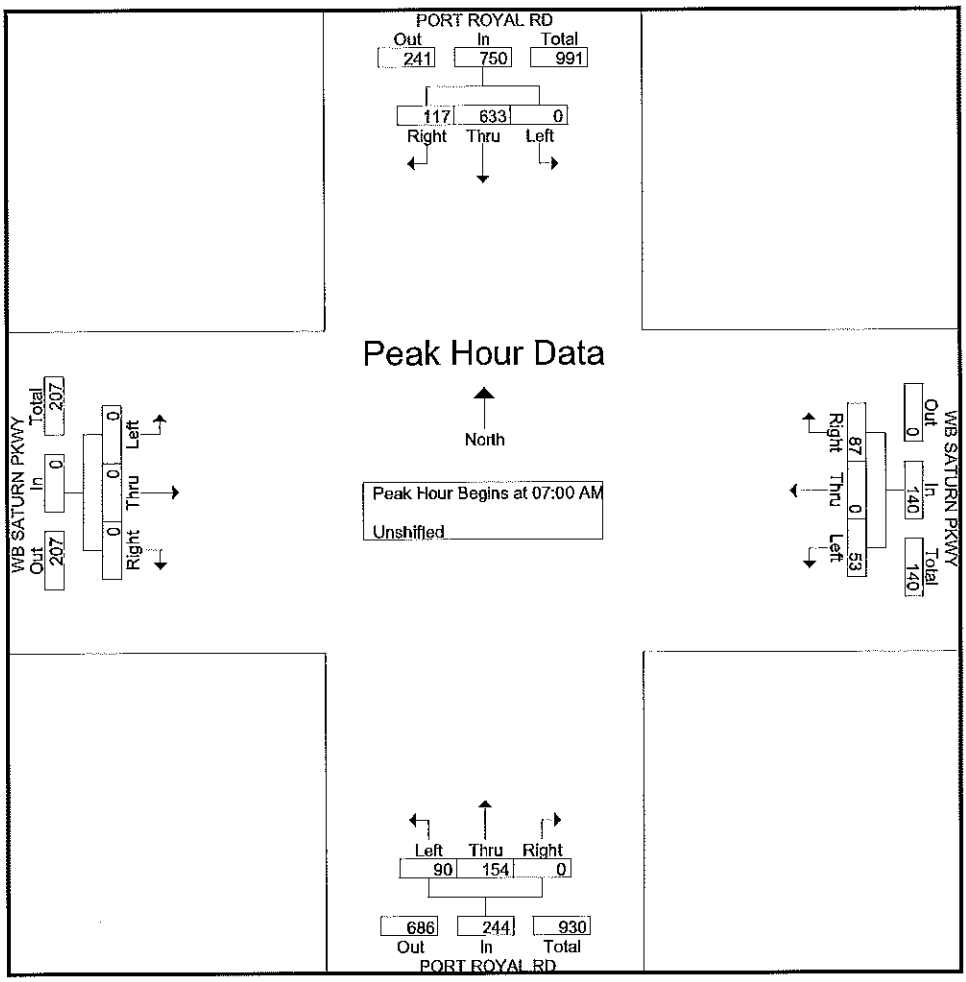
Groups Printed- Unshifted

	PORT ROYAL RD Southbound				WB SATURN PKWY Westbound				PORT ROYAL RD Northbound				WB SATURN PKWY Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
07:00 AM	0	187	30	217	20	0	18	38	20	25	0	45	0	0	0	0	300
07:15 AM	0	176	40	216	10	0	18	28	26	39	0	65	0	0	0	0	309
07:30 AM	0	138	28	166	12	0	22	34	26	50	0	76	0	0	0	0	276
07:45 AM	0	132	19	151	11	0	29	40	18	40	0	58	0	0	0	0	249
Total	0	633	117	750	53	0	87	140	90	154	0	244	0	0	0	0	1134
08:00 AM	0	120	29	149	9	0	20	29	34	69	0	103	0	0	0	0	281
08:15 AM	0	134	23	157	6	0	20	26	9	38	0	47	0	0	0	0	230
08:30 AM	0	107	30	137	9	0	26	35	7	48	0	55	0	0	0	0	227
08:45 AM	0	77	26	103	5	0	22	27	9	35	0	44	0	0	0	0	174
Total	0	438	108	546	29	0	88	117	59	190	0	249	0	0	0	0	912
*** BREAK ***																	
11:00 AM	0	44	27	71	16	0	19	35	8	49	0	57	0	0	0	0	163
11:15 AM	0	64	24	88	5	1	33	39	12	45	0	57	0	0	0	0	184
11:30 AM	0	48	30	78	10	0	31	41	10	39	0	49	0	0	0	0	168
11:45 AM	0	47	20	67	11	0	26	37	4	31	0	35	0	0	0	0	139
Total	0	203	101	304	42	1	109	152	34	164	0	198	0	0	0	0	654
12:00 PM	0	46	23	69	14	0	28	42	12	50	0	62	0	0	0	0	173
12:15 PM	0	67	26	93	17	0	26	43	4	50	0	54	0	0	0	0	190
12:30 PM	0	54	27	81	12	0	40	52	11	46	0	57	0	0	0	0	190
12:45 PM	0	74	30	104	12	0	40	52	2	55	0	57	0	0	0	0	213
Total	0	241	106	347	55	0	134	189	29	201	0	230	0	0	0	0	766
*** BREAK ***																	
02:00 PM	0	53	35	88	10	0	52	62	7	51	0	58	0	0	0	0	208
02:15 PM	0	25	12	37	11	0	30	41	6	30	0	36	0	0	0	0	114
02:30 PM	0	57	32	89	24	0	54	78	7	80	1	88	0	0	0	0	255
02:45 PM	0	73	36	109	25	0	68	93	9	55	0	64	0	0	0	0	266
Total	0	208	115	323	70	0	204	274	29	216	1	246	0	0	0	0	843
03:00 PM	0	71	29	100	23	0	60	83	10	64	0	74	0	0	0	0	257
03:15 PM	0	64	28	92	20	0	91	111	22	94	0	116	0	0	0	0	319
03:30 PM	0	68	46	114	35	0	94	129	26	57	0	83	0	0	0	0	326
03:45 PM	0	79	39	118	40	0	83	123	16	64	0	80	0	0	0	0	321
Total	0	282	142	424	118	0	328	446	74	279	0	353	0	0	0	0	1223
04:00 PM	0	87	39	126	34	0	117	151	6	71	0	77	0	0	0	0	354
04:15 PM	0	85	39	124	50	1	107	158	12	79	0	91	0	0	0	0	373
04:30 PM	0	79	37	116	61	0	131	192	14	62	0	76	0	0	0	0	384
04:45 PM	0	85	53	138	63	0	54	117	14	76	0	90	0	0	0	0	345
Total	0	336	168	504	208	1	409	618	46	288	0	334	0	0	0	0	1456
05:00 PM	0	81	70	151	90	0	143	233	18	72	0	90	0	0	0	0	474
05:15 PM	0	97	59	156	81	0	151	232	11	75	0	86	0	0	0	0	474
05:30 PM	0	97	53	150	55	0	149	204	11	68	0	79	0	0	0	0	433
05:45 PM	0	73	59	132	44	0	112	156	14	59	0	73	0	0	0	0	361
Total	0	348	241	589	270	0	555	825	54	274	0	328	0	0	0	0	1742
Grand Total	0	2689	1098	3787	845	2	1914	2761	415	1766	1	2182	0	0	0	0	8730
Apprch %	0	71	29		30.6	0.1	69.3		19	80.9	0		0	0	0		
Total %	0	30.8	12.6	43.4	9.7	0	21.9	31.6	4.8	20.2	0	25	0	0	0	0	

CDM SMITH Inc.
1100 MARION STREET, SUITE 200
KNOXVILLE, TN 37921
865-963-4300

File Name : Site 3
Site Code : 00000003
Start Date : 2/8/2012
Page No : 2

	PORT ROYAL RD Southbound				WB SATURN PKWY Westbound				PORT ROYAL RD Northbound				WB SATURN PKWY Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 09:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	0	**187**	30	**217**	**20**	0	18	38	20	25	0	45	0	0	0	0	300
07:15 AM	0	176	**40**	216	10	0	18	28	**26**	39	0	65	0	0	0	0	**309**
07:30 AM	0	138	28	166	12	0	22	34	26	**50**	0	76	0	0	0	0	276
07:45 AM	0	132	19	151	11	0	**29**	**40**	18	40	0	58	0	0	0	0	249
Total Volume	0	633	117	750	53	0	87	140	90	154	0	244	0	0	0	0	1134
% App. Total	0	84.4	15.6		37.9	0	62.1		36.9	63.1	0		0	0	0		
PHF	.000	.846	.731	.864	.663	.000	.750	.875	.865	.770	.000	.803	.000	.000	.000	.000	.917



CDM SMITH Inc.
1100 MARION STREET, SUITE 200
KNOXVILLE, TN 37921
865-963-4300

File Name : Site 3
Site Code : 00000003
Start Date : 2/8/2012
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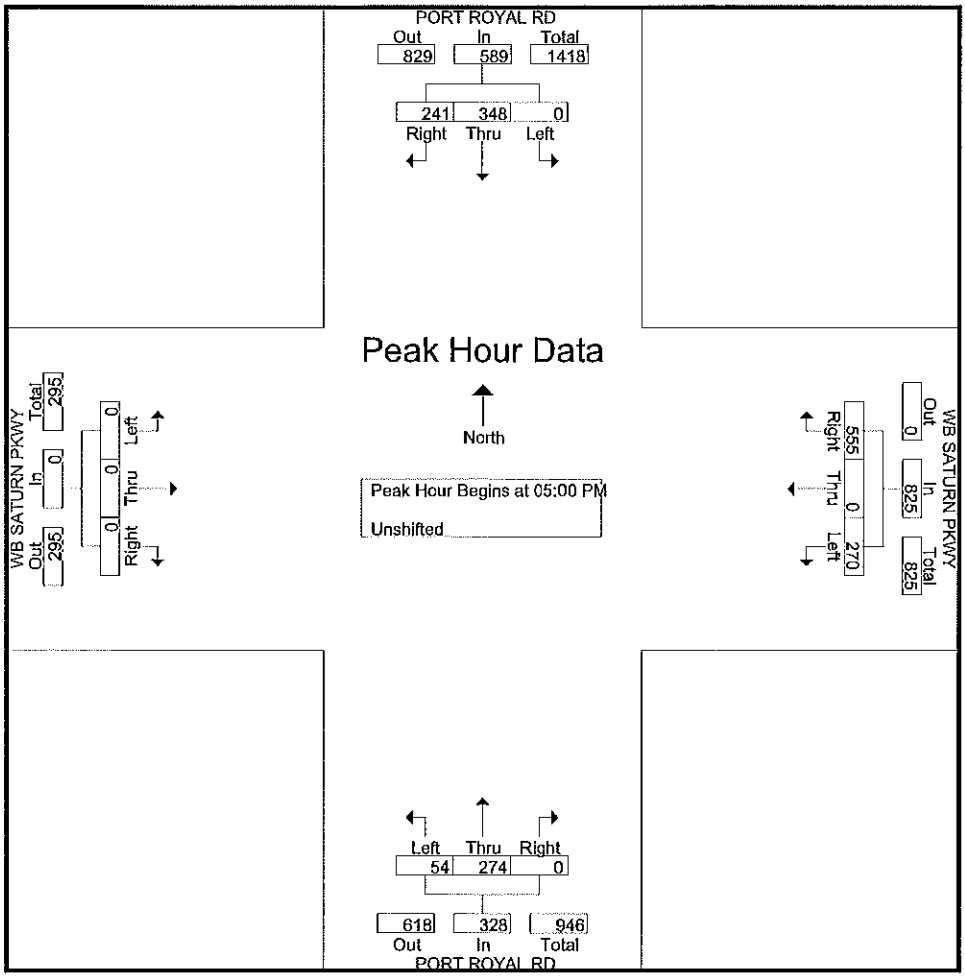
	PORT ROYAL RD Southbound				WB SATURN PKWY Westbound				PORT ROYAL RD Northbound				WB SATURN PKWY Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	0	81	**70**	151	**90**	0	143	**233**	**18**	72	0	**90**	0	0	0	0	**474**
05:15 PM	0	**97**	59	**156**	81	0	**151**	232	11	**75**	0	86	0	0	0	0	474
05:30 PM	0	97	53	150	55	0	149	204	11	68	0	79	0	0	0	0	433
05:45 PM	0	73	59	132	44	0	112	156	14	59	0	73	0	0	0	0	361
Total Volume	0	348	241	589	270	0	555	825	54	274	0	328	0	0	0	0	1742
% App. Total	0	59.1	40.9		32.7	0	67.3		16.5	83.5	0		0	0	0		
PHF	.000	.897	.861	.944	.750	.000	.919	.885	.750	.913	.000	.911	.000	.000	.000	.000	.919



CDM SMITH Inc.
1100 MARION STREET, SUITE 200
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File Name : Site 4
Site Code : 00000004
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Groups Printed- Unshifted

	PORT ROYAL ROAD Southbound				EB SATURN PKWY Westbound				PORT ROYAL ROAD Northbound				EB SATURN PKWY Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
07:00 AM	184	23	2	209	0	0	0	0	0	45	104	149	3	1	21	25	383
07:15 AM	175	23	0	198	0	0	0	0	0	55	94	149	6	0	32	38	385
07:30 AM	134	29	0	163	0	0	0	0	0	62	96	158	12	0	31	43	364
07:45 AM	108	36	0	144	0	0	0	0	0	43	72	115	19	0	36	55	314
Total	601	111	2	714	0	0	0	0	0	205	366	571	40	1	120	161	1446
08:00 AM	105	33	0	138	0	0	0	0	0	89	62	151	20	0	10	30	319
08:15 AM	131	18	0	149	0	0	0	0	0	30	44	74	19	0	4	23	246
08:30 AM	94	21	0	115	0	0	0	0	0	29	39	68	23	0	7	30	213
08:45 AM	74	12	0	86	0	0	0	0	0	27	30	57	22	0	9	31	174
Total	404	84	0	488	0	0	0	0	0	175	175	350	84	0	30	114	952
*** BREAK ***																	
04:00 PM	13	139	102	254	0	0	0	0	56	85	0	141	19	0	43	62	457
*** BREAK ***																	
Total	13	139	102	254	0	0	0	0	56	85	0	141	19	0	43	62	457
05:00 PM	0	178	193	371	0	0	0	0	57	78	0	135	18	0	69	87	593
*** BREAK ***																	
Total	0	178	193	371	0	0	0	0	57	78	0	135	18	0	69	87	593
Grand Total	1018	512	297	1827	0	0	0	0	113	543	541	1197	161	1	262	424	3448
Apprch %	55.7	28	16.3		0	0	0		9.4	45.4	45.2		38	0.2	61.8		
Total %	29.5	14.8	8.6	53	0	0	0	0	3.3	15.7	15.7	34.7	4.7	0	7.6	12.3	

CDM SMITH Inc.
1100 MARION STREET, SUITE 200
KNOXVILLE, TN 37921
865-963-4300

File Name : Site 4
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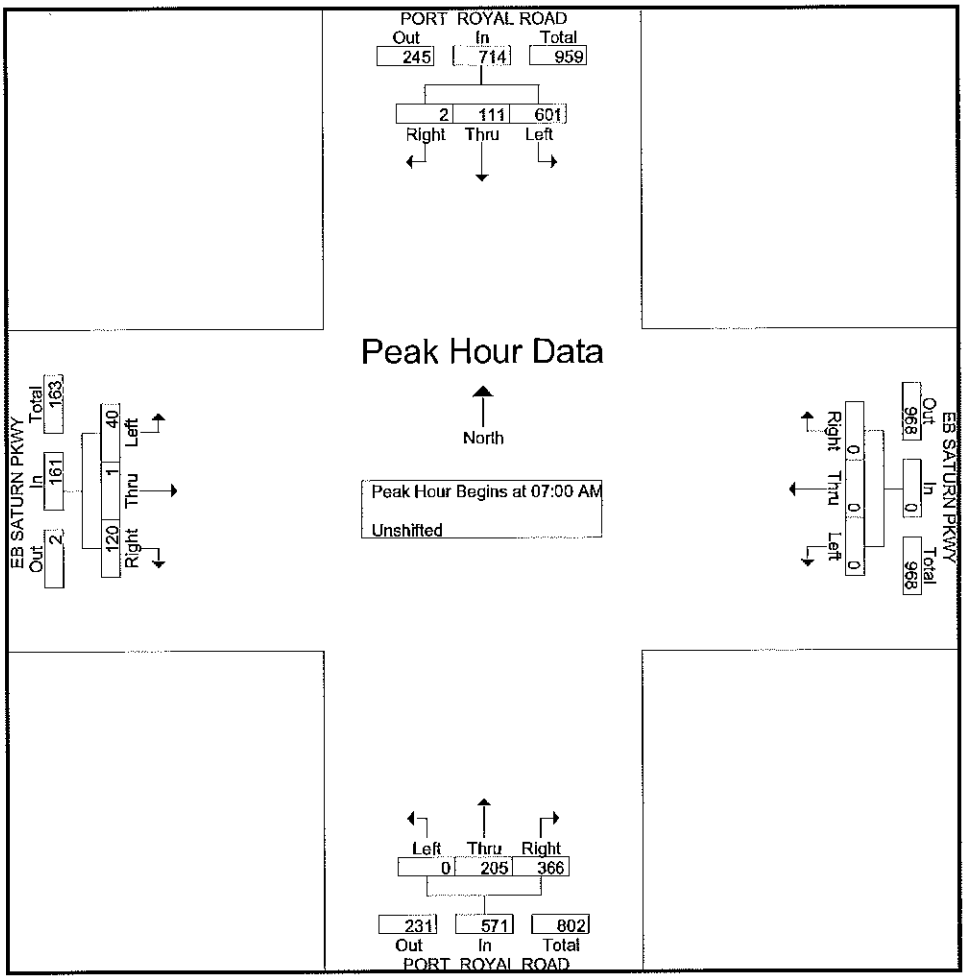
	PORT ROYAL ROAD Southbound				EB SATURN PKWY Westbound				PORT ROYAL ROAD Northbound				EB SATURN PKWY Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 09:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	**184**	23	**2**	**209**	0	0	0	0	0	45	**104**	149	3	**1**	21	25	383
07:15 AM	175	23	0	198	0	0	0	0	0	55	94	149	6	0	32	38	**385**
07:30 AM	134	29	0	163	0	0	0	0	0	**62**	96	**158**	12	0	31	43	364
07:45 AM	108	**36**	0	144	0	0	0	0	0	43	72	115	**19**	0	**36**	**55**	314
Total Volume	601	111	2	714	0	0	0	0	0	205	366	571	40	1	120	161	1446
% App. Total	84.2	15.5	0.3		0	0	0		0	35.9	64.1		24.8	0.6	74.5		
PHF	.817	.771	.250	.854	.000	.000	.000	.000	.000	.827	.880	.903	.526	.250	.833	.732	.939



CDM SMITH Inc.
1100 MARION STREET, SUITE 200
KNOXVILLE, TN 37921
865-963-4300

File Name : Site 4
Site Code : 00000004
Start Date : 2/8/2012
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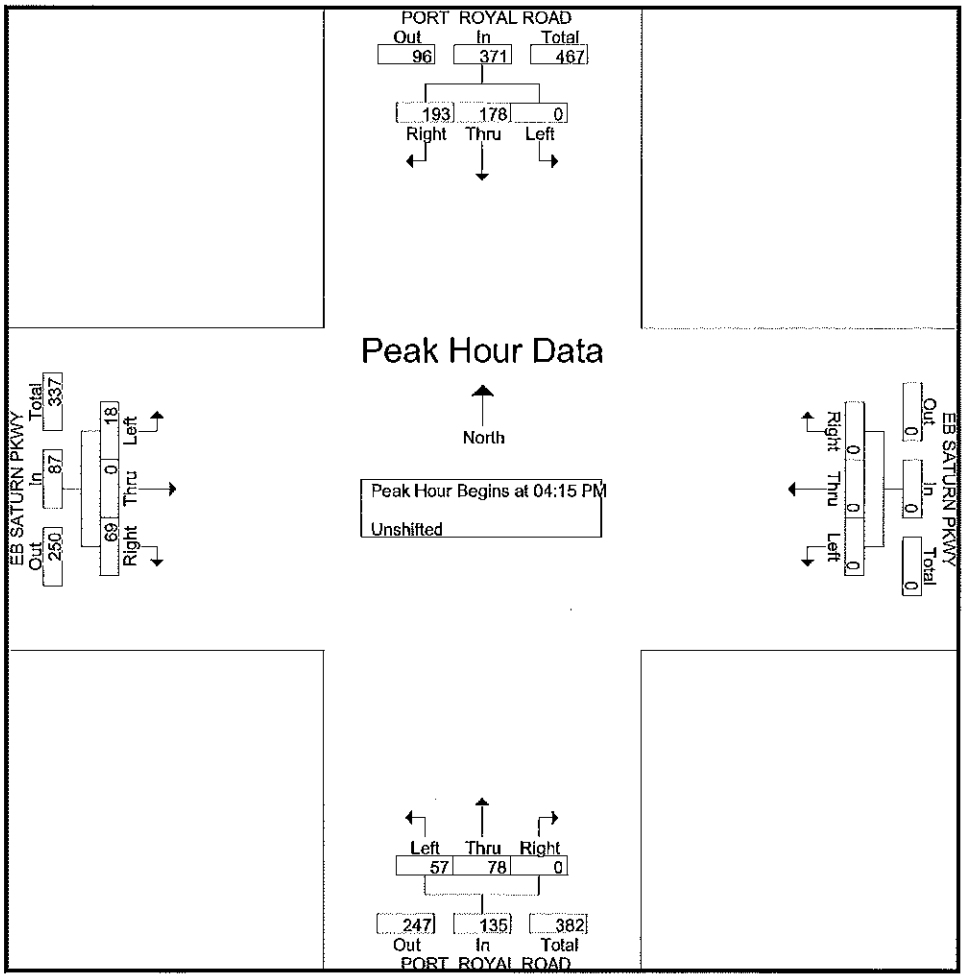
	PORT ROYAL ROAD Southbonnd				EB SATURN PKWY Westbound				PORT ROYAL ROAD Northbound				EB SATURN PKWY Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:15 PM																	
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00 PM	0	178	193	371	0	0	0	0	57	78	0	135	18	0	69	87	593
Total Volume	0	178	193	371	0	0	0	0	57	78	0	135	18	0	69	87	593
% App. Total	0	48	52		0	0	0		42.2	57.8	0		20.7	0	79.3		
PHF	.000	.250	.250	.250	.000	.000	.000	.000	.250	.250	.000	.250	.250	.000	.250	.250	.250



CDM SMITH Inc.
1100 MARION STREET, SUITE 200
KNOXVILLE, TN 37921
865-963-4300

File Name : Site 5
Site Code : 00000005
Start Date : 2/9/2012
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Groups Printed- Unshifted

	US 31 Southbound				BUCKNER ROAD Westbound				US 31 Northbound				THOMPSON RIDGE ROAD Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
07:00 AM	5	50	49	104	6	19	48	73	37	105	5	147	42	13	11	66	390
07:15 AM	8	63	36	107	19	52	69	140	26	98	5	129	62	48	20	130	506
07:30 AM	9	88	16	113	36	19	57	112	2	105	7	114	24	13	10	47	386
07:45 AM	15	83	21	119	33	19	68	120	3	121	9	133	17	9	4	30	402
Total	37	284	122	443	94	109	242	445	68	429	26	523	145	83	45	273	1684
08:00 AM	16	71	17	104	32	50	66	148	15	125	8	148	24	16	12	52	452
08:15 AM	5	53	22	80	31	85	54	170	19	133	13	165	51	42	33	126	541
08:30 AM	10	74	10	94	30	20	70	120	13	136	9	158	42	33	20	95	467
08:45 AM	4	64	14	82	27	9	49	85	6	130	19	155	15	9	3	27	349
Total	35	262	63	360	120	164	239	523	53	524	49	626	132	100	68	300	1809
*** BREAK ***																	
11:00 AM	16	81	14	111	38	12	16	66	5	81	25	111	21	8	7	36	324
11:15 AM	12	76	13	101	25	7	23	55	9	111	21	141	9	14	4	27	324
11:30 AM	13	93	16	122	34	10	24	68	6	83	26	115	13	9	10	32	337
11:45 AM	15	96	16	127	25	8	17	50	11	76	25	112	15	14	12	41	330
Total	56	346	59	461	122	37	80	239	31	351	97	479	58	45	33	136	1315
12:00 PM	14	87	15	116	30	7	22	59	5	86	24	115	24	15	9	48	338
12:15 PM	12	98	17	127	16	7	16	39	2	83	23	108	16	17	3	36	310
12:30 PM	18	92	17	127	25	8	33	66	3	79	25	107	15	26	7	48	348
12:45 PM	24	88	20	132	25	5	19	49	5	83	25	113	23	14	12	49	343
Total	68	365	69	502	96	27	90	213	15	331	97	443	78	72	31	181	1339
*** BREAK ***																	
02:00 PM	33	117	31	181	31	12	25	68	5	76	26	107	26	19	7	52	408
02:15 PM	23	144	39	206	30	25	24	79	12	104	32	148	25	13	5	43	476
02:30 PM	27	101	24	152	33	13	19	65	10	98	24	132	51	38	23	112	461
02:45 PM	24	181	25	230	40	23	17	80	18	85	22	125	20	18	5	43	478
Total	107	543	119	769	134	73	85	292	45	363	104	512	122	88	40	250	1823
03:00 PM	32	155	39	226	29	27	15	71	13	92	19	124	24	24	6	54	475
03:15 PM	50	131	34	215	33	33	12	78	12	74	34	120	26	21	13	60	473
03:30 PM	36	154	22	212	30	23	23	76	9	97	26	132	32	35	19	86	506
03:45 PM	25	151	22	198	43	25	18	86	15	93	23	131	38	60	38	136	551
Total	143	591	117	851	135	108	68	311	49	356	102	507	120	140	76	336	2005
04:00 PM	41	175	43	259	35	23	24	82	4	107	41	152	25	28	25	78	571
04:15 PM	30	154	29	213	46	21	24	91	8	88	45	141	25	35	14	74	519
04:30 PM	41	161	35	237	41	16	23	80	4	92	26	122	27	37	16	80	519
04:45 PM	41	186	37	264	44	19	17	80	9	108	28	145	19	21	11	51	540
Total	153	676	144	973	166	79	88	333	25	395	140	560	96	121	66	283	2149
05:00 PM	38	161	40	239	49	28	20	97	8	108	31	147	22	56	20	98	581
05:15 PM	40	149	38	227	55	20	32	107	3	111	48	162	31	36	17	84	580
05:30 PM	49	165	47	261	45	28	31	104	6	96	40	142	20	46	18	84	591
05:45 PM	48	165	31	244	58	25	30	113	7	99	50	156	19	48	19	86	599
Total	175	640	156	971	207	101	113	421	24	414	169	607	92	186	74	352	2351
Grand Total	774	3707	849	5330	1074	698	1005	2777	310	3163	784	4257	843	835	433	2111	14475
Apprch %	14.5	69.5	15.9		38.7	25.1	36.2		7.3	74.3	18.4		39.9	39.6	20.5		
Total %	5.3	25.6	5.9	36.8	7.4	4.8	6.9	19.2	2.1	21.9	5.4	29.4	5.8	5.8	3	14.6	

CDM SMITH Inc.
1100 MARION STREET, SUITE 200
KNOXVILLE, TN 37921
865-963-4300

File Name : Site 5
Site Code : 00000005
Start Date : 2/9/2012
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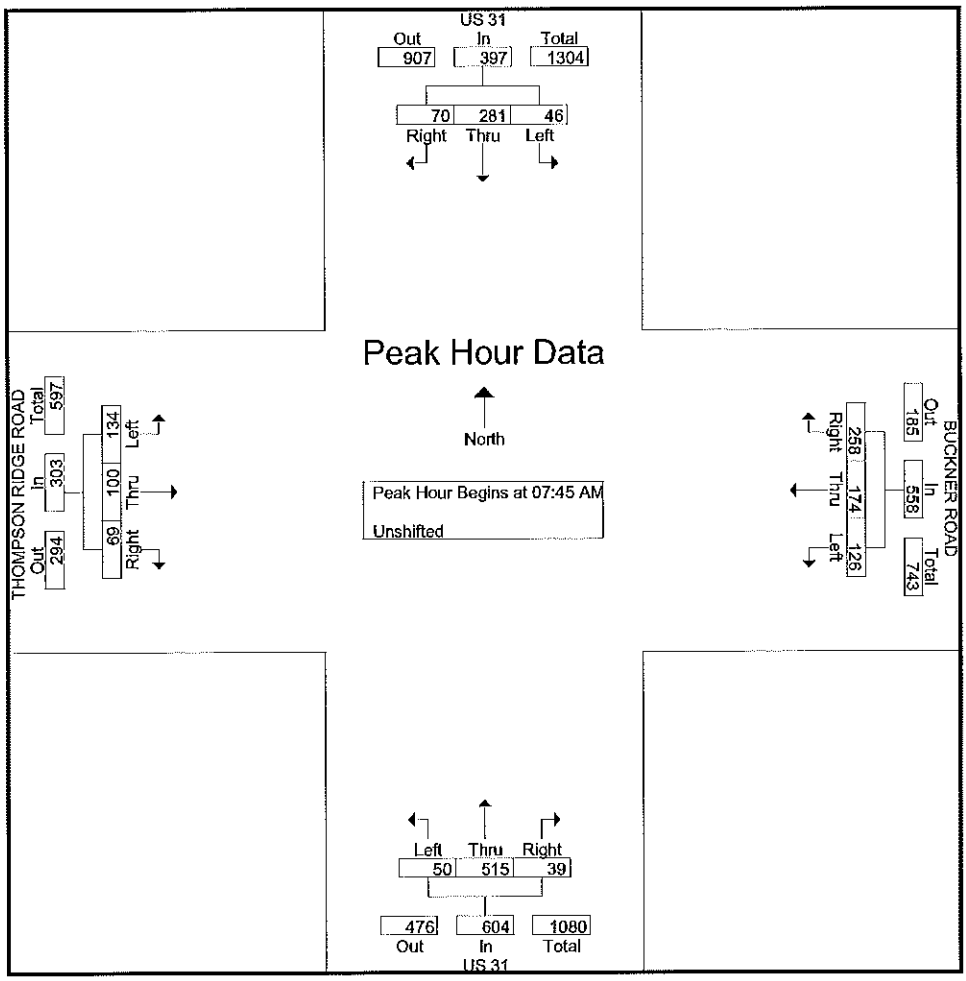
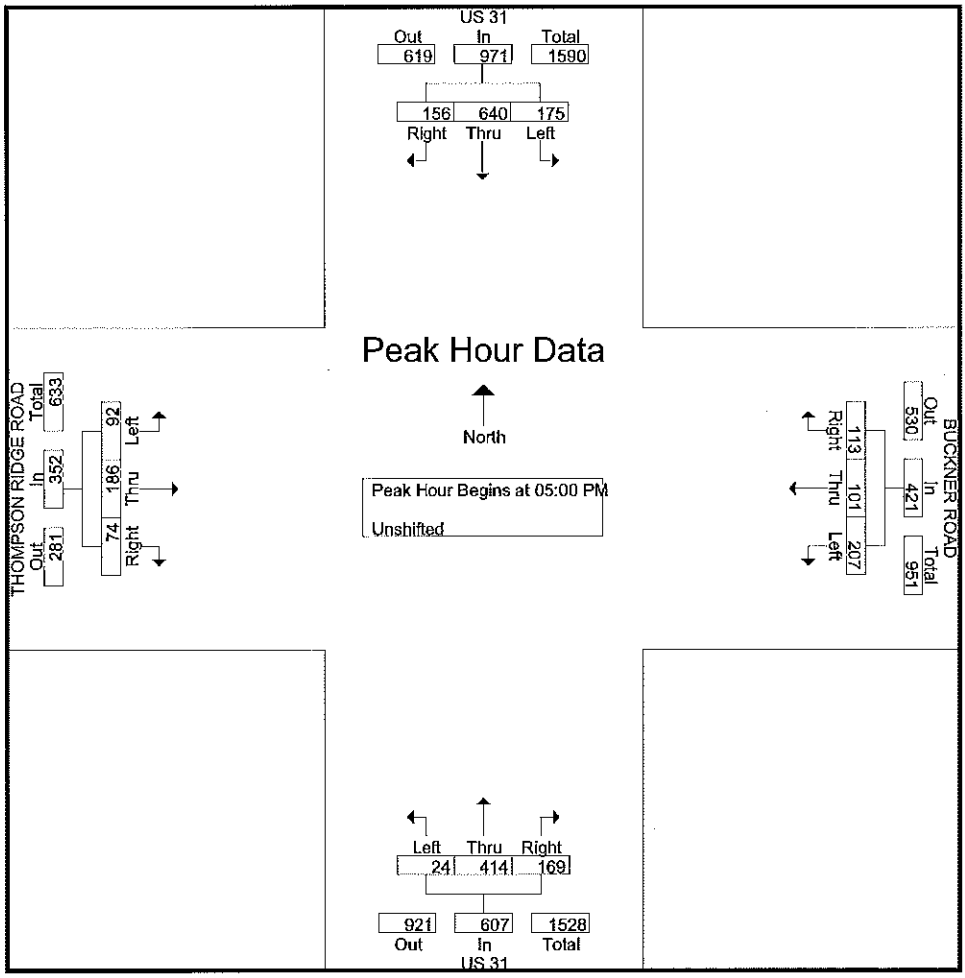
	US 31 Southbound				BUCKNER ROAD Westbound				US 31 Northbound				THOMPSON RIDGE ROAD Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 09:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:45 AM																	
07:45 AM	15	**83**	21	**119**	**33**	19	68	120	3	121	9	133	17	9	**4**	30	402
08:00 AM	**16**	71	17	104	32	50	66	148	15	125	8	148	**24**	16	12	52	**452**
08:15 AM	5	53	**22**	80	31	**85**	54	**170**	**19**	133	**13**	**165**	**51**	**42**	**33**	**126**	**541**
08:30 AM	10	74	10	94	30	20	**70**	120	13	**136**	9	158	42	33	20	95	467
Total Volume	46	281	70	397	126	174	258	558	50	515	39	604	134	100	69	303	1862
% App. Total	11.6	70.8	17.6		22.6	31.2	46.2		8.3	85.3	6.5		44.2	33	22.8		
PHF	.719	.846	.795	.834	.955	.512	.921	.821	.658	.947	.750	.915	.657	.595	.523	.601	.860



CDM SMITH Inc.
1100 MARION STREET, SUITE 200
KNOXVILLE, TN 37921
865-963-4300

File Name : Site 5
Site Code : 00000005
Start Date : 2/9/2012
Page No : 3

	US 31 Southbound				BUCKNER ROAD Westbound				US 31 Northbound				THOMPSON RIDGE ROAD Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	38	161	40	239	49	**28**	20	97	**8**	108	31	147	22	**56**	**20**	**98**	581
05:15 PM	40	149	38	227	55	20	**32**	107	3	**111**	48	**162**	**31**	36	17	84	580
05:30 PM	**49**	**165**	**47**	**261**	45	28	31	104	6	96	40	142	20	46	18	84	591
05:45 PM	48	165	31	244	**58**	25	30	**113**	7	99	**50**	156	19	48	19	86	**599**
Total Volume	175	640	156	971	207	101	113	421	24	414	169	607	92	186	74	352	2351
% App. Total	18	65.9	16.1		49.2	24	26.8		4	68.2	27.8		26.1	52.8	21		
PHF	.893	.970	.830	.930	.892	.902	.883	.931	.750	.932	.845	.937	.742	.830	.925	.898	.981



CDM SMITH Inc.
1100 MARION STREET, SUITE 200
KNOXVILLE, TN 37921
865-963-4300

File Name : Site 6
Site Code : 00000006
Start Date : 2/9/2012
Page No : 1

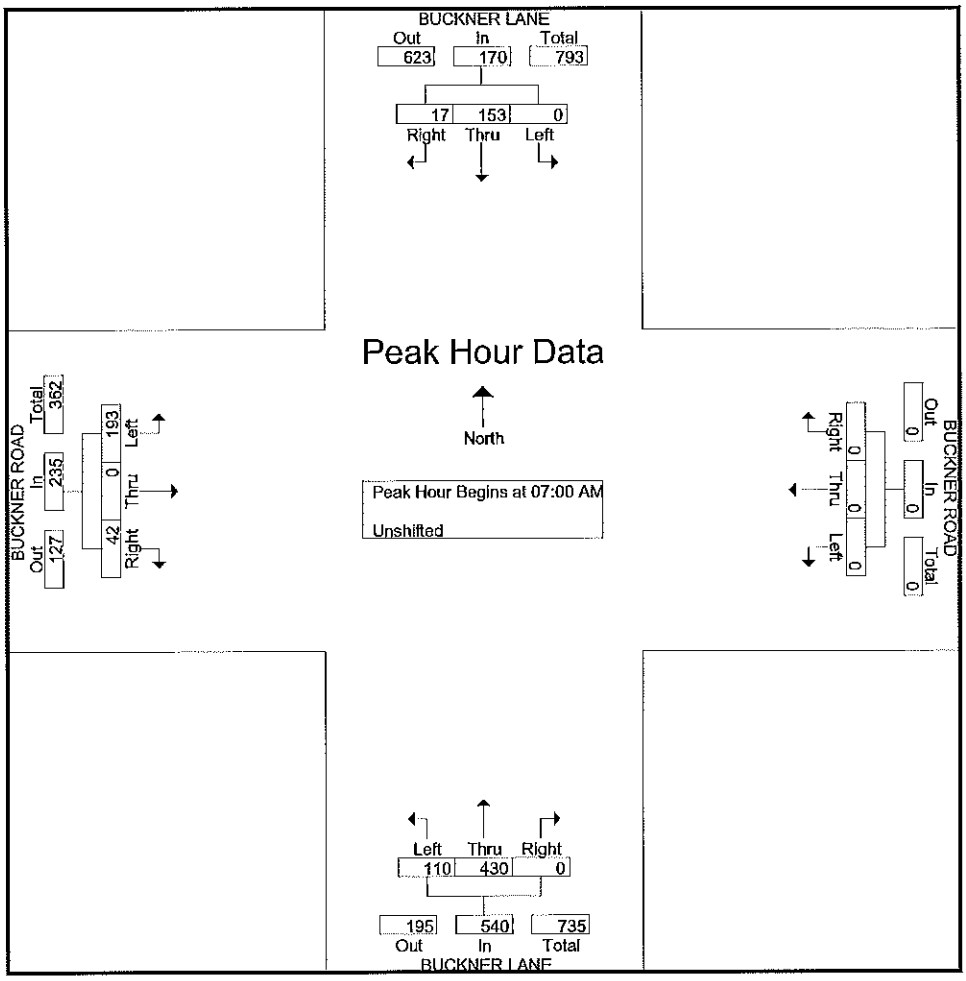
Groups Printed- Unshifted

	BUCKNER LANE Southbound				BUCKNER ROAD Westbound				BUCKNER LANE Northbound				BUCKNER ROAD Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
07:00 AM	0	74	3	77	0	0	0	0	21	99	0	120	59	0	13	72	269
07:15 AM	0	46	3	49	0	0	0	0	45	163	0	208	35	0	15	50	307
07:30 AM	0	17	4	21	0	0	0	0	22	98	0	120	54	0	5	59	200
07:45 AM	0	16	7	23	0	0	0	0	22	70	0	92	45	0	9	54	169
Total	0	153	17	170	0	0	0	0	110	430	0	540	193	0	42	235	945
08:00 AM	0	32	3	35	0	0	0	0	11	68	0	79	35	0	10	45	159
08:15 AM	0	20	12	32	0	0	0	0	5	47	0	52	37	0	10	47	131
08:30 AM	0	21	18	39	0	0	0	0	20	65	0	85	29	0	10	39	163
08:45 AM	0	12	3	15	0	0	0	0	16	51	0	67	18	0	16	34	116
Total	0	85	36	121	0	0	0	0	52	231	0	283	119	0	46	165	569
*** BREAK ***																	
04:00 PM	13	139	102	254	0	0	0	0	56	85	0	141	19	0	43	62	457
*** BREAK ***																	
Total	13	139	102	254	0	0	0	0	56	85	0	141	19	0	43	62	457
05:00 PM	0	178	193	371	0	0	0	0	57	78	0	135	18	0	69	87	593
*** BREAK ***																	
Total	0	178	193	371	0	0	0	0	57	78	0	135	18	0	69	87	593
Grand Total	13	555	348	916	0	0	0	0	275	824	0	1099	349	0	200	549	2564
Apprch %	1.4	60.6	38		0	0	0		25	75	0		63.6	0	36.4		
Total %	0.5	21.6	13.6	35.7	0	0	0	0	10.7	32.1	0	42.9	13.6	0	7.8	21.4	

CDM SMITH Inc.
1100 MARION STREET, SUITE 200
KNOXVILLE, TN 37921
865-963-4300

File Name : Site 6
Site Code : 00000006
Start Date : 2/9/2012
Page No : 2

	BUCKNER LANE Southbound				BUCKNER ROAD Westbound				BUCKNER LANE Northbound				BUCKNER ROAD Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 09:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	0	74	3	77	0	0	0	0	21	99	0	120	59	0	13	72	269
07:15 AM	0	46	3	49	0	0	0	0	45	163	0	208	35	0	15	50	307
07:30 AM	0	17	4	21	0	0	0	0	22	98	0	120	54	0	5	59	200
07:45 AM	0	16	7	23	0	0	0	0	22	70	0	92	45	0	9	54	169
Total Volume	0	153	17	170	0	0	0	0	110	430	0	540	193	0	42	235	945
% App. Total	0	90	10		0	0	0		20.4	79.6	0		82.1	0	17.9		
PHF	.000	.517	.607	.552	.000	.000	.000	.000	.611	.660	.000	.649	.818	.000	.700	.816	.770



CDM SMITH Inc.
1100 MARION STREET, SUITE 200
KNOXVILLE, TN 37921
865-963-4300

File Name : Site 6
Site Code : 00000006
Start Date : 2/9/2012
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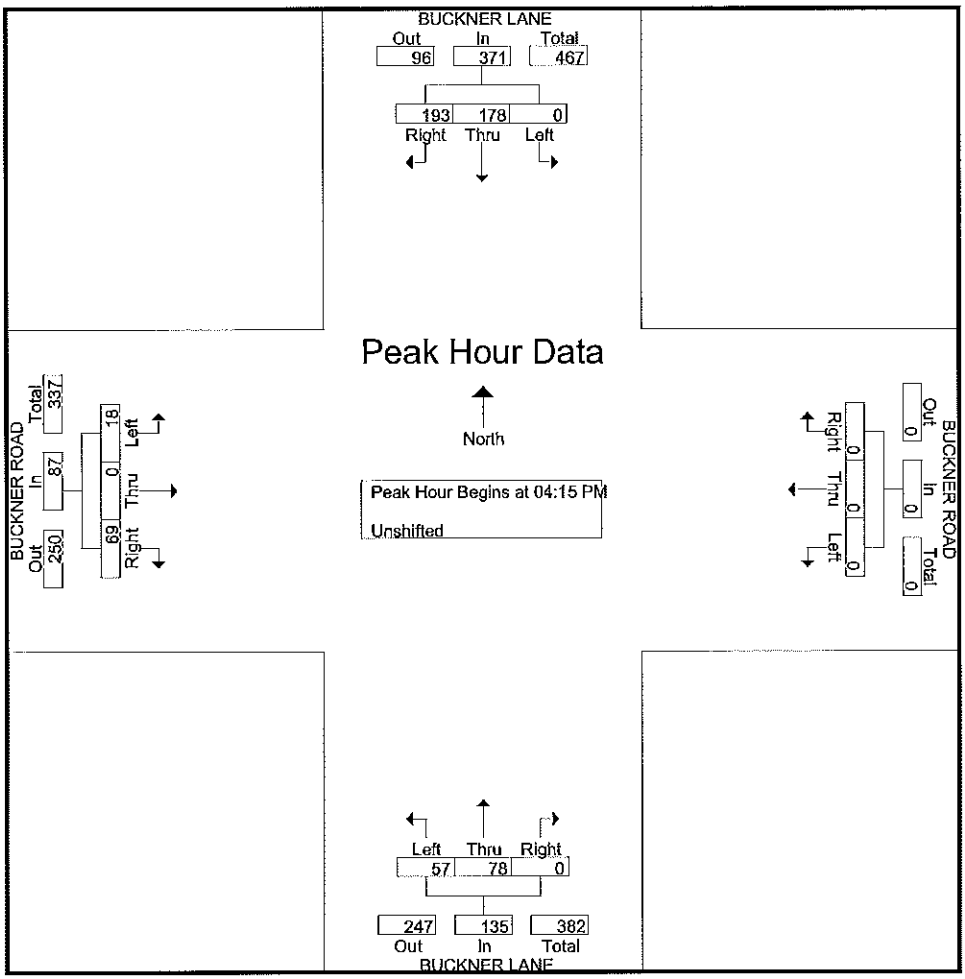
	BUCKNER LANE Southbound				BUCKNER ROAD Westbound				BUCKNER LANE Northbound				BUCKNER ROAD Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:15 PM																	
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00 PM	0	**178**	**193**	**371**	0	0	0	0	**57**	**78**	0	**135**	**18**	0	**69**	**87**	**593**
Total Volume	0	178	193	371	0	0	0	0	57	78	0	135	18	0	69	87	593
% App. Total	0	48	52		0	0	0		42.2	57.8	0		20.7	0	79.3		
PHF	.000	.250	.250	.250	.000	.000	.000	.000	.250	.250	.000	.250	.250	.000	.250	.250	.250



CDM SMITH Inc.
1100 MARION STREET, SUITE 200
KNOXVILLE, TN 37921
865-963-4300

File Name : Site 7
Site Code : 00000007
Start Date : 2/22/2012
Page No : 1

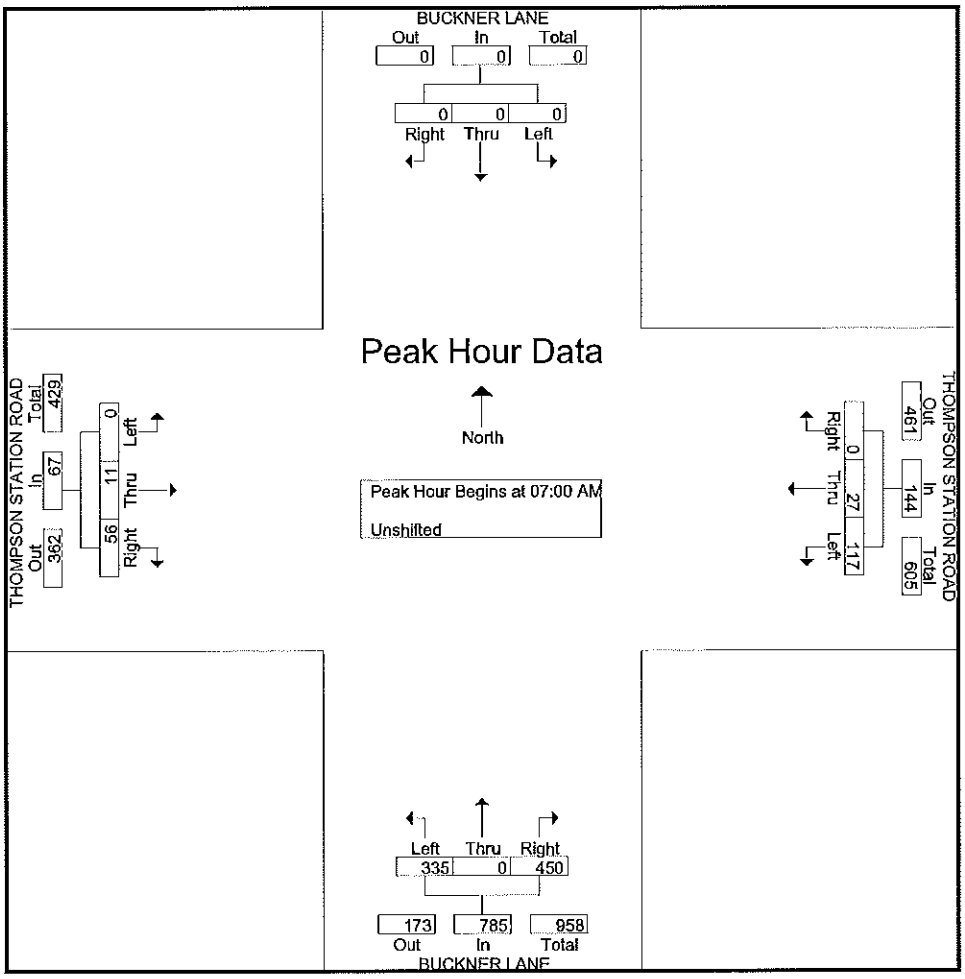
Groups Printed- Unshifted

	BUCKNER LANE Southbound				THOMPSON STATION ROAD Westbound				BUCKNER LANE Northbound				THOMPSON STATION ROAD Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
07:00 AM	0	0	0	0	50	8	0	58	93	0	72	165	0	3	20	23	246
07:15 AM	0	0	0	0	29	5	0	34	101	0	127	228	0	2	20	22	284
07:30 AM	0	0	0	0	15	9	0	24	98	0	150	248	0	2	9	11	283
07:45 AM	0	0	0	0	23	5	0	28	43	0	101	144	0	4	7	11	183
Total	0	0	0	0	117	27	0	144	335	0	450	785	0	11	56	67	996
08:00 AM	0	0	0	0	12	3	0	15	37	0	108	145	0	2	11	13	173
08:15 AM	0	0	0	0	15	7	0	22	24	0	97	121	0	6	10	16	159
08:30 AM	0	0	0	0	18	9	0	27	41	0	69	110	0	4	9	13	150
08:45 AM	0	0	0	0	14	6	0	20	29	0	52	81	0	3	10	13	114
Total	0	0	0	0	59	25	0	84	131	0	326	457	0	15	40	55	596
*** BREAK ***																	
03:00 PM	0	0	0	0	36	5	0	41	19	0	36	55	0	8	91	99	195
03:15 PM	0	0	0	0	65	6	0	71	17	0	21	38	0	6	34	40	149
03:30 PM	0	0	0	0	69	8	0	77	16	0	28	44	0	6	38	44	165
03:45 PM	0	0	0	0	102	11	0	113	14	0	24	38	0	6	34	40	191
Total	0	0	0	0	272	30	0	302	66	0	109	175	0	26	197	223	700
04:00 PM	0	0	0	0	83	8	0	91	14	0	36	50	0	6	34	40	181
04:15 PM	0	0	0	0	95	11	0	106	12	0	30	42	0	7	43	50	198
04:30 PM	0	0	0	0	112	4	0	116	12	0	25	37	0	11	36	47	200
04:45 PM	0	0	0	0	105	11	0	116	21	0	34	55	0	6	51	57	228
Total	0	0	0	0	395	34	0	429	59	0	125	184	0	30	164	194	807
05:00 PM	0	0	0	0	135	10	0	145	23	0	45	68	0	7	51	58	271
05:15 PM	0	0	0	0	150	10	0	160	20	0	39	59	0	14	72	86	305
05:30 PM	0	0	0	0	150	9	0	159	17	0	26	43	0	9	66	75	277
05:45 PM	0	0	0	0	156	10	0	166	23	0	28	51	0	5	53	58	275
Total	0	0	0	0	591	39	0	630	83	0	138	221	0	35	242	277	1128
Grand Total	0	0	0	0	1434	155	0	1589	674	0	1148	1822	0	117	699	816	4227
Apprch %	0	0	0		90.2	9.8	0		37	0	63		0	14.3	85.7		
Total %	0	0	0	0	33.9	3.7	0	37.6	15.9	0	27.2	43.1	0	2.8	16.5	19.3	

CDM SMITH Inc.
1100 MARION STREET, SUITE 200
KNOXVILLE, TN 37921
865-963-4300

File Name : Site 7
Site Code : 00000007
Start Date : 2/22/2012
Page No : 2

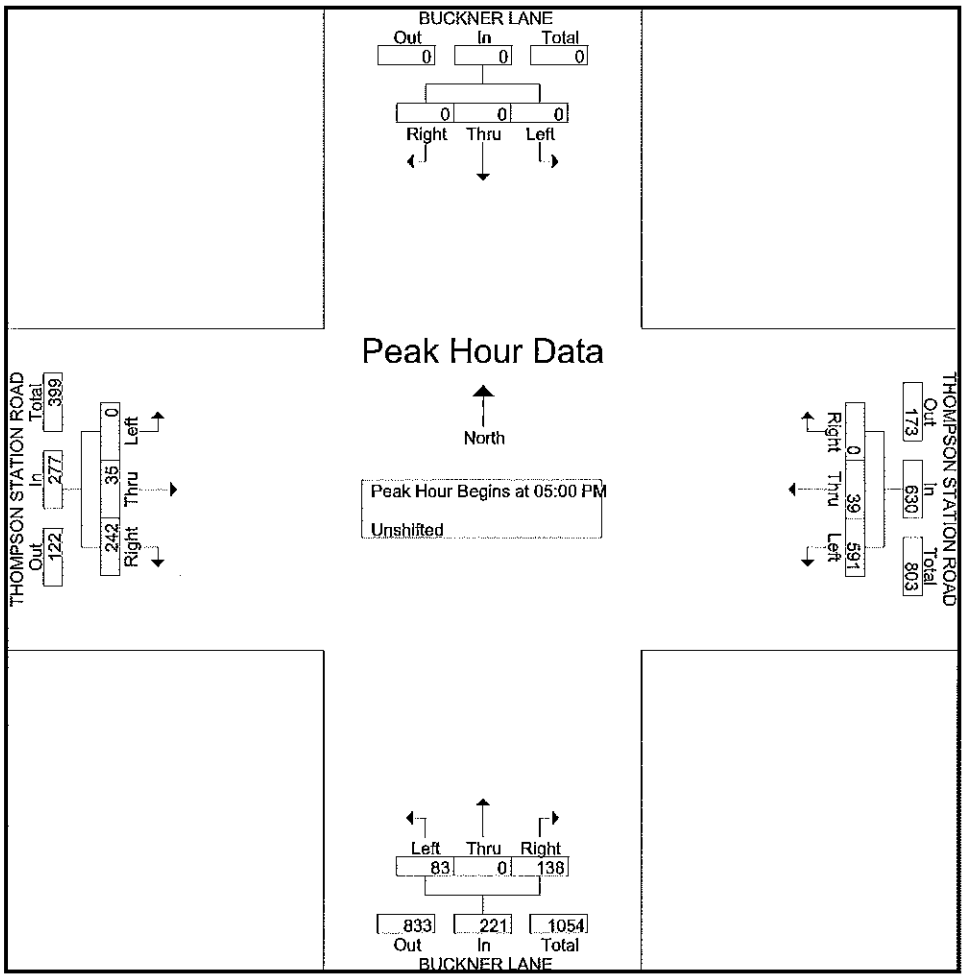
	BUCKNER LANE Southbound				THOMPSON STATION ROAD Westbound				BUCKNER LANE Northbound				THOMPSON STATION ROAD Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 09:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	0	0	0	0	**50**	8	0	**58**	93	0	72	165	0	3	**20**	**23**	246
07:15 AM	0	0	0	0	29	5	0	34	**101**	0	127	228	0	2	20	22	**284**
07:30 AM	0	0	0	0	15	**9**	0	24	98	0	**150**	**248**	0	2	9	11	283
07:45 AM	0	0	0	0	23	5	0	28	43	0	101	144	0	**4**	7	11	183
Total Volume	0	0	0	0	117	27	0	144	335	0	450	785	0	11	56	67	996
% App. Total	0	0	0		81.2	18.8	0		42.7	0	57.3		0	16.4	83.6		
PHF	.000	.000	.000	.000	.585	.750	.000	.621	.829	.000	.750	.791	.000	.688	.700	.728	.877



CDM SMITH Inc.
1100 MARION STREET, SUITE 200
KNOXVILLE, TN 37921
865-963-4300

File Name : Site 7
Site Code : 00000007
Start Date : 2/22/2012
Page No : 3

	BUCKNER LANE Southbound				THOMPSON STATION ROAD Westbound				BUCKNER LANE Northbound				THOMPSON STATION ROAD Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	0	0	0	0	135	10	0	145	23	0	45	68	0	7	51	58	271
05:15 PM	0	0	0	0	150	10	0	160	20	0	39	59	0	14	72	86	305
05:30 PM	0	0	0	0	150	9	0	159	17	0	26	43	0	9	66	75	277
05:45 PM	0	0	0	0	156	10	0	166	23	0	28	51	0	5	53	58	275
Total Volume	0	0	0	0	591	39	0	630	83	0	138	221	0	35	242	277	1128
% App. Total	0	0	0		93.8	6.2	0		37.6	0	62.4		0	12.6	87.4		
PHF	.000	.000	.000	.000	.947	.975	.000	.949	.902	.000	.767	.813	.000	.625	.840	.805	.925



TDOT TRAFFIC COUNT DATA

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION
PROJECT PLANNING DIVISION
SUITE 1000, JAMES K. POLK BUILDING
505 Deaderick Street
NASHVILLE, TENNESSEE 37243-0344

John Schroer
Commissioner

Bill Haslam
Governor

October 23,2012

Mr. Hollis Loveday
CDM Smith
1100 Marion St Suite 200
Knoxville TN 37921

Subject: I-65 Interchange Access Request Study
Spring Hill, Williamson County

Dear Hollis:

We have reviewed the traffic schematics you submitted on August 21, 2012 for the subject project. These traffic figures have our approval for use in the Interchange Access Request study. If I can be of further assistance, please contact me.

Sincerely,

Tony Armstrong

Tony Armstrong
Transportation Manager 1

CC : file
Chris Armstrong

Station #	County	Location	Route #
000196	Maury	SPRING HILL	SR396

Record	Year	AADT
1	2010	21860
2	2009	24593
3	2008	23877
4	2007	28631
5	2006	27704
6	2005	25594
7	2004	25880
8	2003	24946
9	2002	24135
10	2001	21580
11	2000	21152
12	1999	17456
13	1998	18506
14	1997	18135
15	1996	16482
16	1995	15438
17	1994	14499
18	1993	14462
19	1992	13478
20	1991	12504
21	1990	9331
22	1989	7799

Station #	County	Location	Route #
000222	Maury	SATURN PKWY - W. OF I-65	

Record	Year	AADT
1	2010	29059
2	2009	29425
3	2008	29233
4	2007	28212
5	2006	27972
6	2005	27826
7	2004	26389
8	2003	25792
9	2002	24151
10	2001	24076

Station #	County	Location	Route #
000223	Maury	NEAR SPRING HILL	

Record	Year	AADT
1	2010	22563
2	2009	21991
3	2008	23333
4	2007	21691
5	2006	22601
6	2005	25005
7	2004	25000
8	2003	24980
9	2002	23863
10	2001	24391

Station #	County	Location	Route #
000202	Williamson	SOUTH OF SR-840	

Record	Year	AADT
1	2010	56590
2	2009	53150
3	2008	50001
4	2007	55582
5	2006	52517
6	2005	48572
7	2004	50836
8	2003	48087
9	2002	44753
10	2001	40469

Station #	County	Location	Route #
000201	Williamson	W OF I-65	

Record	Year	AADT
1	2010	14800
2	2009	16522
3	2008	15238
4	2007	15113
5	2006	10060
6	2005	9098
7	2004	8339
8	2003	7572
9	2002	6514
10	2001	5627

Station #	County	Location	Route #
000195	Maury	SOUTH OF SATURN PKWY	I0065

Record	Year	AADT
1	2010	30967
2	2009	23944
3	2008	24794
4	2007	30221
5	2006	30795
6	2005	28970
7	2004	29809
8	2003	28433
9	2002	28301
10	2001	30539
11	2000	26986
12	1999	25184
13	1998	25588
14	1997	23805
15	1996	20363
16	1995	20158
17	1994	19052
18	1993	20587
19	1992	18630
20	1991	18754
21	1990	18772
22	1989	20857

Station #	County	Location	Route #
000009	Maury	NORTHEAST SPRING HILL	SR006

Record	Year	AADT
1	2010	14702
2	2009	19836
3	2008	19258
4	2007	18832
5	2006	18007
6	2005	17483
7	2004	13311
8	2003	12924
9	2002	11965
10	2001	12862
11	2000	9902
12	1999	9797
13	1998	10806
14	1997	11042
15	1996	10237
16	1995	9184
17	1994	8880
18	1993	7521
19	1992	8000
20	1991	7895
21	1990	6895
22	1989	6400
23	1988	10016
24	1987	8935
25	1986	10832
26	1985	8626

Station #	County	Location	Route #
000010	Maury	EAST OF SPRING HILL	SR247

Record	Year	AADT
1	2010	9321
2	2009	8048
3	2008	6881
4	2007	6681
5	2006	6126
6	2005	5948
7	2004	5369
8	2003	3100
9	2002	3607
10	2001	3091
11	2000	2493
12	1999	2171
13	1998	1722
14	1997	1394
15	1996	1170
16	1995	1093
17	1994	889
18	1993	662
19	1992	601
20	1991	577
21	1990	508
22	1989	544
23	1988	788
24	1987	632
25	1986	729
26	1985	598

Station #	County	Location	Route #
000126	Williamson	DUPLEX RD. W OF I-65	SR247

Record	Year	AADT
1	2010	5428
2	2009	5760
3	2008	4647
4	2007	6399
5	2006	4718
6	2005	4482
7	2004	2286
8	2003	2219
9	2002	1906
10	2001	1662
11	2000	2067
12	1999	2054
13	1998	1382
14	1997	1120
15	1996	852
16	1995	773
17	1994	651
18	1993	508
19	1992	526
20	1991	388
21	1990	469
22	1989	756
23	1988	552
24	1987	483
25	1986	346
26	1985	284

Station #	County	Location	Route #
000116	Williamson	DUPLEX RD. E OF I-65	SR247

Record	Year	AADT
1	2010	2705
2	2009	2405
3	2008	2330
4	2007	2414
5	2006	2219
6	2005	1241
7	2004	1185
8	2003	1174
9	2002	1053
10	2001	1075
11	2000	1087
12	1999	1088
13	1998	850
14	1997	803
15	1996	604
16	1995	536
17	1994	465
18	1993	450
19	1992	461
20	1991	382
21	1990	388
22	1989	309
23	1988	384
24	1987	300
25	1986	247
26	1985	244

Station #	County	Location	Route #
000065	Williamson	N OF DUPLEX	SR106

Record	Year	AADT
1	2010	4780
2	2009	4817
3	2008	5168
4	2007	5021
5	2006	4992
6	2005	4680
7	2004	4220
8	2003	4170
9	2002	3916
10	2001	4226
11	2000	3595
12	1999	3958
13	1998	3860
14	1997	2862
15	1996	2900
16	1995	2863
17	1994	2626
18	1993	2328
19	1992	2102
20	1991	2250
21	1990	2483
22	1989	2275
23	1988	2080
24	1987	2251
25	1986	2282
26	1985	1656

Station #	County	Location	Route #
000066	Williamson	NEAR THOMPSON STATION, S OF FRANKLIN	01928

Record	Year	AADT
1	2010	2557
2	2009	2590
3	2008	2279
4	2007	3720
5	2006	2571
6	2005	2599
7	2004	2426
8	2003	2127
9	2002	1977
10	2001	1891
11	2000	1897
12	1999	2019
13	1998	1851
14	1997	1400
15	1996	1373
16	1995	1404
17	1994	1219
18	1993	1036
19	1992	1026
20	1991	751
21	1990	701
22	1989	653
23	1988	799
24	1987	780
25	1986	899
26	1985	792

Station #	County	Location	Route #
000067	Williamson	NEAR THOMPSON STATION	SR006

Record	Year	AADT
1	2010	17900
2	2009	18342
3	2008	19891
4	2007	20488
5	2006	21645
6	2005	15488
7	2004	15037
8	2003	14599
9	2002	14037
10	2001	15108
11	2000	13289
12	1999	10915
13	1998	11015
14	1997	9499
15	1996	9418
16	1995	9079
17	1994	10337
18	1993	8121
19	1992	7654
20	1991	7117
21	1990	8427
22	1989	7490
23	1988	11127
24	1987	10883
25	1986	10443
26	1985	9342

I 65 @ SR 840

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000005 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 13 / 2009	**End Date:**	04 / 14 / 2009
Start Time:	11 : 00	**End Time:**	11 : 00
Direction:	5 (Ramp)		

Time	
11:00 - 12:00	246
12:00 - 13:00	219
13:00 - 14:00	260
14:00 - 15:00	276
15:00 - 16:00	270
16:00 - 17:00	291
17:00 - 18:00	325
18:00 - 19:00	221
19:00 - 20:00	122
20:00 - 21:00	119
21:00 - 22:00	111
22:00 - 23:00	80
23:00 - 24:00	58
24:00 - 01:00	36
01:00 - 02:00	26
02:00 - 03:00	31
03:00 - 04:00	37
04:00 - 05:00	57
05:00 - 06:00	126
06:00 - 07:00	318
07:00 - 08:00	419
08:00 - 09:00	335
09:00 - 10:00	277
10:00 - 11:00	231

Total: 4,491

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
06:45 - 07:45	433	0.87	16:30 - 17:30	330	0.81

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
10	100	7	100	10	100

I-65 @ SR 840

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000006 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 13 / 2009	**End Date:**	04 / 14 / 2009
Start Time:	11 : 00	**End Time:**	11 : 00
Direction:	5 (Ramp)		

Time	
11:00 - 12:00	18
12:00 - 13:00	12
13:00 - 14:00	23
14:00 - 15:00	22
15:00 - 16:00	15
16:00 - 17:00	14
17:00 - 18:00	29
18:00 - 19:00	21
19:00 - 20:00	16
20:00 - 21:00	5
21:00 - 22:00	2
22:00 - 23:00	1
23:00 - 24:00	1
24:00 - 01:00	1
01:00 - 02:00	0
02:00 - 03:00	1
03:00 - 04:00	0
04:00 - 05:00	3
05:00 - 06:00	7
06:00 - 07:00	48
07:00 - 08:00	153
08:00 - 09:00	95
09:00 - 10:00	24
10:00 - 11:00	16
Total:	527

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:15 - 08:15	159	0.88	17:00 - 18:00	29	0.73

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
13	100	6	100	13	100

I-65 @ SR 840

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000007 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 13 / 2009	**End Date:**	04 / 14 / 2009
Start Time:	09 : 00	**End Time:**	09 : 00
Direction:	5 (Ramp)		

Time	
09:00 - 10:00	636
10:00 - 11:00	566
11:00 - 12:00	504
12:00 - 13:00	454
13:00 - 14:00	420
14:00 - 15:00	463
15:00 - 16:00	419
16:00 - 17:00	445
17:00 - 18:00	450
18:00 - 19:00	296
19:00 - 20:00	165
20:00 - 21:00	139
21:00 - 22:00	109
22:00 - 23:00	64
23:00 - 24:00	17
24:00 - 01:00	17
01:00 - 02:00	7
02:00 - 03:00	18
03:00 - 04:00	47
04:00 - 05:00	95
05:00 - 06:00	384
06:00 - 07:00	916
07:00 - 08:00	934
08:00 - 09:00	809

Total: 8,374

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
06:15 - 07:15	940	0.89	16:45 - 17:45	472	0.88

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
11	100	6	100	11	100

I-65 @ SR 840

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000008 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 13 / 2009	**End Date:**	04 / 14 / 2009
Start Time:	09 : 00	**End Time:**	09 : 00
Direction:	5 (Ramp)		

Time	
09:00 - 10:00	454
10:00 - 11:00	450
11:00 - 12:00	420
12:00 - 13:00	397
13:00 - 14:00	377
14:00 - 15:00	447
15:00 - 16:00	480
16:00 - 17:00	476
17:00 - 18:00	504
18:00 - 19:00	385
19:00 - 20:00	229
20:00 - 21:00	196
21:00 - 22:00	202
22:00 - 23:00	106
23:00 - 24:00	81
24:00 - 01:00	39
01:00 - 02:00	30
02:00 - 03:00	49
03:00 - 04:00	47
04:00 - 05:00	83
05:00 - 06:00	234
06:00 - 07:00	361
07:00 - 08:00	536
08:00 - 09:00	536

Total: 7,119

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:15 - 08:15	538	0.91	16:45 - 17:45	505	0.86

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
8	100	7	100	8	100

I-65 @ SR 840

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000009 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 13 / 2009	**End Date:**	04 / 14 / 2009
Start Time:	09 : 00	**End Time:**	09 : 00
Direction:	5 (Ramp)		

Time	
09:00 - 10:00	198
10:00 - 11:00	192
11:00 - 12:00	238
12:00 - 13:00	277
13:00 - 14:00	342
14:00 - 15:00	426
15:00 - 16:00	607
16:00 - 17:00	952
17:00 - 18:00	873
18:00 - 19:00	504
19:00 - 20:00	312
20:00 - 21:00	239
21:00 - 22:00	178
22:00 - 23:00	109
23:00 - 24:00	50
24:00 - 01:00	27
01:00 - 02:00	15
02:00 - 03:00	15
03:00 - 04:00	14
04:00 - 05:00	15
05:00 - 06:00	70
06:00 - 07:00	137
07:00 - 08:00	161
08:00 - 09:00	152

Total: 6,103

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
11:30 - 12:30	270	0.78	16:45 - 17:45	985	0.90

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
4	100	14	100	14	100

I-65 @ SR 840

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000010 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 13 / 2009	**End Date:**	04 / 14 / 2009
Start Time:	09 : 00	**End Time:**	09 : 00
Direction:	5 (Ramp)		

Time	
09:00 - 10:00	150
10:00 - 11:00	160
11:00 - 12:00	178
12:00 - 13:00	174
13:00 - 14:00	202
14:00 - 15:00	251
15:00 - 16:00	252
16:00 - 17:00	287
17:00 - 18:00	211
18:00 - 19:00	151
19:00 - 20:00	107
20:00 - 21:00	99
21:00 - 22:00	93
22:00 - 23:00	27
23:00 - 24:00	25
24:00 - 01:00	9
01:00 - 02:00	6
02:00 - 03:00	5
03:00 - 04:00	5
04:00 - 05:00	24
05:00 - 06:00	45
06:00 - 07:00	152
07:00 - 08:00	167
08:00 - 09:00	169

Total: 2,949

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
10:45 - 11:45	189	0.91	16:15 - 17:15	289	0.89

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
6	100	10	100	10	100

I-65 @ SR 840

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000011 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 13 / 2009	**End Date:**	04 / 14 / 2009
Start Time:	10 : 00	**End Time:**	10 : 00
Direction:	5 (Ramp)		

Time	
10:00 - 11:00	496
11:00 - 12:00	427
12:00 - 13:00	327
13:00 - 14:00	390
14:00 - 15:00	361
15:00 - 16:00	368
16:00 - 17:00	407
17:00 - 18:00	403
18:00 - 19:00	311
19:00 - 20:00	118
20:00 - 21:00	107
21:00 - 22:00	73
22:00 - 23:00	43
23:00 - 24:00	24
24:00 - 01:00	13
01:00 - 02:00	6
02:00 - 03:00	13
03:00 - 04:00	24
04:00 - 05:00	73
05:00 - 06:00	254
06:00 - 07:00	920
07:00 - 08:00	974
08:00 - 09:00	864
09:00 - 10:00	674

Total: 7,670

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
06:30 - 07:30	1013	0.88	15:30 - 16:30	425	0.75

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
13	100	6	100	13	100

I-65 @ SR 840

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000012 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 13 / 2009	**End Date:**	04 / 14 / 2009
Start Time:	10 : 00	**End Time:**	10 : 00
Direction:	5 (Ramp)		

Time	
10:00 - 11:00	262
11:00 - 12:00	253
12:00 - 13:00	231
13:00 - 14:00	228
14:00 - 15:00	264
15:00 - 16:00	344
16:00 - 17:00	383
17:00 - 18:00	384
18:00 - 19:00	301
19:00 - 20:00	174
20:00 - 21:00	147
21:00 - 22:00	120
22:00 - 23:00	106
23:00 - 24:00	70
24:00 - 01:00	48
01:00 - 02:00	29
02:00 - 03:00	38
03:00 - 04:00	28
04:00 - 05:00	54
05:00 - 06:00	172
06:00 - 07:00	191
07:00 - 08:00	365
08:00 - 09:00	337
09:00 - 10:00	265

Total: 4,794

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:30 - 08:30	377	0.84	16:30 - 17:30	385	0.93

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
8	100	8	100	8	100

Ramp CCdata 15 Min

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000013 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 13 / 2009	**End Date:**	04 / 14 / 2009
Start Time:	11 : 00	**End Time:**	11 : 00
Direction:	5 (Ramp)		

Time	
11:00 - 12:00	93
12:00 - 13:00	87
13:00 - 14:00	98
14:00 - 15:00	142
15:00 - 16:00	120
16:00 - 17:00	140
17:00 - 18:00	163
18:00 - 19:00	133
19:00 - 20:00	79
20:00 - 21:00	55
21:00 - 22:00	82
22:00 - 23:00	61
23:00 - 24:00	25
24:00 - 01:00	21
01:00 - 02:00	18
02:00 - 03:00	12
03:00 - 04:00	15
04:00 - 05:00	30
05:00 - 06:00	40
06:00 - 07:00	98
07:00 - 08:00	92
08:00 - 09:00	123
09:00 - 10:00	132
10:00 - 11:00	108

Total: 1,967

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
08:45 - 09:45	145	0.84	17:00 - 18:00	163	0.85

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
7	100	8	100	8	100

Ramp cc data 15min

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000014 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 15 / 2009	**End Date:**	04 / 16 / 2009
Start Time:	10 : 00	**End Time:**	10 : 00
Direction:	5 (Ramp)		

Time	
10:00 - 11:00	355
11:00 - 12:00	347
12:00 - 13:00	300
13:00 - 14:00	292
14:00 - 15:00	276
15:00 - 16:00	361
16:00 - 17:00	341
17:00 - 18:00	334
18:00 - 19:00	261
19:00 - 20:00	177
20:00 - 21:00	133
21:00 - 22:00	128
22:00 - 23:00	65
23:00 - 24:00	42
24:00 - 01:00	41
01:00 - 02:00	33
02:00 - 03:00	28
03:00 - 04:00	19
04:00 - 05:00	34
05:00 - 06:00	103
06:00 - 07:00	426
07:00 - 08:00	1,081
08:00 - 09:00	1,067
09:00 - 10:00	497
Total:	6,741

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:15 - 08:15	1174	0.95	15:00 - 16:00	361	0.87

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
14	100	5	100	14	100

Ramp ccdata 15min

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000015 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 15 / 2009	**End Date:**	04 / 16 / 2009
Start Time:	11 : 00	**End Time:**	11 : 00
Direction:	5 (Ramp)		

Time	
11:00 - 12:00	275
12:00 - 13:00	281
13:00 - 14:00	342
14:00 - 15:00	374
15:00 - 16:00	476
16:00 - 17:00	542
17:00 - 18:00	488
18:00 - 19:00	496
19:00 - 20:00	341
20:00 - 21:00	323
21:00 - 22:00	224
22:00 - 23:00	120
23:00 - 24:00	94
24:00 - 01:00	42
01:00 - 02:00	37
02:00 - 03:00	20
03:00 - 04:00	21
04:00 - 05:00	33
05:00 - 06:00	62
06:00 - 07:00	137
07:00 - 08:00	211
08:00 - 09:00	221
09:00 - 10:00	230
10:00 - 11:00	236

Total: 5,626

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
11:30 - 12:30	286	0.79	15:30 - 16:30	554	0.94

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
5	100	10	100	10	100

Ramp ccdata 15 min

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000016 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 15 / 2009	**End Date:**	04 / 16 / 2009
Start Time:	11 : 00	**End Time:**	11 : 00
Direction:	5 (Ramp)		

Time	
11:00 - 12:00	137
12:00 - 13:00	102
13:00 - 14:00	118
14:00 - 15:00	176
15:00 - 16:00	212
16:00 - 17:00	205
17:00 - 18:00	161
18:00 - 19:00	126
19:00 - 20:00	97
20:00 - 21:00	88
21:00 - 22:00	56
22:00 - 23:00	52
23:00 - 24:00	39
24:00 - 01:00	26
01:00 - 02:00	29
02:00 - 03:00	8
03:00 - 04:00	16
04:00 - 05:00	39
05:00 - 06:00	100
06:00 - 07:00	139
07:00 - 08:00	98
08:00 - 09:00	150
09:00 - 10:00	157
10:00 - 11:00	132

Total: 2,463

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
08:15 - 09:15	161	0.82	15:45 - 16:45	226	0.77

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
7	100	9	100	9	100

Ramp I-65 @ SR 96
Murfreesboro Rd.

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000017 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 15 / 2009	**End Date:**	04 / 16 / 2009
Start Time:	10 : 00	**End Time:**	10 : 00
Direction:	5 (Ramp)		

Time	
10:00 - 11:00	390
11:00 - 12:00	401
12:00 - 13:00	313
13:00 - 14:00	315
14:00 - 15:00	403
15:00 - 16:00	373
16:00 - 17:00	364
17:00 - 18:00	429
18:00 - 19:00	374
19:00 - 20:00	197
20:00 - 21:00	142
21:00 - 22:00	111
22:00 - 23:00	69
23:00 - 24:00	72
24:00 - 01:00	20
01:00 - 02:00	13
02:00 - 03:00	10
03:00 - 04:00	19
04:00 - 05:00	30
05:00 - 06:00	129
06:00 - 07:00	376
07:00 - 08:00	455
08:00 - 09:00	537
09:00 - 10:00	429

Total: 5,971

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
08:00 - 09:00	537	0.84	17:00 - 18:00	429	0.93

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
9	100	7	100	9	100

Ramp I-65 @ SR 96
Murfreesboro Rd.

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000018 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 15 / 2009	**End Date:**	04 / 16 / 2009
Start Time:	10 : 00	**End Time:**	10 : 00
Direction:	5 (Ramp)		

Time	
10:00 - 11:00	1,238
11:00 - 12:00	1,288
12:00 - 13:00	1,253
13:00 - 14:00	1,158
14:00 - 15:00	1,206
15:00 - 16:00	1,292
16:00 - 17:00	1,310
17:00 - 18:00	884
18:00 - 19:00	987
19:00 - 20:00	779
20:00 - 21:00	505
21:00 - 22:00	367
22:00 - 23:00	228
23:00 - 24:00	120
24:00 - 01:00	66
01:00 - 02:00	41
02:00 - 03:00	42
03:00 - 04:00	44
04:00 - 05:00	105
05:00 - 06:00	337
06:00 - 07:00	1,428
07:00 - 08:00	2,599
08:00 - 09:00	1,998
09:00 - 10:00	1,420
Total:	20,695

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:00 - 08:00	2599	0.95	16:15 - 17:15	1370	0.93

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
13	100	7	100	13	100

Ramp I-65 @ SR 96
Murfreesboro Rd.

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000019 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 15 / 2009	**End Date:**	04 / 16 / 2009
Start Time:	11 : 00	**End Time:**	11 : 00
Direction:	5 (Ramp)		

Time	
11:00 - 12:00	1,137
12:00 - 13:00	1,195
13:00 - 14:00	1,231
14:00 - 15:00	1,443
15:00 - 16:00	1,564
16:00 - 17:00	2,011
17:00 - 18:00	2,362
18:00 - 19:00	1,675
19:00 - 20:00	1,082
20:00 - 21:00	918
21:00 - 22:00	627
22:00 - 23:00	353
23:00 - 24:00	200
24:00 - 01:00	127
01:00 - 02:00	64
02:00 - 03:00	42
03:00 - 04:00	56
04:00 - 05:00	56
05:00 - 06:00	125
06:00 - 07:00	577
07:00 - 08:00	1,061
08:00 - 09:00	1,150
09:00 - 10:00	1,094
10:00 - 11:00	1,018

Total: 21,168

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:30 - 08:30	1226	0.93	16:45 - 17:45	2375	0.95

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
6	100	11	100	11	100

Ramp I-65 @ SR 96
Murfreesboro Rd.

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000020 (Ramp)
Start Date: 04 / 15 / 2009
Start Time: 11 : 00
Direction: 5 (Ramp)

County: 94 Williamson
End Date: 04 / 16 / 2009
End Time: 11 : 00

Time	
11:00 - 12:00	306
12:00 - 13:00	368
13:00 - 14:00	384
14:00 - 15:00	453
15:00 - 16:00	588
16:00 - 17:00	623
17:00 - 18:00	577
18:00 - 19:00	435
19:00 - 20:00	434
20:00 - 21:00	345
21:00 - 22:00	259
22:00 - 23:00	124
23:00 - 24:00	93
24:00 - 01:00	42
01:00 - 02:00	23
02:00 - 03:00	16
03:00 - 04:00	24
04:00 - 05:00	24
05:00 - 06:00	109
06:00 - 07:00	167
07:00 - 08:00	311
08:00 - 09:00	299
09:00 - 10:00	327
10:00 - 11:00	241

Total: 6,572

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
11:45 - 12:45	350	0.88	15:45 - 16:45	627	0.88

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
5	100	10	100	10	100

Sta 40 3 cdata 15min

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000040 **County:** 94 Williamson
Start Date: 02/03/09 **End Date:** 02/04/09
Start Time: 10:00 **End Time:** 10:00
Direction: 3 (Coverage)

Time	:00	:15	:30	:45	Hour Total
10:00 - 11:00	87	99	95	97	378
11:00 - 12:00	95	100	110	139	444
12:00 - 13:00	130	111	122	104	467
13:00 - 14:00	143	132	116	120	511
14:00 - 15:00	186	168	172	171	697
15:00 - 16:00	208	207	231	208	854
16:00 - 17:00	258	300	332	368	1,258
17:00 - 18:00	385	420	351	282	1,438
18:00 - 19:00	262	239	167	176	844
19:00 - 20:00	163	136	106	85	490
20:00 - 21:00	116	96	90	99	401
21:00 - 22:00	94	89	75	60	318
22:00 - 23:00	67	43	35	31	176
23:00 - 24:00	24	17	15	6	62
24:00 - 01:00	14	9	8	8	39
01:00 - 02:00	6	6	5	2	19
02:00 - 03:00	0	6	11	3	20
03:00 - 04:00	3	3	0	4	10
04:00 - 05:00	0	3	2	6	11
05:00 - 06:00	4	10	19	22	55
06:00 - 07:00	26	39	62	78	205
07:00 - 08:00	107	80	93	114	394
08:00 - 09:00	105	94	95	74	368
09:00 - 10:00	90	72	91	92	345

Total: 9,804

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:15 - 08:15	2022	0.92	16:45 - 17:45	2059	0.92

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
10	75	10	74	10	74

Sta 40 4 cc data 15 min

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000040 **County:** 94 Williamson
Start Date: 02/03/09 **End Date:** 02/04/09
Start Time: 10:00 **End Time:** 10:00
Direction: 4 (Coverage)

Time	:00	:15	:30	:45	Hour Total
10:00 - 11:00	148	122	142	144	556
11:00 - 12:00	131	130	126	138	525
12:00 - 13:00	136	126	124	155	541
13:00 - 14:00	107	111	119	132	469
14:00 - 15:00	136	124	109	125	494
15:00 - 16:00	168	115	129	157	569
16:00 - 17:00	143	123	129	142	537
17:00 - 18:00	130	142	121	127	520
18:00 - 19:00	116	129	102	101	448
19:00 - 20:00	75	71	48	45	239
20:00 - 21:00	32	54	41	41	168
21:00 - 22:00	31	22	30	30	113
22:00 - 23:00	13	18	17	8	56
23:00 - 24:00	10	9	6	10	35
24:00 - 01:00	1	5	2	1	9
01:00 - 02:00	2	2	4	1	9
02:00 - 03:00	0	1	1	1	3
03:00 - 04:00	3	2	6	4	15
04:00 - 05:00	2	9	17	17	45
05:00 - 06:00	23	45	55	84	207
06:00 - 07:00	99	147	202	296	744
07:00 - 08:00	334	384	459	403	1,580
08:00 - 09:00	384	288	321	306	1,299
09:00 - 10:00	204	175	174	164	717

Total: 9,898

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:15 - 08:15	2022	0.92	16:45 - 17:45	2059	0.92

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
10	75	10	74	10	74

SR 840 @ SR 6 (US 31 Columbia Pike)

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000046 **County:** 94 Williamson
Start Date: 02/09/09 **End Date:** 02/10/09
Start Time: 10:00 **End Time:** 10:00
Direction: 0 (Coverage)

Time	:00	:15	:30	:45	Hour Total
10:00 - 11:00	50	51	44	51	196
11:00 - 12:00	41	46	41	60	188
12:00 - 13:00	52	62	70	42	226
13:00 - 14:00	49	68	62	63	242
14:00 - 15:00	43	68	61	103	275
15:00 - 16:00	72	105	70	109	356
16:00 - 17:00	97	103	99	146	445
17:00 - 18:00	184	220	299	189	892
18:00 - 19:00	115	114	76	75	380
19:00 - 20:00	53	53	53	36	195
20:00 - 21:00	21	37	23	30	111
21:00 - 22:00	24	15	17	12	68
22:00 - 23:00	12	5	7	4	28
23:00 - 24:00	4	2	2	2	10
24:00 - 01:00	3	1	0	3	7
01:00 - 02:00	1	0	0	1	2
02:00 - 03:00	0	2	1	0	3
03:00 - 04:00	0	0	0	0	0
04:00 - 05:00	0	0	1	3	4
05:00 - 06:00	1	2	9	9	21
06:00 - 07:00	14	32	36	81	163
07:00 - 08:00	130	181	172	184	667
08:00 - 09:00	186	166	130	76	558
09:00 - 10:00	99	60	64	39	262

Total: 5,299

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:15 - 08:15	723	0.97	17:00 - 18:00	892	0.75

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
14	65	14	65	14	65

SR 840 @ SR 6 (US 31
Columbia Pike)

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000047 (Ramp)	**County:**	94 Williamson
Start Date:	03 / 18 / 2008	**End Date:**	03 / 19 / 2008
Start Time:	10 : 00	**End Time:**	10 : 00
Direction:	5 (Ramp)		

Time	
10:00 - 11:00	301
11:00 - 12:00	284
12:00 - 13:00	272
13:00 - 14:00	278
14:00 - 15:00	266
15:00 - 16:00	310
16:00 - 17:00	314
17:00 - 18:00	284
18:00 - 19:00	199
19:00 - 20:00	121
20:00 - 21:00	77
21:00 - 22:00	56
22:00 - 23:00	36
23:00 - 24:00	12
24:00 - 01:00	13
01:00 - 02:00	10
02:00 - 03:00	10
03:00 - 04:00	25
04:00 - 05:00	60
05:00 - 06:00	251
06:00 - 07:00	335
07:00 - 08:00	330
08:00 - 09:00	344
09:00 - 10:00	303

Total: 4,491

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
05:45 - 06:45	366	0.80	16:15 - 17:15	328	0.89

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
8	100	7	100	8	100

SR 840 @ SR 6
(US 31, Columbia Pike)

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000048 (Ramp)	**County:**	94 Williamson
Start Date:	03 / 18 / 2008	**End Date:**	03 / 19 / 2008
Start Time:	10 : 00	**End Time:**	10 : 00
Direction:	5 (Ramp)		

Time	
10:00 - 11:00	198
11:00 - 12:00	233
12:00 - 13:00	266
13:00 - 14:00	278
14:00 - 15:00	326
15:00 - 16:00	428
16:00 - 17:00	546
17:00 - 18:00	567
18:00 - 19:00	331
19:00 - 20:00	260
20:00 - 21:00	169
21:00 - 22:00	178
22:00 - 23:00	94
23:00 - 24:00	46
24:00 - 01:00	25
01:00 - 02:00	17
02:00 - 03:00	8
03:00 - 04:00	17
04:00 - 05:00	20
05:00 - 06:00	71
06:00 - 07:00	207
07:00 - 08:00	244
08:00 - 09:00	163
09:00 - 10:00	211

Total: 4,903

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
06:45 - 07:45	258	0.82	16:45 - 17:45	592	0.95

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
5	100	12	100	12	100

SR 840 @ SR 6 (US 31 Columbia Pike)

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000049 **County:** 94 Williamson
Start Date: 02/25/09 **End Date:** 02/26/09
Start Time: 10:00 **End Time:** 10:00
Direction: 0 (Coverage)

Time	:00	:15	:30	:45	Hour Total
10:00 - 11:00	35	18	17	19	89
11:00 - 12:00	27	22	25	28	102
12:00 - 13:00	20	27	29	26	102
13:00 - 14:00	22	25	27	27	101
14:00 - 15:00	30	19	26	32	107
15:00 - 16:00	35	38	42	36	151
16:00 - 17:00	58	39	46	44	187
17:00 - 18:00	47	59	73	58	237
18:00 - 19:00	47	44	45	32	168
19:00 - 20:00	44	19	11	14	88
20:00 - 21:00	19	26	15	13	73
21:00 - 22:00	13	5	7	8	33
22:00 - 23:00	4	5	5	5	19
23:00 - 24:00	2	2	2	1	7
24:00 - 01:00	1	1	4	0	6
01:00 - 02:00	2	2	0	0	4
02:00 - 03:00	0	1	0	0	1
03:00 - 04:00	1	1	2	0	4
04:00 - 05:00	1	1	3	4	9
05:00 - 06:00	2	5	5	13	25
06:00 - 07:00	11	15	35	51	112
07:00 - 08:00	61	55	67	73	256
08:00 - 09:00	84	80	37	34	235
09:00 - 10:00	51	28	33	28	140

Total: 2,256

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:30 - 08:30	304	0.90	17:00 - 18:00	237	0.81

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
13	65	11	65	13	65

SR 840 @ SR 106
(US 441; Lewisburg Ave)

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000050 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 06 / 2009	**End Date:**	04 / 07 / 2009
Start Time:	11 : 00	**End Time:**	11 : 00
Direction:	5 (Ramp)		

Time	
11:00 - 12:00	15
12:00 - 13:00	18
13:00 - 14:00	19
14:00 - 15:00	25
15:00 - 16:00	38
16:00 - 17:00	40
17:00 - 18:00	32
18:00 - 19:00	24
19:00 - 20:00	13
20:00 - 21:00	10
21:00 - 22:00	7
22:00 - 23:00	5
23:00 - 24:00	2
24:00 - 01:00	2
01:00 - 02:00	0
02:00 - 03:00	1
03:00 - 04:00	0
04:00 - 05:00	0
05:00 - 06:00	0
06:00 - 07:00	1
07:00 - 08:00	16
08:00 - 09:00	12
09:00 - 10:00	12
10:00 - 11:00	9

Total: 301

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
11:15 - 12:15	16	0.80	15:45 - 16:45	47	0.73

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
5	100	13	100	13	100

SR 840 @ SR 106
(US 441 Lewisburg Ave)

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000051 (Ramp) **County:** 94 Williamson
Start Date: 04 / 06 / 2009 **End Date:** 04 / 07 / 2009
Start Time: 11 : 00 **End Time:** 11 : 00
Direction: 5 (Ramp)

Time	
11:00 - 12:00	171
12:00 - 13:00	164
13:00 - 14:00	133
14:00 - 15:00	142
15:00 - 16:00	132
16:00 - 17:00	146
17:00 - 18:00	187
18:00 - 19:00	127
19:00 - 20:00	76
20:00 - 21:00	44
21:00 - 22:00	34
22:00 - 23:00	19
23:00 - 24:00	18
24:00 - 01:00	4
01:00 - 02:00	2
02:00 - 03:00	3
03:00 - 04:00	8
04:00 - 05:00	32
05:00 - 06:00	106
06:00 - 07:00	329
07:00 - 08:00	526
08:00 - 09:00	397
09:00 - 10:00	292
10:00 - 11:00	194

Total: 3,286

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:00 - 08:00	526	0.94	17:00 - 18:00	187	0.92

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
14	100	6	100	14	100

SR 840 @ SR 106
(US 441; Lewisburg Ave)

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000052 (Ramp) **County:** 94 Williamson
Start Date: 03 / 18 / 2008 **End Date:** 03 / 19 / 2008
Start Time: 10 : 00 **End Time:** 10 : 00
Direction: 5 (Ramp)

Time	
10:00 - 11:00	97
11:00 - 12:00	99
12:00 - 13:00	157
13:00 - 14:00	166
14:00 - 15:00	197
15:00 - 16:00	256
16:00 - 17:00	452
17:00 - 18:00	613
18:00 - 19:00	496
19:00 - 20:00	258
20:00 - 21:00	169
21:00 - 22:00	178
22:00 - 23:00	123
23:00 - 24:00	62
24:00 - 01:00	37
01:00 - 02:00	22
02:00 - 03:00	8
03:00 - 04:00	10
04:00 - 05:00	2
05:00 - 06:00	7
06:00 - 07:00	45
07:00 - 08:00	146
08:00 - 09:00	118
09:00 - 10:00	86

Total: 3,804

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:15 - 08:15	158	0.67	17:15 - 18:15	633	0.94

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
4	100	14	100	14	100

SR 840 SR 106 cdata 15min
(US441 Lewisburg Ave)

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000053 (Ramp)
Start Date: 04 / 06 / 2009
Start Time: 11 : 00
Direction: 5 (Ramp)

County: 94 Williamson
End Date: 04 / 07 / 2009
End Time: 11 : 00

Time	
11:00 - 12:00	28
12:00 - 13:00	18
13:00 - 14:00	14
14:00 - 15:00	18
15:00 - 16:00	11
16:00 - 17:00	15
17:00 - 18:00	15
18:00 - 19:00	13
19:00 - 20:00	8
20:00 - 21:00	4
21:00 - 22:00	2
22:00 - 23:00	1
23:00 - 24:00	1
24:00 - 01:00	0
01:00 - 02:00	1
02:00 - 03:00	0
03:00 - 04:00	2
04:00 - 05:00	0
05:00 - 06:00	9
06:00 - 07:00	21
07:00 - 08:00	41
08:00 - 09:00	35
09:00 - 10:00	12
10:00 - 11:00	24

Total: 293

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:15 - 08:15	48	0.71	16:15 - 17:15	22	0.79

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
13	100	8	100	13	100

Ramp 1 ccdata 15 Min

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000054 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 07 / 2009	**End Date:**	04 / 08 / 2009
Start Time:	11 : 00	**End Time:**	11 : 00
Direction:	5 (Ramp)		

Time	
11:00 - 12:00	31
12:00 - 13:00	39
13:00 - 14:00	50
14:00 - 15:00	68
15:00 - 16:00	83
16:00 - 17:00	69
17:00 - 18:00	31
18:00 - 19:00	49
19:00 - 20:00	48
20:00 - 21:00	41
21:00 - 22:00	36
22:00 - 23:00	24
23:00 - 24:00	15
24:00 - 01:00	6
01:00 - 02:00	6
02:00 - 03:00	5
03:00 - 04:00	1
04:00 - 05:00	2
05:00 - 06:00	9
06:00 - 07:00	20
07:00 - 08:00	72
08:00 - 09:00	34
09:00 - 10:00	35
10:00 - 11:00	43
Total:	817

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:00 - 08:00	72	0.72	15:15 - 16:15	88	0.76

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
9	100	11	100	11	100

Ramp JR 840 Peytonsville.

Duplicate

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000054 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 07 / 2009	**End Date:**	04 / 08 / 2009
Start Time:	11 : 00	**End Time:**	11 : 00
Direction:	5 (Ramp)		

Time	
11:00 - 12:00	31
12:00 - 13:00	39
13:00 - 14:00	50
14:00 - 15:00	68
15:00 - 16:00	83
16:00 - 17:00	69
17:00 - 18:00	31
18:00 - 19:00	49
19:00 - 20:00	48
20:00 - 21:00	41
21:00 - 22:00	36
22:00 - 23:00	24
23:00 - 24:00	15
24:00 - 01:00	6
01:00 - 02:00	6
02:00 - 03:00	5
03:00 - 04:00	1
04:00 - 05:00	2
05:00 - 06:00	9
06:00 - 07:00	20
07:00 - 08:00	72
08:00 - 09:00	34
09:00 - 10:00	35
10:00 - 11:00	43

Total: 817

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:00 - 08:00	72	0.72	15:15 - 16:15	88	0.76

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
9	100	11	100	11	100

SR 840 Peytonsville

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000055 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 07 / 2009	**End Date:**	04 / 08 / 2009
Start Time:	11 : 00	**End Time:**	11 : 00
Direction:	5 (Ramp)		

Time	
11:00 - 12:00	16
12:00 - 13:00	10
13:00 - 14:00	21
14:00 - 15:00	21
15:00 - 16:00	18
16:00 - 17:00	25
17:00 - 18:00	22
18:00 - 19:00	15
19:00 - 20:00	7
20:00 - 21:00	5
21:00 - 22:00	3
22:00 - 23:00	1
23:00 - 24:00	0
24:00 - 01:00	2
01:00 - 02:00	2
02:00 - 03:00	0
03:00 - 04:00	1
04:00 - 05:00	2
05:00 - 06:00	15
06:00 - 07:00	32
07:00 - 08:00	33
08:00 - 09:00	28
09:00 - 10:00	15
10:00 - 11:00	16
Total:	310

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
06:15 - 07:15	37	0.71	16:30 - 17:30	28	0.88

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
12	100	9	100	12	100

SR 840 Peytonsville

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000056 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 07 / 2009	**End Date:**	04 / 08 / 2009
Start Time:	11 : 00	**End Time:**	11 : 00
Direction:	5 (Ramp)		

Time	
11:00 - 12:00	10
12:00 - 13:00	9
13:00 - 14:00	18
14:00 - 15:00	25
15:00 - 16:00	24
16:00 - 17:00	36
17:00 - 18:00	37
18:00 - 19:00	27
19:00 - 20:00	21
20:00 - 21:00	14
21:00 - 22:00	5
22:00 - 23:00	5
23:00 - 24:00	1
24:00 - 01:00	1
01:00 - 02:00	1
02:00 - 03:00	0
03:00 - 04:00	1
04:00 - 05:00	0
05:00 - 06:00	2
06:00 - 07:00	27
07:00 - 08:00	84
08:00 - 09:00	38
09:00 - 10:00	8
10:00 - 11:00	12
Total:	406

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:00 - 08:00	84	0.68	16:45 - 17:45	43	0.77

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
13	100	11	100	13	100

SR 840 Peytonsville

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000057 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 07 / 2009	**End Date:**	04 / 08 / 2009
Start Time:	11 : 00	**End Time:**	11 : 00
Direction:	5 (Ramp)		

Time	
11:00 - 12:00	40
12:00 - 13:00	44
13:00 - 14:00	24
14:00 - 15:00	43
15:00 - 16:00	43
16:00 - 17:00	48
17:00 - 18:00	140
18:00 - 19:00	74
19:00 - 20:00	29
20:00 - 21:00	18
21:00 - 22:00	16
22:00 - 23:00	6
23:00 - 24:00	2
24:00 - 01:00	0
01:00 - 02:00	4
02:00 - 03:00	1
03:00 - 04:00	3
04:00 - 05:00	6
05:00 - 06:00	33
06:00 - 07:00	70
07:00 - 08:00	38
08:00 - 09:00	68
09:00 - 10:00	73
10:00 - 11:00	51
Total:	874

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
08:45 - 09:45	82	0.79	17:15 - 18:15	148	0.71

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
9	100	13	100	13	100

SR 840 Arno Rd

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000058 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 07 / 2009	**End Date:**	04 / 08 / 2009
Start Time:	11 : 00	**End Time:**	11 : 00
Direction:	5 (Ramp)		

Time	
11:00 - 12:00	15
12:00 - 13:00	20
13:00 - 14:00	15
14:00 - 15:00	19
15:00 - 16:00	22
16:00 - 17:00	21
17:00 - 18:00	37
18:00 - 19:00	12
19:00 - 20:00	13
20:00 - 21:00	15
21:00 - 22:00	7
22:00 - 23:00	7
23:00 - 24:00	5
24:00 - 01:00	4
01:00 - 02:00	0
02:00 - 03:00	0
03:00 - 04:00	0
04:00 - 05:00	0
05:00 - 06:00	2
06:00 - 07:00	7
07:00 - 08:00	17
08:00 - 09:00	25
09:00 - 10:00	23
10:00 - 11:00	22
Total:	308

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
08:45 - 09:45	29	0.66	16:30 - 17:30	48	0.67

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
9	100	13	100	13	100

SR 840 Arno Rd

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000059 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 07 / 2009	**End Date:**	04 / 08 / 2009
Start Time:	11 : 00	**End Time:**	11 : 00
Direction:	5 (Ramp)		

Time	
11:00 - 12:00	18
12:00 - 13:00	23
13:00 - 14:00	16
14:00 - 15:00	17
15:00 - 16:00	23
16:00 - 17:00	60
17:00 - 18:00	170
18:00 - 19:00	77
19:00 - 20:00	19
20:00 - 21:00	17
21:00 - 22:00	6
22:00 - 23:00	6
23:00 - 24:00	5
24:00 - 01:00	1
01:00 - 02:00	0
02:00 - 03:00	0
03:00 - 04:00	0
04:00 - 05:00	1
05:00 - 06:00	2
06:00 - 07:00	12
07:00 - 08:00	25
08:00 - 09:00	24
09:00 - 10:00	25
10:00 - 11:00	24
Total:	571

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
09:30 - 10:30	29	0.81	17:00 - 18:00	170	0.73

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
5	100	13	100	13	100

SR 840 Arno Rd

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000060 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 07 / 2009	**End Date:**	04 / 08 / 2009
Start Time:	11 : 00	**End Time:**	11 : 00
Direction:	5 (Ramp)		

Time	
11:00 - 12:00	14
12:00 - 13:00	20
13:00 - 14:00	28
14:00 - 15:00	17
15:00 - 16:00	29
16:00 - 17:00	30
17:00 - 18:00	31
18:00 - 19:00	22
19:00 - 20:00	12
20:00 - 21:00	12
21:00 - 22:00	6
22:00 - 23:00	8
23:00 - 24:00	4
24:00 - 01:00	3
01:00 - 02:00	0
02:00 - 03:00	0
03:00 - 04:00	0
04:00 - 05:00	0
05:00 - 06:00	2
06:00 - 07:00	23
07:00 - 08:00	109
08:00 - 09:00	129
09:00 - 10:00	27
10:00 - 11:00	23
Total:	549

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:30 - 08:30	163	0.67	15:45 - 16:45	37	0.62

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
13	100	7	100	13	100

SR840 Arno Rd

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000061 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 07 / 2009	**End Date:**	04 / 08 / 2009
Start Time:	11 : 00	**End Time:**	11 : 00
Direction:	5 (Ramp)		

Time	
11:00 - 12:00	15
12:00 - 13:00	18
13:00 - 14:00	22
14:00 - 15:00	18
15:00 - 16:00	16
16:00 - 17:00	24
17:00 - 18:00	46
18:00 - 19:00	62
19:00 - 20:00	41
20:00 - 21:00	11
21:00 - 22:00	7
22:00 - 23:00	5
23:00 - 24:00	0
24:00 - 01:00	0
01:00 - 02:00	1
02:00 - 03:00	0
03:00 - 04:00	1
04:00 - 05:00	1
05:00 - 06:00	8
06:00 - 07:00	9
07:00 - 08:00	16
08:00 - 09:00	24
09:00 - 10:00	20
10:00 - 11:00	16
Total:	381

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:45 - 08:45	27	0.75	17:45 - 18:45	70	0.83

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
7	100	13	100	13	100

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000079	**County:**	94 Williamson
Start Date:	03/26/07	**End Date:**	03/27/07
Start Time:	09:00	**End Time:**	09:00
Direction:	1 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
09:00 - 10:00	612	680	667	661	2,620
10:00 - 11:00	571	514	630	538	2,253
11:00 - 12:00	569	539	513	535	2,156
12:00 - 13:00	534	523	526	554	2,137
13:00 - 14:00	508	539	564	534	2,145
14:00 - 15:00	522	643	611	558	2,334
15:00 - 16:00	558	503	635	571	2,267
16:00 - 17:00	533	535	550	494	2,112 ✓
17:00 - 18:00	503	499	536	506	2,044
18:00 - 19:00	480	473	418	386	1,757
19:00 - 20:00	295	299	308	248	1,150
20:00 - 21:00	235	221	251	220	927
21:00 - 22:00	216	231	224	174	845
22:00 - 23:00	172	176	193	192	733
23:00 - 24:00	111	116	135	101	463
24:00 - 01:00	98	101	57	63	319
01:00 - 02:00	61	74	75	81	291
02:00 - 03:00	91	77	75	79	322
03:00 - 04:00	63	83	95	92	333
04:00 - 05:00	88	122	147	173	530
05:00 - 06:00	249	282	389	463	1,383
06:00 - 07:00	622	889	1,116	1,079	3,706 4229
07:00 - 08:00	910	888	1,063	1,065	3,926
08:00 - 09:00	1,082	1,019	985	1,037	4,123

Total: 40,876

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:45 - 08:45	5679	0.96	16:15 - 17:15	6260	0.96

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
7	73	8	67	8	67

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000079	**County:**	94 Williamson
Start Date:	03/26/07	**End Date:**	03/27/07
Start Time:	09:00	**End Time:**	09:00
Direction:	2 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
09:00 - 10:00	388	388	403	420	1,599
10:00 - 11:00	399	469	462	417	1,747
11:00 - 12:00	394	412	525	472	1,803
12:00 - 13:00	452	456	477	494	1,879
13:00 - 14:00	559	533	566	567	2,225
14:00 - 15:00	524	612	596	625	2,357
15:00 - 16:00	736	730	816	881	3,163
16:00 - 17:00	876	1,061	1,082	1,037	4,056 4178
17:00 - 18:00	998	1,026	1,045	990	4,059
18:00 - 19:00	931	777	705	600	3,013
19:00 - 20:00	526	518	474	383	1,901
20:00 - 21:00	468	433	398	382	1,681
21:00 - 22:00	337	420	389	308	1,454
22:00 - 23:00	305	278	240	203	1,026
23:00 - 24:00	175	223	175	153	726
24:00 - 01:00	144	110	103	92	449
01:00 - 02:00	108	85	119	73	385
02:00 - 03:00	84	83	90	77	334
03:00 - 04:00	95	72	83	76	326
04:00 - 05:00	72	96	109	106	383
05:00 - 06:00	131	166	237	220	754
06:00 - 07:00	223	268	357	359	1,207
07:00 - 08:00	356	366	403	405	1,530
08:00 - 09:00	284	357	482	402	1,525

Total: 39,582

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:45 - 08:45	5679	0.96	16:15 - 17:15	6260	0.96

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
7	73	8	67	8	67

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000080 **County:** 94 Williamson
Start Date: 05/30/06 **End Date:** 05/31/06
Start Time: 10:00 **End Time:** 10:00
Direction: 1 (Coverage)

Time	:00	:15	:30	:45	Hour Total
10:00 - 11:00	523	557	544	522	2,146
11:00 - 12:00	478	513	455	522	1,968
12:00 - 13:00	506	532	509	513	2,060
13:00 - 14:00	473	530	544	571	2,118
14:00 - 15:00	582	625	582	540	2,329
15:00 - 16:00	536	582	480	468	2,066
16:00 - 17:00	449	542	479	559	2,029
17:00 - 18:00	466	500	477	520	1,963
18:00 - 19:00	430	353	342	328	1,453
19:00 - 20:00	283	292	316	280	1,171
20:00 - 21:00	274	226	223	238	961
21:00 - 22:00	216	190	169	206	781
22:00 - 23:00	225	230	118	150	723
23:00 - 24:00	162	118	117	73	470
24:00 - 01:00	95	87	83	67	332
01:00 - 02:00	47	104	57	69	277
02:00 - 03:00	57	72	77	83	289
03:00 - 04:00	88	111	92	102	393
04:00 - 05:00	106	157	154	209	626
05:00 - 06:00	307	399	546	678	1,930
06:00 - 07:00	921	1,005	851	870	3,647
07:00 - 08:00	877	839	776	726	3,218
08:00 - 09:00	658	671	655	637	2,621
09:00 - 10:00	649	645	551	528	2,373

2046

Total: 37,944

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
06:15 - 07:15	5006	0.92	16:15 - 17:15	5642	0.96

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
7	72	7	64	7	64

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000080 **County:** 94 Williamson
Start Date: 05/30/06 **End Date:** 05/31/06
Start Time: 10:00 **End Time:** 10:00
Direction: 2 (Coverage)

Time	:00	:15	:30	:45	Hour Total
10:00 - 11:00	405	457	426	425	1,713
11:00 - 12:00	418	444	419	497	1,778
12:00 - 13:00	458	460	520	490	1,928
13:00 - 14:00	565	524	546	567	2,202
14:00 - 15:00	567	625	632	610	2,434
15:00 - 16:00	681	708	707	848	2,944
16:00 - 17:00	861	902	894	911	3,568 3596
17:00 - 18:00	889	889	819	875	3,472
18:00 - 19:00	757	613	551	518	2,439
19:00 - 20:00	473	429	394	444	1,740
20:00 - 21:00	422	401	381	413	1,617
21:00 - 22:00	372	354	262	300	1,288
22:00 - 23:00	240	266	215	190	911
23:00 - 24:00	196	158	145	123	622
24:00 - 01:00	109	138	116	88	451
01:00 - 02:00	100	123	66	76	365
02:00 - 03:00	93	97	83	82	355
03:00 - 04:00	94	84	117	99	394
04:00 - 05:00	110	126	124	193	553
05:00 - 06:00	237	235	208	301	981
06:00 - 07:00	304	350	297	366	1,317
07:00 - 08:00	390	412	332	300	1,434
08:00 - 09:00	400	393	468	409	1,670
09:00 - 10:00	465	438	397	444	1,744

Total: 37,920

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
06:15 - 07:15	5006	0.92	16:15 - 17:15	5642	0.96

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
7	72	7	64	7	64

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000083	**County:**	94 Williamson
Start Date:	03/18/08	**End Date:**	03/19/08
Start Time:	11:00	**End Time:**	11:00
Direction:	0 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
11:00 - 12:00	59	58	48	41	206
12:00 - 13:00	62	76	67	46	251
13:00 - 14:00	50	64	59	59	232
14:00 - 15:00	62	68	76	63	269
15:00 - 16:00	74	78	70	71	293
16:00 - 17:00	102	111	135	120	468
17:00 - 18:00	154	134	181	160	629
18:00 - 19:00	116	106	93	68	383
19:00 - 20:00	64	35	52	35	186
20:00 - 21:00	22	14	32	26	94
21:00 - 22:00	23	22	23	17	85
22:00 - 23:00	23	15	17	13	68
23:00 - 24:00	10	10	11	5	36
24:00 - 01:00	6	7	5	2	20
01:00 - 02:00	2	5	3	3	13
02:00 - 03:00	0	4	2	3	9
03:00 - 04:00	2	1	4	0	7
04:00 - 05:00	0	2	4	5	11
05:00 - 06:00	10	5	15	29	59
06:00 - 07:00	35	36	76	138	285
07:00 - 08:00	162	184	168	199	713
08:00 - 09:00	170	116	125	99	510
09:00 - 10:00	81	81	65	64	291
10:00 - 11:00	47	51	52	57	207

Total: 5,325

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:15 - 08:15	721	0.91	17:00 - 18:00	629	0.87

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
14	65	12	65	14	65

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000094	**County:**	94 Williamson
Start Date:	03/18/08	**End Date:**	03/19/08
Start Time:	11:00	**End Time:**	11:00
Direction:	0 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
11:00 - 12:00	147	165	137	159	608
12:00 - 13:00	169	168	164	192	693
13:00 - 14:00	154	174	191	170	689
14:00 - 15:00	205	181	186	185	757
15:00 - 16:00	210	192	260	224	886
16:00 - 17:00	259	231	270	260	1,020
17:00 - 18:00	286	242	273	199	1,000
18:00 - 19:00	204	203	172	160	739
19:00 - 20:00	140	111	92	87	430
20:00 - 21:00	96	92	62	62	312
21:00 - 22:00	72	54	61	62	249
22:00 - 23:00	60	54	34	29	177
23:00 - 24:00	43	14	10	9	76
24:00 - 01:00	31	23	8	6	68
01:00 - 02:00	11	10	6	10	37
02:00 - 03:00	5	4	4	1	14
03:00 - 04:00	6	7	14	13	40
04:00 - 05:00	10	25	17	21	73
05:00 - 06:00	60	82	96	100	338
06:00 - 07:00	210	239	236	197	882
07:00 - 08:00	231	221	245	193	890
08:00 - 09:00	220	190	157	188	755
09:00 - 10:00	197	201	179	171	748
10:00 - 11:00	155	159	143	133	590

Total: 12,071

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
06:15 - 07:15	903	0.94	16:45 - 17:45	1061	0.93

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
7	65	9	65	9	65

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000095	**County:**	94 Williamson
Start Date:	03/18/08	**End Date:**	03/19/08
Start Time:	11:00	**End Time:**	11:00
Direction:	0 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
11:00 - 12:00	64	72	92	62	290
12:00 - 13:00	79	90	73	61	303
13:00 - 14:00	99	88	92	49	328
14:00 - 15:00	94	55	85	55	289
15:00 - 16:00	63	88	109	99	359
16:00 - 17:00	102	115	101	93	411
17:00 - 18:00	97	91	103	92	383
18:00 - 19:00	82	81	83	55	301
19:00 - 20:00	49	43	48	34	174
20:00 - 21:00	51	24	26	37	138
21:00 - 22:00	44	41	28	32	145
22:00 - 23:00	35	23	14	8	80
23:00 - 24:00	17	8	15	8	48
24:00 - 01:00	10	5	1	9	25
01:00 - 02:00	3	4	6	2	15
02:00 - 03:00	1	4	3	3	11
03:00 - 04:00	0	5	3	3	11
04:00 - 05:00	5	9	15	5	34
05:00 - 06:00	21	30	22	35	108
06:00 - 07:00	76	93	125	124	418
07:00 - 08:00	97	129	140	118	484
08:00 - 09:00	116	107	110	85	418
09:00 - 10:00	80	77	81	89	327
10:00 - 11:00	68	69	66	70	273

Total: 5,373

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:15 - 08:15	503	0.90	15:30 - 16:30	425	0.92

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
9	65	8	65	9	65

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000096	**County:**	94 Williamson
Start Date:	01/28/08	**End Date:**	01/29/08
Start Time:	11:00	**End Time:**	11:00
Direction:	3 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
11:00 - 12:00	257	208	288	310	1,063
12:00 - 13:00	283	282	279	276	1,120
13:00 - 14:00	255	260	241	269	1,025
14:00 - 15:00	251	256	252	302	1,061
15:00 - 16:00	288	300	299	259	1,146
16:00 - 17:00	278	271	291	293	1,133
17:00 - 18:00	320	271	251	205	1,047
18:00 - 19:00	209	194	135	151	689
19:00 - 20:00	105	109	98	91	403
20:00 - 21:00	90	84	88	92	354
21:00 - 22:00	84	53	34	38	209
22:00 - 23:00	32	25	33	27	117
23:00 - 24:00	24	18	30	20	92
24:00 - 01:00	7	14	14	23	58
01:00 - 02:00	10	7	2	7	26
02:00 - 03:00	11	9	8	10	38
03:00 - 04:00	2	4	7	13	26
04:00 - 05:00	11	16	27	39	93
05:00 - 06:00	40	66	68	146	320
06:00 - 07:00	131	196	220	243	790
07:00 - 08:00	255	303	280	263	1,101
08:00 - 09:00	237	258	260	265	1,020
09:00 - 10:00	242	223	227	216	908
10:00 - 11:00	222	233	229	238	922

Total: 14,761

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
11:45 - 12:45	2251	0.95	16:30 - 17:30	2480	0.97

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
8	51	9	53	9	53

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000096	**County:**	94 Williamson
Start Date:	01/28/08	**End Date:**	01/29/08
Start Time:	11:00	**End Time:**	11:00
Direction:	4 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
11:00 - 12:00	161	255	237	284	937
12:00 - 13:00	239	277	297	248	1,061
13:00 - 14:00	239	271	243	260	1,013
14:00 - 15:00	238	231	267	267	1,003
15:00 - 16:00	251	251	274	255	1,031
16:00 - 17:00	247	286	290	340	1,163
17:00 - 18:00	320	355	278	280	1,233
18:00 - 19:00	229	208	212	153	802
19:00 - 20:00	139	144	139	105	527
20:00 - 21:00	110	102	95	64	371
21:00 - 22:00	86	75	74	63	298
22:00 - 23:00	42	34	35	43	154
23:00 - 24:00	34	16	19	19	88
24:00 - 01:00	10	16	15	15	56
01:00 - 02:00	7	5	9	10	31
02:00 - 03:00	6	8	11	6	31
03:00 - 04:00	6	6	4	7	23
04:00 - 05:00	6	17	23	13	59
05:00 - 06:00	24	48	61	64	197
06:00 - 07:00	59	127	150	140	476
07:00 - 08:00	197	160	234	230	821
08:00 - 09:00	233	221	278	224	956
09:00 - 10:00	240	204	219	216	879
10:00 - 11:00	220	204	191	189	804

Total: 14,014

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
11:45 - 12:45	2251	0.95	16:30 - 17:30	2480	0.97

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
8	51	9	53	9	53

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000142	**County:**	94 Williamson
Start Date:	06/29/09	**End Date:**	06/30/09
Start Time:	11:00	**End Time:**	11:00
Direction:	0 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
11:00 - 12:00	241	288	279	295	1,103
12:00 - 13:00	286	291	310	305	1,192
13:00 - 14:00	309	240	309	253	1,111
14:00 - 15:00	281	284	285	289	1,139
15:00 - 16:00	258	278	266	283	1,085
16:00 - 17:00	301	283	333	273	1,190
17:00 - 18:00	308	271	300	239	1,118
18:00 - 19:00	279	252	249	260	1,040
19:00 - 20:00	172	154	149	142	617
20:00 - 21:00	119	126	95	101	441
21:00 - 22:00	83	66	65	55	269
22:00 - 23:00	60	61	45	43	209
23:00 - 24:00	27	32	32	17	108
24:00 - 01:00	22	15	8	13	58
01:00 - 02:00	7	5	6	2	20
02:00 - 03:00	9	6	8	5	28
03:00 - 04:00	6	5	9	6	26
04:00 - 05:00	17	9	14	18	58
05:00 - 06:00	33	45	45	103	226
06:00 - 07:00	113	144	181	221	659
07:00 - 08:00	206	258	236	316	1,016
08:00 - 09:00	271	256	286	272	1,085
09:00 - 10:00	234	247	255	261	997
10:00 - 11:00	242	247	263	254	1,006

Total: 15,801

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
11:45 - 12:45	1182	0.95	12:15 - 13:15	1215	0.98

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
7	65	8	65	8	65

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000144	**County:**	94 Williamson
Start Date:	02/09/09	**End Date:**	02/10/09
Start Time:	10:00	**End Time:**	10:00
Direction:	0 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
10:00 - 11:00	327	372	379	389	1,467
11:00 - 12:00	370	396	404	446	1,616
12:00 - 13:00	437	422	415	429	1,703
13:00 - 14:00	409	403	442	449	1,703
14:00 - 15:00	406	460	464	491	1,821
15:00 - 16:00	522	475	498	498	1,993
16:00 - 17:00	491	545	530	469	2,035
17:00 - 18:00	570	535	524	473	2,102
18:00 - 19:00	368	364	284	276	1,292
19:00 - 20:00	209	235	199	187	830
20:00 - 21:00	161	140	123	115	539
21:00 - 22:00	94	84	61	72	311
22:00 - 23:00	48	39	42	37	166
23:00 - 24:00	29	23	14	22	88
24:00 - 01:00	15	13	7	11	46
01:00 - 02:00	9	12	11	3	35
02:00 - 03:00	8	6	5	7	26
03:00 - 04:00	7	8	17	17	49
04:00 - 05:00	14	34	42	49	139
05:00 - 06:00	89	116	144	178	527
06:00 - 07:00	253	375	438	476	1,542
07:00 - 08:00	503	570	556	515	2,144
08:00 - 09:00	531	443	434	412	1,820
09:00 - 10:00	363	374	376	384	1,497

Total: 25,491

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:15 - 08:15	2172	0.95	16:15 - 17:15	2114	0.93

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
9	65	8	65	9	65

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000164 **County:** 94 Williamson
Start Date: 02/09/09 **End Date:** 02/10/09
Start Time: 11:00 **End Time:** 11:00
Direction: 1 (Coverage)

Time	:00	:15	:30	:45	Hour Total
11:00 - 12:00	129	131	127	123	510
12:00 - 13:00	132	142	134	158	566
13:00 - 14:00	141	117	144	135	537
14:00 - 15:00	137	144	135	137	553
15:00 - 16:00	147	141	153	174	615
16:00 - 17:00	158	170	160	144	632
17:00 - 18:00	153	143	148	147	591
18:00 - 19:00	135	114	122	82	453
19:00 - 20:00	72	77	93	74	316
20:00 - 21:00	63	39	44	46	192
21:00 - 22:00	39	31	31	22	123
22:00 - 23:00	20	19	16	14	69
23:00 - 24:00	17	11	10	12	50
24:00 - 01:00	9	5	4	4	22
01:00 - 02:00	2	1	4	2	9
02:00 - 03:00	1	1	0	1	3
03:00 - 04:00	1	2	2	2	7
04:00 - 05:00	3	10	4	10	27
05:00 - 06:00	16	13	17	43	89
06:00 - 07:00	62	61	82	146	351
07:00 - 08:00	190	215	235	241	881
08:00 - 09:00	258	229	204	222	913
09:00 - 10:00	171	160	173	143	647
10:00 - 11:00	157	140	150	147	594

Total: 8,750

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:45 - 08:45	1446	0.95	17:15 - 18:15	1453	0.97

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
8	64	8	61	8	61

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000164	**County:**	94 Williamson
Start Date:	02/09/09	**End Date:**	02/10/09
Start Time:	11:00	**End Time:**	11:00
Direction:	2 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
11:00 - 12:00	119	111	120	116	466
12:00 - 13:00	133	140	146	152	571
13:00 - 14:00	118	167	139	125	549
14:00 - 15:00	142	146	140	137	565
15:00 - 16:00	157	203	174	156	690
16:00 - 17:00	183	162	204	202	751
17:00 - 18:00	188	205	212	228	833
18:00 - 19:00	235	213	216	163	827
19:00 - 20:00	153	130	129	83	495
20:00 - 21:00	106	97	63	63	329
21:00 - 22:00	51	51	45	42	189
22:00 - 23:00	25	35	25	22	107
23:00 - 24:00	21	18	11	12	62
24:00 - 01:00	5	5	6	2	18
01:00 - 02:00	9	8	2	1	20
02:00 - 03:00	5	2	2	1	10
03:00 - 04:00	5	1	0	0	6
04:00 - 05:00	0	2	0	4	6
05:00 - 06:00	8	6	12	20	46
06:00 - 07:00	19	25	47	54	145
07:00 - 08:00	87	106	93	107	393
08:00 - 09:00	122	133	152	104	511
09:00 - 10:00	120	111	120	122	473
10:00 - 11:00	117	120	120	117	474

Total: 8,536

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:45 - 08:45	1446	0.95	17:15 - 18:15	1453	0.97

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
8	64	8	61	8	61

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000169	**County:**	94 Williamson
Start Date:	02/03/09	**End Date:**	02/04/09
Start Time:	11:00	**End Time:**	11:00
Direction:	0 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
11:00 - 12:00	234	249	294	256	1,033
12:00 - 13:00	283	289	295	297	1,164
13:00 - 14:00	279	240	277	255	1,051
14:00 - 15:00	263	265	268	264	1,060
15:00 - 16:00	318	254	249	241	1,062
16:00 - 17:00	281	278	260	300	1,119
17:00 - 18:00	304	309	340	295	1,248
18:00 - 19:00	271	251	206	170	898
19:00 - 20:00	150	148	116	114	528
20:00 - 21:00	108	115	90	108	421
21:00 - 22:00	94	73	76	64	307
22:00 - 23:00	55	45	32	33	165
23:00 - 24:00	30	18	26	18	92
24:00 - 01:00	18	23	18	9	68
01:00 - 02:00	7	6	8	6	27
02:00 - 03:00	8	3	2	4	17
03:00 - 04:00	3	4	1	6	14
04:00 - 05:00	4	6	5	11	26
05:00 - 06:00	16	18	21	25	80
06:00 - 07:00	38	36	58	99	231
07:00 - 08:00	162	178	165	170	675
08:00 - 09:00	196	160	151	180	687
09:00 - 10:00	150	154	172	174	650
10:00 - 11:00	183	187	183	211	764

Total: 13,387

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
11:45 - 12:45	1123	0.95	16:45 - 17:45	1253	0.92

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
8	65	9	65	9	65

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000195 **County:** 94 Williamson
Start Date: 02/03/09 **End Date:** 02/04/09
Start Time: 11:00 **End Time:** 11:00
Direction: 0 (Coverage)

Time	:00	:15	:30	:45	Hour Total
11:00 - 12:00	184	190	200	203	777
12:00 - 13:00	218	201	204	200	823
13:00 - 14:00	205	217	221	230	873
14:00 - 15:00	201	227	262	371	1,061
15:00 - 16:00	278	263	289	303	1,133
16:00 - 17:00	303	294	324	369	1,290
17:00 - 18:00	349	379	353	340	1,421
18:00 - 19:00	282	241	201	166	890
19:00 - 20:00	184	120	121	105	530
20:00 - 21:00	150	103	97	110	460
21:00 - 22:00	129	96	80	102	407
22:00 - 23:00	83	63	59	29	234
23:00 - 24:00	24	26	13	17	80
24:00 - 01:00	16	19	16	14	65
01:00 - 02:00	5	6	3	4	18
02:00 - 03:00	5	4	4	4	17
03:00 - 04:00	2	7	3	8	20
04:00 - 05:00	4	11	13	19	47
05:00 - 06:00	19	37	34	56	146
06:00 - 07:00	72	128	160	245	605
07:00 - 08:00	323	263	268	250	1,104
08:00 - 09:00	223	224	236	205	888
09:00 - 10:00	164	166	184	165	679
10:00 - 11:00	149	155	188	156	648

Total: 14,216

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:00 - 08:00	1104	0.85	16:45 - 17:45	1450	0.96

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
8	65	10	65	10	65

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000196 **County:** 94 Williamson
Start Date: 02/03/09 **End Date:** 02/04/09
Start Time: 12:00 **End Time:** 12:00
Direction: 0 (Coverage)

Time	:00	:15	:30	:45	Hour Total
12:00 - 13:00	137	132	146	142	557
13:00 - 14:00	132	124	153	135	544
14:00 - 15:00	148	124	159	156	587
15:00 - 16:00	142	172	208	185	707
16:00 - 17:00	210	207	244	210	871
17:00 - 18:00	267	236	225	208	936
18:00 - 19:00	190	146	134	103	573
19:00 - 20:00	94	84	82	61	321
20:00 - 21:00	57	63	63	69	252
21:00 - 22:00	46	57	32	47	182
22:00 - 23:00	45	41	17	11	114
23:00 - 24:00	6	8	3	6	23
24:00 - 01:00	9	5	2	2	18
01:00 - 02:00	3	5	3	3	14
02:00 - 03:00	0	0	4	2	6
03:00 - 04:00	3	3	3	5	14
04:00 - 05:00	6	12	10	12	40
05:00 - 06:00	19	42	49	47	157
06:00 - 07:00	72	116	216	186	590
07:00 - 08:00	221	224	232	171	848
08:00 - 09:00	161	161	170	151	643
09:00 - 10:00	142	96	127	118	483
10:00 - 11:00	134	112	123	137	506
11:00 - 12:00	122	137	119	133	511

Total: 9,497

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
06:45 - 07:45	863	0.93	16:30 - 17:30	957	0.90

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
9	65	10	65	10	65

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000199	**County:**	94 Williamson
Start Date:	12/09/09	**End Date:**	12/10/09
Start Time:	10:00	**End Time:**	10:00
Direction:	3 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
10:00 - 11:00	104	102	107	119	432
11:00 - 12:00	119	125	103	128	475
12:00 - 13:00	114	103	127	113	457
13:00 - 14:00	115	121	106	130	472
14:00 - 15:00	146	156	152	153	607
15:00 - 16:00	152	137	170	171	630
16:00 - 17:00	190	172	168	187	717
17:00 - 18:00	178	168	152	126	624
18:00 - 19:00	99	90	75	79	343
19:00 - 20:00	74	66	68	62	270
20:00 - 21:00	70	63	51	46	230
21:00 - 22:00	51	58	35	47	191
22:00 - 23:00	34	47	26	25	132
23:00 - 24:00	19	37	20	26	102
24:00 - 01:00	28	18	17	16	79
01:00 - 02:00	9	12	14	16	51
02:00 - 03:00	16	3	6	14	39
03:00 - 04:00	7	8	11	13	39
04:00 - 05:00	14	22	27	35	98
05:00 - 06:00	51	54	81	78	264
06:00 - 07:00	99	139	186	165	589
07:00 - 08:00	210	210	165	171	756
08:00 - 09:00	176	172	154	130	632
09:00 - 10:00	123	132	92	118	465

Total: 8,694

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:00 - 08:00	1530	0.95	16:30 - 17:30	1501	1.00

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
8	51	8	53	8	51

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000199	**County:**	94 Williamson
Start Date:	12/09/09	**End Date:**	12/10/09
Start Time:	10:00	**End Time:**	10:00
Direction:	4 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
10:00 - 11:00	129	140	128	132	529
11:00 - 12:00	115	125	131	132	503
12:00 - 13:00	111	106	165	109	491
13:00 - 14:00	141	117	146	152	556
14:00 - 15:00	146	132	169	197	644
15:00 - 16:00	123	163	157	186	629
16:00 - 17:00	166	177	202	190	735
17:00 - 18:00	199	209	215	209	832
18:00 - 19:00	183	147	129	97	556
19:00 - 20:00	78	71	72	69	290
20:00 - 21:00	89	69	59	79	296
21:00 - 22:00	54	51	64	57	226
22:00 - 23:00	46	44	41	31	162
23:00 - 24:00	24	19	33	21	97
24:00 - 01:00	18	14	22	14	68
01:00 - 02:00	18	18	15	15	66
02:00 - 03:00	7	6	13	22	48
03:00 - 04:00	7	24	17	31	79
04:00 - 05:00	3	22	17	29	71
05:00 - 06:00	42	59	87	55	243
06:00 - 07:00	71	87	143	146	447
07:00 - 08:00	173	193	207	201	774
08:00 - 09:00	167	166	150	161	644
09:00 - 10:00	146	128	127	134	535

Total: 9,521

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:00 - 08:00	1530	0.95	16:30 - 17:30	1501	1.00

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
8	51	8	53	8	51

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000200	**County:**	94 Williamson
Start Date:	12/09/09	**End Date:**	12/10/09
Start Time:	10:00	**End Time:**	10:00
Direction:	3 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
10:00 - 11:00	112	103	105	127	447
11:00 - 12:00	125	121	124	111	481
12:00 - 13:00	121	117	132	111	481
13:00 - 14:00	121	128	114	125	488
14:00 - 15:00	147	169	156	166	638
15:00 - 16:00	158	163	181	186	688
16:00 - 17:00	190	185	182	191	748
17:00 - 18:00	175	183	150	125	633
18:00 - 19:00	106	88	86	88	368
19:00 - 20:00	66	86	70	87	309
20:00 - 21:00	81	72	59	61	273
21:00 - 22:00	63	67	41	53	224
22:00 - 23:00	41	50	27	27	145
23:00 - 24:00	24	43	24	30	121
24:00 - 01:00	25	21	16	13	75
01:00 - 02:00	11	10	20	17	58
02:00 - 03:00	10	3	8	12	33
03:00 - 04:00	7	6	16	10	39
04:00 - 05:00	13	22	29	36	100
05:00 - 06:00	43	66	80	73	262
06:00 - 07:00	95	150	151	172	568
07:00 - 08:00	195	182	184	177	738
08:00 - 09:00	187	195	145	132	659
09:00 - 10:00	127	129	95	121	472

Total: 9,048

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:00 - 08:00	1433	0.98	16:30 - 17:30	1604	0.90

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
8	52	8	54	8	54

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000200 **County:** 94 Williamson
Start Date: 12/09/09 **End Date:** 12/10/09
Start Time: 10:00 **End Time:** 10:00
Direction: 4 (Coverage)

Time	:00	:15	:30	:45	Hour Total
10:00 - 11:00	148	147	138	159	592
11:00 - 12:00	126	116	148	124	514
12:00 - 13:00	148	93	190	116	547
13:00 - 14:00	148	136	150	164	598
14:00 - 15:00	146	140	181	181	648
15:00 - 16:00	145	163	157	185	650
16:00 - 17:00	174	191	211	193	769
17:00 - 18:00	207	262	224	222	915
18:00 - 19:00	194	161	154	123	632
19:00 - 20:00	102	76	70	68	316
20:00 - 21:00	87	74	65	80	306
21:00 - 22:00	62	49	63	64	238
22:00 - 23:00	50	45	47	25	167
23:00 - 24:00	31	19	26	27	103
24:00 - 01:00	18	13	21	14	66
01:00 - 02:00	21	17	16	13	67
02:00 - 03:00	9	9	10	19	47
03:00 - 04:00	11	20	19	33	83
04:00 - 05:00	5	17	26	27	75
05:00 - 06:00	51	64	100	70	285
06:00 - 07:00	86	97	138	149	470
07:00 - 08:00	170	172	174	179	695
08:00 - 09:00	167	152	181	179	679
09:00 - 10:00	149	137	150	126	562

Total: 10,024

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:00 - 08:00	1433	0.98	16:30 - 17:30	1604	0.90

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
8	52	8	54	8	54

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000201 **County:** 94 Williamson
Start Date: 12/09/09 **End Date:** 12/10/09
Start Time: 10:00 **End Time:** 10:00
Direction: 3 (Coverage)

Time	:00	:15	:30	:45	Hour Total	
10:00 - 11:00	115	133	121	112	481	
11:00 - 12:00	111	126	106	102	445	
12:00 - 13:00	90	91	115	88	384	
13:00 - 14:00	102	113	93	98	406	
14:00 - 15:00	87	92	88	114	381	
15:00 - 16:00	124	134	121	121	500	
16:00 - 17:00	146	167	123	132	568	586
17:00 - 18:00	164	148	130	109	551	
18:00 - 19:00	101	95	83	66	345	
19:00 - 20:00	46	46	36	34	162	
20:00 - 21:00	47	26	44	32	149	
21:00 - 22:00	24	26	29	11	90	
22:00 - 23:00	13	18	11	13	55	
23:00 - 24:00	11	9	9	4	33	
24:00 - 01:00	1	7	5	5	18	
01:00 - 02:00	1	4	2	4	11	
02:00 - 03:00	9	4	2	3	18	
03:00 - 04:00	4	7	14	9	34	
04:00 - 05:00	7	14	28	27	76	
05:00 - 06:00	34	64	84	142	324	
06:00 - 07:00	141	212	249	254	856	
07:00 - 08:00	236	276	230	202	944	
08:00 - 09:00	190	199	183	177	749	
09:00 - 10:00	152	149	132	153	586	

Total: 8,166

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
06:30 - 07:30	1449	0.92	16:30 - 17:30	1649	0.89

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
9	70	10	66	10	66

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000201	**County:**	94 Williamson
Start Date:	12/09/09	**End Date:**	12/10/09
Start Time:	10:00	**End Time:**	10:00
Direction:	4 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
10:00 - 11:00	81	83	88	91	343
11:00 - 12:00	77	77	96	91	341
12:00 - 13:00	91	99	78	107	375
13:00 - 14:00	113	119	119	120	471
14:00 - 15:00	128	145	149	160	582
15:00 - 16:00	148	166	175	212	701
16:00 - 17:00	192	174	239	252	857
17:00 - 18:00	298	293	207	201	999
18:00 - 19:00	104	175	202	165	646
19:00 - 20:00	216	189	120	111	636
20:00 - 21:00	98	122	117	98	435
21:00 - 22:00	100	79	64	70	313
22:00 - 23:00	66	52	54	32	204
23:00 - 24:00	44	48	25	17	134
24:00 - 01:00	22	27	15	11	75
01:00 - 02:00	4	15	6	6	31
02:00 - 03:00	4	4	6	6	20
03:00 - 04:00	5	9	1	8	23
04:00 - 05:00	4	7	6	7	24
05:00 - 06:00	10	24	43	46	123
06:00 - 07:00	26	54	81	103	264
07:00 - 08:00	134	116	98	83	431
08:00 - 09:00	112	120	87	103	422
09:00 - 10:00	108	95	100	110	413

Total: 8,863

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
06:30 - 07:30	1449	0.92	16:30 - 17:30	1649	0.89

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
9	70	10	66	10	66

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000202 **County:** 94 Williamson
Start Date: 06/29/09 **End Date:** 06/30/09
Start Time: 10:00 **End Time:** 10:00
Direction: 1 (Coverage)

	Time	:00	:15	:30	:45	Hour Total	
	10:00 - 11:00	448	422	389	406	1,665	
	11:00 - 12:00	469	452	377	409	1,707	
	12:00 - 13:00	421	440	420	412	1,693	
	13:00 - 14:00	414	446	384	431	1,675	
	14:00 - 15:00	420	433	395	424	1,672	
3-4	15:00 - 16:00	481	377	424	441	1,723	
4-5	16:00 - 17:00	431	422	372	433	1,658	1661
4:15-5:15	17:00 - 18:00	434	413	426	340	1,613	
	18:00 - 19:00	336	297	274	234	1,141	
	19:00 - 20:00	253	192	252	227	924	
	20:00 - 21:00	204	244	205	169	822	
	21:00 - 22:00	217	208	170	146	741	
	22:00 - 23:00	147	143	107	86	483	
	23:00 - 24:00	86	78	95	81	340	
	24:00 - 01:00	60	53	65	76	254	
	01:00 - 02:00	69	48	52	48	217	
	02:00 - 03:00	70	67	58	53	248	
	03:00 - 04:00	82	83	98	115	378	
	04:00 - 05:00	120	130	153	218	621	
	05:00 - 06:00	305	362	493	657	1,817	
	06:00 - 07:00	847	811	726	803	3,187	
	07:00 - 08:00	802	719	554	561	2,636	
	08:00 - 09:00	570	560	505	488	2,123	
	09:00 - 10:00	464	496	424	437	1,821	

Total: 31,159

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
06:15 - 07:15	4188	0.95	15:45 - 16:45	4458	0.94

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
7	75	7	63	7	63

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

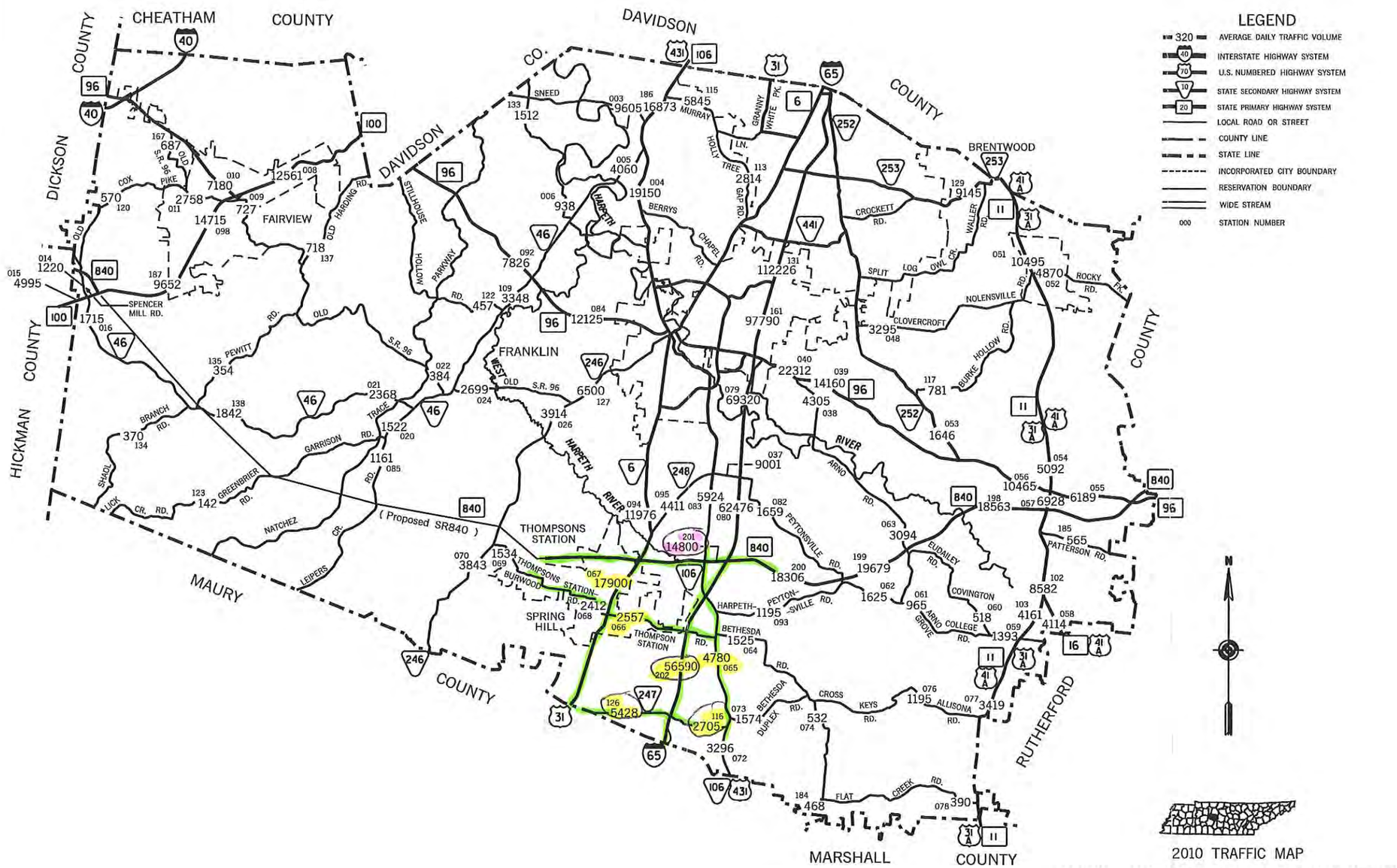
Station Number: 000202 **County:** 94 Williamson
Start Date: 06/29/09 **End Date:** 06/30/09
Start Time: 10:00 **End Time:** 10:00
Direction: 2 (Coverage)

Time	:00	:15	:30	:45	Hour Total	
10:00 - 11:00	326	314	323	327	1,290	
11:00 - 12:00	376	374	363	385	1,498	
12:00 - 13:00	402	411	376	324	1,513	
13:00 - 14:00	386	434	406	393	1,619	
14:00 - 15:00	428	395	455	476	1,754	
15:00 - 16:00	607	536	615	568	2,326	
16:00 - 17:00	756	725	743	475	2,699	2792
17:00 - 18:00	467	536	577	642	2,222	
18:00 - 19:00	734	814	682	644	2,874	
19:00 - 20:00	436	393	386	344	1,559	
20:00 - 21:00	320	297	297	282	1,196	
21:00 - 22:00	320	266	262	253	1,101	
22:00 - 23:00	247	184	182	164	777	
23:00 - 24:00	190	168	144	111	613	
24:00 - 01:00	88	98	76	87	349	
01:00 - 02:00	72	82	66	48	268	
02:00 - 03:00	72	69	71	66	278	
03:00 - 04:00	54	102	86	64	306	
04:00 - 05:00	56	92	91	120	359	
05:00 - 06:00	122	181	195	198	696	
06:00 - 07:00	225	233	237	274	969	
07:00 - 08:00	302	302	323	309	1,236	
08:00 - 09:00	363	369	385	388	1,505	
09:00 - 10:00	415	411	383	427	1,636	1636

Total: 30,643

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
06:15 - 07:15	4188	0.95	15:45 - 16:45	4458	0.94

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
7	75	7	63	7	63



2010 TRAFFIC MAP

WILLIAMSON COUNTY

TENNESSEE

PREPARED BY THE
TENNESSEE DEPARTMENT OF TRANSPORTATION
LONG RANGE AND PROJECT PLANNING DIVISIONS
IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALE
1 0 1 2 3 4 MILES
1 0 1 2 3 4 KILOMETERS

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000064	**County:**	94 Williamson
Start Date:	04/04/11	**End Date:**	04/05/11
Start Time:	12:00	**End Time:**	12:00
Direction:	0 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
12:00 - 13:00	20	18	15	25	78
13:00 - 14:00	16	15	16	14	61
14:00 - 15:00	9	14	13	13	49
15:00 - 16:00	14	22	27	30	93
16:00 - 17:00	80	33	23	41	177
17:00 - 18:00	25	23	20	33	101
18:00 - 19:00	29	13	23	19	84
19:00 - 20:00	3	16	3	12	34
20:00 - 21:00	7	4	9	5	25
21:00 - 22:00	2	8	7	2	19
22:00 - 23:00	3	3	2	6	14
23:00 - 24:00	3	2	0	2	7
24:00 - 01:00	2	0	4	1	7
01:00 - 02:00	0	0	0	0	0
02:00 - 03:00	0	1	0	1	2
03:00 - 04:00	1	1	0	4	6
04:00 - 05:00	0	1	0	2	3
05:00 - 06:00	2	4	7	6	19
06:00 - 07:00	7	9	18	20	54
07:00 - 08:00	23	41	26	28	118
08:00 - 09:00	28	37	94	96	255
09:00 - 10:00	33	23	19	19	94
10:00 - 11:00	13	15	15	9	52
11:00 - 12:00	15	16	12	13	56

Total: 1,408

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
08:15 - 09:15	260	0.68	16:00 - 17:00	177	0.55

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
13	65	13	65	13	65

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000067	**County:**	94 Williamson
Start Date:	04/06/11	**End Date:**	04/07/11
Start Time:	11:00	**End Time:**	11:00
Direction:	0 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
11:00 - 12:00	252	268	220	246	986
12:00 - 13:00	235	259	266	224	984
13:00 - 14:00	263	249	256	259	1,027
14:00 - 15:00	313	316	310	329	1,268
15:00 - 16:00	384	391	379	375	1,529
16:00 - 17:00	384	392	401	404	1,581
17:00 - 18:00	419	406	409	366	1,600
18:00 - 19:00	415	394	414	357	1,580
19:00 - 20:00	290	260	239	223	1,012
20:00 - 21:00	206	223	259	213	901
21:00 - 22:00	194	189	178	134	695
22:00 - 23:00	105	107	96	69	377
23:00 - 24:00	41	63	54	29	187
24:00 - 01:00	27	53	28	16	124
01:00 - 02:00	15	10	8	9	42
02:00 - 03:00	9	10	13	9	41
03:00 - 04:00	9	11	17	21	58
04:00 - 05:00	15	18	33	50	116
05:00 - 06:00	40	66	103	182	391
06:00 - 07:00	184	276	389	409	1,258
07:00 - 08:00	428	472	482	443	1,825
08:00 - 09:00	368	359	343	365	1,435
09:00 - 10:00	313	300	291	303	1,207
10:00 - 11:00	239	210	246	230	925

Total: 21,149

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:00 - 08:00	1825	0.95	16:45 - 17:45	1638	0.98

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
9	65	8	65	9	65

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000066	**County:**	94 Williamson
Start Date:	04/06/11	**End Date:**	04/07/11
Start Time:	11:00	**End Time:**	11:00
Direction:	0 (Coverage)		

Time	**:00**	**:15**	**:30**	**:45**	**Hour Total**
11:00 - 12:00	46	34	26	45	151
12:00 - 13:00	35	41	34	50	160
13:00 - 14:00	32	43	37	29	141
14:00 - 15:00	50	62	52	35	199
15:00 - 16:00	63	51	55	54	223
16:00 - 17:00	46	58	50	48	202
17:00 - 18:00	79	63	55	58	255
18:00 - 19:00	57	72	85	95	309
19:00 - 20:00	55	41	44	30	170
20:00 - 21:00	26	58	62	72	218
21:00 - 22:00	45	23	20	21	109
22:00 - 23:00	16	7	9	6	38
23:00 - 24:00	2	6	7	2	17
24:00 - 01:00	1	3	4	3	11
01:00 - 02:00	0	1	0	0	1
02:00 - 03:00	2	4	1	0	7
03:00 - 04:00	1	0	0	2	3
04:00 - 05:00	1	0	1	1	3
05:00 - 06:00	6	1	10	17	34
06:00 - 07:00	11	16	34	60	121
07:00 - 08:00	106	134	103	69	412
08:00 - 09:00	35	54	54	52	195
09:00 - 10:00	40	39	47	38	164
10:00 - 11:00	37	40	40	29	146

Total: 3,289

Peak AM	**Peak Total**	**Peak Hour Factor**	**Peak PM**	**Peak Total**	**Peak Hour Factor**
07:00 - 08:00	412	0.77	18:00 - 19:00	309	0.81

Peak AM %	**Dir Dist AM %**	**Peak PM %**	**Dir Dist PM %**	**Daily Peak %**	**Daily Dir Dist %**
13	65	9	65	13	65

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000116	**County:**	94 Williamson
Start Date:	04/06/11	**Eud Date:**	04/07/11
Start Time:	10:00	**End Time:**	10:00
Directiou:	0 (Coverage)		

Time	**:00**	**:15**	**:30**	**:45**	**Hour Total**
10:00 - 11:00	34	32	25	17	108
11:00 - 12:00	21	24	19	24	88
12:00 - 13:00	37	18	18	27	100
13:00 - 14:00	35	25	24	36	120
14:00 - 15:00	33	31	42	43	149
15:00 - 16:00	34	46	47	37	164
16:00 - 17:00	47	57	53	64	221
17:00 - 18:00	70	74	51	64	259
18:00 - 19:00	43	55	41	37	176
19:00 - 20:00	34	24	21	25	104
20:00 - 21:00	40	20	21	17	98
21:00 - 22:00	14	12	18	5	49
22:00 - 23:00	8	6	7	4	25
23:00 - 24:00	1	5	0	4	10
24:00 - 01:00	0	2	1	0	3
01:00 - 02:00	2	0	1	0	3
02:00 - 03:00	3	0	0	1	4
03:00 - 04:00	1	1	0	1	3
04:00 - 05:00	1	9	4	7	21
05:00 - 06:00	14	17	19	26	76
06:00 - 07:00	48	65	104	115	332
07:00 - 08:00	72	68	52	58	250
08:00 - 09:00	62	58	36	26	182
09:00 - 10:00	27	22	16	21	86

Total: 2,631

Peak AM	**Peak Total**	**Peak Hour Factor**	**Peak PM**	**Peak Total**	**Peak Hour Factor**
06:30 - 07:30	359	0.78	16:30 - 17:30	261	0.88

Peak AM %	**Dir Dist AM %**	**Peak PM %**	**Dir Dist PM %**	**Daily Peak %**	**Daily Dir Dist %**
14	65	10	65	14	65

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000126	**County:**	94 Williamson
Start Date:	04/06/11	**End Date:**	04/07/11
Start Time:	10:00	**End Time:**	10:00
Direction:	0 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
10:00 - 11:00	72	71	71	67	281
11:00 - 12:00	75	95	86	77	333
12:00 - 13:00	91	77	78	79	325
13:00 - 14:00	89	87	110	101	387
14:00 - 15:00	90	96	106	115	407
15:00 - 16:00	116	130	149	139	534
16:00 - 17:00	133	144	134	151	562
17:00 - 18:00	167	147	146	146	606
18:00 - 19:00	137	135	139	99	510
19:00 - 20:00	73	81	77	122	353
20:00 - 21:00	86	69	52	41	248
21:00 - 22:00	36	39	24	15	114
22:00 - 23:00	13	7	5	6	31
23:00 - 24:00	4	2	5	5	16
24:00 - 01:00	3	0	1	0	4
01:00 - 02:00	0	0	1	2	3
02:00 - 03:00	3	0	2	0	5
03:00 - 04:00	0	0	2	3	5
04:00 - 05:00	9	7	12	17	45
05:00 - 06:00	18	18	19	53	108
06:00 - 07:00	85	97	119	137	438
07:00 - 08:00	118	89	112	140	459
08:00 - 09:00	156	93	99	86	434
09:00 - 10:00	70	63	65	62	260

Total: 6,468

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:30 - 08:30	501	0.80	16:45 - 17:45	611	0.91

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
8	65	9	65	9	65

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000195	**County:**	60 Maury
Start Date:	11/24/08	**End Date:**	11/25/08
Start Time:	15:00	**End Time:**	15:00
Direction:	1 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
15:00 - 16:00	229	236	216	188	869
16:00 - 17:00	201	217	207	229	854
17:00 - 18:00	222	200	230	211	863
18:00 - 19:00	187	188	157	139	671
19:00 - 20:00	140	124	111	132	507
20:00 - 21:00	142	142	110	121	515
21:00 - 22:00	95	88	120	97	400
22:00 - 23:00	88	116	106	66	376
23:00 - 24:00	69	78	70	66	283
24:00 - 01:00	37	44	55	59	195
01:00 - 02:00	55	41	44	49	189
02:00 - 03:00	37	27	50	47	161
03:00 - 04:00	40	42	36	39	157
04:00 - 05:00	64	82	91	84	321
05:00 - 06:00	91	155	146	134	526
06:00 - 07:00	181	207	181	201	770
07:00 - 08:00	177	188	213	191	769
08:00 - 09:00	185	205	197	222	809
09:00 - 10:00	232	209	213	226	880
10:00 - 111:00	229	198	276	253	956
11:00 - 12:00	268	269	298	224	1,059
12:00 - 13:00	249	259	297	217	1,022
13:00 - 14:00	235	269	305	303	1,112
14:00 - 15:00	252	319	293	275	1,139

Total: 15,403

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
10:30 - 11:30	2053	0.96	16:45 - 17:45	2194	0.94

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
6	52	7	60	7	60

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000195 **County:** 60 Maury
Start Date: 11/12/08 **End Date:** 11/13/08
Start Time: 10:00 **End Time:** 10:00
Direction: 2 (Coverage)

Time	:00	:15	:30	:45	Hour Total
10:00 - 11:00	240	259	246	242	987
11:00 - 12:00	235	264	221	246	966
12:00 - 13:00	216	230	223	214	883
13:00 - 14:00	221	208	235	239	903
14:00 - 15:00	252	211	256	290	1,009
15:00 - 16:00	300	260	295	296	1,151
16:00 - 17:00	298	269	294	316	1,177
17:00 - 18:00	362	312	323	322	1,319
18:00 - 19:00	304	278	266	290	1,138
19:00 - 20:00	306	287	203	181	977
20:00 - 21:00	176	191	170	197	734
21:00 - 22:00	161	126	159	126	572
22:00 - 23:00	122	151	112	115	500
23:00 - 24:00	129	112	91	135	467
24:00 - 01:00	113	71	76	85	345
01:00 - 02:00	73	66	89	58	286
02:00 - 03:00	53	65	79	52	249
03:00 - 04:00	56	59	82	42	239
04:00 - 05:00	90	45	46	90	271
05:00 - 06:00	80	69	99	81	329
06:00 - 07:00	76	121	120	118	435
07:00 - 08:00	174	139	149	179	641
08:00 - 09:00	209	195	196	181	781
09:00 - 10:00	176	213	251	222	862

Total: 17,221

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
10:30 - 11:30	2053	0.96	16:45 - 17:45	2194	0.94

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
6	52	7	60	7	60

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000196	**County:**	60 Maury
Start Date:	05/03/11	**End Date:**	05/04/11
Start Time:	15:00	**End Time:**	15:00
Direction:	3 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
15:00 - 16:00	182	148	182	196	708
16:00 - 17:00	208	199	204	157	768
17:00 - 18:00	198	190	198	211	797
18:00 - 19:00	199	206	206	186	797
19:00 - 20:00	174	142	142	121	579
20:00 - 21:00	116	88	107	88	399
21:00 - 22:00	81	66	77	79	303
22:00 - 23:00	64	68	79	35	246
23:00 - 24:00	70	54	38	37	199
24:00 - 01:00	42	23	43	22	130
01:00 - 02:00	23	26	17	11	77
02:00 - 03:00	11	8	14	11	44
03:00 - 04:00	15	18	10	11	54
04:00 - 05:00	19	17	15	24	75
05:00 - 06:00	29	58	48	58	193
06:00 - 07:00	89	139	148	179	555
07:00 - 08:00	296	402	447	364	1,509
08:00 - 09:00	339	330	274	243	1,186
09:00 - 10:00	277	204	214	204	899
10:00 - 111:00	189	214	215	188	806
11:00 - 12:00	178	178	189	158	703
12:00 - 13:00	168	186	160	151	665
13:00 - 14:00	177	191	155	150	673
14:00 - 15:00	168	184	179	184	715

Total: 13,080

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:15 - 08:15	2362	0.86	17:00 - 18:00	2156	0.97

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
9	66	8	63	9	66

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000196	**County:**	60 Maury
Start Date:	05/03/11	**End Date:**	05/04/11
Start Time:	14:00	**End Time:**	14:00
Direction:	4 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
14:00 - 15:00	181	160	185	212	738
15:00 - 16:00	250	239	263	277	1,029
16:00 - 17:00	285	347	325	351	1,308
17:00 - 18:00	355	356	348	300	1,359
18:00 - 19:00	268	281	217	161	927
19:00 - 20:00	157	181	155	139	632
20:00 - 21:00	127	130	142	120	519
21:00 - 22:00	90	117	117	80	404
22:00 - 23:00	64	85	75	56	280
23:00 - 24:00	42	50	40	68	200
24:00 - 01:00	75	47	41	19	182
01:00 - 02:00	13	17	14	18	62
02:00 - 03:00	10	8	17	11	46
03:00 - 04:00	11	11	13	16	51
04:00 - 05:00	20	8	9	27	64
05:00 - 06:00	33	51	123	99	306
06:00 - 07:00	72	102	124	136	434
07:00 - 08:00	158	201	239	191	789
08:00 - 09:00	179	159	162	187	687
09:00 - 10:00	154	148	150	144	596
10:00 - 11:00	123	150	186	179	638
11:00 - 12:00	120	154	160	161	595
12:00 - 13:00	155	176	139	158	628
13:00 - 14:00	150	190	212	194	746

Total: 13,220

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:15 - 08:15	2362	0.86	17:00 - 18:00	2156	0.97

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
9	66	8	63	9	66

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000065	**County:**	94 Williamson
Start Date:	04/04/11	**End Date:**	04/05/11
Start Time:	12:00	**End Time:**	12:00
Direction:	0 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
12:00 - 13:00	45	46	36	28	155
13:00 - 14:00	45	42	48	41	176
14:00 - 15:00	59	33	54	55	201
15:00 - 16:00	70	63	68	62	263
16:00 - 17:00	87	86	109	86	368
17:00 - 18:00	100	97	101	87	385
18:00 - 19:00	84	63	68	38	253
19:00 - 20:00	48	31	32	16	127
20:00 - 21:00	31	27	26	17	101
21:00 - 22:00	15	13	23	20	71
22:00 - 23:00	9	16	12	13	50
23:00 - 24:00	6	9	10	5	30
24:00 - 01:00	13	6	8	5	32
01:00 - 02:00	0	0	4	0	4
02:00 - 03:00	1	2	0	2	5
03:00 - 04:00	1	1	5	6	13
04:00 - 05:00	3	5	6	8	22
05:00 - 06:00	8	19	32	44	103
06:00 - 07:00	42	83	136	164	425
07:00 - 08:00	164	168	127	131	590
08:00 - 09:00	84	87	90	98	359
09:00 - 10:00	57	43	46	53	199
10:00 - 11:00	46	37	53	50	186
11:00 - 12:00	48	45	42	40	175

Total: 4,293

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
06:30 - 07:30	632	0.94	16:30 - 17:30	392	0.90

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
14	65	9	65	14	65

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000202	**County:**	94 Williamson
Start Date:	06/29/09	**End Date:**	06/30/09
Start Time:	10:00	**End Time:**	10:00
Direction:	1 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
10:00 - 11:00	448	422	389	406	1,665
11:00 - 12:00	469	452	377	409	1,707
12:00 - 13:00	421	440	420	412	1,693
13:00 - 14:00	414	446	384	431	1,675
14:00 - 15:00	420	433	395	424	1,672
15:00 - 16:00	481	377	424	441	1,723
16:00 - 17:00	431	422	372	433	1,658
17:00 - 18:00	434	413	426	340	1,613
18:00 - 19:00	336	297	274	234	1,141
19:00 - 20:00	253	192	252	227	924
20:00 - 21:00	204	244	205	169	822
21:00 - 22:00	217	208	170	146	741
22:00 - 23:00	147	143	107	86	483
23:00 - 24:00	86	78	95	81	340
24:00 - 01:00	60	53	65	76	254
01:00 - 02:00	69	48	52	48	217
02:00 - 03:00	70	67	58	53	248
03:00 - 04:00	82	83	98	115	378
04:00 - 05:00	120	130	153	218	621
05:00 - 06:00	305	362	493	657	1,817
06:00 - 07:00	847	811	726	803	3,187
07:00 - 08:00	802	719	554	561	2,636
08:00 - 09:00	570	560	505	488	2,123
09:00 - 10:00	464	496	424	437	1,821

Total: 31,159

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
06:15 - 07:15	4188	0.95	15:45 - 16:45	4458	0.94

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
7	75	7	63	7	63

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000202	**County:**	94 Williamson
Start Date:	06/29/09	**End Date:**	06/30/09
Start Time:	10:00	**End Time:**	10:00
Direction:	2 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
10:00 - 11:00	326	314	323	327	1,290
11:00 - 12:00	376	374	363	385	1,498
12:00 - 13:00	402	411	376	324	1,513
13:00 - 14:00	386	434	406	393	1,619
14:00 - 15:00	428	395	455	476	1,754
15:00 - 16:00	607	536	615	568	2,326
16:00 - 17:00	756	725	743	475	2,699
17:00 - 18:00	467	536	577	642	2,222
18:00 - 19:00	734	814	682	644	2,874
19:00 - 20:00	436	393	386	344	1,559
20:00 - 21:00	320	297	297	282	1,196
21:00 - 22:00	320	266	262	253	1,101
22:00 - 23:00	247	184	182	164	777
23:00 - 24:00	190	168	144	111	613
24:00 - 01:00	88	98	76	87	349
01:00 - 02:00	72	82	66	48	268
02:00 - 03:00	72	69	71	66	278
03:00 - 04:00	54	102	86	64	306
04:00 - 05:00	56	92	91	120	359
05:00 - 06:00	122	181	195	198	696
06:00 - 07:00	225	233	237	274	969
07:00 - 08:00	302	302	323	309	1,236
08:00 - 09:00	363	369	385	388	1,505
09:00 - 10:00	415	411	383	427	1,636

Total: 30,643

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
06:15 - 07:15	4188	0.95	15:45 - 16:45	4458	0.94

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
7	75	7	63	7	63

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000201	**County:**	94 Williamson
Start Date:	04/25/11	**End Date:**	04/26/11
Start Time:	11:00	**End Time:**	11:00
Direction:	3 (Coverage)		

Time	**:00**	**:15**	**:30**	**:45**	**Hour Total**
11:00 - 12:00	102	104	101	116	423
12:00 - 13:00	78	83	134	91	386
13:00 - 14:00	103	111	75	100	389
14:00 - 15:00	106	97	105	129	437
15:00 - 16:00	138	120	112	129	499
16:00 - 17:00	124	137	148	151	560
17:00 - 18:00	123	192	147	122	584
18:00 - 19:00	112	147	100	90	449
19:00 - 20:00	69	71	50	49	239
20:00 - 21:00	53	57	58	35	203
21:00 - 22:00	38	25	26	25	114
22:00 - 23:00	16	24	25	8	73
23:00 - 24:00	11	8	6	11	36
24:00 - 01:00	10	5	5	2	22
01:00 - 02:00	4	0	6	0	10
02:00 - 03:00	3	2	2	5	12
03:00 - 04:00	7	7	8	10	32
04:00 - 05:00	6	13	28	23	70
05:00 - 06:00	21	50	84	100	255
06:00 - 07:00	132	234	229	190	785
07:00 - 08:00	205	179	243	259	886
08:00 - 09:00	189	161	160	136	646
09:00 - 10:00	135	130	139	118	522
10:00 - 11:00	97	117	111	117	442

Total: 8,074

Peak AM	**Peak Total**	**Peak Hour Factor**	**Peak PM**	**Peak Total**	**Peak Hour Factor**
07:00 - 08:00	1519	0.90	16:30 - 17:30	1564	0.90

Peak AM %	**Dir Dist AM %**	**Peak PM %**	**Dir Dist PM %**	**Daily Peak %**	**Daily Dir Dist %**
9	58	9	61	9	61

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

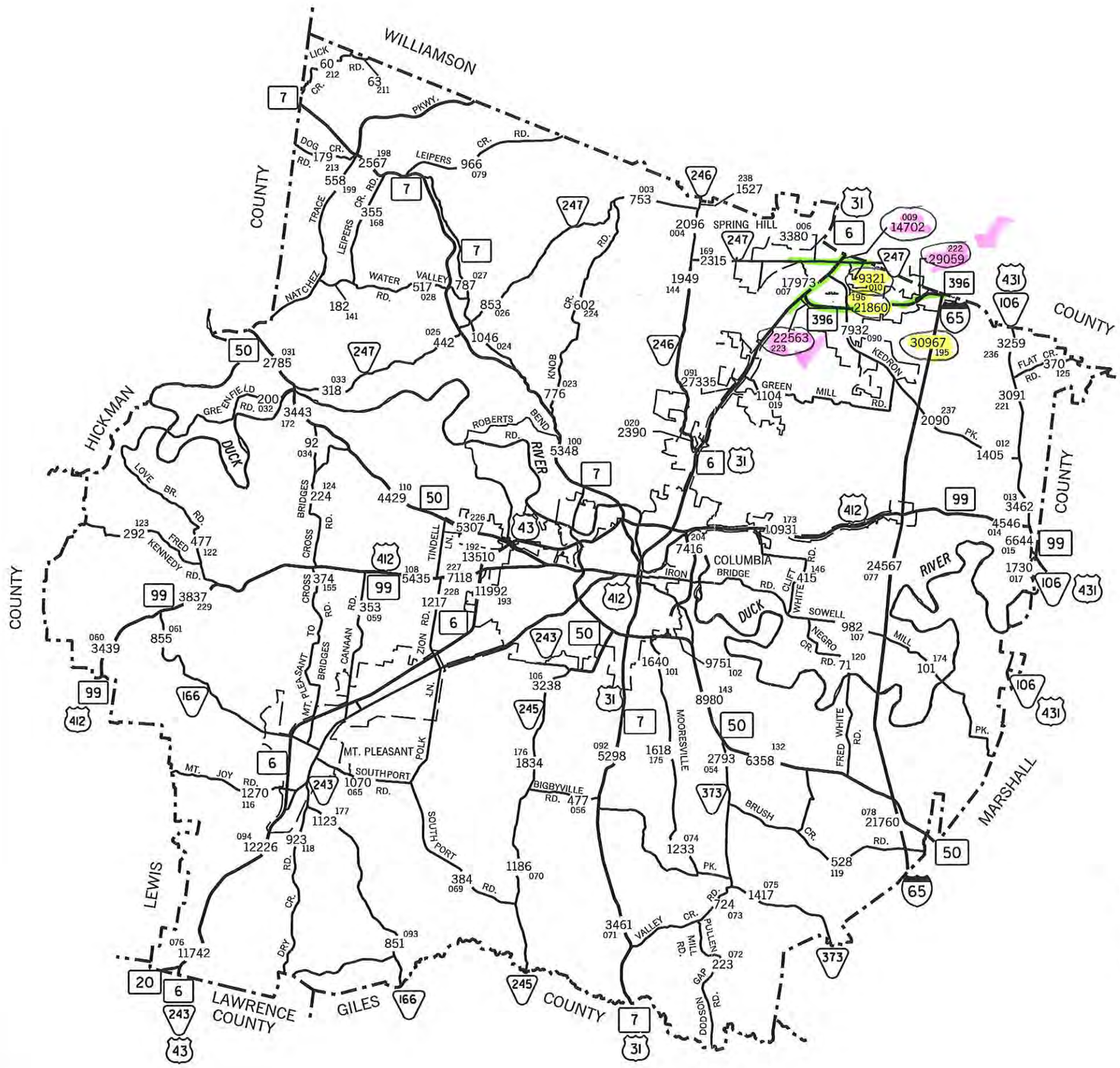
Station Number:	000201	**County:**	94 Williamson
Start Date:	04/25/11	**End Date:**	04/26/11
Start Time:	11:00	**End Time:**	11:00
Direction:	4 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
11:00 - 12:00	94	76	115	79	364
12:00 - 13:00	98	87	113	84	382
13:00 - 14:00	92	110	126	130	458
14:00 - 15:00	138	110	127	133	508
15:00 - 16:00	156	173	176	200	705
16:00 - 17:00	207	228	263	251	949
17:00 - 18:00	194	242	245	251	932
18:00 - 19:00	207	264	273	222	966
19:00 - 20:00	187	131	109	121	548
20:00 - 21:00	118	106	123	79	426
21:00 - 22:00	90	85	95	76	346
22:00 - 23:00	53	45	52	46	196
23:00 - 24:00	31	30	27	26	114
24:00 - 01:00	19	13	11	9	52
01:00 - 02:00	11	6	10	3	30
02:00 - 03:00	7	4	1	3	15
03:00 - 04:00	9	3	3	8	23
04:00 - 05:00	4	1	3	5	13
05:00 - 06:00	9	6	22	36	73
06:00 - 07:00	25	34	66	101	226
07:00 - 08:00	146	173	149	165	633
08:00 - 09:00	107	145	108	87	447
09:00 - 10:00	82	88	69	78	317
10:00 - 11:00	64	72	67	78	281

Total: 9,004

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:00 - 08:00	1519	0.90	16:30 - 17:30	1564	0.90

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
9	58	9	61	9	61



LEGEND

- 320 — AVERAGE DAILY TRAFFIC VOLUME
- 40 — INTERSTATE HIGHWAY SYSTEM
- 70 — U.S. NUMBERED HIGHWAY SYSTEM
- 10 — STATE SECONDARY HIGHWAY SYSTEM
- 20 — STATE PRIMARY HIGHWAY SYSTEM
- LOCAL ROAD OR STREET
- COUNTY LINE
- STATE LINE
- INCORPORATED CITY BOUNDARY
- RESERVATION BOUNDARY
- WIDE STREAM
- 000 — STATION NUMBER

2010 TRAFFIC MAP

MAURY COUNTY

TENNESSEE

PREPARED BY THE
TENNESSEE DEPARTMENT OF TRANSPORTATION
LONG RANGE AND PROJECT PLANNING DIVISIONS
IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALE
1 0 1 2 3 4 MILES
1 0 1 2 3 4 KILOMETERS

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000010	**County:**	60 Maury
Start Date:	05/09/11	**End Date:**	05/10/11
Start Time:	12:00	**End Time:**	12:00
Direction:	0 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
12:00 - 13:00	152	129	159	148	588
13:00 - 14:00	162	134	148	155	599
14:00 - 15:00	150	138	151	169	608
15:00 - 16:00	171	194	191	192	748
16:00 - 17:00	200	221	198	201	820
17:00 - 18:00	222	231	254	221	928
18:00 - 19:00	190	213	209	169	781
19:00 - 20:00	139	156	147	143	585
20:00 - 21:00	142	127	99	74	442
21:00 - 22:00	69	65	55	52	241
22:00 - 23:00	38	41	29	15	123
23:00 - 24:00	21	17	10	11	59
24:00 - 01:00	8	12	9	13	42
01:00 - 02:00	12	5	1	9	27
02:00 - 03:00	4	5	2	1	12
03:00 - 04:00	2	0	1	2	5
04:00 - 05:00	3	9	6	7	25
05:00 - 06:00	8	23	28	45	104
06:00 - 07:00	52	59	86	110	307
07:00 - 08:00	86	131	147	158	522
08:00 - 09:00	144	150	170	153	617
09:00 - 10:00	140	131	130	123	524
10:00 - 11:00	132	136	130	137	535
11:00 - 12:00	116	122	139	131	508

Total: 9,750

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:45 - 08:45	622	0.91	17:00 - 18:00	928	0.91

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
6	65	10	65	10	65

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000064 **County:** 94 Williamson
Start Date: 04/04/11 **End Date:** 04/05/11
Start Time: 12:00 **End Time:** 12:00
Direction: 0 (Coverage)

Time	:00	:15	:30	:45	Hour Total
12:00 - 13:00	20	18	15	25	78
13:00 - 14:00	16	15	16	14	61
14:00 - 15:00	9	14	13	13	49
15:00 - 16:00	14	22	27	30	93
16:00 - 17:00	80	33	23	41	177
17:00 - 18:00	25	23	20	33	101
18:00 - 19:00	29	13	23	19	84
19:00 - 20:00	3	16	3	12	34
20:00 - 21:00	7	4	9	5	25
21:00 - 22:00	2	8	7	2	19
22:00 - 23:00	3	3	2	6	14
23:00 - 24:00	3	2	0	2	7
24:00 - 01:00	2	0	4	1	7
01:00 - 02:00	0	0	0	0	0
02:00 - 03:00	0	1	0	1	2
03:00 - 04:00	1	1	0	4	6
04:00 - 05:00	0	1	0	2	3
05:00 - 06:00	2	4	7	6	19
06:00 - 07:00	7	9	18	20	54
07:00 - 08:00	23	41	26	28	118
08:00 - 09:00	28	37	94	96	255
09:00 - 10:00	33	23	19	19	94
10:00 - 11:00	13	15	15	9	52
11:00 - 12:00	15	16	12	13	56

Total: 1,408

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
08:15 - 09:15	260	0.68	16:00 - 17:00	177	0.55

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
13	65	13	65	13	65

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000066	**County:**	94 Williamson
Start Date:	04/06/11	**End Date:**	04/07/11
Start Time:	11:00	**End Time:**	11:00
Direction:	0 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
11:00 - 12:00	46	34	26	45	151
12:00 - 13:00	35	41	34	50	160
13:00 - 14:00	32	43	37	29	141
14:00 - 15:00	50	62	52	35	199
15:00 - 16:00	63	51	55	54	223
16:00 - 17:00	46	58	50	48	202
17:00 - 18:00	79	63	55	58	255
18:00 - 19:00	57	72	85	95	309
19:00 - 20:00	55	41	44	30	170
20:00 - 21:00	26	58	62	72	218
21:00 - 22:00	45	23	20	21	109
22:00 - 23:00	16	7	9	6	38
23:00 - 24:00	2	6	7	2	17
24:00 - 01:00	1	3	4	3	11
01:00 - 02:00	0	1	0	0	1
02:00 - 03:00	2	4	1	0	7
03:00 - 04:00	1	0	0	2	3
04:00 - 05:00	1	0	1	1	3
05:00 - 06:00	6	1	10	17	34
06:00 - 07:00	11	16	34	60	121
07:00 - 08:00	106	134	103	69	412
08:00 - 09:00	35	54	54	52	195
09:00 - 10:00	40	39	47	38	164
10:00 - 11:00	37	40	40	29	146

Total: 3,289

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Honr Factor
07:00 - 08:00	412	0.77	18:00 - 19:00	309	0.81

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
13	65	9	65	13	65

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000067 **County:** 94 Williamson
Start Date: 04/06/11 **End Date:** 04/07/11
Start Time: 11:00 **End Time:** 11:00
Direction: 0 (Coverage)

Time	:00	:15	:30	:45	Hour Total
11:00 - 12:00	252	268	220	246	986
12:00 - 13:00	235	259	266	224	984
13:00 - 14:00	263	249	256	259	1,027
14:00 - 15:00	313	316	310	329	1,268
15:00 - 16:00	384	391	379	375	1,529
16:00 - 17:00	384	392	401	404	1,581
17:00 - 18:00	419	406	409	366	1,600
18:00 - 19:00	415	394	414	357	1,580
19:00 - 20:00	290	260	239	223	1,012
20:00 - 21:00	206	223	259	213	901
21:00 - 22:00	194	189	178	134	695
22:00 - 23:00	105	107	96	69	377
23:00 - 24:00	41	63	54	29	187
24:00 - 01:00	27	53	28	16	124
01:00 - 02:00	15	10	8	9	42
02:00 - 03:00	9	10	13	9	41
03:00 - 04:00	9	11	17	21	58
04:00 - 05:00	15	18	33	50	116
05:00 - 06:00	40	66	103	182	391
06:00 - 07:00	184	276	389	409	1,258
07:00 - 08:00	428	472	482	443	1,825
08:00 - 09:00	368	359	343	365	1,435
09:00 - 10:00	313	300	291	303	1,207
10:00 - 11:00	239	210	246	230	925

Total: 21,149

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:00 - 08:00	1825	0.95	16:45 - 17:45	1638	0.98

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
9	65	8	65	9	65

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000116	**County:**	94 Williamson
Start Date:	04/06/11	**End Date:**	04/07/11
Start Time:	10:00	**End Time:**	10:00
Direction:	0 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
10:00 - 11:00	34	32	25	17	108
11:00 - 12:00	21	24	19	24	88
12:00 - 13:00	37	18	18	27	100
13:00 - 14:00	35	25	24	36	120
14:00 - 15:00	33	31	42	43	149
15:00 - 16:00	34	46	47	37	164
16:00 - 17:00	47	57	53	64	221
17:00 - 18:00	70	74	51	64	259
18:00 - 19:00	43	55	41	37	176
19:00 - 20:00	34	24	21	25	104
20:00 - 21:00	40	20	21	17	98
21:00 - 22:00	14	12	18	5	49
22:00 - 23:00	8	6	7	4	25
23:00 - 24:00	1	5	0	4	10
24:00 - 01:00	0	2	1	0	3
01:00 - 02:00	2	0	1	0	3
02:00 - 03:00	3	0	0	1	4
03:00 - 04:00	1	1	0	1	3
04:00 - 05:00	1	9	4	7	21
05:00 - 06:00	14	17	19	26	76
06:00 - 07:00	48	65	104	115	332
07:00 - 08:00	72	68	52	58	250
08:00 - 09:00	62	58	36	26	182
09:00 - 10:00	27	22	16	21	86

Total: 2,631

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
06:30 - 07:30	359	0.78	16:30 - 17:30	261	0.88

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
14	65	10	65	14	65

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000126	**County:**	94 Williamson
Start Date:	04/06/11	**End Date:**	04/07/11
Start Time:	10:00	**End Time:**	10:00
Direction:	0 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
10:00 - 11:00	72	71	71	67	281
11:00 - 12:00	75	95	86	77	333
12:00 - 13:00	91	77	78	79	325
13:00 - 14:00	89	87	110	101	387
14:00 - 15:00	90	96	106	115	407
15:00 - 16:00	116	130	149	139	534
16:00 - 17:00	133	144	134	151	562
17:00 - 18:00	167	147	146	146	606
18:00 - 19:00	137	135	139	99	510
19:00 - 20:00	73	81	77	122	353
20:00 - 21:00	86	69	52	41	248
21:00 - 22:00	36	39	24	15	114
22:00 - 23:00	13	7	5	6	31
23:00 - 24:00	4	2	5	5	16
24:00 - 01:00	3	0	1	0	4
01:00 - 02:00	0	0	1	2	3
02:00 - 03:00	3	0	2	0	5
03:00 - 04:00	0	0	2	3	5
04:00 - 05:00	9	7	12	17	45
05:00 - 06:00	18	18	19	53	108
06:00 - 07:00	85	97	119	137	438
07:00 - 08:00	118	89	112	140	459
08:00 - 09:00	156	93	99	86	434
09:00 - 10:00	70	63	65	62	260

Total: 6,468

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:30 - 08:30	501	0.80	16:45 - 17:45	611	0.91

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
8	65	9	65	9	65

I-65 s/o
SR 396

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000195 **County:** 60 Maury
Start Date: 11/24/08 **End Date:** 11/25/08
Start Time: 15:00 **End Time:** 15:00
Direction: 1 (Coverage)

Time	:00	:15	:30	:45	Hour Total
15:00 - 16:00	229	236	216	188	869
16:00 - 17:00	201	217	207	229	854
17:00 - 18:00	222	200	230	211	863
18:00 - 19:00	187	188	157	139	671
19:00 - 20:00	140	124	111	132	507
20:00 - 21:00	142	142	110	121	515
21:00 - 22:00	95	88	120	97	400
22:00 - 23:00	88	116	106	66	376
23:00 - 24:00	69	78	70	66	283
24:00 - 01:00	37	44	55	59	195
01:00 - 02:00	55	41	44	49	189
02:00 - 03:00	37	27	50	47	161
03:00 - 04:00	40	42	36	39	157
04:00 - 05:00	64	82	91	84	321
05:00 - 06:00	91	155	146	134	526
06:00 - 07:00	181	207	181	201	770
07:00 - 08:00	177	188	213	191	769
08:00 - 09:00	185	205	197	222	809
09:00 - 10:00	232	209	213	226	880
10:00 - 111:00	229	198	276	253	956
11:00 - 12:00	268	269	298	224	1,059
12:00 - 13:00	249	259	297	217	1,022
13:00 - 14:00	235	269	305	303	1,112
14:00 - 15:00	252	319	293	275	1,139

Total: 15,403

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
10:30 - 11:30	2053	0.96	16:45 - 17:45	2194	0.94

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
6	52	7	60	7	60

I-65 S/o
SR 396

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000195 **County:** 60 Maury
Start Date: 11/12/08 **End Date:** 11/13/08
Start Time: 10:00 **End Time:** 10:00
Direction: 2 (Coverage)

Time	:00	:15	:30	:45	Hour Total
10:00 - 11:00	240	259	246	242	987
11:00 - 12:00	235	264	221	246	966
12:00 - 13:00	216	230	223	214	883
13:00 - 14:00	221	208	235	239	903
14:00 - 15:00	252	211	256	290	1,009
15:00 - 16:00	300	260	295	296	1,151
16:00 - 17:00	298	269	294	316	1,177
17:00 - 18:00	362	312	323	322	1,319
18:00 - 19:00	304	278	266	290	1,138
19:00 - 20:00	306	287	203	181	977
20:00 - 21:00	176	191	170	197	734
21:00 - 22:00	161	126	159	126	572
22:00 - 23:00	122	151	112	115	500
23:00 - 24:00	129	112	91	135	467
24:00 - 01:00	113	71	76	85	345
01:00 - 02:00	73	66	89	58	286
02:00 - 03:00	53	65	79	52	249
03:00 - 04:00	56	59	82	42	239
04:00 - 05:00	90	45	46	90	271
05:00 - 06:00	80	69	99	81	329
06:00 - 07:00	76	121	120	118	435
07:00 - 08:00	174	139	149	179	641
08:00 - 09:00	209	195	196	181	781
09:00 - 10:00	176	213	251	222	862

Total: 17,221

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
10:30 - 11:30	2053	0.96	16:45 - 17:45	2194	0.94

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
6	52	7	60	7	60

SR 396

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000196	**County:**	60 Maury
Start Date:	05/03/11	**End Date:**	05/04/11
Start Time:	15:00	**End Time:**	15:00
Direction:	3 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
15:00 - 16:00	182	148	182	196	708
16:00 - 17:00	208	199	204	157	768
17:00 - 18:00	198	190	198	211	797
18:00 - 19:00	199	206	206	186	797
19:00 - 20:00	174	142	142	121	579
20:00 - 21:00	116	88	107	88	399
21:00 - 22:00	81	66	77	79	303
22:00 - 23:00	64	68	79	35	246
23:00 - 24:00	70	54	38	37	199
24:00 - 01:00	42	23	43	22	130
01:00 - 02:00	23	26	17	11	77
02:00 - 03:00	11	8	14	11	44
03:00 - 04:00	15	18	10	11	54
04:00 - 05:00	19	17	15	24	75
05:00 - 06:00	29	58	48	58	193
06:00 - 07:00	89	139	148	179	555
07:00 - 08:00	296	402	447	364	1,509
08:00 - 09:00	339	330	274	243	1,186
09:00 - 10:00	277	204	214	204	899
10:00 - 111:00	189	214	215	188	806
11:00 - 12:00	178	178	189	158	703
12:00 - 13:00	168	186	160	151	665
13:00 - 14:00	177	191	155	150	673
14:00 - 15:00	168	184	179	184	715

Total: 13,080

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:15 - 08:15	2362	0.86	17:00 - 18:00	2156	0.97

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
9	66	8	63	9	66

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000196	**County:**	60 Maury
Start Date:	05/03/11	**End Date:**	05/04/11
Start Time:	14:00	**End Time:**	14:00
Direction:	4 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
14:00 - 15:00	181	160	185	212	738
15:00 - 16:00	250	239	263	277	1,029
16:00 - 17:00	285	347	325	351	1,308
17:00 - 18:00	355	356	348	300	1,359
18:00 - 19:00	268	281	217	161	927
19:00 - 20:00	157	181	155	139	632
20:00 - 21:00	127	130	142	120	519
21:00 - 22:00	90	117	117	80	404
22:00 - 23:00	64	85	75	56	280
23:00 - 24:00	42	50	40	68	200
24:00 - 01:00	75	47	41	19	182
01:00 - 02:00	13	17	14	18	62
02:00 - 03:00	10	8	17	11	46
03:00 - 04:00	11	11	13	16	51
04:00 - 05:00	20	8	9	27	64
05:00 - 06:00	33	51	123	99	306
06:00 - 07:00	72	102	124	136	434
07:00 - 08:00	158	201	239	191	789
08:00 - 09:00	179	159	162	187	687
09:00 - 10:00	154	148	150	144	596
10:00 - 11:00	123	150	186	179	638
11:00 - 12:00	120	154	160	161	595
12:00 - 13:00	155	176	139	158	628
13:00 - 14:00	150	190	212	194	746

Total: 13,220

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:15 - 08:15	2362	0.86	17:00 - 18:00	2156	0.97

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
9	66	8	63	9	66

I-65

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000202 **County:** 94 Williamson
Start Date: 06/29/09 **End Date:** 06/30/09
Start Time: 10:00 **End Time:** 10:00
Direction: 1 (Coverage)
NB

Time	:00	:15	:30	:45	Hour Total
10:00 - 11:00	448	422	389	406	1,665
11:00 - 12:00	469	452	377	409	1,707
12:00 - 13:00	421	440	420	412	1,693
13:00 - 14:00	414	446	384	431	1,675
14:00 - 15:00	420	433	395	424	1,672
15:00 - 16:00	481	377	424	441	1,723
16:00 - 17:00	431	422	372	433	1,658
17:00 - 18:00	434	413	426	340	1,613
18:00 - 19:00	336	297	274	234	1,141
19:00 - 20:00	253	192	252	227	924
20:00 - 21:00	204	244	205	169	822
21:00 - 22:00	217	208	170	146	741
22:00 - 23:00	147	143	107	86	483
23:00 - 24:00	86	78	95	81	340
24:00 - 01:00	60	53	65	76	254
01:00 - 02:00	69	48	52	48	217
02:00 - 03:00	70	67	58	53	248
03:00 - 04:00	82	83	98	115	378
04:00 - 05:00	120	130	153	218	621
05:00 - 06:00	305	362	493	657	1,817
06:00 - 07:00	847	811	726	803	3,187
07:00 - 08:00	802	719	554	561	2,636
08:00 - 09:00	570	560	505	488	2,123
09:00 - 10:00	464	496	424	437	1,821

Total: 31,159

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
06:15 - 07:15	4188	0.95	15:45 - 16:45	4458	0.94

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
7	75	7	63	7	63

I-65

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000202 **County:** 94 Williamson
Start Date: 06/29/09 **End Date:** 06/30/09
Start Time: 10:00 **End Time:** 10:00
Direction: 2 (Coverage)
SB

Time	:00	:15	:30	:45	Hour Total
10:00 - 11:00	326	314	323	327	1,290
11:00 - 12:00	376	374	363	385	1,498
12:00 - 13:00	402	411	376	324	1,513
13:00 - 14:00	386	434	406	393	1,619
14:00 - 15:00	428	395	455	476	1,754
15:00 - 16:00	607	536	615	568	2,326
16:00 - 17:00	756	725	743	475	2,699
17:00 - 18:00	467	536	577	642	2,222
18:00 - 19:00	734	814	682	644	2,874
19:00 - 20:00	436	393	386	344	1,559
20:00 - 21:00	320	297	297	282	1,196
21:00 - 22:00	320	266	262	253	1,101
22:00 - 23:00	247	184	182	164	777
23:00 - 24:00	190	168	144	111	613
24:00 - 01:00	88	98	76	87	349
01:00 - 02:00	72	82	66	48	268
02:00 - 03:00	72	69	71	66	278
03:00 - 04:00	54	102	86	64	306
04:00 - 05:00	56	92	91	120	359
05:00 - 06:00	122	181	195	198	696
06:00 - 07:00	225	233	237	274	969
07:00 - 08:00	302	302	323	309	1,236
08:00 - 09:00	363	369	385	388	1,505
09:00 - 10:00	415	411	383	427	1,636

Total: 30,643

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
06:15 - 07:15	4188	0.95	15:45 - 16:45	4458	0.94

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
7	75	7	63	7	63

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000065	**County:**	94 Williamson
Start Date:	04/04/11	**End Date:**	04/05/11
Start Time:	12:00	**End Time:**	12:00
Direction:	0 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
12:00 - 13:00	45	46	36	28	155
13:00 - 14:00	45	42	48	41	176
14:00 - 15:00	59	33	54	55	201
15:00 - 16:00	70	63	68	62	263
16:00 - 17:00	87	86	109	86	368
17:00 - 18:00	100	97	101	87	385
18:00 - 19:00	84	63	68	38	253
19:00 - 20:00	48	31	32	16	127
20:00 - 21:00	31	27	26	17	101
21:00 - 22:00	15	13	23	20	71
22:00 - 23:00	9	16	12	13	50
23:00 - 24:00	6	9	10	5	30
24:00 - 01:00	13	6	8	5	32
01:00 - 02:00	0	0	4	0	4
02:00 - 03:00	1	2	0	2	5
03:00 - 04:00	1	1	5	6	13
04:00 - 05:00	3	5	6	8	22
05:00 - 06:00	8	19	32	44	103
06:00 - 07:00	42	83	136	164	425
07:00 - 08:00	164	168	127	131	590
08:00 - 09:00	84	87	90	98	359
09:00 - 10:00	57	43	46	53	199
10:00 - 11:00	46	37	53	50	186
11:00 - 12:00	48	45	42	40	175

Total: 4,293

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
06:30 - 07:30	632	0.94	16:30 - 17:30	392	0.90

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
14	65	9	65	14	65

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000009	**County:**	60 Maury
Start Date:	05/11/11	**End Date:**	05/12/11
Start Time:	10:00	**End Time:**	10:00
Direction:	0 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
10:00 - 11:00	257	233	276	267	1,033
11:00 - 12:00	241	303	283	302	1,129
12:00 - 13:00	288	353	306	278	1,225
13:00 - 14:00	327	300	326	265	1,218
14:00 - 15:00	289	291	305	339	1,224
15:00 - 16:00	307	288	274	310	1,179
16:00 - 17:00	336	320	312	306	1,274
17:00 - 18:00	316	333	328	309	1,286
18:00 - 19:00	290	304	288	244	1,126
19:00 - 20:00	246	239	269	236	990
20:00 - 21:00	213	195	177	172	757
21:00 - 22:00	161	142	119	88	510
22:00 - 23:00	81	66	56	33	236
23:00 - 24:00	43	52	27	24	146
24:00 - 01:00	10	37	16	7	70
01:00 - 02:00	15	19	13	5	52
02:00 - 03:00	11	4	4	9	28
03:00 - 04:00	9	9	17	8	43
04:00 - 05:00	16	22	21	27	86
05:00 - 06:00	47	54	109	91	301
06:00 - 07:00	137	180	125	141	583
07:00 - 08:00	142	169	201	187	699
08:00 - 09:00	220	214	236	278	948
09:00 - 10:00	247	234	229	242	952

Total: 17,095

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
11:45 - 12:45	1249	0.88	17:00 - 18:00	1286	0.91

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
7	65	8	65	8	65

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000222	**County:**	60 Maury
Start Date:	05/02/11	**End Date:**	05/03/11
Start Time:	13:00	**End Time:**	13:00
Direction:	3 (Coverage)		

Time	:00	:15	:30	:45	Hour Total
13:00 - 14:00	168	201	158	170	697
14:00 - 15:00	205	189	158	168	720
15:00 - 16:00	147	170	204	179	700
16:00 - 17:00	182	184	185	185	736
17:00 - 18:00	178	239	206	178	801
18:00 - 19:00	159	122	124	92	497
19:00 - 20:00	81	97	61	64	303
20:00 - 21:00	74	74	83	81	312
21:00 - 22:00	49	57	51	45	202
22:00 - 23:00	81	55	34	34	204
23:00 - 24:00	39	39	25	13	116
24:00 - 01:00	9	17	13	11	50
01:00 - 02:00	8	5	12	13	38
02:00 - 03:00	18	14	18	14	64
03:00 - 04:00	27	27	21	33	108
04:00 - 05:00	36	66	70	103	275
05:00 - 06:00	115	165	198	277	755
06:00 - 07:00	353	598	696	598	2,245
07:00 - 08:00	595	557	417	360	1,929
08:00 - 09:00	375	296	304	264	1,239
09:00 - 10:00	218	250	223	194	885
10:00 - 11:00	164	157	207	170	698
11:00 - 12:00	171	170	134	158	633
12:00 - 13:00	145	173	145	192	655

Total: 14,862

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
06:30 - 07:30	2996	0.94	16:45 - 17:45	2808	0.95

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
10	75	9	71	10	75

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000222 **County:** 60 Maury
Start Date: 05/02/11 **End Date:** 05/03/11
Start Time: 13:00 **End Time:** 13:00
Direction: 4 (Coverage)

Time	:00	:15	:30	:45	Hour Total
13:00 - 14:00	169	171	156	186	682
14:00 - 15:00	194	215	226	266	901
15:00 - 16:00	257	320	307	396	1,280
16:00 - 17:00	396	483	460	446	1,785
17:00 - 18:00	521	497	536	444	1,998
18:00 - 19:00	428	335	316	279	1,358
19:00 - 20:00	268	228	221	191	908
20:00 - 21:00	150	205	175	137	667
21:00 - 22:00	149	136	137	98	520
22:00 - 23:00	84	83	75	63	305
23:00 - 24:00	63	63	58	53	237
24:00 - 01:00	31	37	35	20	123
01:00 - 02:00	22	21	18	16	77
02:00 - 03:00	17	17	13	19	66
03:00 - 04:00	8	16	6	18	48
04:00 - 05:00	5	8	17	31	61
05:00 - 06:00	26	52	88	85	251
06:00 - 07:00	84	91	103	123	401
07:00 - 08:00	151	173	150	153	627
08:00 - 09:00	149	112	120	108	489
09:00 - 10:00	120	154	135	133	542
10:00 - 11:00	137	105	148	110	500
11:00 - 12:00	129	133	133	128	523
12:00 - 13:00	158	153	165	142	618

Total: 14,967

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
06:30 - 07:30	2996	0.94	16:45 - 17:45	2808	0.95

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
10	75	9	71	10	75

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000223 **County:** 60 Maury
Start Date: 05/02/11 **End Date:** 05/03/11
Start Time: 13:00 **End Time:** 13:01
Direction: 3 (Coverage)

Time	:00	:15	:30	:45	Hour Total
13:00 - 14:00	152	167	137	148	604
14:00 - 15:00	230	161	165	194	750
15:00 - 16:00	215	156	200	170	741
16:00 - 17:00	185	184	179	182	730
17:00 - 18:00	186	229	183	167	765
18:00 - 19:00	157	118	97	85	457
19:00 - 20:00	95	81	66	80	322
20:00 - 21:00	91	96	94	82	363
21:00 - 22:00	52	53	56	43	204
22:00 - 23:00	112	47	39	25	223
23:00 - 24:00	49	39	23	8	119
24:00 - 01:00	12	13	18	6	49
01:00 - 02:00	7	7	7	13	34
02:00 - 03:00	20	8	9	22	59
03:00 - 04:00	16	19	16	24	75
04:00 - 05:00	24	61	38	71	194
05:00 - 06:00	89	101	121	188	499
06:00 - 07:00	258	369	351	268	1,246
07:00 - 08:00	248	227	205	237	917
08:00 - 09:00	200	174	207	149	730
09:00 - 10:00	146	164	133	146	589
10:00 - 11:00	120	118	154	141	533
11:00 - 12:00	135	121	110	147	513
12:00 - 13:00	141	130	143	172	586

Total: 11,302

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
06:15 - 07:15	1725	0.93	16:30 - 17:30	1945	0.93

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
8	72	9	60	9	60

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

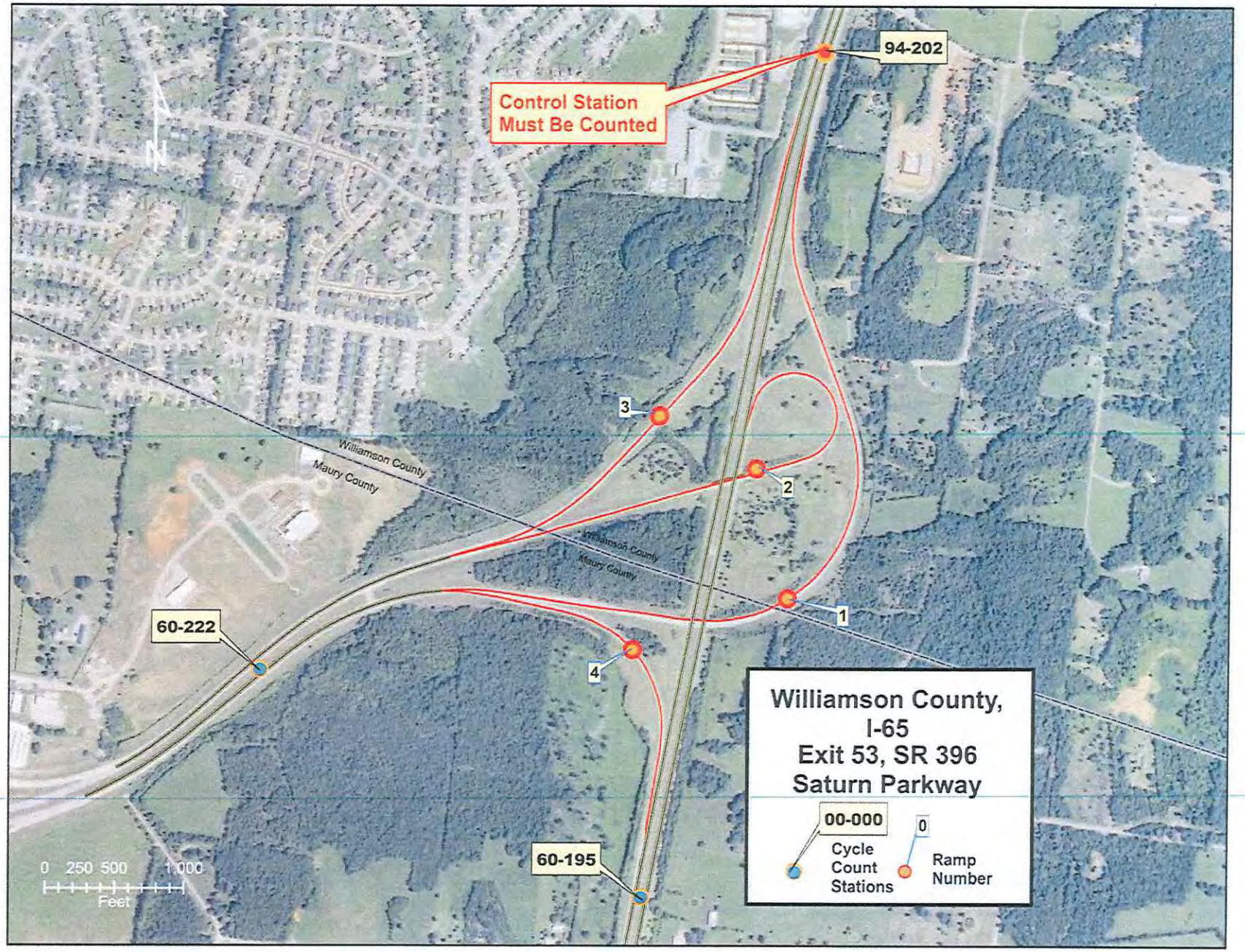
Station Number: 000223 **County:** 60 Maury
Start Date: 05/02/11 **End Date:** 05/03/11
Start Time: 13:00 **End Time:** 13:00
Direction: 4 (Coverage)

Time	:00	:15	:30	:45	Hour Total
13:00 - 14:00	150	162	140	168	620
14:00 - 15:00	156	152	197	184	689
15:00 - 16:00	190	244	240	271	945
16:00 - 17:00	301	282	295	290	1,168
17:00 - 18:00	291	293	278	254	1,116
18:00 - 19:00	233	208	178	169	788
19:00 - 20:00	173	142	152	112	579
20:00 - 21:00	103	127	99	82	411
21:00 - 22:00	86	77	99	71	333
22:00 - 23:00	58	54	55	36	203
23:00 - 24:00	32	42	32	38	144
24:00 - 01:00	23	23	18	6	70
01:00 - 02:00	13	21	16	14	64
02:00 - 03:00	9	9	17	17	52
03:00 - 04:00	6	18	6	20	50
04:00 - 05:00	9	15	14	34	72
05:00 - 06:00	35	55	89	110	289
06:00 - 07:00	82	94	95	140	411
07:00 - 08:00	160	234	228	180	802
08:00 - 09:00	141	129	137	121	528
09:00 - 10:00	116	143	145	133	537
10:00 - 11:00	127	105	147	119	498
11:00 - 12:00	133	116	117	125	491
12:00 - 13:00	159	123	126	136	544

Total: 11,404

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
06:15 - 07:15	1725	0.93	16:30 - 17:30	1945	0.93

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
8	72	9	60	9	60


94-202
Control Station
Must Be Counted
3
2
1
4
60-222
60-195
Williamson County
Maury County
Williamson County
Maury County
0 250 500 1,000
Feet
Williamson County,
I-65
Exit 53, SR 396
Saturn Parkway
00-000
Cycle
Count
Stations
0
Ramp
Number

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000001 (Ramp)	**County:**	94 Williamson
Start Date:	05 / 10 / 2011	**End Date:**	05 / 11 / 2011
Start Time:	11 : 00	**End Time:**	11 : 00
Direction:	5 (Ramp)		

Time		
11:00 - 12:00	703	
12:00 - 13:00	729	
13:00 - 14:00	680	
14:00 - 15:00	728	
15:00 - 16:00	670	
16:00 - 17:00	754	→ (PM) 4:00 - 5:00 PM
17:00 - 18:00	751	
18:00 - 19:00	584	
19:00 - 20:00	373	
20:00 - 21:00	309	
21:00 - 22:00	256	
22:00 - 23:00	209	
23:00 - 24:00	134	
24:00 - 01:00	65	
01:00 - 02:00	55	
02:00 - 03:00	50	
03:00 - 04:00	80	
04:00 - 05:00	203	
05:00 - 06:00	587	
06:00 - 07:00	1,988	
07:00 - 08:00	2,190	→ (AM) 7:00 - 8:00 AM
08:00 - 09:00	1,388	
09:00 - 10:00	1,066	
10:00 - 11:00	811	
Total:	15,363	

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
06:30 - 07:30	2469	0.93	16:15 - 17:15	802	0.92

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
14	100	5	100	14	100

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000002 (Ramp)	**County:**	94 Williamson
Start Date:	05 / 10 / 2011	**End Date:**	05 / 11 / 2011
Start Time:	11 : 00	**End Time:**	11 : 00
Direction:	5 (Ramp)		

Time		
11:00 - 12:00	39	
12:00 - 13:00	34	
13:00 - 14:00	45	
14:00 - 15:00	50	
15:00 - 16:00	58	
16:00 - 17:00	60	
17:00 - 18:00	72	→ (PM) 5:00 - 6:00
18:00 - 19:00	59	
19:00 - 20:00	46	
20:00 - 21:00	41	
21:00 - 22:00	21	
22:00 - 23:00	15	
23:00 - 24:00	6	
24:00 - 01:00	5	
01:00 - 02:00	3	
02:00 - 03:00	3	
03:00 - 04:00	5	
04:00 - 05:00	11	
05:00 - 06:00	26	
06:00 - 07:00	54	→ AM 6:00 - 7:00 AM
07:00 - 08:00	53	
08:00 - 09:00	43	
09:00 - 10:00	49	
10:00 - 11:00	38	

Total: 836

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:15 - 08:15	61	0.69	16:45 - 17:45	77	0.80

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
7	100	9	100	9	100

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000003 (Ramp)	**County:**	94 Williamson
Start Date:	05 / 10 / 2011	**End Date:**	05 / 11 / 2011
Start Time:	10 : 00	**End Time:**	10 : 00
Direction:	5 (Ramp)		

Time		
10:00 - 11:00	542	
11:00 - 12:00	589	
12:00 - 13:00	640	
13:00 - 14:00	764	
14:00 - 15:00	1,004	
15:00 - 16:00	1,458	
16:00 - 17:00	1,882	
17:00 - 18:00	1,840	→ (PM) 5:00-6:00
18:00 - 19:00	1,146	
19:00 - 20:00	794	
20:00 - 21:00	702	
21:00 - 22:00	519	
22:00 - 23:00	403	
23:00 - 24:00	218	
24:00 - 01:00	127	
01:00 - 02:00	79	
02:00 - 03:00	70	
03:00 - 04:00	59	
04:00 - 05:00	117	
05:00 - 06:00	323	
06:00 - 07:00	489	
07:00 - 08:00	646	→ AM 7:00-8:00
08:00 - 09:00	529	
09:00 - 10:00	589	
Total:	15,529	

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
06:45 - 07:45	689	0.79	16:15 - 17:15	1975	0.93

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
4	100	13	100	13	100

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000004 (Ramp)	**County:**	94 Williamson
Start Date:	05 / 10 / 2011	**End Date:**	05 / 11 / 2011
Start Time:	11 : 00	**End Time:**	11 : 00
Direction:	5 (Ramp)		

Time	
11:00 - 12:00	32
12:00 - 13:00	50
13:00 - 14:00	40
14:00 - 15:00	76
15:00 - 16:00	59
16:00 - 17:00	71
17:00 - 18:00	81 → PM 5:00-6:00PM
18:00 - 19:00	49
19:00 - 20:00	46
20:00 - 21:00	42
21:00 - 22:00	41
22:00 - 23:00	32
23:00 - 24:00	11
24:00 - 01:00	10
01:00 - 02:00	11
02:00 - 03:00	4
03:00 - 04:00	4
04:00 - 05:00	6
05:00 - 06:00	15
06:00 - 07:00	36
07:00 - 08:00	60 → AM 7:00-8:00AM
08:00 - 09:00	56
09:00 - 10:00	37
10:00 - 11:00	36

Total: 905

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:00 - 08:00	60	0.58	16:45 - 17:45	81	0.78

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
7	100	9	100	9	100

Williamson County, I-65
Exit 59, SR 840
00-000
Cycle Count Station
0
Ramp Number
N
31
65
840
94-080
7
8
94-200
6
5
9
10
11
94-201
44
45
43
42
12
94-202
Control Station Must Be Counted
0 250 500 1,000
Feet

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000005 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 25 / 2011	**End Date:**	04 / 26 / 2011
Start Time:	11 : 00	**End Time:**	11 : 00
Direction:	5 (Ramp)		

Time	
11:00 - 12:00	306
12:00 - 13:00	235
13:00 - 14:00	264
14:00 - 15:00	316
15:00 - 16:00	376 → (PM)
16:00 - 17:00	348
17:00 - 18:00	280
18:00 - 19:00	196
19:00 - 20:00	157
20:00 - 21:00	150
21:00 - 22:00	99
22:00 - 23:00	72
23:00 - 24:00	47
24:00 - 01:00	49
01:00 - 02:00	25
02:00 - 03:00	34
03:00 - 04:00	44
04:00 - 05:00	110
05:00 - 06:00	248
06:00 - 07:00	557
07:00 - 08:00	734 → AM
08:00 - 09:00	286
09:00 - 10:00	224
10:00 - 11:00	195
Total:	5,352

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
06:45 - 07:45	791	0.75	15:30 - 16:30	391	0.84

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
14	100	7	100	14	100

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000006 (Ramp)	**County:**	94 Williamson
Start Date:	05 / 10 / 2011	**End Date:**	05 / 11 / 2011
Start Time:	11 : 00	**End Time:**	11 : 00
Direction:	5 (Ramp)		

Time	
11:00 - 12:00	17
12:00 - 13:00	19
13:00 - 14:00	23
14:00 - 15:00	23
15:00 - 16:00	23
16:00 - 17:00	24
17:00 - 18:00	30 → PM 5:00-6:00
18:00 - 19:00	26
19:00 - 20:00	12
20:00 - 21:00	9
21:00 - 22:00	7
22:00 - 23:00	7
23:00 - 24:00	2
24:00 - 01:00	3
01:00 - 02:00	0
02:00 - 03:00	0
03:00 - 04:00	1
04:00 - 05:00	0
05:00 - 06:00	6
06:00 - 07:00	99
07:00 - 08:00	275 → AM 7:00-8:00
08:00 - 09:00	65
09:00 - 10:00	25
10:00 - 11:00	19
Total:	715

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
06:45 - 07:45	293	0.80	17:00 - 18:00	30	0.68

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
13	100	4	100	13	100

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000007 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 25 / 2011	**End Date:**	04 / 26 / 2011
Start Time:	10 : 00	**End Time:**	10 : 00
Direction:	5 (Ramp)		

Time	
10:00 - 11:00	464
11:00 - 12:00	438
12:00 - 13:00	420
13:00 - 14:00	369
14:00 - 15:00	464
15:00 - 16:00	459
16:00 - 17:00	476 → PM
17:00 - 18:00	463
18:00 - 19:00	305
19:00 - 20:00	196
20:00 - 21:00	141
21:00 - 22:00	86
22:00 - 23:00	51
23:00 - 24:00	26
24:00 - 01:00	19
01:00 - 02:00	7
02:00 - 03:00	30
03:00 - 04:00	43
04:00 - 05:00	120
05:00 - 06:00	536
06:00 - 07:00	557 → AM
07:00 - 08:00	517
08:00 - 09:00	449
09:00 - 10:00	460

Total: 7,096

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
05:30 - 06:30	688	0.80	16:45 - 17:45	508	0.88

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
10	100	7	100	10	100

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000008 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 25 / 2011	**End Date:**	04 / 26 / 2011
Start Time:	10 : 00	**End Time:**	10 : 00
Direction:	5 (Ramp)		

Time	
10:00 - 11:00	433
11:00 - 12:00	425
12:00 - 13:00	369
13:00 - 14:00	448
14:00 - 15:00	416
15:00 - 16:00	551
16:00 - 17:00	715 → PM 4:00-5:00
17:00 - 18:00	710
18:00 - 19:00	386
19:00 - 20:00	264
20:00 - 21:00	204
21:00 - 22:00	153
22:00 - 23:00	102
23:00 - 24:00	68
24:00 - 01:00	60
01:00 - 02:00	44
02:00 - 03:00	57
03:00 - 04:00	73
04:00 - 05:00	88
05:00 - 06:00	250
06:00 - 07:00	343
07:00 - 08:00	454 → AM 7:00-8:00
08:00 - 09:00	414
09:00 - 10:00	396

Total: 7,423

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:00 - 08:00	454	0.77	16:15 - 17:15	783	0.88

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
6	100	11	100	11	100

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000009 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 25 / 2011	**End Date:**	04 / 26 / 2011
Start Time:	11 : 00	**End Time:**	11 : 00
Direction:	5 (Ramp)		

Time		
11:00 - 12:00	220	
12:00 - 13:00	233	
13:00 - 14:00	306	
14:00 - 15:00	344	
15:00 - 16:00	479	
16:00 - 17:00	717	→ (PM) 4:00-5:00
17:00 - 18:00	590	
18:00 - 19:00	680	
19:00 - 20:00	471	
20:00 - 21:00	357	
21:00 - 22:00	293	
22:00 - 23:00	161	
23:00 - 24:00	102	
24:00 - 01:00	45	
01:00 - 02:00	19	
02:00 - 03:00	16	
03:00 - 04:00	13	
04:00 - 05:00	10	
05:00 - 06:00	23	
06:00 - 07:00	69	
07:00 - 08:00	126	
08:00 - 09:00	134	
09:00 - 10:00	146	
10:00 - 11:00	149	→ AM 10:00-11:00

Total: 5,703

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
11:30 - 12:30	240	0.90	16:00 - 17:00	717	0.86

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
4	100	13	100	13	100

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000010 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 25 / 2011	**End Date:**	04 / 26 / 2011
Start Time:	11 : 00	**End Time:**	11 : 00
Direction:	5 (Ramp)		

Time		
11:00 - 12:00	141	
12:00 - 13:00	130	
13:00 - 14:00	176	
14:00 - 15:00	186	
15:00 - 16:00	201	
16:00 - 17:00	201	→ (PM) 4:00 - 5:00
17:00 - 18:00	96	
18:00 - 19:00	103	
19:00 - 20:00	107	
20:00 - 21:00	116	
21:00 - 22:00	90	
22:00 - 23:00	44	
23:00 - 24:00	37	
24:00 - 01:00	19	
01:00 - 02:00	7	
02:00 - 03:00	6	
03:00 - 04:00	7	
04:00 - 05:00	11	
05:00 - 06:00	11	
06:00 - 07:00	64	
07:00 - 08:00	136	
08:00 - 09:00	172	→ AM 8:00 - 9:00 AM
09:00 - 10:00	148	
10:00 - 11:00	143	
Total:	2,352	

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
08:30 - 09:30	173	0.90	15:30 - 16:30	213	0.90

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
7	100	9	100	9	100

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000011 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 25 / 2011	**End Date:**	04 / 26 / 2011
Start Time:	11 : 00	**End Time:**	11 : 00
Direction:	5 (Ramp)		

Time		
11:00 - 12:00	300	
12:00 - 13:00	297	
13:00 - 14:00	270	
14:00 - 15:00	317	
15:00 - 16:00	315	
16:00 - 17:00	344	
17:00 - 18:00	381	→ PM 5:00-6:00
18:00 - 19:00	262	
19:00 - 20:00	145	
20:00 - 21:00	118	
21:00 - 22:00	66	
22:00 - 23:00	46	
23:00 - 24:00	23	
24:00 - 01:00	9	
01:00 - 02:00	3	
02:00 - 03:00	13	
03:00 - 04:00	22	
04:00 - 05:00	73	
05:00 - 06:00	285	
06:00 - 07:00	588	→ AM 6:00-7:00
07:00 - 08:00	478	
08:00 - 09:00	357	
09:00 - 10:00	365	
10:00 - 11:00	337	

Total: 5,414

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
05:45 - 06:45	596	0.76	16:30 - 17:30	391	0.84

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
11	100	7	100	11	100

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

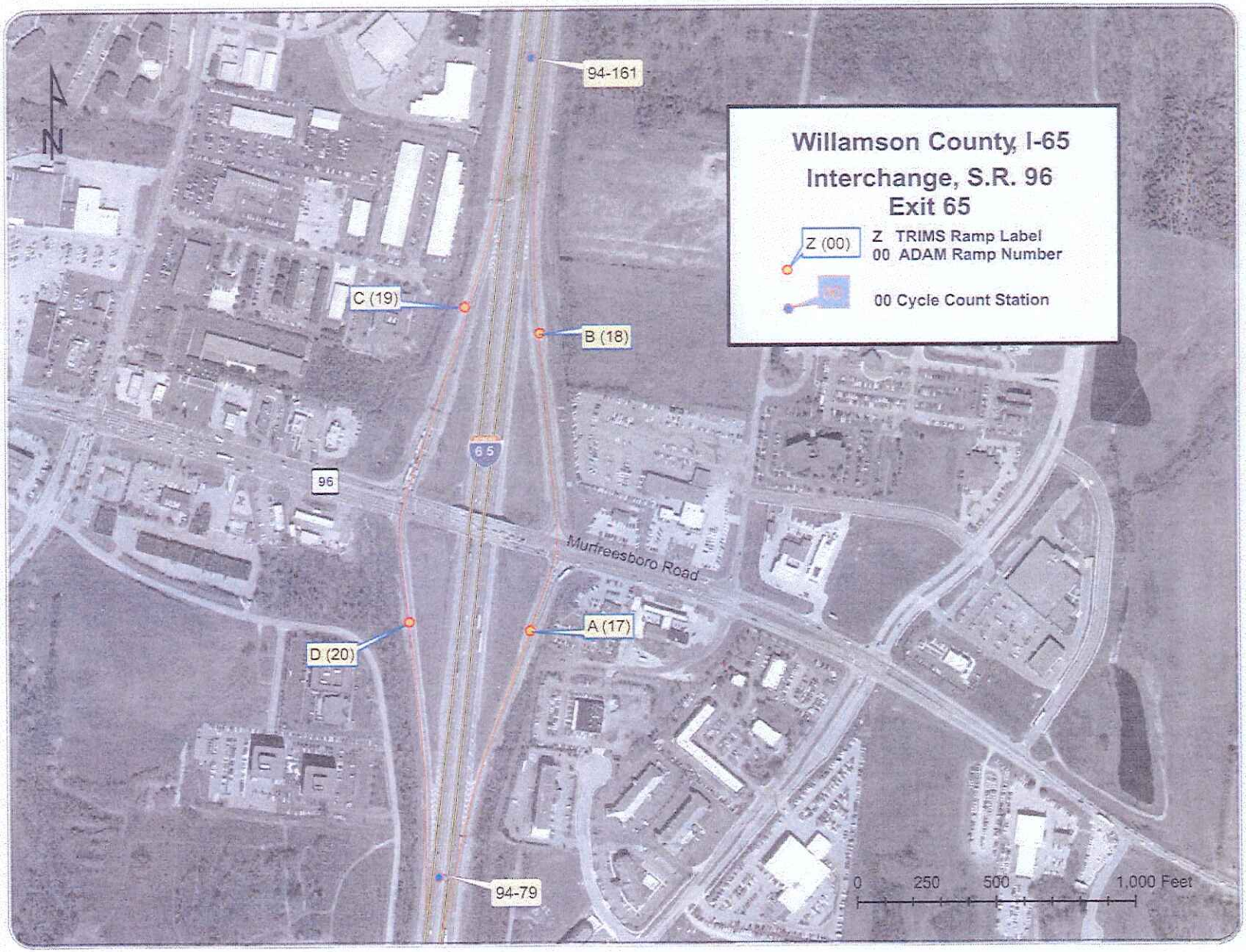
Station Number:	000012 (Ramp)	**County:**	94 Williamson
Start Date:	04 / 25 / 2011	**End Date:**	04 / 26 / 2011
Start Time:	11 : 00	**End Time:**	11 : 00
Direction:	5 (Ramp)		

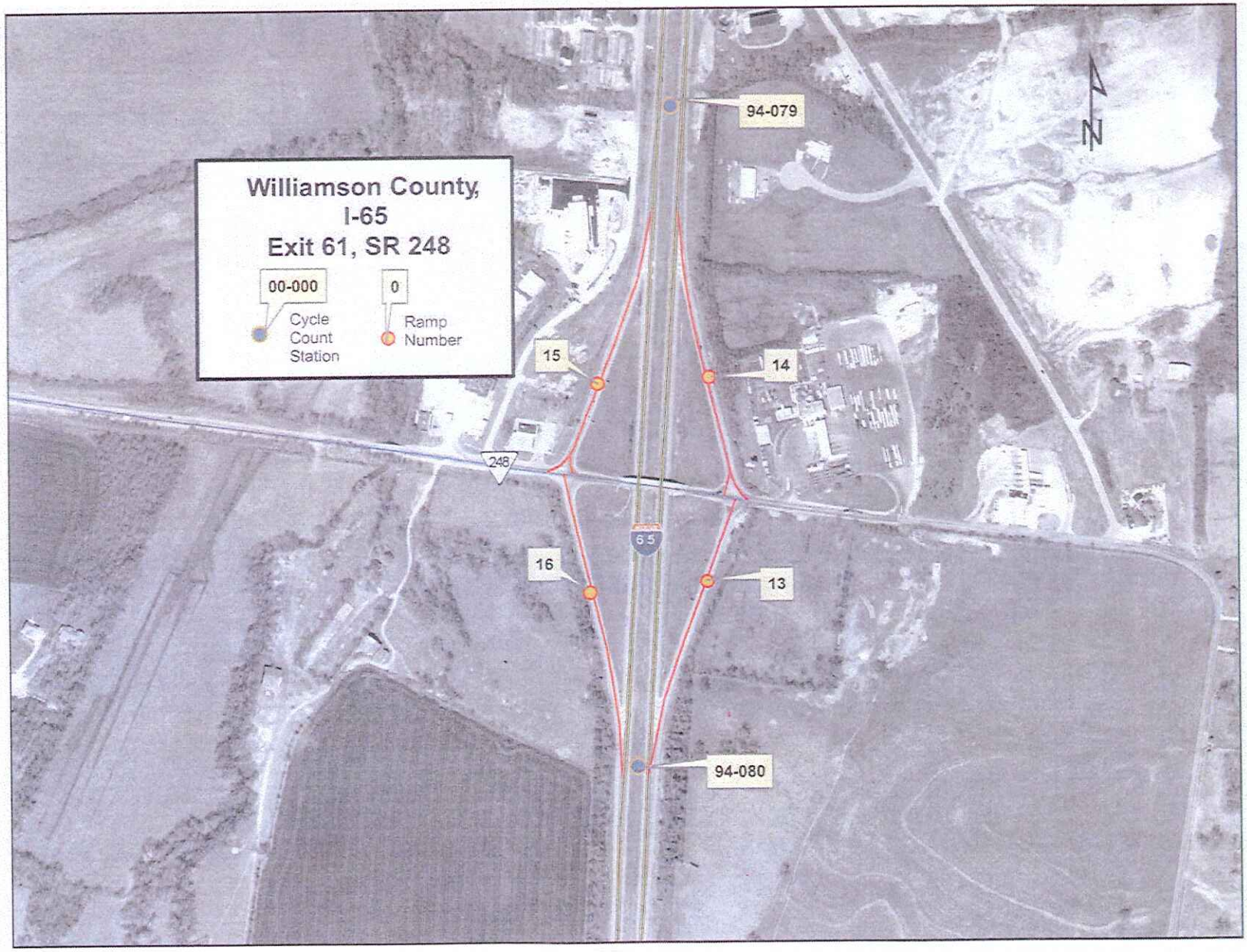
Time	
11:00 - 12:00	292
12:00 - 13:00	277
13:00 - 14:00	292
14:00 - 15:00	300
15:00 - 16:00	366
16:00 - 17:00	577
17:00 - 18:00	614 → (PM) 5:00-6:00
18:00 - 19:00	376
19:00 - 20:00	205
20:00 - 21:00	180
21:00 - 22:00	147
22:00 - 23:00	94
23:00 - 24:00	59
24:00 - 01:00	53
01:00 - 02:00	26
02:00 - 03:00	51
03:00 - 04:00	59
04:00 - 05:00	65
05:00 - 06:00	138
06:00 - 07:00	241
07:00 - 08:00	397 → AM
08:00 - 09:00	340
09:00 - 10:00	308
10:00 - 11:00	259

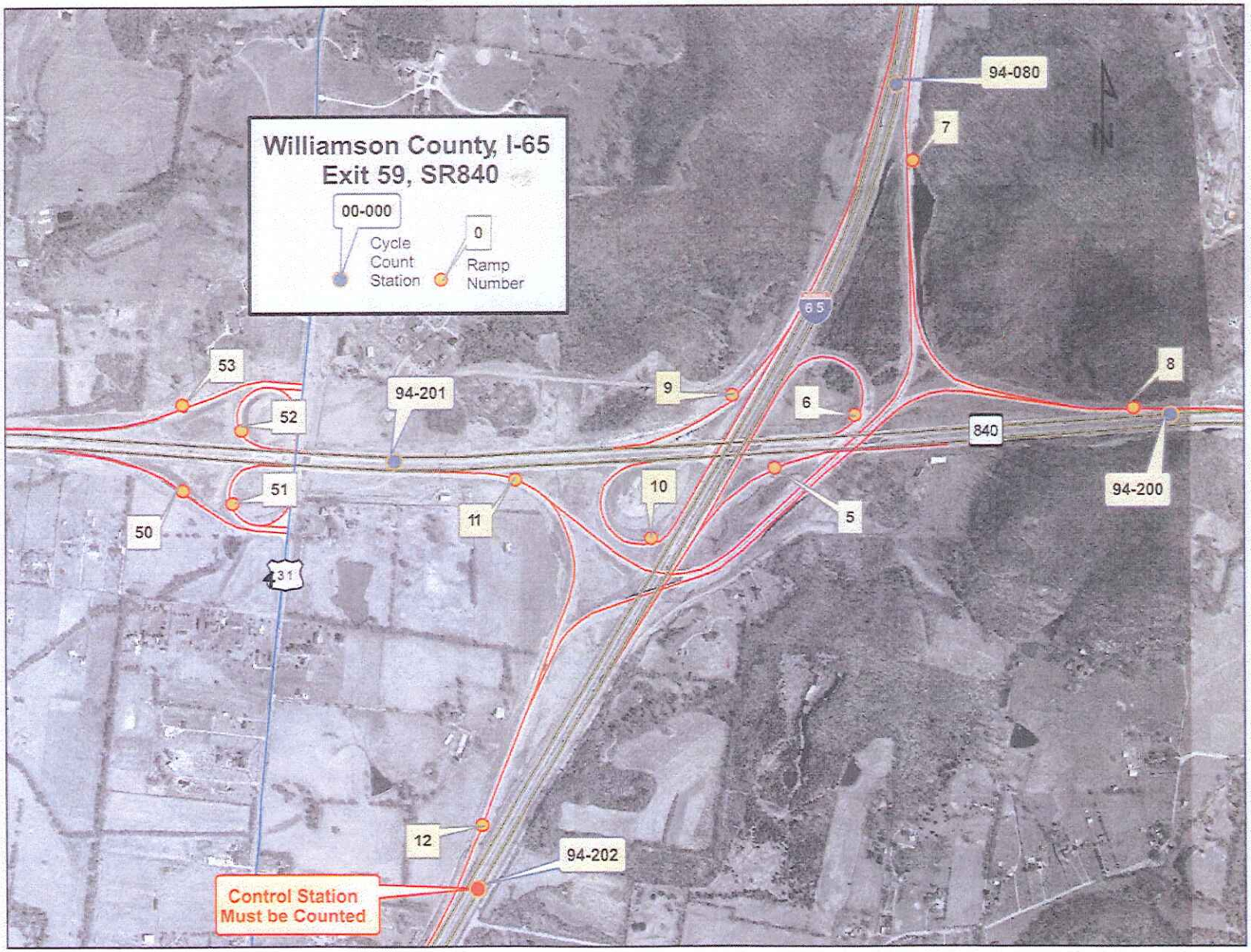
Total: 5,716

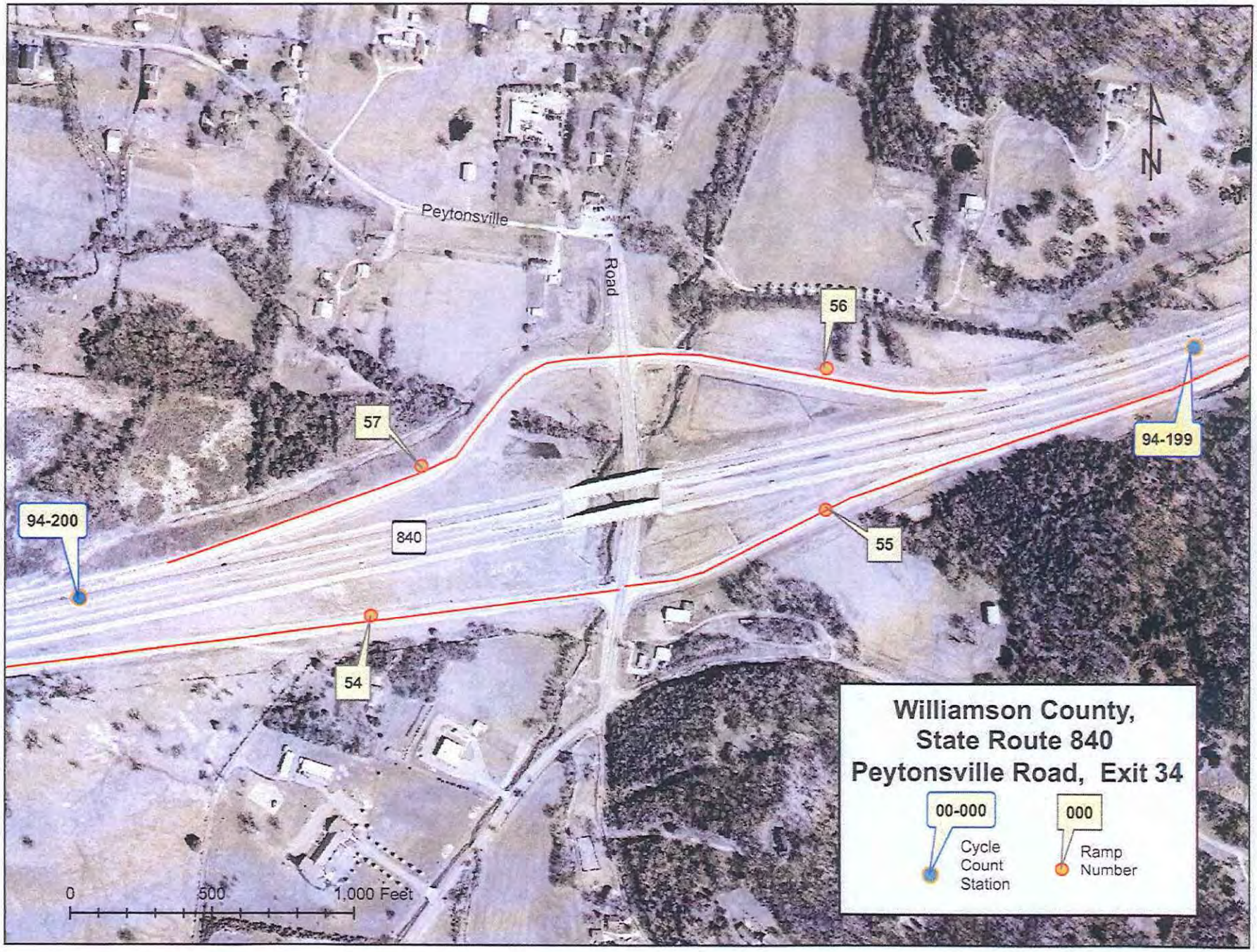
Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:15 - 08:15	400	0.79	16:30 - 17:30	679	0.96

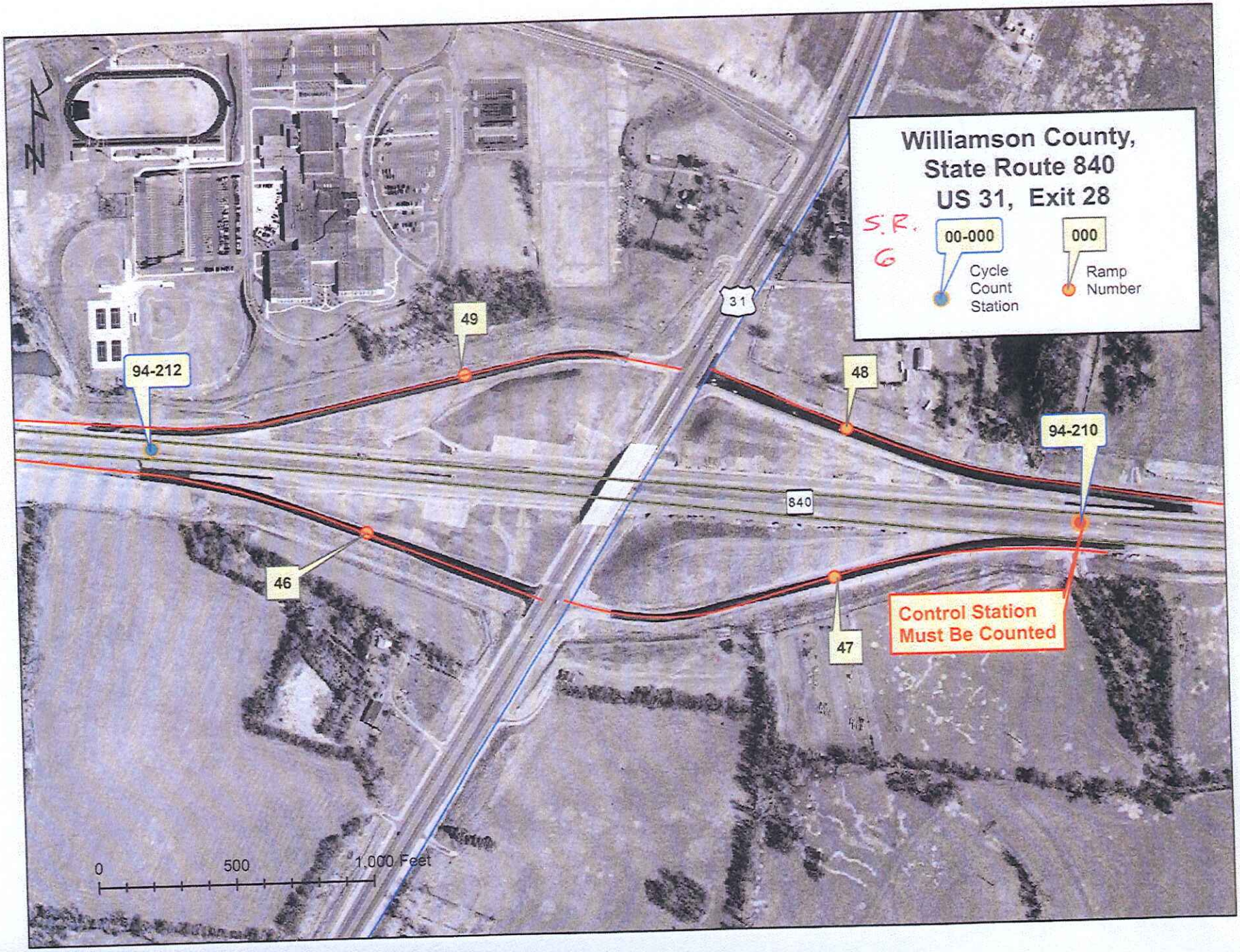
Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
7	100	12	100	12	100


Willamson County, I-65
Interchange, S.R. 96
Exit 65
Z (00)
Z TRIMS Ramp Label
00 ADAM Ramp Number
00 Cycle Count Station
N
94-161
C (19)
B (18)
65
96
Murfreesboro Road
A (17)
D (20)
94-79
0
250
500
1,000 Feet

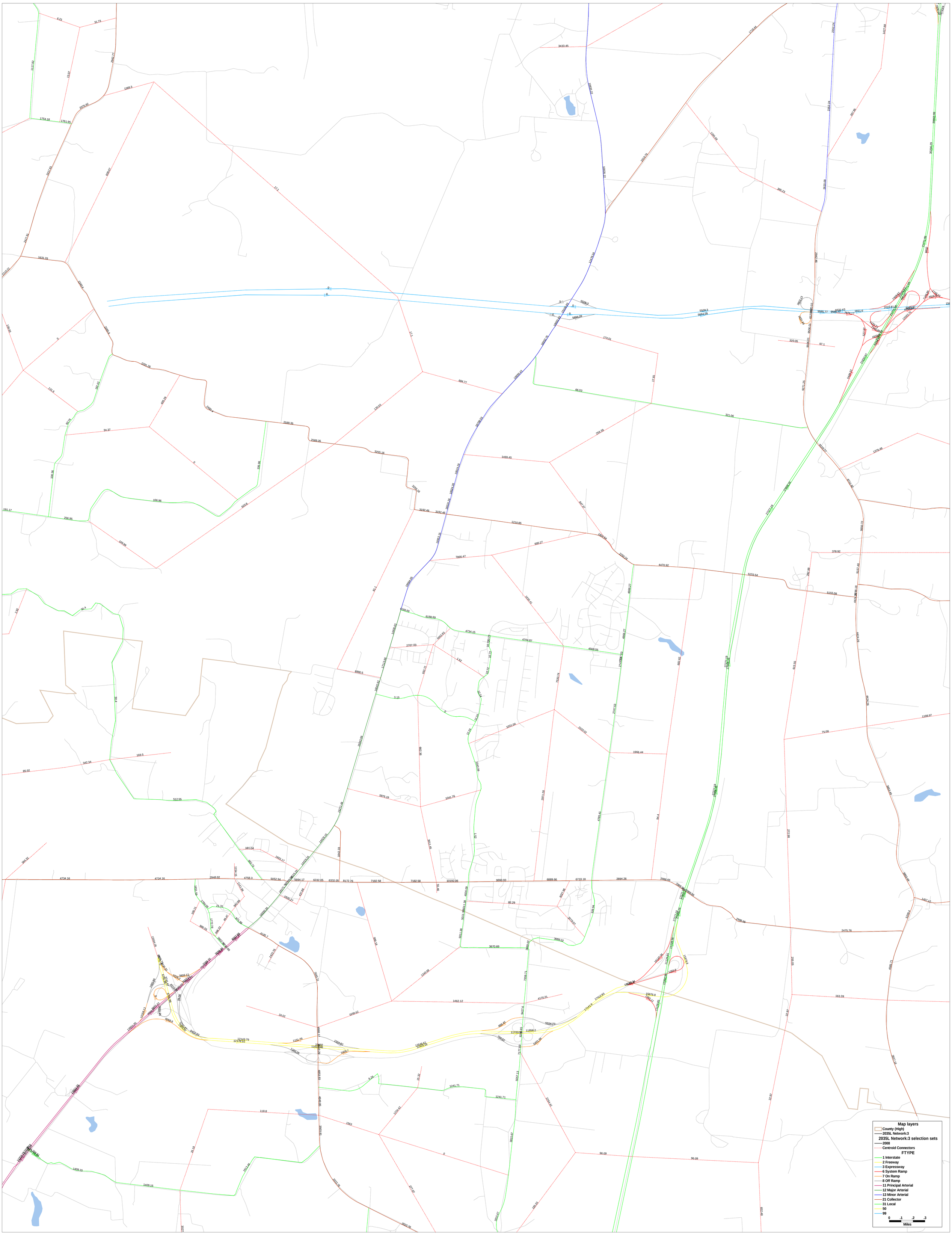

Williamson County,
I-65
Exit 61, SR 248
00-000
Cycle Count Station
0
Ramp Number
94-079
15
14
248
65
16
13
94-080
N

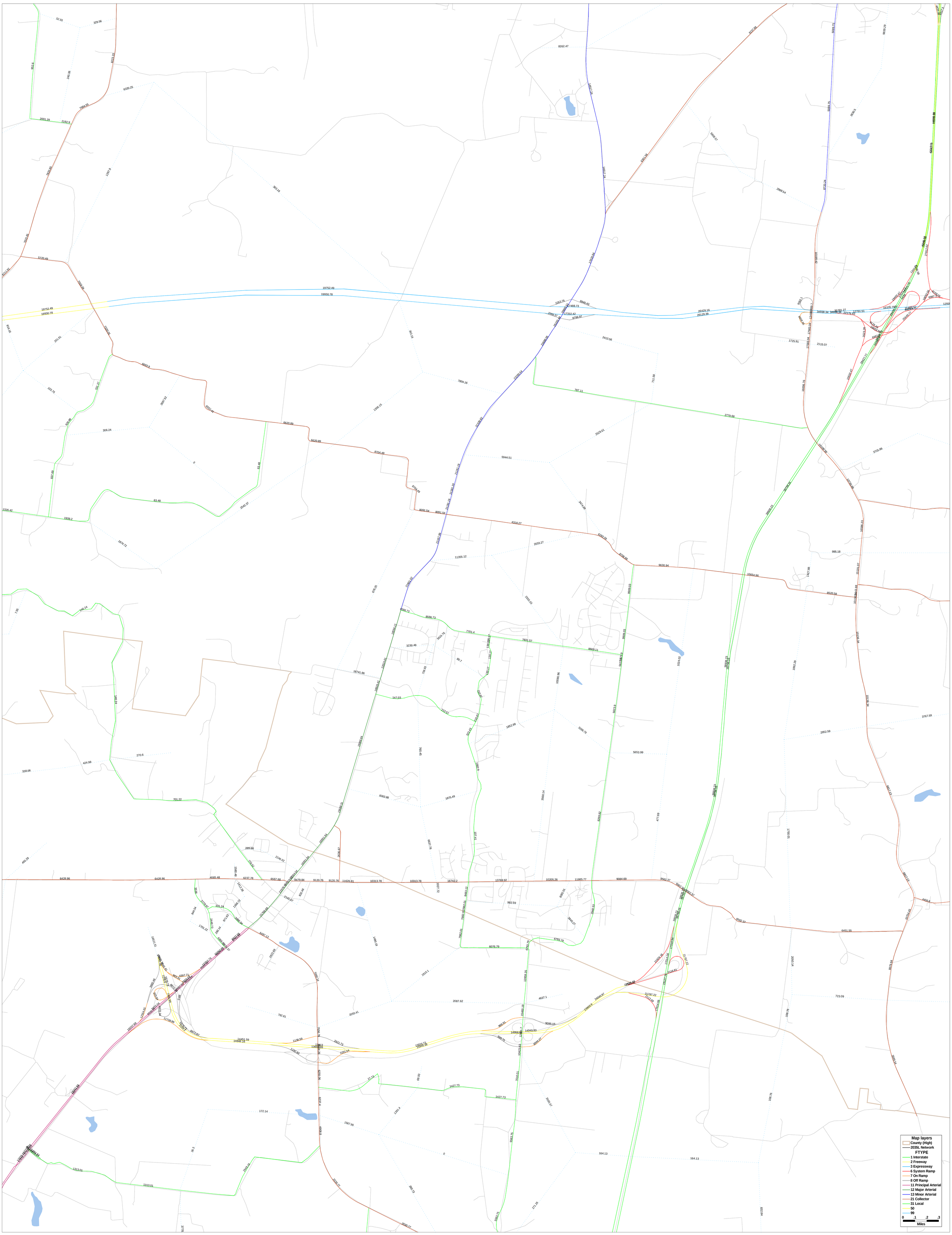

Williamson County, I-65
Exit 59, SR840
00-000
Cycle Count Station
0
Ramp Number
94-080
7
N
65
8
53
94-201
9
6
52
840
94-200
51
10
5
50
11
31
12
94-202
Control Station
Must be Counted

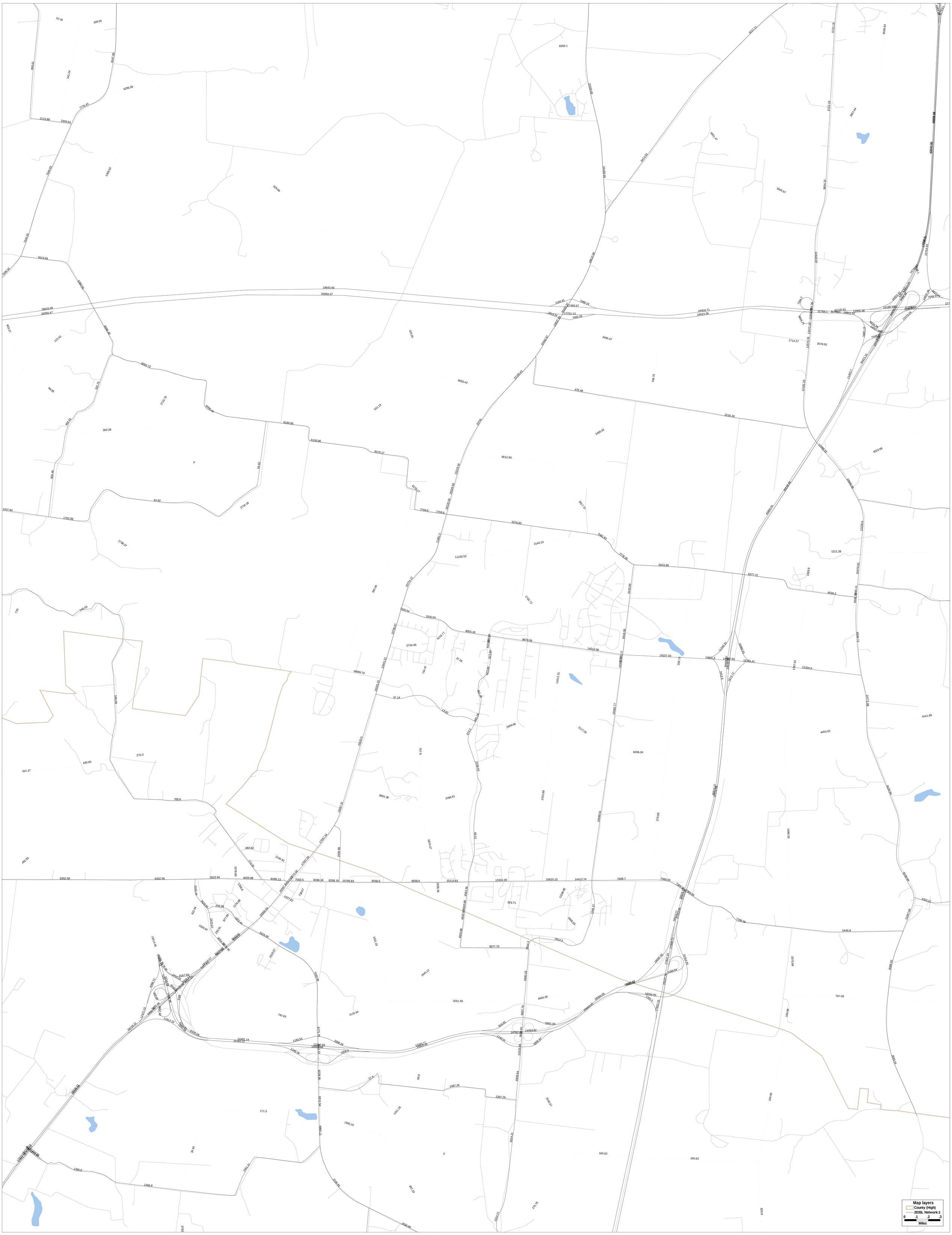

Williamson County,
State Route 840
Peytonsville Road, Exit 34
00-000
Cycle Count Station
000
Ramp Number
Peytonsville
Road
840
N
56
57
55
54
94-199
94-200
0
500
1,000 Feet

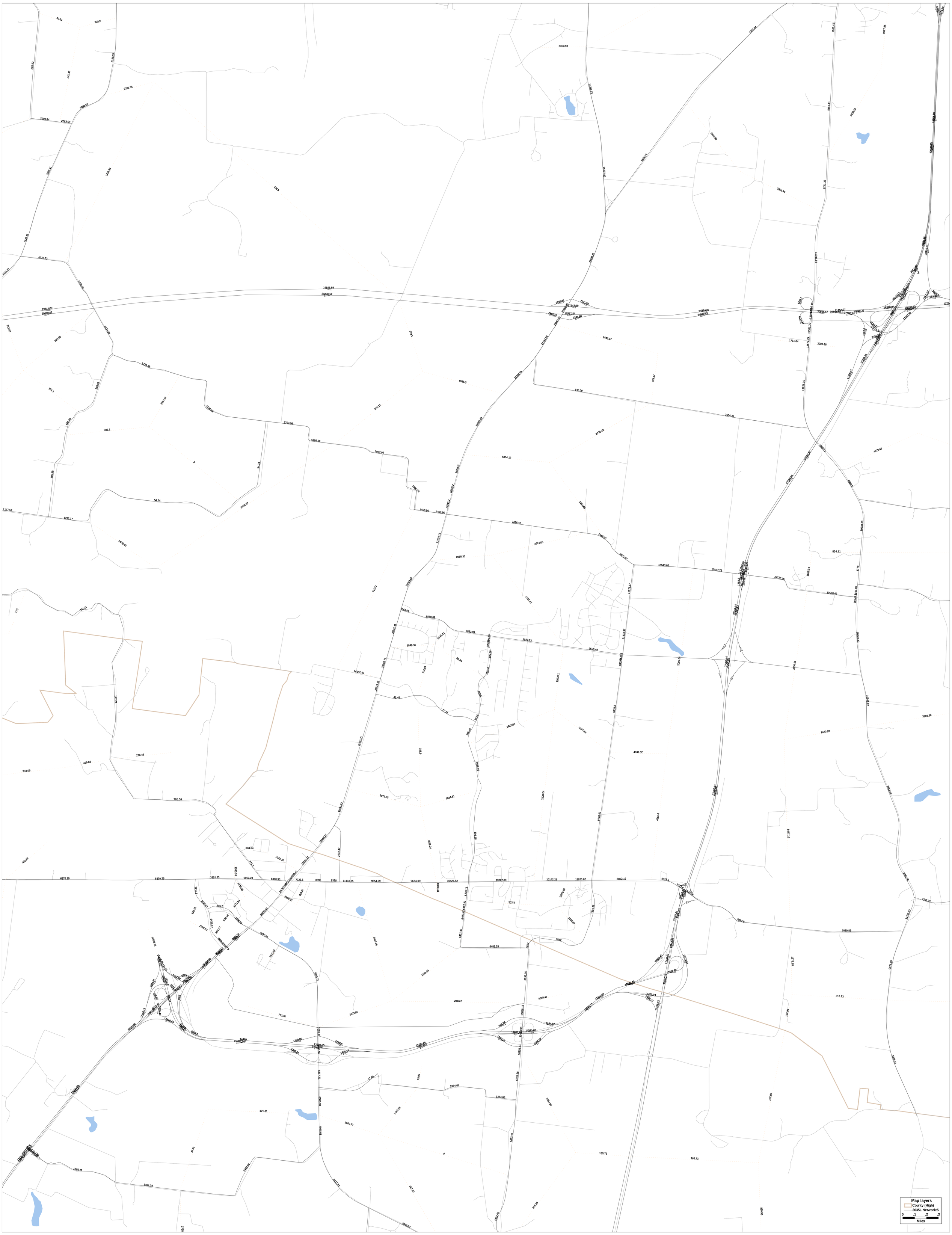

Williamson County,
State Route 840
US 31, Exit 28
S.R. 6
00-000
Cycle Count Station
000
Ramp Number
31
840
94-212
49
48
94-210
46
47
Control Station Must Be Counted
0
500
1,000 Feet

TRAVEL DEMAND MODEL OUTPUT


Map layers
County (High)
2035L Network:3
2035L Network:3 selection sets
2008
Centroid Connectors
FTYPE
1 Interstate
2 Freeway
3 Expressway
6 System Ramp
7 On Ramp
8 Off Ramp
11 Principal Arterial
12 Major Arterial
13 Minor Arterial
21 Collector
31 Local
50
99
0 .1 .2 .3
Miles


Map layers
County (High)
2035L Network
FTYPE
1 Interstate
2 Freeway
3 Expressway
6 System Ramp
7 On Ramp
8 Off Ramp
11 Principal Arterial
12 Major Arterial
13 Minor Arterial
21 Collector
31 Local
50
99
0 .1 .2 .3
Miles


Map layers
County (High)
2035L Network:1
0 .1 .2 .3
Miles


Map layers
County (High)
2035L Network:5
0 .1 .2 .3
Miles

APPENDIX 6- AGENCY COORDINATION AND PUBLIC INVOLVEMENT

CONCURRENCE LETTERS

City of
SPRING HILL
TENNESSEE
est. 1809

October 8, 2013

Mr. Paul Degges
Chief Engineer
Tennessee Department of Transportation
James K. Polk Building, Suite 700
505 Deaderick Street
Nashville, TN 37243

RE: Support for I-65 Interchange Between Saturn Parkway and SR 840

Dear Mr. Degges:

As Mayor of the City of Spring Hill, I am writing to express my support for a new interchange on I-65 between Saturn Parkway and SR 840.

The City of Spring Hill, along with the Town of Thompson's Station and Williamson County, committed funds in 2011 to fund a study to submit an Interstate Access Request (IAR) to the Federal Highway Administration (FHWA) for a new interchange on I-65 in Williamson County. On April 18, 2011, the City of Spring Hill Board of Mayor and Aldermen did unanimously adopt Resolution 11-43 funding $35,000 of the cost of the IAR and pledging support for the interchange. This interchange is needed to provide better access and to alleviate congestion in southern Williamson County and northern Maury County, including Spring Hill and Thompson's Station.

I ask that you give this IAR your considered judgment and submit it to the FHWA based on the need for an interchange in our community.

Respectfully,

Rick Graham
Mayor, City of Spring Hill

Encl: Resolution 11-43

199 Town Center Parkway
P.O. Box 789
Spring Hill, TN 37174

Phone 931.486.2252
Fax 931.486.0516
www.springhilltn.org

WILLIAMSON COUNTY
Rogers C. Anderson, County Mayor
1320 West Main Street, Suite 125
Franklin, Tennessee 37064
(615) 790-5700, Fax (615) 790-5818

October 25, 2013

Mr. Paul Degges, Chief Engineer
Tennessee Department of Transportation
James K. Polk Building-Suite 700
505 Deaderick Street
Nashville, Tennessee 37243

Dear Mr. Degges:

As demonstrated in the Tennessee Department of Transportation's (TDOT) recent Region 3 Meeting, the population in Williamson County continues to be at the top of the charts for growth. With Tennessee's population is expected to increase by two (2) million people by the year 2040, and a 55% growth in the TDOT Region 3, transportation growth and infrastructure needs continue to need to be addressed in an expeditious manner.

In 2010, Williamson County partnered with the Town of Thompson's Station and the City of Spring Hill to contract with CDM Smith for a new Interchange Access Request (IAR) study to be located along the I-65 Corridor in southern Williamson County.

CDM Smith Property Manager, Robby Dickenson indicates that this study is being submitted to TDOT for review prior to the final document submittal to the Federal Highway Administration (FHWA) for approval. The addition of this new interchange would bring additional interstate access and help alleviate secondary road congestion in southern Williamson County.

As Mayor of Williamson County, I respectfully request that you give this IAR positive consideration for approval that can be provided to the FHWA.

If you need additional information or wish to discuss this proposal in further detail, feel free to contact me.

Sincerely,

Rogers C. Anderson, Mayor
Williamson County

RCA/dg

Printed on recycled paper

JACK JOHNSON
SENATOR

11 LEGISLATIVE PLAZA
NASHVILLE, TENNESSEE 37243

(615) 741-2495
(615) 253-0321 (FAX)

Senate Chamber
State of Tennessee
NASHVILLE

CHAIRMAN
COMMERCE AND LABOR

VICE CHAIRMAN
STATE AND LOCAL GOVERNMENT

October 29, 2013

Mr. Paul Degges
Chief Engineer
Tennessee Department of Transportation
James K. Polk Building, Suite 700
505 Deaderick Street
Nashville, TN 37243

RE: Support for I-65 Interchange Between Saturn Parkway and SR 840

Dear Mr. Degges:

As a members of the Tennessee General Assembly representing all of Williamson County, we are writing to pledge our support for a new interchange on I-65 between Saturn Parkway and SR 840.

Williamson County is one of the most rapidly growing counties in the state and Spring Hill, which is in southern Williamson County, has seen exponential population growth over the last twenty years. This interchange is needed to provide better access and to alleviate congestion in southern Williamson County.

We ask that you give this interchange your considered judgment and submit the request to the FHWA based on the need for an interchange in our community.

Thank you for your consideration of this issue. Please feel free to contact either of us if you should need more information.

Respectfully,

Sen. Jack Johnson

Rep. Charles Sargent

Rep. Jeremy Durham

Rep. Glen Casada

23rd DISTRICT
WILLIAMSON COUNTY
sen.jack.johnson@capitol.tn.gov

JOEY HENSLEY, MD
SENATOR

309 WAR MEMORIAL BUILDING
NASHVILLE, TENNESSEE 37243
(615) 741-3100
1-800-449-8366 EXT. 13100
FAX (615) 253-0231

855 SUMMERTOWN HIGHWAY
HOHENWALD, TENNESSEE 38462
(931) 796-2018
CELL (931) 212-8823

E-MAIL: sen.joey.hensley@capitol.tn.gov

Senate
State of Tennessee
NASHVILLE

28TH LEGSLATIVE DISTRICT
MAURY, LAWRENCE, LEWIS, PERRY,
GILES AND WAYNE COUNTIES

MEMBER OF COMMITTEES
FINANCE
EDUCATION
HEALTH

SECOND VICE-CHAIR
HEALTH COMMITTEE

CHAIRMAN
HIGHER EDUCATION
SUB-COMMITTEE

October 28, 2013

Mr. Paul Degges
Chief Engineer
Tennessee Department of Transportation
James K. Polk Building, Suite 700
505 Deaderick Street
Nashville, TN 37243

RE: Support for I-65 Interchange Between Saturn Parkway and SR 840

Dear Mr. Degges:

As a member of the Tennessee State Senate representing State Senate District 28, which includes Giles, Lawrence, Lewis, Maury, Perry, and Wayne Counties including the Maury County portion of Spring Hill, I am writing to pledge my support for a new interchange on I-65 between Saturn Parkway and SR 840.

Spring Hill is one of the most rapidly growing cities in the State of Tennessee, having grown from a population of 1,464 in 1990 to 29,036 in 2010. This interchange is needed to provide better access and to alleviate congestion in Spring Hill.

I ask that you give this interchange your considered judgment and submit the request to the FHWA based on the need for an interchange in our community.

Respectfully,

Joey Hensley MD

Sen. Joey Hensley
Tennessee State Senate
District 28

TDOT LETTER OF APPROVAL

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION
PROJECT PLANNING DIVISION
SUITE 1000, JAMES K. POLK BUILDING
505 Deaderick Street
NASHVILLE, TENNESSEE 37243-0344

John Schroer
Commissioner

Bill Haslam
Governor

October 23,2012

Mr. Hollis Loveday
CDM Smith
1100 Marion St Suite 200
Knoxville TN 37921

Subject: I-65 Interchange Access Request Study
Spring Hill, Williamson County

Dear Hollis:

We have reviewed the traffic schematics you submitted on August 21, 2012 for the subject project. These traffic figures have our approval for use in the Interchange Access Request study. If I can be of further assistance, please contact me.

Sincerely,

Tony Armstrong

Tony Armstrong
Transportation Manager 1

CC : file
Chris Armstrong

APPENDIX 7- FHWA INTERSTATE ACCESS POLICY POINTS

Prompt List for Review of Interstate System Access Change Requests

Adequately Addressed?		FHWA Interstate Access Policy Points
Yes	No	
X		**Policy Point 1:** The need being addressed by the request cannot be adequately satisfied by existing interchanges to the Interstate, and/or local roads and streets in the corridor can neither provide the desired access, nor can they be reasonably improved (such as access control along surface streets, improving traffic control, modifying ramp terminals and intersections, adding turn bays or lengthening storage) to satisfactorily accommodate the design-year traffic demands (23 CFR 625.2(a)).
X		**Policy Point 2:** The need being addressed by the request cannot be adequately satisfied by reasonable transportation system management (such as ramp metering, mass transit, and HOV facilities), geometric design, and alternative improvements to the Interstate without the proposed change(s) in access (23 CFR 625.2(a)).
X		**Policy Point 3:** An operational and safety analysis has concluded that the proposed change in access does not have a significant adverse impact on the safety and operation of the Interstate facility (which includes mainline lanes, existing, new, or modified ramps, ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis shall, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access (23 CFR 625.2(a), 655.603(d) and 771.111(f)). The crossroads and the local street network, to at least the first major intersection on either side of the proposed change in access, shall be included in this analysis to the extent necessary to fully evaluate the safety and operational impacts that the proposed change in access and other transportation improvements may have on the local street network (23 CFR 625.2(a) and 655.603(d)). Requests for a proposed change in access must include a description and assessment of the impacts and ability of the proposed changes to safely and efficiently collect, distribute and accommodate traffic on the Interstate facility, ramps, intersection of ramps with crossroad, and local street network (23 CFR 625.2(a) and 655.603(d)). Each request must also include a conceptual plan of the type and location of the signs proposed to support each design alternative (23 U.S.C. 109(d) and 23 CFR 655.603(d)).
X		**Policy Point 4:** The proposed access connects to a public road only and will provide for all traffic movements. Less than ``full interchanges" may be considered on a case-by-case basis for applications requiring special access for managed lanes (e.g., transit, HOVs, HOT lanes) or park and ride lots. The proposed access will be designed to meet or exceed current standards (23 CFR 625.2(a), 625.4(a)(2), and 655.603(d)).
X		**Policy Point 5:** The proposal considers and is consistent with local and regional land use and transportation plans. Prior to receiving final approval, all requests for new or revised access must be included in an adopted Metropolitan Transportation Plan, in the adopted Statewide or Metropolitan Transportation Improvement Program (STIP or TIP), and the Congestion Management Process within transportation management areas, as appropriate, and as specified in 23 CFR part 450, and the transportation conformity requirements of 40 CFR parts 51 and 93.
X		**Policy Point 6:** In corridors where the potential exists for future multiple interchange additions, a comprehensive corridor or network study must accompany all requests for new or revised access with recommendations that address all of the proposed and desired access changes within the context of a longer-range system or network plan (23 U.S.C. 109(d), 23 CFR 625.2(a), 655.603(d), and 771.111).
X		**Policy Point 7:** When a new or revised access point is due to a new, expanded, or substantial change in current or planned future development or land use, requests must demonstrate appropriate coordination has occurred between the development and any proposed transportation system improvements (23 CFR 625.2(a) and 655.603(d)). The request must describe the commitments agreed upon to assure adequate collection and dispersion of the traffic resulting from the development with the adjoining local street network and Interstate access point (23 CFR 625.2(a) and 655.603(d)).
X		**Policy Point 8:** The proposal can be expected to be included as an alternative in the required environmental evaluation, review and processing. The proposal should include supporting information and current status of the environmental processing (23 CFR 771.111).

Policy Point 1: "The need being addressed by the request cannot be adequately satisfied by existing interchanges to the Interstate, and/or local roads and streets in the corridor can neither provide the desired access, nor can they be reasonably improved (such as access control along surface streets, improving traffic control, modifying ramp terminals and intersections, adding turn bays or lengthening storage) to satisfactorily accommodate the design-year traffic demands (23 CFR 625.2(a))."				
Addressed Adequately?			**Question**	**Reference Location**
Y	**N**	**N/A**		
X			Does the access request clearly describe the need and purpose of the proposal and identify project goals and objectives that are specific and measurable?	*Chapter 1.C*
X			Is the proposal in the best interest of the public, or does it merely serve a narrow interest?	*Chapter 1.C, PP1*
X			Is the proposal serving a regional transportation need, or is it merely compensating for deficiencies in the local network of arterials and collectors?	*Chapter 1.C, PP1*
X			In lieu of granting new access, is there any reasonable alternative consisting of improvements to the existing roadway(s) or adjacent access points that could serve the need and purpose?	*Chapter 5.C, Table 8*
X			Has the evaluation of existing interchanges and the local road network taken into account all proposed improvements currently identified in the State and/or Regional Long Range Plan?	*Chapter 4.A, Figure 8*
X			Will the proposed change in access result in needed upgrades or improvements to the cross road for a significant distance away from the interchange?	*Chapter 4.B; Figure A5; PP1*

Policy Point 2: "The need being addressed by the request cannot be adequately satisfied by reasonable transportation system management (such as ramp metering, mass transit, and HOV facilities), geometric design, and alternative improvements to the Interstate without the proposed change(s) in access (23 CFR 625.2(a))."				
Addressed Adequately?			**Question**	**Reference Location**
Y	**N**	**N/A**		
		X	Was FHWA actively involved in preliminary studies and decisions? If not, then more detailed information may be required in support of proposed action.	*N/A*
X			Did the study area cover sufficient area to allow for an evaluation of all reasonable alternatives?	*Chapter 1.B, Figure 2*
X			Was a No-Build Alternative evaluated?	*Chapter 5.C, Figures A3A & A3B*
X			Considering the context of the proposal, is this the best location for the proposed new interchange?	*Chapter 7.B*
X			Were different interchange configurations (Tight diamond, SPDI, Parclo) considered?	AASHTO Greenbook Chapter 10; *yes but none were drafted*
		X	Were pedestrians and bicyclists considered in the alternative evaluation?	*When more detailed planning and design occurs, they will be addressed.*
X			Was there an evaluation of different intersection configurations (stop control, signal, roundabout, free right turns, etc?)	*Chapters 5.D & 5.E; Tables 11 & 12*
X			Have Transportation Systems Management (i.e. HOV, ITS, Ramp Metering, Transit etc.) options been evaluated as an alternative to a new or modification to an existing interchange?	*Chapter 7.A, PP2*
X			Did the report discuss how TSM alternatives were evaluated and eliminated from consideration?	*Chapter 7.A*
		X	Does the proposal consider any future planned TSM strategies and is the design consistent with the ability to implement the future TSM strategies?	*There are no planned TSM strategies.*

Policy Point 3: "An operational and safety analysis has concluded that the proposed change in access does not have a significant adverse impact on the safety and operation of the Interstate facility (which includes mainline lanes, existing, new, or modified ramps, ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis shall, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access (23 CFR 625.2(a), 655.603(d) and 771.111(f)). The crossroads and the local street network, to at least the first major intersection on either side of the proposed change in access, shall be included in this analysis to the extent necessary to fully evaluate the safety and operational impacts that the proposed change in access and other transportation improvements may have on the local street network (23 CFR 625.2(a) and 655.603(d)). Requests for a proposed change in access must include a description and assessment of the impacts and ability of the proposed changes to safely and efficiently collect, distribute and accommodate traffic on the Interstate facility, ramps, intersection of ramps with crossroad, and local street network (23 CFR 625.2(a) and 655.603(d)). Each request must also include a conceptual plan of the type and location of the signs proposed to support each design alternative (23 U.S.C. 109(d) and 23 CFR 655.603(d))."

Addressed Adequately?			Question	Reference Location
Y	**N**	**N/A**		
X			Does the report demonstrate that a proper traffic operational analysis was conducted? The analysis should include the applicable basic freeway segments, freeway weaving segments, freeway ramp segments, ramp junctions and crossroad intersections related to the proposed access point and at least the two adjacent interchanges.	*Chapters 5.C, 5.D, & 5.E; Tables 8-13*
		X	Does the report include a **safety** analysis of the mainline, ramps and intersections of the proposed access point and the nearest adjacent interchange (provided they are near enough that it is reasonable to assume there may be impacts)?	*This is a proposed new interchange.*
X			Has the design traffic volume been validated?	*Chapters 2.D & 3.A; Traffic was approved by TDOT*
X			Does the report include verification that the data used in the traffic analysis is consistent with the traffic and air quality models MPOs use to develop their current Transportation Plan (20-year) and Transportation Improvement Program (TIP)?	*Chapter 2.D; Appendix 5.E*
X			Does the report include a design period of 20 years commencing at the time of project approval (PS&E approval)?	*Chapter 3.A*
X			Does the report include quantitative analyses and results to identify operational differences between alternatives that are heavily congested?	*Chapters 5.C, 5.D, & 5.E*
		X	Has a conceptual signing plan been provided?	*N/A*
		X	Is guidance signing (i.e., way-finding or trail blazing signs) clear and simple?	MUTCD Chapter 2E: Guide Signs – Freeways and Expressways; *N/A*
X			Do the results of the operational analysis result in a significant adverse impact to existing or future conditions?	*Chapters 5.C, 5.D, & 5.E*
X			Will the proposed change in access result in needed upgrades or improvements to the cross road for a significant distance away from the interchange? If so, have impacts to the local network been disclosed and fully evaluated?"	*Chapters 4.B & 4.C; Appendix 2; PP1*
X			Are the cross roads or adjacent surface level roads and intersections affected by the proposed access point analyzed to the extent (length) where impacts caused or affecting the new proposed access point are disclosed to the appropriate managing jurisdiction?	*Chapters 4.B & 4.C; Appendix 2; PP1*
		X	Are pedestrian and/or bicycle facilities included (as appropriate) and do these facilities provide for reasonable accommodation?	*Bike and pedestrian facilities can be included in design plans.*

X			Does the proposed access secure sufficient Limits of Access adjacent to the Interchange ramps?	AASHTO's "A Policy on Design Standards Interstate System, 2005" Pg. 2; NCHRP Synthesis 332; *Appendix 2*
X			Does the proximity of the nearest crossroad intersections to the ramps contribute to safety or operational problems? Can they be mitigated??	*Chapter 4.B; Appendix B; PP3*
X			In addition to HCS, what analysis tools were employed and were they appropriate?	*Chapter 5.A; Synchro*
		X	Has the proposal distinguished between nominal safety (i.e. adherence to design policies and standards) and substantive safety (actual and expected safety performance)?	*The new interchange will be designed and constructed to AASHTO standards.*
X			Will any individual elements within the recommended alternative be degraded operationally as a result of this action? If yes, are reasons provided to accept them?	*Chapters 5.C, 5.D, & 5.E; PP3*
		X	In evaluating whether the proposal has a "significant adverse impact" on safety, has the State Strategic Highway Safety Plan been used as a benchmark?	*The new interchange will be designed and constructed to AASHTO standards.*
X			Are the proposed interchange design configurations able to satisfactorily accommodate the design year traffic volumes?	*Chapter 5.D*
		X	If the project is to be built in stages, has the traffic operational and safety analyses considered the interim stages of the proposal?	*It will not be built in stages.*

Policy Point 4: "The proposed access connects to a public road only and will provide for all traffic movements. Less than "full interchanges" may be considered on a case-by-case basis for applications requiring special access for managed lanes (e.g., transit, HOVs, HOT lanes) or park and ride lots. The proposed access will be designed to meet or exceed current standards (23 CFR 625.2(a), 625.4(a)(2), and 655.603(d))."

Addressed Adequately?			Question	Reference Location
Y	**N**	**N/A**		
X			Does the proposed access connect to a public road?	*Chapter 4.B; PP4*
X			Are all traffic movements for full interchange access provided?	*Chapter 4.B; PP4*
		X	If not, is the proposed access for special purposes such as transit vehicles, HOVs, and/or a park and ride lot?	*N/A*
		X	If a partial interchange is proposed, is there sufficient justification for providing only a partial interchange?	AASHTO Greenbook 2004 Pg. 821-823; *N/A*
		X	If a partial interchange is proposed; was a full interchange evaluated as an alternative and is there sufficient justification to eliminate or discard it?	*N/A*
		X	Is sufficient ROW available (or being acquired) to provide a full interchange at a future date (staged construction)?	*N/A*
		X	Are you comfortable with how the missing movements will be accommodated on the surface streets and adjacent interchanges?	*N/A*
		X	Does FHWA support the selection of design controls/criteria and desired operational goals?	*N/A*
X			Does the proposed access meet or exceed current design standards for the Interstate System?	AASHTO's Greenbook and A Policy on Design Standards Interstate System, 2005; *Chapter 4.B; Appendix 2*
		X	If not, have anticipated design exceptions been identified and reviewed (at least conceptually)?	*N/A*

Policy Point 4: "The proposed access connects to a public road only and will provide for all traffic movements. Less than "full interchanges" may be considered on a case-by-case basis for applications requiring special access for managed lanes (e.g., transit, HOVs, HOT lanes) or park and ride lots. The proposed access will be designed to meet or exceed current standards (23 CFR 625.2(a), 625.4(a)(2), and 655.603(d))."				
Addressed Adequately?			**Question**	**Reference Location**
Y	**N**	**N/A**		
		X	If expected design exceptions could have significant operational impacts on the Interstate and/or Crossroad system, are mitigation measures described?	*N/A*
X			Will the length of access control along the crossroad provide for acceptable operations and safety? (100-300' is a minimum. Additional access control is strongly encouraged when needed for safety and operational enhancement)	AASHTO "A Policy on Design Standards Interstate System" 2005; *Chapter 4.B; Appendix 2*
		X	Does FHWA support selection of opening and design years?	*N/A*
			Has each movement of the proposal been "tested" for ease of operation?	AASHTO Greenbook 2004 Pg. 863; *Chapter 5.D*
Have all design criteria (including but not limited to the following) been adequately addressed?				
X			a. Sight distance at ramp terminals (Don't overlook signal heads obscured by structures.)	AASHTO Greenbook 2004 Pg. 841; *Chapter 4.B; Appendix 2; PP4*
X			b. Sufficient storage on ramp to prevent queues from spilling on to the Interstate (based on current and/or future projected traffic demand)	*Chapter 5.D*
X			c. Vertical clearance	AASHTO "A Policy on Design Standards Interstate System" 2005; *Chapter 4.B; Appendix 2; PP4*
		X	d. Pedestrian access through the interchange	AASHTO Greenbook 2004 Pg. 864: *N/A*
X			e. Length of acceleration/deceleration lanes	AASHTO Greenbook 2004 Pg. 823, 847; *Chapter 4.B; Appendix 2; PP4*
X			f. Length of tapers	AASHTO Greenbook 2004 Pg. 849; *Chapter 4.B; Appendix 2; PP4*
X			g. Spacing between ramps	Greenbook pg 843 & Ex. 10-68 and operational analysis; *Chapter 4.B; Appendix 2; PP4*
X			h. Lane continuity	AASHTO Greenbook 2004 Pg. 810; *Chapter 4.B; Appendix 2; PP4*
X			i. Lane balance	AASHTO Greenbook 2004 Pg. 810 AASHTO Greenbook 2004 Pg. 807; *Chapter 4.B; Appendix 2; PP4*
X			j. Uniformity in interchange design and operational patterns (i.e. right-side ramps, exit design consistent w/adjacent interchanges)	*Chapter 4.B; Appendix 2; PP4*

Policy Point 5: "The proposal considers and is consistent with local and regional land use and transportation plans. Prior to receiving final approval, all requests for new or revised access must be included in an adopted Metropolitan Transportation Plan, in the adopted Statewide or Metropolitan Transportation Improvement Program (STIP or TIP), and the Congestion Management Process within transportation management areas, as appropriate, and as specified in 23 CFR part 450, and the transportation conformity requirements of 40 CFR parts 51 and 93."				
Addressed Adequately?			**Question**	**Reference Location**
Y	**N**	**N/A**		
X			Does the IJR discuss or include (as appropriate) other project(s), studies or planned actions that may have an effect on the report analysis results?	*Chapter 4.A, Figure 8*
X			Does the project conform to the local planning, MPO or other related plans?	*Chapter 4.A, Figure 8; P1; PP5*
X			Does the report include an endorsement of land use plans by the appropriate government entity before it is utilized for traffic generation purposes?	*Chapter 2.E, Figure 5*
X			Is the access request located within a Transportation Management Areas? (TMAs are metropolitan areas of 200,000 or more in population)	http://hepgis.fhwa.dot.gov/hepgis_v2/Urbanboundaries/Map.aspx
X			Is the access request located within a non-attainment area for air quality? (requests for access in a non-attainment or maintenance areas for air quality must be a part of a conforming transportation plan)	*Chapter 7.C*
X			Is the project included in the TIP/STIP and LRTP?	*Chapter 4.A, Figure 8; P1; PP5*
X			Is the access point covered as a part of an Interstate corridor study or plan? *(especially important for areas where the potential exists for construction of future adjacent interchanges)*	*Chapter 4.A*

Policy Point 6: "In corridors where the potential exists for future multiple interchange additions, a comprehensive corridor or network study must accompany all requests for new or revised access with recommendations that address all of the proposed and desired access changes within the context of a longer-range system or network plan (23 U.S.C. 109(d), 23 CFR 625.2(a), 655.603(d), and 771.111)."				
Addressed Adequately?			**Question**	**Reference Location**
Y	**N**	**N/A**		
X			Is it possible that new interchange(s) not addressed in the IJR could be added within an area of influence to the proposed access point? (If so, could the proposal preclude or otherwise be affected by any future access points?)	*P1; PP6*
		X	Does the IJR report include the traffic volumes generated by any future additional interchanges within a vicinity of influence that are proposed?	*N/A*
X			Does the IJR report fail to include any other proposed interstate access points within a vicinity of influence that are being proposed or are in the current long range construction program?	*Chapter 1.A; PP6*

Policy Point 7: "When a new or revised access point is due to a new, expanded, or substantial change in current or planned future development or land use, requests must demonstrate appropriate coordination has occurred between the development and any proposed transportation system improvements (23 CFR 625.2(a) and 655.603(d)). The request must describe the commitments agreed upon to assure adequate collection and dispersion of the traffic resulting from the development with the adjoining local street network and Interstate access point (23 CFR 625.2(a) and 655.603(d))."				
Addressed Adequately?			**Question**	**Reference Location**
Y	**N**	**N/A**		
X			Does the access request adequately demonstrate that an appropriate effort of coordination has been made with appropriate proposed developments?	*PP6, PP7*
X			Are the proposed improvements compatible with the existing street network or are other improvements needed?	*Chapter 6.A; Appendix 2*
X			Are there any pre-condition contingencies required in regards to the timing of other improvements?	*PP7*
X			Have all commitments to improve the local transportation network been included in a TIP/STIP/LRTP prior to the Interstate access approval (final approval of NEPA document)?	*Chapter 7.C*
		X	If pre-condition contingencies are required, are pertinent parties in agreement with these contingencies and is this documented?	*No pre-conditions required.*
X			If the proposed improvements are founded on the need for providing access to new development, are appropriate commitments in place to ensure that the development will likely occur as planned?	*PP7*
		X	If project is privately funded, are appropriate measures in place to ensure improvements will be completed if the developer is unable to meet financial obligations?	*Project is not privately funded.*
X			If the purpose and need to accommodate new development/traffic demands aren't fully known, is a worst case scenario used for future traffic?	*Chapter 1.C*
		X	Does the project require financial or infrastructure commitments from other agencies, organizations, or private entities?	*N/A*

Policy Point 8: "The proposal can be expected to be included as an alternative in the required environmental evaluation, review and processing. The proposal should include supporting information and current status of the environmental processing (23 CFR 771.111)."				
Addressed Adequately?			**Question**	**Reference Location**
Y	**N**	**N/A**		
X			Are there any known social or environmental issues that could affect the proposal?	*Chapter 2.E, PP8*
X			Is the project consistent with the current TIP/STIP and LRTP and/or proposed amendments to the plan?	*Chapter 4.A; P1; PP5*
X			Although NEPA is a separate action, is an environmental overview for the proposed improvements included?	*Chapter 7.C*
X			Is it appropriate to emphasize to the project stakeholders that the access approval will be handled as a two-step process? (i.e. Step 1: Engineering and Operational Acceptability and Step 2: Environmental Approvals)	*PP8*
X			Are all funding commitments included in a TIP/STIP/LRTP prior to the Interstate access approval (prior to final approval of the NEPA document)?	*PP5*
X			Are all commitments included in a TIP/STIP/LRTP prior to the Interstate access approval (prior to final approval of the NEPA document)?	*Chapter 4A, Figure 8, PP5*

October 23, 2013

HAND DELIVERED

Ms. Wendy Deats
Town Planner
1550 Thompson's Station Road West
Thompson's Station, Tennessee 37179

RE: HOLT PROPERTY
TRAFFIC IMPACT ASSESSMENT UPDATE
TOWN OF THOMPSON'S STATION, TENNESSEE
13-049 / 9740

Dear Wendy:

The Holt Property is located on Columbia Pike approximately one half mile north of the intersection of Columbia Pike and Thompson Station Road. Based upon discussion between Ragan-Smith and Town on Thompson's Station staff, an evaluation of the access to this site from Columbia Pike has been requested to identify any impacts related to the Holt Property site development plan. The purpose of this letter is to provide the Town of Thompson's Station with information related to the access at the Holt Property.

This letter provides an update to the initial traffic impact assessment dated September 16, 2013 based upon changes to the number of proposed dwelling units and commercial land uses.

Project Description

The Holt Property site development plan includes 58 single family dwelling units and a commercial section fronting Columbia Pike that will include approximately 14,000 square feet of office space. Access to the residential and commercial portions of the site will be provided by one driveway located near the northern boundary of the site, approximately 3,000 feet north of the intersection of Columbia Pike and Thompson Station Road.

Existing and Background Traffic Volumes

Existing peak hour traffic volumes at the proposed access to the Holt Property were obtained to identify the peak hours for capacity analysis. According to the traffic counts, the peak hours for analysis on Columbia Pike at the Holt Property Access are ***7:00 a.m. to 8:00 a.m.*** and ***5:30 p.m. to 6:30 p.m.***

The existing traffic count on Columbia Pike at the Holt Property Access was increased by 2% per year to account for background traffic growth between 2013 and 2016. The derivation of future traffic on Columbia Pike at the Holt Property Access is shown on the enclosed figure.

Trip Generation and Assignment

In order to quantify site related traffic, an estimate of site traffic generation was established. Trip generation rates for the development were established using information for the weekday a.m. and p.m. peak hour of the adjacent street as shown in the *Trip Generation Manual, 9th Edition* published by the Institute of Transportation Engineers (ITE). Trip generation for the Holt Property as shown on the site development plan is presented in Table 1 below.

TABLE 1							
TRIP GENERATION							
Land Use	Daily	Weekday A.M. Peak Hour			Weekday P.M. Peak Hour		
		Enter	Exit	Total	Enter	Exit	Total
Single Family Detached Homes (58 lots)	636	13	37	50	40	24	64
General Office (14,000 gsf)	295	35	5	40	15	76	91
TOTAL	**931**	**48**	**42**	**90**	**55**	**100**	**155**

Trips were distributed onto Columbia Pike generally based upon existing traffic patterns with 75% oriented to/from the north and 25% oriented to/from the south. The derivation of future traffic on Columbia Pike at the Holt Property Access is shown on the enclosed figure.

Intersection Capacity Analysis

In order to gauge the site impact and identify necessary mitigating measures, capacity analyses were conducted according to the methodology and procedures outlined in the Highway Capacity Manual, 2010, published by the Transportation Research Board. Capacity analysis results for the intersection of Columbia Pike at the Holt Property Access are shown in Table 2 below.

TABLE 2					
INTERSECTION CAPACITY ANALYSIS RESULTS					
Location	Year	Development Condition	Control	Level of Service	
				A.M.	P.M.
Columbia Pike at Holt Property Access	2016	Total	Unsignalized	B / D / D (1)	A / C / B (1)
(1) SB Left / WB Left / WB Right					

Level of service (LOS) criteria for unsignalized intersections is shown in Table 3.

TABLE 3		
DESCRIPTIONS OF LEVEL OF SERVICE FOR UNSIGNALIZED INTERSECTIONS		
Level of Service	Description	Avg. Total Delay (sec./veh.)
A	Little or no delay	0 - 10
B	Short traffic delay	> 10 and ≤ 15
C	Average traffic delay	> 15 and ≤ 25
D	Long delay	> 25 and ≤ 35
E	Very long delay - long queues for side street left turns	> 35 and ≤ 50
F	Insufficient gaps to allow a side street to cross major traffic stream	> 50
Source: Highway Capacity Manual, HCM 2010		

Conclusions and Recommendations

Columbia Pike is a two lane roadway connecting the Town of Thompson's Station north to the City of Franklin and south to the City of Spring Hill. One travel lane is provided in each direction. Capacity analysis results show that traffic operations on Columbia Pike at the Holt Property Access will be characterized by acceptable levels of service during the a.m. and p.m. peak hours. The addition of a left turn lane on Columbia Pike will allow some vehicles to exit the site in two steps by using the striped median as a refuge area. This will reduce delay for vehicles exiting the site resulting in acceptable levels of service during the a.m. and p.m. peak hours.

At times the existing traffic signal on Columbia Pike south of the site at Thompson Station Road can cause long queues that may block the Holt Property Access. During periods when the queue from the existing traffic signal blocks the Holt Property Access, traffic exiting the site will be able to turn right without issue but left turns onto Columbia Pike will be difficult and may ultimately rely on individual driver behavior as some drivers on Columbia Pike will allow left turns exiting the Holt Property to enter Columbia Pike.

In summary, we offer the following recommendations for the Holt Property Access to Columbia Pike:

- A southbound left turn lane should be constructed on Columbia Pike with a storage length of 160 feet. Bay and approach tapers should be designed in accordance with TDOT standards and design guidelines.

- With the development of the commercial and retail portions of the Holt Property, a northbound right turn lane should be constructed on Columbia Pike with a storage length of 200 feet and a taper length of 140 feet. A northbound right turn lane is not necessary if only the residential portion of the Holt Property is developed.

If you have any questions or comments regarding the traffic analysis for the Holt Property, we would be happy to discuss them with you at your convenience.

Sincerely,

RAGAN-SMITH ASSOCIATES, INC.

Brandon S. Baxter

Brandon S. Baxter, P.E., PTOE
Transportation Engineer

BSB:djb

Enclosures

c: Mr. Brian Rowe (via email)

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000067 **County:** 94 Williamson
Start Date: 03/12/13 **End Date:** 03/13/13
Start Time: 11:00 **End Time:** 11:00
Direction: 0 (Coverage)

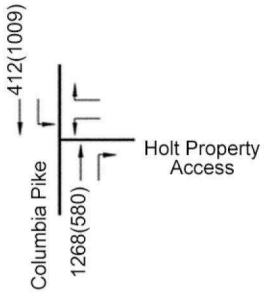
Time	:00	:15	:30	:45	Hour Total
11:00 - 12:00	268	239	233	253	993
12:00 - 13:00	273	282	270	293	1,118
13:00 - 14:00	254	265	268	289	1,076
14:00 - 15:00	295	294	303	313	1,205
15:00 - 16:00	385	347	367	325	1,424
16:00 - 17:00	377	385	381	394	1,537
17:00 - 18:00	377	377	386	400	1,540
18:00 - 19:00	401	402	359	327	1,489
19:00 - 20:00	296	238	248	213	995
20:00 - 21:00	202	197	213	249	861
21:00 - 22:00	226	163	142	121	652
22:00 - 23:00	98	90	94	67	349
23:00 - 24:00	52	56	66	32	206
24:00 - 01:00	33	34	34	20	121
01:00 - 02:00	13	13	15	19	60
02:00 - 03:00	10	7	5	12	34
03:00 - 04:00	7	9	14	10	40
04:00 - 05:00	14	27	21	33	95
05:00 - 06:00	38	67	105	173	383
06:00 - 07:00	191	251	340	370	1,152
07:00 - 08:00	423	421	447	389	1,680
08:00 - 09:00	399	330	364	350	1,443
09:00 - 10:00	345	277	245	319	1,186
10:00 - 11:00	248	256	278	267	1,049

Total: 20,688

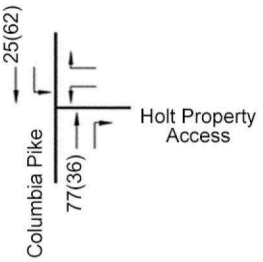
Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:00 - 08:00	1680	0.94	17:30 - 18:30	1589	0.99

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
8	65	8	65	8	65

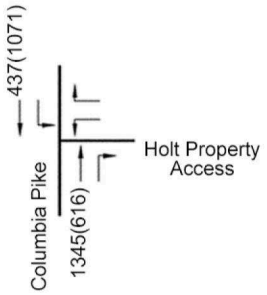
2013 Existing Traffic Volumes



2016 Background Growth
(assume growth rate of 2% per year)

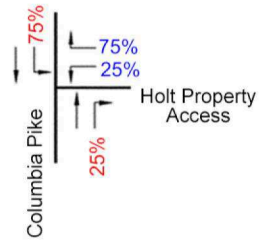


2016 Background Traffic Volumes

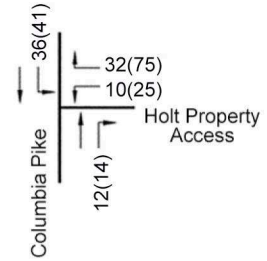


Site Trip Distribution

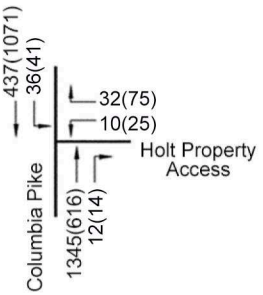
Inbound %
Outbound %



Site Traffic Volumes



2016 Total Traffic Volumes



Peak Hours
A.M.(P.M.)

RAGAN•SMITH

Holt Property
Columbia Pike at Site Access
Intersection Traffic Volumes

Figure
A1

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*bsb*	Intersection	*ColumbiaPk@HoltProperty*
Agency/Co.	*Ragan-Smith Associates*	Jurisdiction	*Thompson Station, TN*
Date Performed	*10/23/2013*	Analysis Year	*2016*
Analysis Time Period	*AM Peak Hour*		

Project Description *Holt Property*

East/West Street: *Holt Property* | North/South Street: *Columbia Pike*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*1345*	*12*	*36*	*437*	
Peak-Hour Factor, PHF	*1.00*	*0.94*	*0.94*	*0.94*	*0.94*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*1430*	*12*	*38*	*464*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Two Way Left Turn Lane*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*1*	*1*	*1*	*0*
Configuration		*T*	*R*	*L*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*10*		*32*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.94*	*1.00*	*0.94*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*10*	*0*	*34*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*1*	*0*	*1*
Configuration				*L*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*L*	*L*		*R*			
v (veh/h)		*38*	*10*		*34*			
C (m) (veh/h)		*476*	*167*		*167*			
v/c		*0.08*	*0.06*		*0.20*			
95% queue length		*0.26*	*0.19*		*0.73*			
Control Delay (s/veh)		*13.2*	*27.9*		*32.0*			
LOS		*B*	*D*		*D*			
Approach Delay (s/veh)	--	--	*31.1*					
Approach LOS	--	--	*D*					

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*bsb*	Intersection	*ColumbiaPk@HoltProperty*
Agency/Co.	*Ragan-Smith Associates*	Jurisdiction	*Thompson Station, TN*
Date Performed	*10/23/2013*	Analysis Year	*2016*
Analysis Time Period	*PM Peak Hour*		

Project Description *Holt Property*

East/West Street: *Holt Property* | North/South Street: *Columbia Pike*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*616*	*14*	*41*	*1071*	
Peak-Hour Factor, PHF	*1.00*	*0.99*	*0.99*	*0.99*	*0.99*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*622*	*14*	*41*	*1081*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Two Way Left Turn Lane*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*1*	*1*	*1*	*0*
Configuration		*T*	*R*	*L*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*25*		*75*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.99*	*1.00*	*0.99*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*25*	*0*	*75*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*1*	*0*	*1*
Configuration				*L*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*L*	*L*		*R*			
v (veh/h)		*41*	*25*		*75*			
C (m) (veh/h)		*957*	*206*		*490*			
v/c		*0.04*	*0.12*		*0.15*			
95% queue length		*0.13*	*0.41*		*0.54*			
Control Delay (s/veh)		*8.9*	*24.9*		*13.7*			
LOS		*A*	*C*		*B*			
Approach Delay (s/veh)	--	--	*16.5*					
Approach LOS	--	--	*C*					

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CITY OF SPRING CAPITAL IMPROVEMENT PLAN
REGIONAL TRANSPORTATION PROJECTS AND ROAD IMPROVEMENT PLAN
AS OF 6/5/2013

Regional Transportation Program (RTP) and Road Imporvement Plan (RIP) Totals						
Expenditures	**Prior Years**	**FY 13/14**	**FY 14/15**	**FY 15/16**	**FY 16/17**	**FY 17/18**
Land	0	1,000,000	1,000,000	500,000	2,041,800	0
Professional Services	1,365,573	1,850,000	6,505,000	3,340,000	7,295,000	850,000
Construction	0	0	0	4,807,213	16,547,214	11,678,000
Utility Relocation	0	0	0	0	800,000	0
Total	**$1,365,573**	**$2,850,000**	**$7,505,000**	**$8,647,213**	**$26,684,014**	**$12,528,000**

Regional Transportation Program (RTP) and Road Imporvement Plan (RIP) Totals						
Funding Source	**Prior Years**	**FY 13/14**	**FY 14/15**	**FY 15/16**	**FY 16/17**	**FY 17/18**
General Fund \ Adequate Facilities	246,115	50,000	265,000	50,000	95,000	0
Bond Fund	0	1,900,000	2,400,000	2,503,000	15,051,800	5,358,160
Special Funds	85,000	240,000	3,560,000	375,000	4,310,000	1,050,000
State or Federal Funding	1,034,458	660,000	1,280,000	5,719,213	7,227,214	6,119,840
Total	**$1,365,573**	**$2,850,000**	**$7,505,000**	**$8,647,213**	**$26,684,014**	**$12,528,000**

Regional Transportation Program (RTP) Totals						
Expenditures	**Prior Years**	**FY 13/14**	**FY 14/15**	**FY 15/16**	**FY 16/17**	**FY 17/18**
Land	0	1,000,000	1,000,000	0	171,800	0
Professional Services	1,315,573	1,060,000	2,330,000	1,065,000	5,050,000	0
Construction	0	0	0	4,807,213	4,807,214	7,478,000
Utility Relocation	0	0	0	0	0	0
Total	**$1,315,573**	**$2,060,000**	**$3,330,000**	**$5,872,213**	**$10,029,014**	**$7,478,000**

Regional Transportation Program (RTP) Totals						
Funding Source	**Prior Years**	**FY 13/14**	**FY 14/15**	**FY 15/16**	**FY 16/17**	**FY 17/18**
General Fund \ Adequate Facilities	196,115	0	240,000	0	70,000	0
Bond Fund	0	1,400,000	1,400,000	153,000	1,451,800	1,358,160
Special Funds	85,000	0	410,000	0	1,280,000	0
State or Federal Funding	1,034,458	660,000	1,280,000	5,719,213	7,227,214	6,119,840
Total	**$1,315,573**	**$2,060,000**	**$3,330,000**	**$5,872,213**	**$10,029,014**	**$7,478,000**

Road Improvement Plan (RIP) Totals						
Expenditures	**Prior Years**	**FY 13/14**	**FY 14/15**	**FY 15/16**	**FY 16/17**	**FY 17/18**
Land	0	0	0	500,000	1,870,000	0
Professional Services	50,000	790,000	4,175,000	2,275,000	2,245,000	850,000
Construction	0	0	0	0	11,740,000	4,200,000
Utility Relocation	0	0	0	0	800,000	0
Total	**$50,000**	**$790,000**	**$4,175,000**	**$2,775,000**	**$16,655,000**	**$5,050,000**

Road Improvement Plan (RIP) Totals						
Funding Source	**Prior Years**	**FY 13/14**	**FY 14/15**	**FY 15/16**	**FY 16/17**	**FY 17/18**
General Fund \ Adequate Facilities	50,000	50,000	25,000	50,000	25,000	0
Bond Fund	0	500,000	1,000,000	2,350,000	13,600,000	4,000,000
Special Funds	0	240,000	3,150,000	375,000	3,030,000	1,050,000
State or Federal Funding	0	0	0	0	0	0
Total	**$50,000**	**$790,000**	**$4,175,000**	**$2,775,000**	**$16,655,000**	**$5,050,000**

Project Name: Duplex Road Widening

Spring Hill MTP Project Number: P4

Spring Hill CIP Project Number: RTP1

Length: 3.33 Miles

Improvement: Widen from two to three lanes

Project Fund: General, Bond, State or Federal

Estimated Start Date: 2009

Estimated Date of Completion: 2016

Description:
Duplex Road serves as a major East-West connector through the City and provides access to numerous residential developments. Although this roadway currently operates at LOS C or better during the peak hour, traffic increases on this roadway are expected to result in LOS D and LOS E. To provide sufficient access to developments, improve safety, and improve traffic operations, Duplex Road should be widened to provide one standard-width travel lane for each direction of travel and a center turn lane with sufficient shoulders. Vertical alignment issues should also be corrected as part of this improvement. Once improved, this roadway is expected to operate at LOS A, LOS B and LOS C in 2030.

Stage		YR 1	YR 2	YR 3	YR 4	YR 5	
		(4) Right of Way	(4) Right of Way	(5) Construction	(5) Construction		
Expenditures	**Prior Years**	**FY 13/14**	**FY 14/15**	**FY 15/16**	**FY 16/17**		**Totals**
Land	0	1,000,000	1,000,000	0	0	0	2,000,000
Professional Services	1,195,573	1,000,000	1,000,000	300,000	300,000	0	3,795,573
Construction	0	0	0	4,807,213	4,807,214	0	9,614,427
Utility Relocation	0	0	0	0	0	0	0
Total	**$1,195,573**	**$2,000,000**	**$2,000,000**	**$5,107,213**	**$5,107,214**	**$0**	**$15,410,000**

		YR 1	YR 2	YR 3	YR 4	YR 5	
Funding Source	**Prior Years**	**FY 13/14**	**FY 14/15**	**FY 15/16**	**FY 16/17**	**0**	**Totals**
General Fund \ Adequate Facilities	161,115	0	0	0	0	0	161,115
Bond Fund	0	1,400,000	1,400,000	0	0	0	2,800,000
Special Funds	0	0	0	0	0	0	0
State or Federal Funding	1,034,458	600,000	600,000	5,107,213	5,107,214	0	12,448,885
Total	**$1,195,573**	**$2,000,000**	**$2,000,000**	**$5,107,213**	**$5,107,214**	**$0**	**$15,410,000**

Project Development Process Key

(1) Study	(3) Design	(5) Construction
(2) Planning	(4) Right of Way	

6/5/2013

Project Name: I-65 Interchange / Buckner Road Extension

Spring Hill MTP Project Number: P9, P10, P31 & P33

Spring Hill CIP Project Number: RTP2

Length: .86 Miles & Interchange

Improvement: Construct Interchange and connector three-lane roadways

Project Fund: General, Bond, Special, State or Federal

Estimated Start Date: 2012

Estimated Date of Completion: 2020

Description:
Significant development has occurred in the Northern portion of the City in recent years, and the trend is expected to continue. To accommodate the increasing traffic volumes, the proposed project would will extend Buckner Road as a three-lane roadway from the Eastern terminous at Buckner Lane and connect to a new interchange at Interstate 65, which will improve access for the City. Once constructed, this roadway is expected to operate at LOS A in 2030.

Results of an Interchange Access Study initiated in 2012 with CDM Smith is pending. Funding for the IAS was provided by Spring Hill, Thompson's Station, Williamson County and a private property owner.

Stage		YR 1	YR 2	YR 4	YR 6	YR 8	
		(1) Study	(2) Planning	(3) Design	(4) Right of Way	(5) Construction	
Expenditures	**Prior Years**	**FY 13/14**	**FY 14/15**	**FY 16/17**	**FY 18/19**	**FY 20/21**	**Totals**
Land	0	0	0	0	1,200,000	0	1,200,000
Professional Services	120,000	0	480,000	2,100,000	0	500,000	3,200,000
Construction	0	0	0	0	0	20,000,000	20,000,000
Utility Relocation	0	0	0	0	0	0	0
Total	**$120,000**	**$0**	**$480,000**	**$2,100,000**	**$1,200,000**	**$20,500,000**	**$24,400,000**

		YR 1	YR 2	YR 4	YR 6	YR 8	
Funding Source	**Prior Years**	**FY 13/14**	**FY 14/15**	**FY 16/17**	**FY 18/19**	**FY 20/21**	**Totals**
General Fund \ Adequate Facilities	35,000	0	120,000	0	0	0	155,000
Bond Fund	0	0	0	1,050,000	0	1,025,000	2,075,000
Special Funds	85,000	0	360,000	1,050,000	1,200,000	3,075,000	5,770,000
State or Federal Funding	0	0	0	0	0	16,400,000	16,400,000
Total	**$120,000**	**$0**	**$480,000**	**$2,100,000**	**$1,200,000**	**$20,500,000**	**$24,400,000**

Project Development Process Key

(1) Study	(3) Design	(5) Construction
(2) Planning	(4) Right of Way	

6/6/2013

Project Name: Beechcroft Rail Crossing (SR247)

Spring Hill MTP Project Number: P28

Spring Hill CIP Project Number: RTP3

Length: N/A

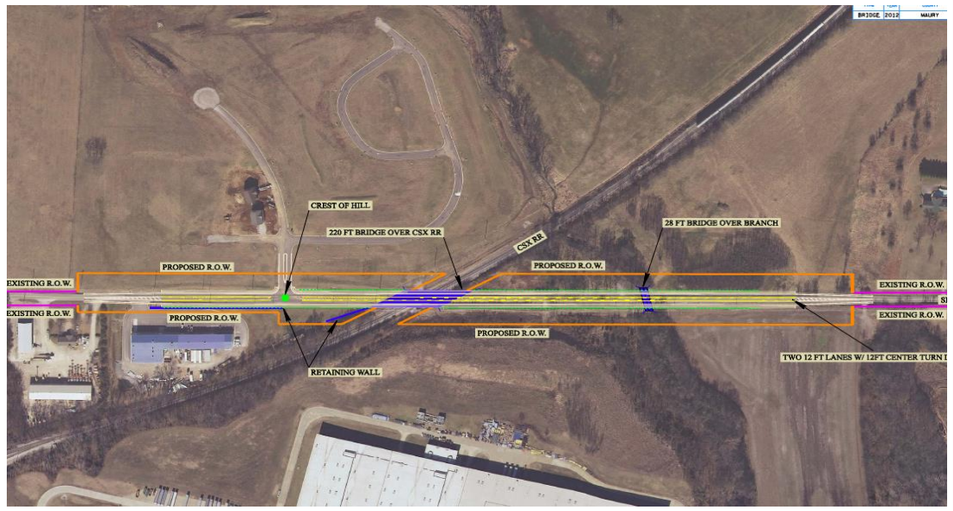
Improvement: Construct bridge over CSX Railway

Project Fund: General, Bond, State or Federal

Estimated Start Date: 2013

Estimated Date of Completion: 2017

Description:
The traffic delays caused by the CSX railroad crossing are expected to increase as traffic volumes increase on Beechcroft Road. The proposed project will eliminate this issue and improve safety by providing a bridge on Beechcroft Road over the CSX Railroad.



Stage		YR 1	YR 2	YR 3	YR 4	YR 5	
		(3) Design	(4) Right of Way	(5) Construction			
Expenditures	**Prior Years**	**FY 15/16**	**FY 16/17**	**FY 17/18**			**Totals**
Land	0	0	171,800	0	0	0	171,800
Professional Services	0	765,000	0	0	0	0	765,000
Construction	0	0	0	7,478,000	0	0	7,478,000
Utility Relocation	0	0	0	0	0	0	0
Total	**$0**	**$765,000**	**$171,800**	**$7,478,000**	**$0**	**$0**	**$8,414,800**

		YR 1	YR 2	YR 3	YR 4	YR 5	
Funding Source	**Prior Years**	**FY 15/16**	**FY 16/17**	**FY 17/18**	**0**	**0**	**Totals**
General Fund \ Adequate Facilities	0	0	0	0	0	0	0
Bond Fund	0	153,000	171,800	1,358,160	0	0	1,682,960
Special Funds	0	0	0	0	0	0	0
State or Federal Funding	0	612,000	0	6,119,840	0	0	6,731,840
Total	**$0**	**$765,000**	**$171,800**	**$7,478,000**	**$0**	**$0**	**$8,414,800**

Project Development Process Key

(1) Study	(3) Design	(5) Construction
(2) Planning	(4) Right of Way	

6/5/2013

Project Name: SR-6/US-31 (Main Street) Widening

Spring Hill MTP Project Number: P2 & P3

Spring Hill CIP Project Number: RTP4

Length: 3 Miles

Improvement: Reconstruct Three-lanes in Downtown, Widen to four-lanes North

Project Fund: General, Bond, Special, State or Federal

Estimated Start Date: 2012

Estimated Date of Completion: 2020

Description:
This project will widen the existing two-lane portion of Main Street from Kedron Road to Miles Johnson Parkway to three-lanes, including streetscape and landscape improvements in downtown Spring Hill. North of Miles Johnson Parkway, this project will provide a wider cross-section consisting of four-lanes and a median with turn lanes at intersections. These improvements will help accomodate the anticipated traffic volumes and address access control issues. Once improved, this roadway will operate at LOS D and LOS C in 2030.

A T-DOT Transportation Planning Report completed in 2010 identified Alternatives that should be considered, and recommended Spot Improvements be completed to address capacity and safety issues. The study further identified that additional Study is needed.

Stage		YR 1	YR 2	YR 4	YR 6	YR 8	
		(1) Study	(2) Planning	(3) Design	(4) Right of Way	(5) Construction	
Expenditures	**Prior Years**	**FY 13/14**	**FY 14/15**	**FY 16/17**	**FY 18/19**	**FY 20/21**	**Totals**
Land	0	0	0	0	2,400,000	0	2,400,000
Professional Services	0	60,000	500,000	2,300,000	0	500,000	3,360,000
Construction	0	0		0	0	20,440,000	20,440,000
Utility Relocation	0	0	0	0	1,000,000	1,000,000	2,000,000
Total	**$0**	**$60,000**	**$500,000**	**$2,300,000**	**$3,400,000**	**$21,940,000**	**$28,200,000**

		YR 1	YR 2	YR 4	YR 6	YR 8	
Funding Source	**Prior Years**	**FY 13/14**	**FY 14/15**	**FY 16/17**	**FY 18/19**	**FY 20/21**	**Totals**
General Fund \ Adequate Facilities	0	0	50,000	0	0	0	50,000
Bond Fund	0	0	0	230,000	1,700,000	0	1,930,000
Special Funds	0	0	50,000	230,000	1,700,000	0	1,980,000
State or Federal Funding	0	60,000	400,000	1,840,000	0	21,940,000	24,240,000
Total	**$0**	**$60,000**	**$500,000**	**$2,300,000**	**$3,400,000**	**$21,940,000**	**$28,200,000**

Project Development Process Key

(1) Study
(2) Planning
(3) Design
(4) Right of Way
(5) Construction

6/5/2013

Project Name: Beechcroft Road Widening (SR 247)

Spring Hill MTP Project Number: P29

Spring Hill CIP Project Number: RTP5

Length: 2.65 Miles

Improvement: Widen from two-lanes to three-lanes or five-lane cross section.

Project Fund: General, Bond, State or Federal

Estimated Start Date: 2014

Estimated Date of Completion: 2022

Description:
Currently, Beechcroft Road is a narrow two-lane collector road that provides access to residential and commercial properties and connects the City of Spring Hill to Carter's Creek Pike. Based on projected development trends, traffic volumes are expected to increase, and the existing cross-section will no longer be adequate. The proposed project will widen Beechcroft Road to three-lanes or more, with turn lanes at warranted locations, between Doctor Robertson Road and SR-6/US-31. The project will also connect an offset issue at the intersection of SR-6/US-31, Beechcroft Road and Duplex Road. This segment of Beechcroft Road currently operates at LOS C during the peak hour and will operate at LOS A and LOS B in 2030 once improved. Additional study is needed to determine final need.

Stage		YR 1	YR 3	YR 5	YR 7	YR 9	
		(1) Study	(2) Planning	(3) Design	(4) Right of Way	(5) Construction	
Expenditures	**Prior Years**	**FY 14/15**	**FY 16/17**	**FY 18/19**	**FY 20/21**	**FY 22/23**	**Totals**
Land	0	0	0	0	3,000,000	0	3,000,000
Professional Services	0	350,000	350,000	1,500,000		400,000	2,600,000
Construction	0	0	0	0	0	12,400,000	12,400,000
Utility Relocation	0	0	0	0	0	1,000,000	1,000,000
Total	**$0**	**$350,000**	**$350,000**	**$1,500,000**	**$3,000,000**	**$13,800,000**	**$19,000,000**

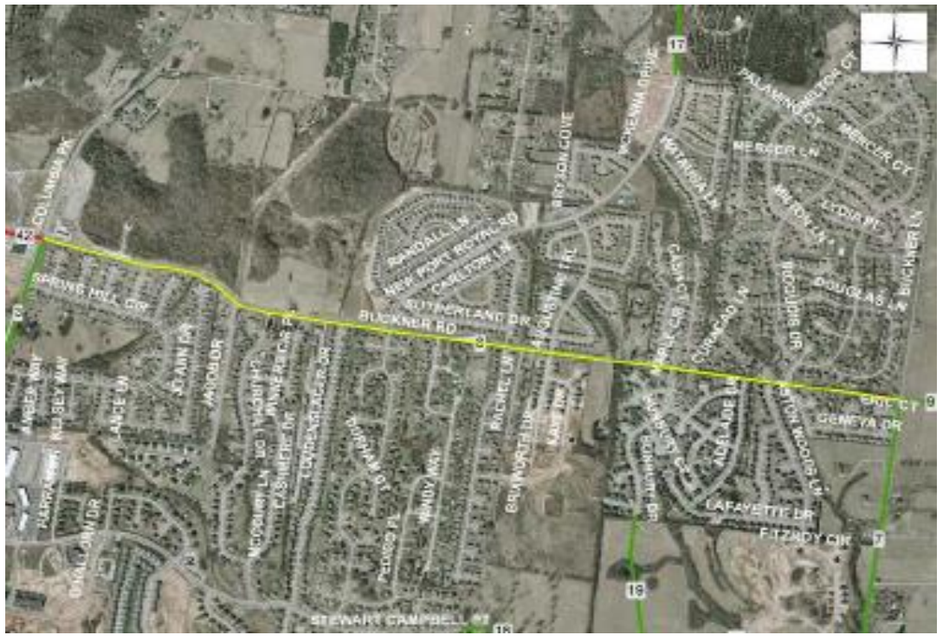
		YR 1	YR 3	YR 5	YR 7	YR 9	
Funding Source	**Prior Years**	**FY 14/15**	**FY 16/17**	**FY 18/19**	**FY 20/21**	**FY 22/23**	**Totals**
General Fund \ Adequate Facilities	0	70,000	70,000	0	0	0	140,000
Bond Fund	0	0	0	300,000	3,000,000	0	3,300,000
Special Funds	0	0	0	0	0	0	0
State or Federal Funding	0	280,000	280,000	1,200,000	0	13,800,000	15,560,000
Total	**$0**	**$350,000**	**$350,000**	**$1,500,000**	**$3,000,000**	**$13,800,000**	**$19,000,000**

Project Development Process Key

(1) Study
(2) Planning
(3) Design
(4) Right of Way
(5) Construction

6/5/2013

Project Name:	Buckner Road Widening
Spring Hill MTP Project Number:	P8
Spring Hill CIP Project Number:	RIP1
Length:	1.94 Miles
Improvement:	Widen from two to three lanes
Project Fund:	General or Bond
Estimated Start Date:	2013
Estimated Date of Completion:	2020



Description:
Buckner Road is a collector street that provides access to residential developments. This roadway will serve as a major east-west route through the city. To accommodate the projected traffic volumes, this project will widen Buckner Road from SR-6/US-31 to Buckner Lane to provide a three-lane cross-section. Currently, this segment of Buckner Road operates at LOS D or better during the peak hour. Once improved, it will operate at LOS B and LOS C in 2030.

Further Study must be completed to determine the final improvement (three or four lanes), whether bicycle lanes, sidewalks, and other appurtenances will be required.

		YR 1	YR 2	YR 4	YR 6	YR 8	
Stage		(1) Study	(2) Planning	(3) Design	(4) Right of Way	(5) Construction	
Expenditures	**Prior Years**	**FY 13/14**	**FY 14/15**	**FY 16/17**	**FY 18/19**	**FY 20/21**	**Totals**
Land	0	0	0	0	1,000,000	0	1,000,000
Professional Services	0	50,000	250,000	1,100,000	0	590,000	1,990,000
Construction	0	0	0	0	0	10,500,000	10,500,000
Utility Relocation	0	0	0	0	0	500,000	500,000
Total	**$0**	**$50,000**	**$250,000**	**$1,100,000**	**$1,000,000**	**$11,590,000**	**$13,990,000**

		YR 1	YR 2	YR 4	YR 6	YR 8	
Funding Source	**Prior Years**	**FY 13/14**	**FY 14/15**	**FY 16/17**	**FY 18/19**	**FY 20/21**	**Totals**
General Fund \ Adequate Facilities	0	50,000	0	0	0	0	50,000
Bond Fund	0	0	250,000	1,100,000	1,000,000	11,590,000	13,940,000
Special Funds	0	0	0	0	0	0	0
State or Federal Funding	0	0	0	0	0	0	0
Total	**$0**	**$50,000**	**$250,000**	**$1,100,000**	**$1,000,000**	**$11,590,000**	**$13,990,000**

Project Development Process Key

(1) Study
(2) Planning
(3) Design
(4) Right of Way
(5) Construction

6/5/2013

Project Name: Port Royal Rd Widening (Saturn Pwy to Duplex Rd)

Spring Hill MTP Project Number: P22

Spring Hill CIP Project Number: RIP2

Length: 1.69

Improvement: Widen from two to three lanes

Project Fund: Bond or Special

Estimated Start Date: 2013

Estimated Date of Completion: 2016

Description:
Port Royal Road provides a north-south connection through the city and provides access to numerous residential properties. The proposed project will improve the roadway's cross-section to accommodate the projected traffic volumes, and it will improve the roadway's horizontal and vertical alignment. In particular, it will eliminate the two ninety degree turns that are located between Saturn Parkway and Duplex Road. This segment of Port Royal Road currently operates at LOS C or better during the peak hour. Once improved, this segment will operate LOS A in 2030.

Further Study must be completed to determine the final improvement (three or four lanes), whether bicycle lanes, sidewalks, and other appurtenances will be required.

Stage		YR 1	YR 2	YR 3	YR 4	YR 5	
		(2) Planning	(3) Design	(4) Right of Way	(5) Construction		
Expenditures	**Prior Years**	**FY 13/14**	**FY 14/15**	**FY 15/16**	**FY 16/17**		**Totals**
Land	0	0	0	500,000	0	0	500,000
Professional Services	0	240,000	950,000		370,000	0	1,560,000
Construction	0	0	0	0	9,240,000	0	9,240,000
Utility Relocation	0	0	0	0	800,000	0	800,000
Total	**$0**	**$240,000**	**$950,000**	**$500,000**	**$10,410,000**	**$0**	**$12,100,000**

		YR 1	YR 2	YR 3	YR 4	YR 5	
Funding Source	**Prior Years**	**FY 13/14**	**FY 14/15**	**FY 15/16**	**FY 16/17**	**0**	**Totals**
General Fund \ Adequate Facilities	0	0	0	0	0	0	0
Bond Fund	0	0	475,000	250,000	10,410,000	0	11,135,000
Special Funds	0	240,000	475,000	250,000	0	0	965,000
State or Federal Funding	0	0	0	0	0	0	0
Total	**$0**	**$240,000**	**$950,000**	**$500,000**	**$10,410,000**	**$0**	**$12,100,000**

Project Development Process Key

(1) Study	(3) Design	(5) Construction
(2) Planning	(4) Right of Way	

6/5/2013

Project Name: Reserves Boulevard

Spring Hill MTP Project Number: P11

Spring Hill CIP Project Number: RIP3

Length: 0.7

Improvement: Construct a new three-lane road from Kedron Rd to Port Royal Rd

Project Fund: Bond & Private Development Partners

Estimated Start Date: 2012

Estimated Date of Completion: 2014

Description:
Properties along the North side of Saturn Parkway are expected to develop with residential, retail and institutional health care related uses, including a 24 hr Emergency Room. This project will provide sufficient access to these properties and will accommodate projected traffic volumes by constructing a new three-lane road from SR-6/US-31 to Port Royal Road. In addition to providing access to the properties in this area, the new road will intersect with Kedron Road and Port Royal Road / Reserves Boulevard Connection (P16 in the SH MTP), two north-south routes. The new road is projected to operate at LOS A in 2030.

Stage		YR 1	YR 2	YR 3	YR 4	YR 5	
		(3) Design	(5) Construction				
Expenditures	**Prior Years**	**FY 13/14**	**FY 14/15**				**Totals**
Land	0	0	0	0	0	0	0
Professional Services	0	500,000	2,500,000	0	0	0	3,000,000
Construction	0	0	0	0	0	0	0
Utility Relocation	0	0	0	0	0	0	0
Total	**$0**	**$500,000**	**$2,500,000**	**$0**	**$0**	**$0**	**$3,000,000**

		YR 1	YR 2	YR 3	YR 4	YR 5	
Funding Source	**Prior Years**	**FY 13/14**	**FY 14/15**	**0**	**0**	**0**	**Totals**
General Fund \ Adequate Facilities	0	0	0	0	0	0	0
Bond Fund	0	500,000	0	0	0	0	500,000
Special Funds	0	0	2,500,000	0	0	0	2,500,000
State or Federal Funding	0	0	0	0	0	0	0
Total	**$0**	**$500,000**	**$2,500,000**	**$0**	**$0**	**$0**	**$3,000,000**

Project Development Process Key

(1) Study	(3) Design	(5) Construction
(2) Planning	(4) Right of Way	

6/5/2013

Project Name: Buckner Lane Widening

Spring Hill MTP Project Number: P7

Spring Hill CIP Project Number: RIP4

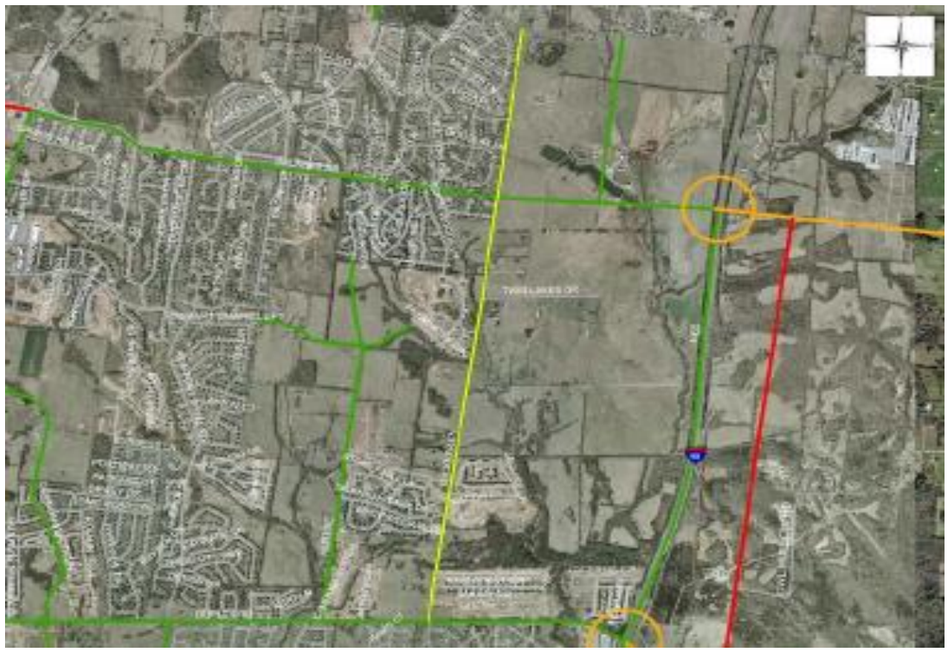
Length: 2.65

Improvement: Widen from Two to Three-lanes

Project Fund: General, Bond or Special

Estimated Start Date: 2013

Estimated Date of Completion: 2018



Description:
Buckner Lane serves as a North-South connector through the Northern half of the city and provides access to numerous residential development. Properties along the East side of Buckner Lane, as well as a few properties along the West side of Buckner Lane, are primarily undeveloper or are used for agricultural purposes. As indicated by recent developments trends in Spring Hill, these properties are expected to rapidly develop with potential mixed uses. To maintain sufficient traffic operations on Buckner Lane in the future, this road should be widen to provide additional travel lanes. Currently this road operates at LOS C or better during the peak hour. Once improved, it is expected to operate at LOS A, LOS C or LOS D in 2030.

Further Study must be completed to determine the final improvement (three or four lanes), whether bicycle lanes, sidewalks, and other appurtenances will be required.

		YR 1	YR 2	YR 3	YR 5	YR 6	
Stage		(2) Planning	(3) Design	(4) Right of Way	(5) Construction		
Expenditures	**Prior Years**	**FY 14/15**	**FY 15/16**	**FY 16/17**	**FY 18/19**		**Totals**
Land	0	0	0	1,000,000	0	0	1,000,000
Professional Services	50,000	250,000	1,500,000	0	490,000	0	2,290,000
Construction	0	0	0	0	14,700,000	0	14,700,000
Utility Relocation	0	0	0	0	1,000,000	0	1,000,000
Total	**$50,000**	**$250,000**	**$1,500,000**	**$1,000,000**	**$16,190,000**	**$0**	**$18,990,000**

		YR 1	YR 2	YR 3	YR 5	YR 6	
Funding Source	**Prior Years**	**FY 14/15**	**FY 15/16**	**FY 16/17**	**FY 18/19**	**0**	**Totals**
General Fund \ Adequate Facilities	50,000	25,000	0	0	0	0	75,000
Bond Fund	0	225,000	1,500,000	500,000	8,095,000	0	10,320,000
Special Funds	0	0	0	500,000	8,095,000	0	8,595,000
State or Federal Funding	0	0	0	0	0	0	0
Total	**$50,000**	**$250,000**	**$1,500,000**	**$1,000,000**	**$16,190,000**	**$0**	**$18,990,000**

Project Development Process Key

(1) Study
(2) Planning
(3) Design
(4) Right of Way
(5) Construction

6/5/2013

Project Name:	Tom Lunn Rd Extension
Spring Hill MTP Project Number:	P27
Spring Hill CIP Project Number:	RIP5
Length:	.75 miles
Improvement:	Construct new three-lane road
Project Fund:	Bond or Special
Estimated Start Date:	2014
Estimated Date of Completion:	2017

Description:
This project will begin at terminus of existing Tom Lunn Road and Port Royal Road and exted east to Rice Road (SH MTP P24). This road connects to John Lunn Road/Royal Park Boulevard (SH MTP P4), which ends at Kedron Road. The extension of Tom Lunn Road will provide an East-West connection from Kedron Road to Rice Road.

Further Study must be completed to determine the final improvement (three or four lanes), whether bicycle lanes, sidewalks, and other appurtenances will be required.

		YR 1	YR 2	YR 3	YR 4	YR 5	
Stage		(2) Planning	(3) Design	(4) Right of Way	(5) Construction		
Expenditures	**Prior Years**	**FY 14/15**	**FY 15/16**	**FY 16/17**	**FY 17/18**		**Totals**
Land	0	0	0	240,000	0	0	240,000
Professional Services	0	50,000	210,000	0	100,000	0	360,000
Construction	0	0	0	0	2,000,000	0	2,000,000
Utility Relocation	0	0	0	0	0	0	0
Total	**$0**	**$50,000**	**$210,000**	**$240,000**	**$2,100,000**	**$0**	**$2,600,000**

		YR 1	YR 2	YR 3	YR 4	YR 5	
Funding Source	**Prior Years**	**FY 14/15**	**FY 15/16**	**FY 16/17**	**FY 17/18**	**0**	**Totals**
General Fund \ Adequate Facilities	0	0		0	0	0	0
Bond Fund	0	50,000	210,000	240,000	1,050,000	0	1,550,000
Special Funds	0	0	0	0	1,050,000	0	1,050,000
State or Federal Funding	0	0	0	0	0	0	0
Total	**$0**	**$50,000**	**$210,000**	**$240,000**	**$2,100,000**	**$0**	**$2,600,000**

Project Development Process Key

(1) Study	(3) Design	(5) Construction
(2) Planning	(4) Right of Way	

6/5/2013

Project Name: Wilkes Lane

Spring Hill MTP Project Number: P21

Spring Hill CIP Project Number: RIP6

Length: .62 miles

Improvement: Widen to provide standard two-lane cross section with trun lanes

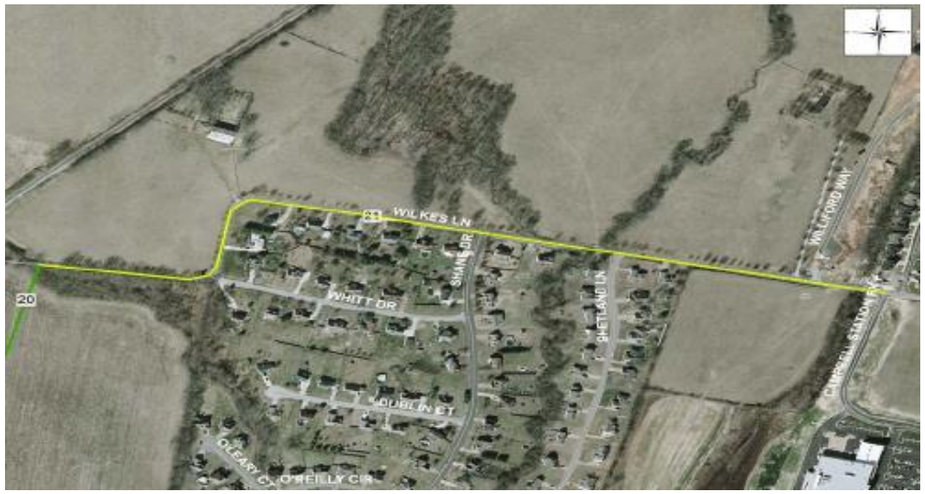
Project Fund: General, Bond or Special

Estimated Start Date: 2014

Estimated Date of Completion: 2017

Description:
This project will improve access to residential and commercial properties along SR-6/US-31. Once constructed, the new roadway will operate at LOS A in 2030.

Further Study must be completed to determine the final improvement, whether bicycle lanes, sidewalks, and other appurtenances will be required.



Stage		YR 1	YR 2	YR 3	YR 4	YR 5	
		(3) Design	(4) Right of Way	(5) Construction			
Expenditures	**Prior Years**	**FY 15/16**	**FY 16/17**	**FY 17/18**			**Totals**
Land	0	0	130,000	0	0	0	130,000
Professional Services	0	270,000	0	0	0	0	270,000
Construction	0	0	0	2,200,000	0	0	2,200,000
Utility Relocation	0	0	0	0	0	0	0
Total	**$0**	**$270,000**	**$130,000**	**$2,200,000**	**$0**	**$0**	**$2,600,000**

		YR 1	YR 2	YR 3	YR 4	YR 5	
Funding Source	**Prior Years**	**FY 15/16**	**FY 16/17**	**FY 17/18**	**0**	**0**	**Totals**
General Fund \ Adequate Facilities	0	0	0	0	0	0	0
Bond Fund	0	270,000	100,000	2,200,000	0	0	2,570,000
Special Funds	0	0	30,000	0	0	0	30,000
State or Federal Funding	0	0	0	0	0	0	0
Total	**$0**	**$270,000**	**$130,000**	**$2,200,000**	**$0**	**$0**	**$2,600,000**

Project Development Process Key

(1) Study	(3) Design	(5) Construction
(2) Planning	(4) Right of Way	

6/5/2013

Project Name: John Lunn Rd / Royal Park Extension

Spring Hill MTP Project Number: P5

Spring Hill CIP Project Number: RIP7

Length: 1.71 miles

Improvement: Reconstruct to provide three-lane collector

Project Fund: General, Bond or Special

Estimated Start Date: 2015

Estimated Date of Completion: 2019

Description:
John Lunn Road and Royal Park Boulevard are collector streets that provide an East-West connection between Kedron Road and Port Royal Road, just South of Saturn Parkway. John Lunn Road is very narrow and has horizontal and vertical curve issues. Also, these streets form an offset intersection at Timberline Drive, and it would be desirable to realign the intersection to provide a direct connection to Kedron Road and Port Royal Road. Currently, these roads operate at LOS B or better at the peak hour. Once improved, these roads will operate at LOS A in 2030.

Further Study must be completed to determine the final improvement, whether bicycle lanes, sidewalks, and other appurtenances will be required.

		YR 1	YR 2	YR 3	YR 4	YR 5	
Stage		(1) Study	(2) Planning	(3) Design	(4) Right of Way	(5) Construction	
Expenditures	**Prior Years**	**FY 15/16**	**FY 16/17**	**FY 17/18**	**FY 18/19**	**FY 19/20**	**Totals**
Land	0	0	0	0	615,000	0	615,000
Professional Services	0	60,000	175,000	750,000	0	200,000	1,185,000
Construction	0	0	0	0	0	7,400,000	7,400,000
Utility Relocation	0	0	0	0	0	300,000	300,000
Total	**$0**	**$60,000**	**$175,000**	**$750,000**	**$615,000**	**$7,900,000**	**$9,500,000**

		YR 1	YR 2	YR 3	YR 4	YR 5	
Funding Source	**Prior Years**	**FY 15/16**	**FY 16/17**	**FY 17/18**	**FY 18/19**	**FY 19/20**	**Totals**
General Fund \ Adequate Facilities	0	0	25,000	0	0	0	25,000
Bond Fund	0	60,000	150,000	750,000	115,000	2,400,000	3,475,000
Special Funds	0	0	0	0	500,000	5,500,000	6,000,000
State or Federal Funding	0	0	0	0	0	0	0
Total	**$0**	**$60,000**	**$175,000**	**$750,000**	**$615,000**	**$7,900,000**	**$9,500,000**

Project Development Process Key

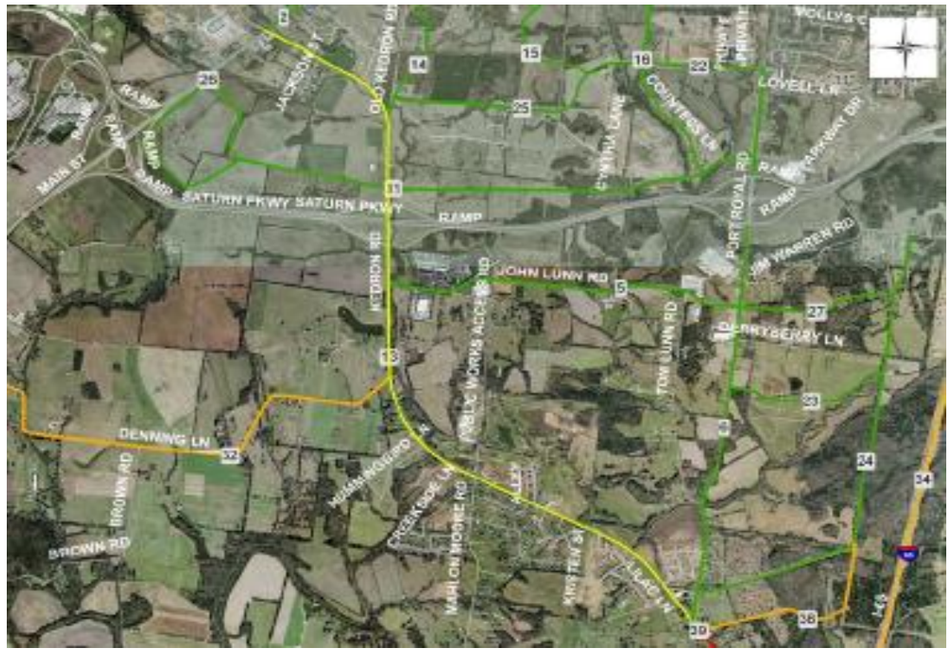
(1) Study
(2) Planning
(3) Design
(4) Right of Way
(5) Construction

6/5/2013

Project Name:	Kedron Road Widening
Spring Hill MTP Project Number:	P13
Spring Hill CIP Project Number:	RIP8
Length:	4.12 miles
Improvement:	Widen from Two to Three-lanes
Project Fund:	Bond
Estimated Start Date:	2015
Estimated Date of Completion:	2022

Description:
Kedron Road is an important collector that connects SR-6/US-31, Saturn Parkway and Port Royal Road. In the future, it is planned to connect to Interstate 65, with a new interchange. Currently, Kedron Road has two travel lanes, and properties along Kedron Road are primarily zoned for residential uses. This project will widen Kedron Road to three lanes to accomodate the projected traffic volumes. Once improved, this segment of Kedron Road will operate at LOS C, LOS D or LOS E in 2030.

Further Study must be completed to determine the final improvement (three or four lanes), whether bicycle lanes, sidewalks, and other appurtenances will be required.



Stage		YR 1	YR 2	YR 4	YR 6	YR 8	
		(1) Study	(2) Planning	(3) Design	(4) Right of Way	(5) Construction	
Expenditures	**Prior Years**	**FY 15/16**	**FY 16/17**	**FY 18/19**	**FY 20/21**	**FY 22/23**	**Totals**
Land	0	0	0	0	1,500,000	0	1,500,000
Professional Services	0	60,000	600,000	2,400,000	0	700,000	3,760,000
Construction	0	0	0	0	0	23,240,000	23,240,000
Utility Relocation	0	0	0	0	0	1,000,000	1,000,000
Total	**$0**	**$60,000**	**$600,000**	**$2,400,000**	**$1,500,000**	**$24,940,000**	**$29,500,000**

		YR 1	YR 2	YR 4	YR 6	YR 8	
Funding Source	**Prior Years**	**FY 15/16**	**FY 16/17**	**FY 18/19**	**FY 20/21**	**FY 22/23**	**Totals**
General Fund \ Adequate Facilities	0	0	0	0	0	0	0
Bond Fund	0	60,000	600,000	2,400,000	1,500,000	24,940,000	29,500,000
Special Funds	0	0	0	0	0	0	0
State or Federal Funding	0	0	0	0	0	0	0
Total	**$0**	**$60,000**	**$600,000**	**$2,400,000**	**$1,500,000**	**$24,940,000**	**$29,500,000**
							0

Project Development Process Key

(1) Study	(3) Design	(5) Construction
(2) Planning	(4) Right of Way	

6/5/2013

Project Name: Crossings Circle Extension

Spring Hill MTP Project Number: P26

Spring Hill CIP Project Number: RIP9

Length: 0.6

Improvement: Construct a new three-lane road

Project Fund: General, Bond or Special

Estimated Start Date: 2014

Estimated Date of Completion: 2016

Description:
Coordination with property owners, including further study of potential historic treatments to protect and provide access to existing Spring Hill Battlefield will likely be required.

Stage		YR 1	YR 2	YR 3	YR 5		
		(2) Planning	(3) Design	(4) Right of Way	(5) Construction		
Expenditures	**Prior Years**	**FY 14/15**	**FY 15/16**	**FY 16/17**	**FY 16/17**		**Totals**
Land	0	0	0	500,000	0	0	500,000
Professional Services	0	175,000	175,000	0	0	0	350,000
Construction	0	0	0	0	2,500,000	0	2,500,000
Utility Relocation	0	0	0	0	0	0	0
Total	**$0**	**$175,000**	**$175,000**	**$500,000**	**$2,500,000**	**$0**	**$3,350,000**

		YR 1	YR 2	YR 3	YR 5		
Funding Source	**Prior Years**	**FY 14/15**	**FY 15/16**	**FY 16/17**	**FY 16/17**	**0**	**Totals**
General Fund \ Adequate Facilities	0	0	50,000	0	0	0	50,000
Bond Fund	0	0	0	0	500,000	0	500,000
Special Funds	0	175,000	125,000	500,000	2,000,000	0	2,800,000
State or Federal Funding	0	0	0	0	0	0	0
Total	**$0**	**$175,000**	**$175,000**	**$500,000**	**$2,500,000**	**$0**	**$3,350,000**

Project Development Process Key

(1) Study	(3) Design	(5) Construction
(2) Planning	(4) Right of Way	

6/5/2013

A JOINT RESOLUTION
City of Spring Hill Resolution 13-21
Town of Thompson's Station Resolution 13-005

A JOINT RESOLUTION OF THE CITY OF SPRING HILL AND THE TOWN OF THOMPSON'S STATION RELATING TO THE ESTABLISHMENT OF A TRANSPORTATION TASK FORCE

WHEREAS, the City of Spring Hill (Spring Hill) is a municipality, a portion of which is located in southern Williamson County, Tennessee, and a portion of which is located in northern Maury County, Tennessee, whose legislative body is the Board of Mayor and Aldermen; and

WHEREAS, the Town of Thompson's Station (Thompson's Station) is a municipality located in southern Williamson County, Tennessee, whose legislative body is the Board of Mayor and Aldermen; and

WHEREAS, Spring Hill and Thompson's Station adopted a Joint Resolution in February 2010 affirming a shared commitment to coordinate transportation planning; and

WHEREAS, there is an immediate need to identify transportation issues which are shared by and affect each municipality, prioritize the issues, and develop feasible solutions to address those transportation issues; and

WHEREAS, Spring Hill and Thompson's Station desire to establish a Transportation Task Force (Task Force) as a means to accomplish intergovernmental coordination between the municipalities in regards to transportation issues and that such coordination will benefit both municipalities as well as citizens and property owners of the entire region; and

WHEREAS, Task Force members should have a familiarity or experience with transportation or civil planning and should rely on resources or best practices from a variety of places throughout the country that may be effective in developing solutions to these transportation issues; and

WHEREAS, this joint resolution is a statement of will by both Spring Hill and Thompson's Station that both parties are in agreement that there is no intent for this Joint Resolution to restrict either Spring Hill or Thompson's Station authority to make decisions consistent with this Joint Resolution, or otherwise, pertaining to transportation issues within their municipal corporate boundaries as either Spring Hill or Thompson's Station determines.

NOW, THEREFORE BE IT RESOLVED, by the Board of Mayor and Aldermen of the City of Spring Hill, Tennessee, and the Board of Mayor and Aldermen of the Town of Thompson's Station Tennessee that there is hereby created and established the Spring Hill and Thompson's Station Transportation Task Force (Task Force) which shall exist from and after the passage of this joint resolution, and shall expire on the earlier of December 31, 2013 or immediately following the presentation to each municipality of such reports or recommendations as are directed by this joint resolution required to complete its charge;

NOW, THEREFORE BE IT FURTHER RESOLVED, the Task Force shall be composed of members appointed by the Mayors of each municipality. Each Mayor shall appoint three (3) members

representing each municipality, along with at least one (1) staff member(s) from each municipality to support the work of the Task Force. Any member of the Task Force may be removed and replaced in the manner of initial appointment;

NOW, THEREFORE BE IT FURTHER RESOLVED, the Task Force members appointed by the Mayors of each municipality shall have a demonstrated familiarity or experience with transportation or civil planning. At its first meeting, the Task Force shall elect a Chairman, Vice-Chairman and Secretary from among its members and shall, formally or informally, adopt its own rules of procedure. The Task Force shall maintain records of meetings and findings which shall be open to inspection by the public and shall encourage public input and work with members from the County, State and/or Nashville Area MPO;

NOW, THEREFORE BE IT FURTHER RESOLVED, the charge of the Task Force shall include: identifying the transportation needs which affect both municipalities, prioritize addressing these needs, and developing feasible solutions to address these transportation needs through, and not limited to, the development of a multi-jurisdictional transportation plan or recommendation for the updating of each municipality's Major Thoroughfare Plan;

NOW, THEREFORE BE IT FURTHER RESOLVED, the Task Force shall meet at least monthly until such charge is complete, and may tender such progress reports to Board of Mayor and Aldermen for each municipality as the Task Force may deem appropriate;

Passed and adopted by the Board of Mayor and Aldermen of the City of Spring Hill, Tennessee on the 19th day of February, 2013.

ATTEST:

Michael Dinwiddie, Mayor

April Goad, City Recorder

Passed and adopted by the Board of Mayor and Aldermen of the Town of Thompson's Station, Tennessee on the 12th day of February, 2013.

ATTEST:

Corey Napier, Mayor

Doug Goetsch, Town Recorder

P.O. Box 100
Thompson's Station, TN 37179
Phone: (615) 794-4333
Fax: (615) 794-3313
www.thompsons-station.com

Town of
Thompson's Station Memo

To: Thompson's Station Board of Mayor and Aldermen
City of Spring Hill Board of Mayor and Aldermen

From: Wendy Deats, Town Planner

Date: February 11, 2013

Re: Transportation task force

Background

In February 2010, the Boards of Mayor and Aldermen for Thompson's Station and Spring Hill adopted a Joint Resolution affirming a shared commitment to coordinate land use and transportation planning. As a result, discussions between Thompson's Station and Spring Hill have determined that the creation of a task force could be in the best interest of the communities. The task force would have the responsibility of identifying the transportation needs and recommending solutions to better meet those needs of the overall communities within this area.

Staff recommends that the task force include a small group of leaders within the two jurisdictions with the goals of: A) identifying the transportation needs which affect both municipalities; B) prioritizing the needs/issues; and C) developing feasible solutions to address those transportation needs. After establishing a list of issues with the transportation system, research into the best practices from a variety of places throughout the country can be effective in developing solutions to these issues. The task force members can rely on the practices used for effective transportation to help guide the future within this area. As information is gathered and evaluated, it will be important to invite key members from the County, State and/or the Nashville Area MPO in order to get feedback and support along the development of these practices.

The information gathered can then be utilized in updating the each jurisdiction's major thoroughfare plan or a multi-jurisdictional plan can be adopted.

Schedule

- Form task force (Spring 2013)
  --no less than five (5) members and no more than seven (7) members
- Identify list of needs (Spring 2013)
  --develop list of issues
  --develop the end product for the task force
- Develop solutions
  --research what top communities are doing to handle transportation issues
  --compare possible solutions with needs to determine effectiveness
- Look into the future needs for the area
  --access data and determine what improvements can be put into the plan
- Prepare Update to Major Thoroughfare Plan or write multi-jurisdictional MTP
- Public Input
- Board adoption

Recommendation

Prepare a joint resolution to establish the Transportation Task Force and begin working on appointments for the task force.

Williamson County, Tennessee
Planning Department
1320 West Main Street - Suite 400
Franklin, Tennessee 37064
Voice: 615.790-5725 Fax: 615.591-8531

WILLIAMSON COUNTY MAJOR THOROUGHFARE PLAN UPDATE

ADOPTED DECEMBER 15, 2011 BY THE WILLIAMSON COUNTY REGIONAL PLANNING COMMISSION

Williamson County Functionally Classified Roads

FREEWAYS

I-65
I-40
SR 840

ARTERIALS

Columbia Pk
Highway 100
Hillsboro Rd
Lewisburg Pk
Mack Hatcher Pkwy
Nolensville Rd
SR 96 East
SR 96 West

COLLECTORS

Arno Rd
Arno-Allisona Rd
Arno-College Grove Rd
Arno-Peytonsville Rd
Bethesda Rd
Bethesda-Duplex Rd
Big East Fork Rd
Buckner Ln
Burke Hollow Rd
Carothers Rd
Carters Creek Pk
Clovercroft Rd
Comstock Rd
Cox Rd
Cross Keys Rd
Del Rio Pk
Duplex Rd
Eudailey-Covington Rd
Fernvale Rd
Flat Creek Rd
Garrison Rd
Greenbrier Rd
Harpeth-Peytonsville Rd
Leipers Creek Rd
Liberty Pk
Old Cox Pk
Old Harding Rd
Old Hillsboro Rd
Old Natchez Trace
Old SR 96
Patterson Rd
Pewitt Rd
Peytonsville Rd
Pinewood Rd
Pulltight Hill Rd
Rocky Fork Rd
South Lick Creek Rd
Shoal Branch Rd
Sneed Rd
South Harpeth Rd
Southall Rd
Spencer Mill Rd
Split Log Rd
Stillhouse Hollow Rd
Temple Rd
Thompson's Station Rd
Trinity Rd
Vaughn Rd
Waller Rd
Wilson Pk

Williamson County Major Thoroughfare Plan Projects

Capacity-related projects (C-#) have been identified because of the need for increased roadway capacity in existing corridors due to existing or future traffic growth from new development. These improvements generally apply to existing roadways and would be accomplished through the widening of existing roads. Improvements are sometimes given as widen to 2/3 or 4/5 lanes. This means that, due to the contextual setting of these roads, one consistent cross-section may not be most applicable. For example, a constant two-way left turn lane may be needed in some places, but a left turn lane constructed at a particular location may be a preferred design in other places. More detailed design analysis will be required as implementation of these projects progress.

C-1

Project: Highway 100 widening
Description: Widen Highway 100 to 4/5 lanes from the Davidson County Line to SR 840 (assumes corresponding widening of Highway 100 through Fairview City Limits)
Purpose: Segment expected to reach capacity by 2035 planning horizon with capacity exceeded in some locations. Project will accommodate Fairview's projected growth in population and employment.
Coordinated Plans: 2035 LRTP (unfunded project), 1996 Williamson County MTP
Implementation: Plan, design, and program as state route improvement
Right-of-Way: 120'
Cost: $31,280,000

C-2

Project: Sneed Road widening
Description: Widen Sneed Road to 3 lanes from the Davidson County Line to Hillsboro Road
Purpose: Segment expected to reach capacity by 2035 planning horizon. Project should improve safety and non-motorized accommodations.
Coordinated Plans: 1996 Williamson County MTP
Implementation: Plan and design as county improvement. Potential coordination with future development initiatives.
Right-of-Way: 72'
Cost: $34,910,000

C-3

Project: Hillsboro Road widening
Description: Widen Hillsboro Road to 4/5 lanes from the Davidson County Line to Berry's Chapel Road
Purpose: Project should mitigate existing capacity shortages which are expected to worsen over planning horizon.
Coordinated Plans: 2035 LRTP (unfunded project), 1996 Williamson County MTP
Implementation: Plan, design, and program as state route improvement
Right-of-Way: 120' typical. 84' in Activity Center area at Grassland
Cost: $47,740,000

C-4

Project: State Route 96 West widening
Description: Widen SR 96 West to 3 lanes from the Franklin City Limit to Temple Road Ext (proposed – see N-1)
Purpose: Segment expected to reach capacity by 2035 planning horizon.
Coordinated Plans: 2035 LRTP (unfunded project), 2010 Franklin MTP, 1996 Williamson County MTP
Implementation: Plan, design, and program as state route improvement
Right-of-Way: 120'
Cost: $26,580,000

C-5

Project: Rocky Fork Road widening
Description: Widen Rocky Fork Road to 3 lanes from the Nolensville City Limit to Rutherford County Line
Purpose: Some segments expected to approach capacity by 2035 planning horizon.
Coordinated Plans: 2005 Nolensville MTP
Implementation: Plan, design, and program as county improvement in coordination with municipal improvements and/or future developer initiatives
Right-of-Way: 72'
Cost: $14,360,000

C-6

Project: Clovercroft Road
Description: Widen Clovercroft Road to 2/3 lanes from Nolensville Road to Wilson Pike
Purpose: Some segments expected to approach capacity by 2035 planning horizon. Facilitate Rutherford/Williamson commutes to Cool Springs, I-65.
Coordinated Plans: 2035 LRTP (unfunded project)
Implementation: Plan and design as county improvement. Potential coordination with future development initiatives.
Right-of-Way: 72'
Cost: $21,990,000

C-7

Project: Nolensville Road widening
Description: Widen Nolensville Road to 4/5 lanes from the Nolensville Town Limit to Shelbyville Highway
Purpose: Segment expected to reach capacity by 2035 planning horizon with capacity exceeded in some locations.
Coordinated Plans: 2035 LRTP (unfunded project), 2005 Nolensville MTP
Implementation: Plan, design, and program as state route improvement
Right-of-Way: 120' typical. 84' in Village and Activity Center areas at Triune and Kirkland.
Cost: $72,360,000

C-8

Project: State Route 96 East widening
Description: Widen SR 96 to 4/5 lanes from Arno Road to the Rutherford County Line
Purpose: Segment expected to reach capacity by 2035 planning horizon with capacity exceeded in some locations. Facilitate role as suburban character corridor in Preferred Growth scenario.
Coordinated Plans: 2035 LRTP, 2010 Franklin MTP, 1996 Williamson County MTP
Implementation: Plan, design, and program as state route improvement
Right-of-Way: 120' typical. 84' in Village and Activity Center areas at Arrington and Triune.
Cost: $102,960,000

C-9

Project: Arno Road widening
Description: Widen Arno Road to 3 lanes from SR 96 East to SR 840
Purpose: Some segments expected to exceed capacity by 2035 planning horizon.
Coordinated Plans: 2010 Franklin MTP
Implementation: Plan and design as county improvement. Potential coordination with future development initiatives.
Right-of-Way: 72' typical. 60' in Village area at Rudderville.
Cost: $47,270,000

C-10

Project: Lewisburg Pike widening
Description: Widen Lewisburg Pike to 4/5 lanes from the Franklin City Limit to Thompson's Station Road
Purpose: Some segments expected to exceed capacity by 2035 planning horizon.
Coordinated Plans: 2035 LRTP, 2010 Franklin MTP, 1996 Williamson County MTP
Implementation: Plan, design, and program as state route improvement
Right-of-Way: 120'
Cost: $57,270,000

C-11

Project: Columbia Pike widening
Description: Widen Columbia Pike to 4/5 lanes from Coleman Road to Goose Creek Bypass
Purpose: Segment expected to reach capacity by 2035 planning horizon.
Coordinated Plans: 2035 LRTP (unfunded project), 2010 Franklin MTP, 1996 Williamson County MTP
Implementation: Plan, design, and program as state route improvement
Right-of-Way: 120'
Cost: $25,770,000

C-12

Project: Carters Creek Pike
Description: Widen Carters Creek Pike to 2/3 lanes from the Franklin City Limit to SR 840
Purpose: Some segments expected to reach or exceed capacity by 2035 planning horizon.
Coordinated Plans: 2035 LRTP (unfunded project), 2010 Franklin MTP, 1996 Williamson County MTP
Implementation: Plan, design, and program as state route improvement
Right-of-Way: 96'
Cost: $52,870,000

C-13

Project: Coleman Road widening
Description: Widen Coleman Road to 3 lanes from Kittrell Road to Columbia Pike
Purpose: Consistency with Franklin MTP
Coordinated Plans: 2010 Franklin MTP
Implementation: Plan, design, and program as county improvement in coordination with municipal improvements and/or future developer initiatives
Right-of-Way: 72'
Cost: $10,010,000

C-14

Project: Duplex Road widening
Description: Widen Duplex Road to 3 lanes from I-65 to Lewisburg Pike
Purpose: Segment expected to reach capacity by 2035 planning horizon with capacity exceeded in some locations.
Coordinated Plans: 2035 LRTP, Spring Hill MTP
Implementation: Plan, design, and program as county improvement in coordination with municipal improvements and/or future developer initiatives
Right-of-Way: 96'
Cost: $18,300,000

C-15

Project: I-65 widening
Description: Widen I-65 to 8 lanes from SR 840 to the Maury County Line
Purpose: Segment expected to reach capacity by 2035 planning horizon
Coordinated Plans: 2010 Franklin MTP, Spring Hill MTP
Implementation: Plan, design, and program as federal interstate improvement
Right-of-Way: Per TDOT
Cost: $36,600,000

C-16

Project: York Road widening
Description: Widen York Road to 2/3 lanes from Fly Road Extension to Rocky Fork Road
Purpose: Consistency with Nolensville MTP
Coordinated Plans: Nolensville MTP
Implementation: Plan, design, and program as county improvement in coordination with municipal improvements and/or future developer initiatives
Right-of-Way: 72'
Cost: $8,830,000

C-17

Project: Kidd/Mcfarlin Road widening
Description: Widen Kidd/Mcfarlin Road to 2/3 lanes from Nolensville Road to the Rutherford County Line
Purpose: Consistency with Nolensville MTP
Coordinated Plans: Nolensville MTP
Implementation: Plan, design, and program as county improvement in coordination with municipal improvements and/or future developer initiatives
Right-of-Way: 72'
Cost: $22,190,000

New roadway projects (N-#) have been identified for construction in new alignments for various reasons. First, capacity shortages may exist in an existing corridor, but there is limited opportunity to add capacity in that existing corridor. In these cases, a new road would provide an alternative to the existing corridor. Second, a new road may be specified due to the lack of other alternative routes in a particular part of the county. Third, an existing road may be extended to provide a longer range of mobility and thereby increase the effectiveness of the existing roadway. Fourth, a new road may be needed to structure future development. These projects are marked with an asterics and should be pursued only when development activities occur in a previously undeveloped portion of the county. Fifth, a new construction project may be shown in the Williamson County Major Thoroughfare Plan only in order to be consistent with the previously adopted roadway plans of adjacent jurisdictions.

N-1*

Project: Temple Road Extension
Description: Extend Temple Road as 2/3 lanes from near Green Road to SR 96 West
Purpose: Enhanced north-south mobility. Alternative route to Old Natchez Trace.
Coordinated Plans: 1996 Williamson County MTP
Implementation: Plan, design, and program as county improvement in coordination with future developer initiatives
Right-of-Way: 72'
Cost: $23,210,000

N-2

Project: Old Charlotte Pike Extension
Description: Extend Old Charlotte Pike as 2 lanes from Del Rio Pike to SR 96 West
Purpose: Enhanced north-south mobility. Intermediate route in between Old Hillsboro Road and Hillsboro Road.
Coordinated Plans: 2010 Franklin MTP
Implementation: Plan, design, and program as county improvement in coordination with municipal projects and future developer initiatives
Right-of-Way: 72'
Cost: $13,970,000

N-3

Project: Mack Hatcher Parkway Extension
Description: Extend Mack Hatcher Parkway as 4/5 lanes from Hillsboro Road to Columbia Pike
Purpose: Enhanced mobility west of Franklin.
Coordinated Plans: 2010 Franklin MTP, 1996 Williamson County MTP
Implementation: Plan, design, and program as state route project
Right-of-Way: 250'
Cost: $159,810,000

N-4

Project: McEwen Drive Extension
Description: Extend McEwen Drive as 4/5 lanes from Wilson Pike to Pleasant Hill Road
Purpose: Enhanced east/west mobility to I-65/Cool Springs
Coordinated Plans: 2035 LRTP
Implementation: Plan, design, and program as county project with a high degree of local jurisdiction coordination and participation
Right-of-Way: 120'
Cost: $17,540,000

N-5

Project: Liberty Pike Extension
Description: Extend Liberty Pike as 2/3 lanes to Wilson Pike
Purpose: Logical terminus of Liberty Pike corridor
Coordinated Plans: 2010 Franklin MTP
Implementation: Plan, design, and program as county project with jurisdictional coordination
Right-of-Way: 60'
Cost: $4,190,000

N-6

Project: Wilson Pike Reconstruction
Description: Reconstruct Wilson Pike as 2/3 lanes from McEwen Drive to SR 96 East
Purpose: Correct substandard alignment, roadway features. Segment expected to reach or exceed capacity by 2035 planning horizon.
Coordinated Plans: 2035 LRTP, 2010 Franklin MTP, 1996 Williamson County MTP
Implementation: Plan, design, and program as state route project
Right-of-Way: 96' typical. 60' in Village area at Arrington.
Cost: $41,370,000

N-7

Project: Market Street Extension
Description: Construct Market Street extension as 2 lanes from Clovercroft Road to SR 96 East
Purpose: Consistency with Franklin MTP
Coordinated Plans: 2010 Franklin MTP
Implementation: Plan, design, and program as county project with jurisdictional coordination
Right-of-Way: 72'
Cost: $7,550,000

N-8

Project: N Chapel Road Extension
Description: Extend N Chapel Road as 2 lanes from 90° curve to the proposed Trinity Road Extension
Purpose: Consistency with Franklin MTP
Coordinated Plans: 2010 Franklin MTP
Implementation: Plan, design, and program as county project with jurisdictional coordination
Right-of-Way: 72'
Cost: $4,090,000

N-9

Project: N Chapel Road Extension
Description: Extend N Chapel Road as 2 lanes from SR 96 East to 90° curve
Purpose: Consistency with Franklin MTP
Coordinated Plans: 2010 Franklin MTP
Implementation: Plan, design, and program as county project with jurisdictional coordination
Right-of-Way: 72'
Cost: $1,510,000

N-10*

Project: Trinity Road Extension
Description: Extend Trinity Road as 2/3 lanes from Trinity Road to Clovercroft Road
Purpose: Provide north/south alternative to Wilson Pike from SR 840 to Clovercroft Road
Coordinated Plans: 2010 Franklin MTP, 1996 Williamson County MTP
Implementation: Plan, design, and program as county improvement in coordination with municipal projects and future developer initiatives
Right-of-Way: 72'
Cost: $20,920,000

N-11

Project: Peytonsville Road Extension
Description: Extend Peytonsville Road as 2/3 lanes from Peytonsville Road to Long Lane
Purpose: East/west mobility, including access to existing Peytonsville Road interchange
Coordinated Plans: 2035 LRTP (unfunded project), 2010 Franklin MTP, 1996 Williamson County MTP
Implementation: Plan, design, and program as county project with jurisdictional coordination and possible extension/redesignation of state route system
Right-of-Way: 60'
Cost: $4,880,000

N-12

Project: Buckner Road Extension
Description: Extend Buckner Road as 2/3 lanes from Buckner Lane to Lewisburg Pike
Purpose: East/west mobility, including access to potential future I-65 interchange
Coordinated Plans: 2035 LRTP, Spring Hill MTP
Implementation: Plan, design, and program as county improvement with high degree of coordination with multi-municipal objectives and future developer initiatives
Right-of-Way: 72'
Cost: $13,900,000

N-13

Project: Saturn Parkway Extension
Description: Extend Saturn Parkway as 4/5 lanes from I-65 to Lewisburg Pike
Purpose: East/west mobility, including access to existing Saturn Parkway interchange
Coordinated Plans: Spring Hill MTP
Implementation: Plan, design, and program as state route project
Right-of-Way: 148'
Cost: $23,500,000

N-14*

Project: Evergreen Road Extension
Description: Extend Evergreen Road as 2/3 lanes from Town Center Parkway Extension (proposed) to Carters Creek Pike (use partial Sedberry Road alignment)
Purpose: North/south alternative to Columbia Pike
Coordinated Plans: 2010 Franklin MTP, Spring Hill MTP
Implementation: Plan, design, and program as county improvement in coordination with municipal projects and future developer initiatives
Right-of-Way: 72'
Cost: $60,970,000

N-15*

Project: Thompson's Station Road Extension
Description: Extend Thompson's Station Road as 2/3 lanes from Thompson's Station Road to Carters Creek Pike (use partial alignments of Evergreen Road and Backer Road)
Purpose: East/west mobility south of SR 840
Coordinated Plans:
Implementation: Plan, design, and program as county improvement in coordination with municipal projects and future developer initiatives
Right-of-Way: 72'
Cost: $34,750,000

N-16

Project: Lewisburg Pike Connector and Interchange
Description: Construct Lewisburg Pike Connector as 2/3 lanes from Lewisburg Pike to a proposed I-65 interchange
Purpose: Additional interstate access in between Goose Creek and SR 840 in coordination with Franklin MTP
Coordinated Plans: 2010 Franklin MTP
Implementation: Plan, design, and program as county improvement in coordination with municipal projects
Right-of-Way: 96'
Cost: $24,650,000

N-17*

Project: New Roadway construction
Description: Construct new roadway as 2/3 lanes from Hillsboro Road to Urban Growth Boundary
Purpose: Accommodate growth in Franklin's western sector in coordination with Franklin MTP
Coordinated Plans: 2010 Franklin MTP
Implementation: Plan, design, and program as county improvement in coordination with municipal projects and future developer initiatives
Right-of-Way: 60'
Cost: $7,350,000

N-18

Project: Lewisburg Pike Connector Extension
Description: Construct new roadway as 2/3 lanes from the proposed I-65 Interchange to Long Lane
Purpose: Consistency with Franklin MTP
Coordinated Plans: 2010 Franklin MTP
Implementation: Plan, design, and program as county improvement in coordination with municipal projects
Right-of-Way: 72'
Cost: $12,390,000

N-19*

Project: Del Rio Pike Extension
Description: Extend Del Rio Pike as 2 lanes from Carlisle Lane to Urban Growth Boundary
Purpose: Accommodate growth in Franklin's western sector in coordination with Franklin MTP
Coordinated Plans: 2010 Franklin MTP
Implementation: Plan, design, and program as county improvement in coordination with municipal projects and future developer initiatives
Right-of-Way: 60'
Cost: $5,310,000

N-20

Project: Split Log Road Extension
Description: Extend Split Log Road as 2/3 lanes from Sam Donald Road to Sunset Road
Purpose: East/west alternative to Ragsdale Road
Coordinated Plans: Brentwood current planning initiatives
Implementation: Plan, design, and program as county improvement in coordination with municipal projects and future developer initiatives
Right-of-Way: 72'
Cost: $8,400,000

N-21

Project: Town Center Parkway Extension
Description: Extend Buckner Road (Town Center Parkway) as 2/3 lanes from Buckner Road to Maury County Line
Purpose: Circumferential mobility in western Spring Hill (project extends south into Maury County)
Coordinated Plans: Spring Hill MTP
Implementation: Plan, design, and program as county improvement in coordination with municipal projects and future developer initiatives
Right-of-Way: 72'
Cost: $18,900,000

N-22

Project: Kedron Road Connector
Description: Construct new roadway as 2/3 lanes from Buckner Road Extension (prop) to the Maury County Line
Purpose: North/south mobility east of I-65 in coordination with Spring Hill MTP
Coordinated Plans: Spring Hill MTP
Implementation: Plan, design, and program as county improvement in coordination with municipal projects and future developer initiatives
Right-of-Way: 72'
Cost: $43,700,000

N-23

Project: Waller Road Extension
Description: Extend Waller Road as 2/3 lanes from Sunset Road to Clovercroft Road
Purpose: North/south alternative to Nolensville Road
Coordinated Plans: Nolensville MTP
Implementation: Plan, design, and program as county improvement in coordination with municipal projects and future developer initiatives
Right-of-Way: 72'
Cost: $13,510,000

N-24

Project: New Roadway construction
Description: Construct new road as 2 lanes from Kidd Road to Rocky Fork Road
Purpose: Accommodate growth in Nolensville's eastern sector in coordination with Nolensville MTP
Coordinated Plans: Nolensville MTP
Implementation: Plan, design, and program as county improvement in coordination with municipal projects and future developer initiatives
Right-of-Way: 72'
Cost: $11,210,000

N-25

Project: New Roadway construction
Description: Construct new road as 2 lanes from proposed road (N-24) to Fly Road
Purpose: Accommodate growth in Nolensville's eastern sector in coordination with Nolensville MTP
Coordinated Plans: Nolensville MTP
Implementation: Plan, design, and program as county improvement in coordination with municipal projects and future developer initiatives
Right-of-Way: 72'
Cost: $5,510,000

N-26

Project: Fly Road Extension

Description: Extend Fly Road as 2 lanes from Rocky Springs Road to York Road

Purpose: North/south alternative to Nolensville Road

Coordinated Plans: Nolensville MTP

Implementation: Plan, design, and program as county improvement in coordination with municipal projects and future developer initiatives

Right-of-Way: 72'

Cost: $7,410,000

Some primary county roads have been identified as in need of safety improvements which are not capacity related or identified in other jurisdictional plans. Generally, the roads identified for these safety improvements are those which have no shoulders, travel lane widths of less than 11 feet, and an average daily traffic volume of more than 1,000 vehicles per day. The recommended improvements would consist of adding a minimum two-foot stabilized shoulder and, where more complete construction could be accomplished without major property impacts, widening the travel lanes to at least 11 feet wide. Contextual sensitivity will be stressed in implementing these roadway improvements. Safety improvements have been identified for the following road segments:

Carothers Road from South Carothers Parkway to Arno Road

Del Rio Pike from Old Hillsboro Road to Cotton Lane

Old Natchez Trace from Sneed Road to Old Hillsboro Road

N Berrys Chapel Road from Hidden Valley Road to Holly Tree Gap Road

Mobleys Cut Road from Leipers Creek Road to Johnson Hollow Road

Johnson Hollow Road from Mobleys Cut Road to Carters Creek Pike

Popes Chapel Road from Carters Creek Pike to Sugar Ridge Road

County Roadways not in the Major Thoroughfare Plan

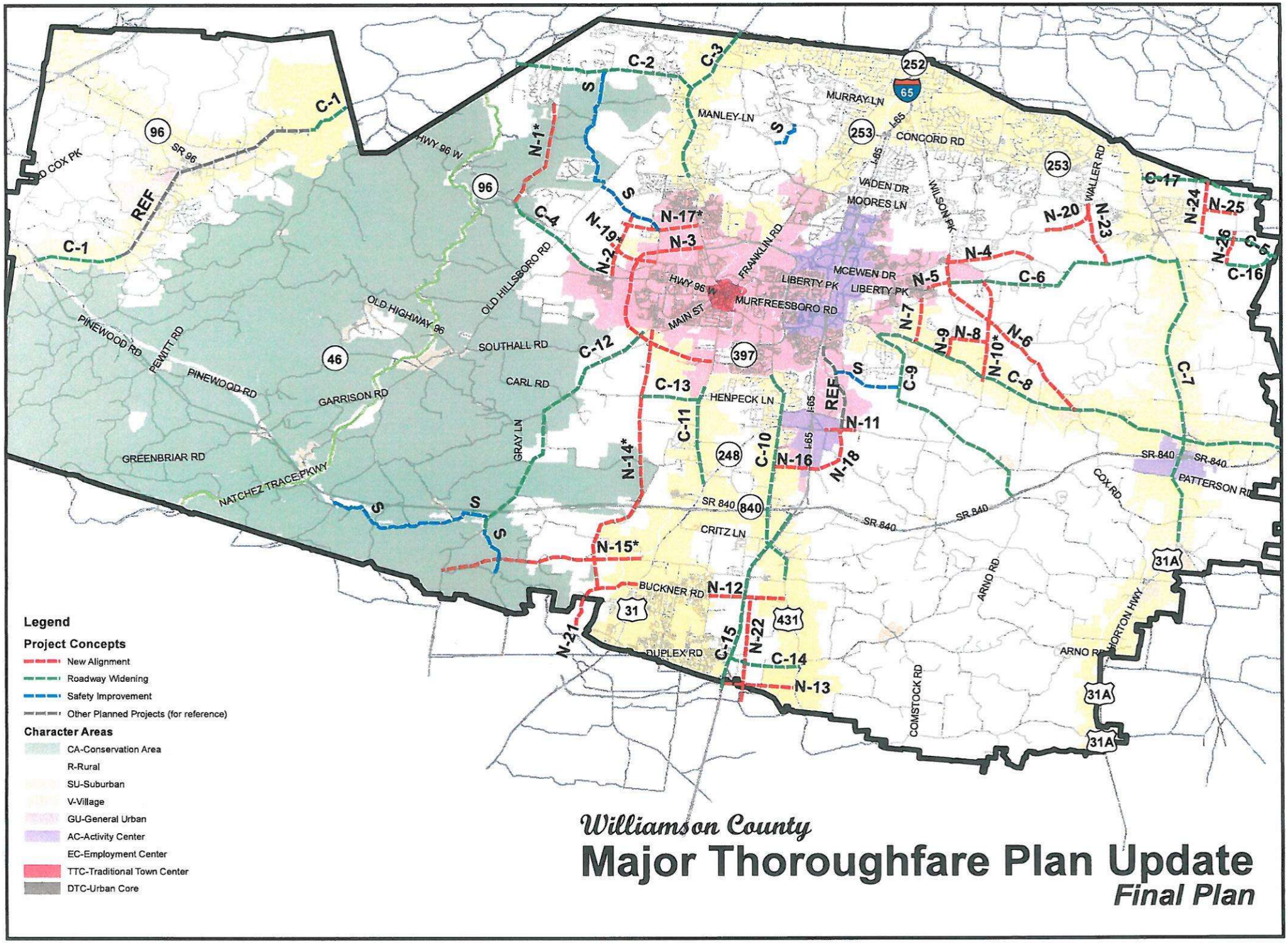
Other functionally classified roadways not included in the Major Thoroughfare Plan list of projects have minimum right-of-way requirements. The right-of-way widths listed below are applicable when improvements to or development along a roadway not included in the Major Thoroughfare Plan occurs. The widths mentioned are total right-of-way, and will generally be measured symmetrically from the existing roadway centerline.

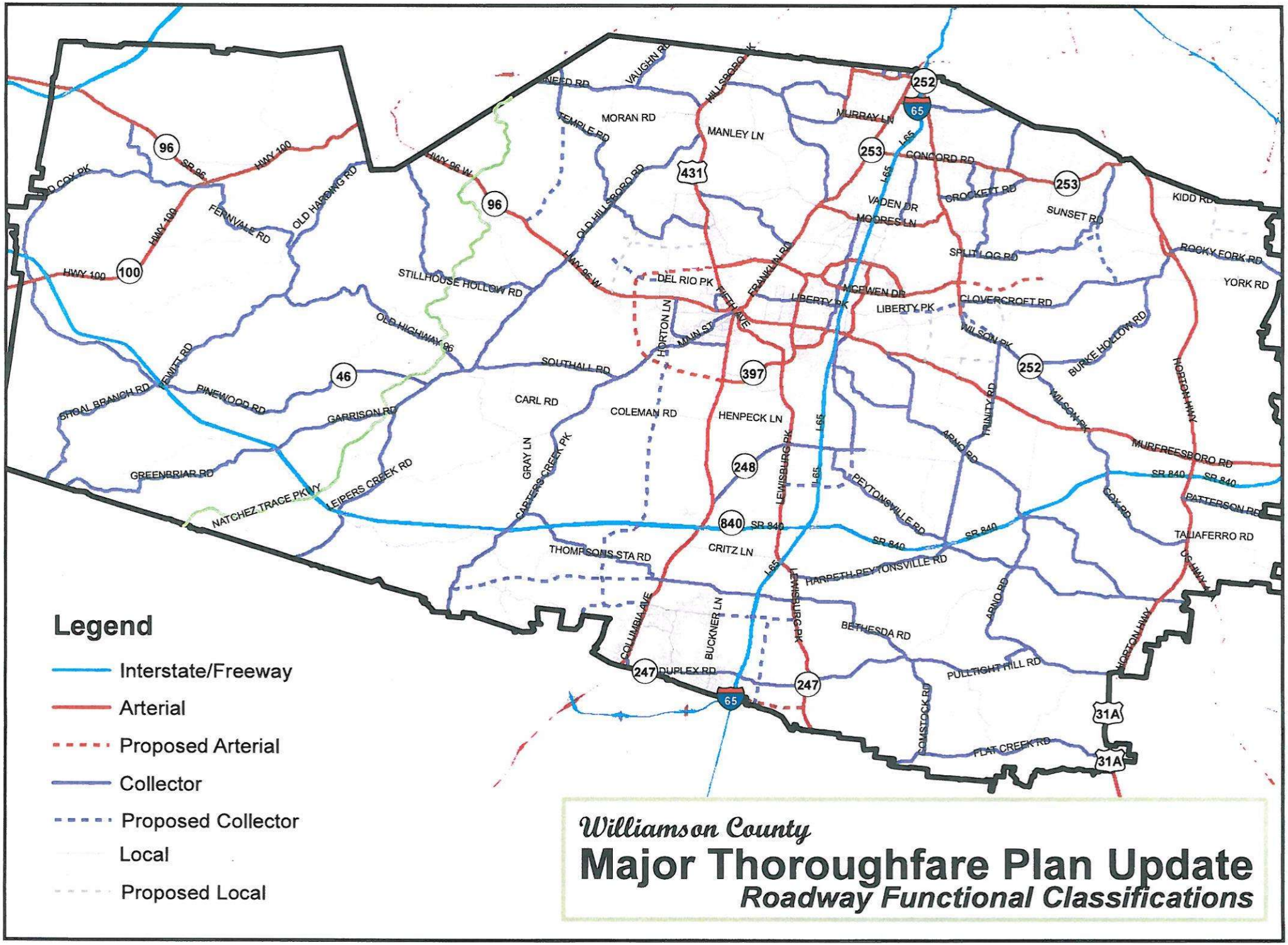
Arterial: 96'

Collector: 60'

Safety: 50'

Local: 50'


Legend
Project Concepts
New Alignment
Roadway Widening
Safety Improvement
Other Planned Projects (for reference)
Character Areas
CA-Conservation Area
R-Rural
SU-Suburban
V-Village
GU-General Urban
AC-Activity Center
EC-Employment Center
TTC-Traditional Town Center
DTC-Urban Core
Williamson County
Major Thoroughfare Plan Update
Final Plan


Legend
Interstate/Freeway
Arterial
Proposed Arterial
Collector
Proposed Collector
Local
Proposed Local
Williamson County
Major Thoroughfare Plan Update
Roadway Functional Classifications
MORAN RD
MANLEY LN
MURRAY LN
CONCORD RD
CROCKETT RD
VADEN DR
MOORES LN
SUNSET RD
KIDD RD
SPLIT LOG RD
ROCKY FORK RD
YORK RD
DEL RIO PK
MCEWEN DR
LIBERTY PK
CLOVERCROFT RD
WILSON PK
BURKE HOLLOW RD
HORTON HWY
MURFREESBORO RD
SR 840
PATTERSON RD
TALLAFERRO RD
US HWY 31
STILLHOUSE HOLLOW RD
OLD HIGHWAY 96
SOUTHALL RD
CARL RD
COLEMAN RD
HENPECK LN
GRAY LN
CARTERS CREEK PK
LEIPERS CREEK RD
NATCHEZ TRACE PKWY
GREENBRIAR RD
PINEWOOD RD
GARRISON RD
STOAL BRANCH RD
FEWELL RD
FERNVALE RD
OLD HARDING RD
HWY 100
HWY 96 W
OLD HILLSBORO RD
TEMPLE RD
VAUGHN RD
HILLSBORO PK
FRANKLIN RD
MAIN ST
HORTON LN
LEWISBURG PK
PEYTONSVILLE RD
ARNO RD
TRINITY RD
COX RD
CRITZ LN
THOMPSONS STA RD
HARPETH PEYTONSVILLE RD
BETHESDA RD
PULLIGHT HILL RD
COMSTOCK RD
FLAT CREEK RD
COLUMBIA AVE
BUCKNER LN
DUPLEX RD
I-65
252
253
431
96
100
46
397
248
840
247
31A

TRANSPORTATION

Assessment of the Existing Transportation System

The transportation assessment portion of the Spring Hill Comprehensive Plan provides an overview of the current transportation network within Spring Hill's Urban Growth Boundary (UGB), or the study area. All forms of transportation, including highway, air, rail, and bicycle/pedestrian systems were evaluated to assess the adequacy of the existing transportation network to serve future travel demands. The safety of the transportation system was also a main consideration while assessing opportunities for improvements to transportation in the city.

EXISTING STREET AND HIGHWAY SYSTEM

This section provides an overview of the existing roadway network in Spring Hill, including a discussion of functional classifications, traffic volume, levels of service, and crash data. Traffic volumes obtained from TDOT count stations within the study area and the most recent traffic counts from the City of Spring Hill provided the basis for the existing conditions analysis. Evaluating the existing condition of the City's roadway network helped identify roadway deficiencies and transportation projects to address congestion, safety, and other travel related issues.

The existing conditions analysis was conducted for all functionally classified routes within the city's UGB. Some of the more frequently traveled routes in the study area include I-65, SR 396 (Saturn Parkway), US 31, US 431 (Lewisburg Pike), and SR 247 (Duplex Road). All of these routes provide connections that promote the movement of people, goods, and services between Spring Hill and the rest of the region.

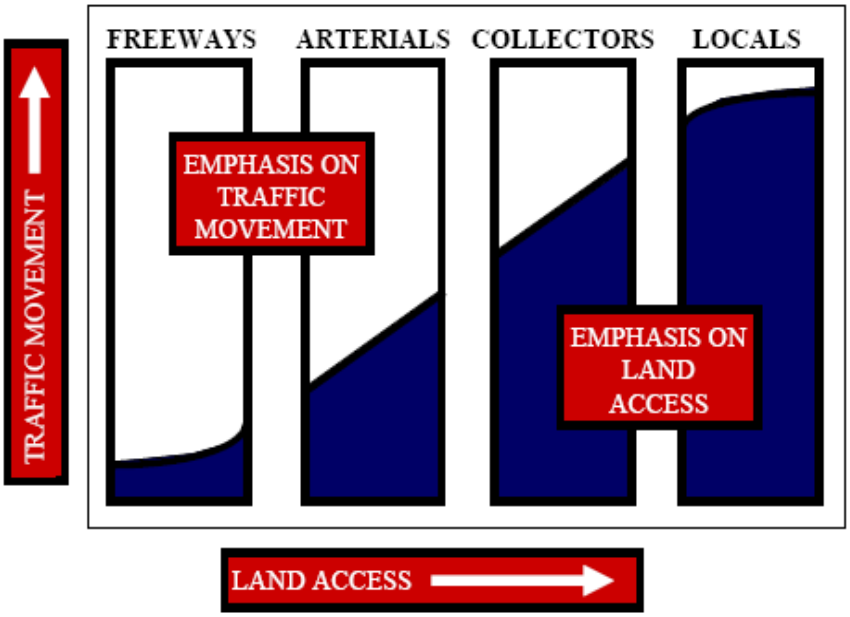
Functional Classification

The existing roadway facilities in Spring Hill are each classified according to the amount of access and mobility they provide, or how the road *functions*. According to the Federal Highway Administration (FHWA), functional classification is the process by which streets and highways are grouped into classes, or systems, according to the character of service they are intended to provide. It is a hierarchical organization of streets and highways that facilitates the safe and efficient operation of vehicles along different types of facilities. It then becomes necessary to determine how travel can be channeled within the transportation network in a logical and efficient manner using these facilities. Functional classification defines the nature of this channelization process by defining the role that any particular road or street should play in serving the flow of trips through the highway network.[1]

Figure 4-1 below shows schematically how various street classifications relate to each other in terms of movement and access. As land access increases, traffic movement decreases on the lower classified roadways and vice versa – as land access decreases, traffic movement increases along the higher classified roads.

[1] http://www.fhwa.dot.gov/planning/fctoc.htm

Figure 4-1: Traffic Movement and Land Access



The federal functional classification of existing facilities is required in order for a roadway to be eligible for federal funding under current transportation legislation. The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) states that a roadway must be "functionally classified" as a collector or higher to be eligible for federal funds designated for roadway improvement projects. The functional classification of existing facilities is also significant because it specifies the desired amount of access control, or locations where vehicles can enter or leave a roadway. When there is no access control, intersecting roads or driveways may connect to the mainline at any point. Typically, local roads have no access control. With partial control of access there is minimum spacing of access locations. With full access control, connections are only allowed at major crossroads – such as interchanges along an interstate. Full or partial control of access helps reduce traffic conflicts.[2] Following is a brief description of functional classes of roadways and examples of each in Spring Hill.

Freeway

A divided arterial highway for through traffic, with full access control, high speeds, and grade separation at major intersections. I-65 and SR 396 (Saturn Parkway) function as freeways in Spring Hill.

Arterial

A class of road serving major traffic movements (high-speed, high volume) for travel between main points of interest. Arterials emphasize a high level of mobility for through movement. While they may provide access to abutting land, their primary function is to serve traffic moving through the area. Therefore, arterials require a much higher level of access control than collectors or local streets. US 31 and US 431 are examples of arterials in the study area.

Collector

In rural areas, a route that serves intra-county rather than statewide travel. In urban areas, a street that provides direct access to neighborhoods and arterials. As their name suggests, collector roadways have the primary purpose of collecting traffic from local roadways and distributing it to its destination or to an arterial roadway. Collectors offer a compromise between mobility and access. Duplex Road, Buckner Lane, and Buckner Road are examples of Spring Hill collectors.

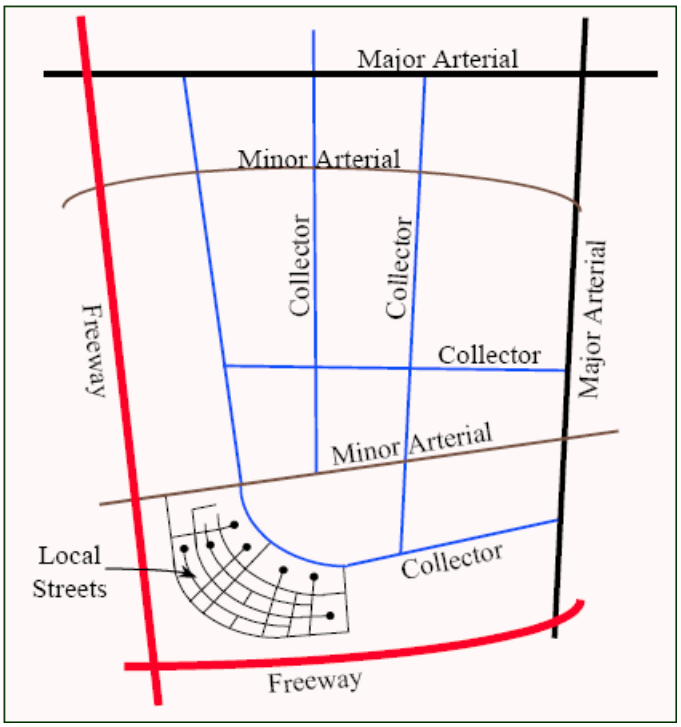
[2] http://www.tdot.state.tn.us/sr475/glossary.htm

Local Street

Local streets are not considered major roadways. Their primary function is to provide direct access to land with little emphasis on the movement of through traffic. Belshire Way, Denning Lane, and Derryberry Lane are examples of local streets in Spring Hill.

This plan focuses on Spring Hill's functionally classified roads. These roadways have the greatest impact on the transportation system, as they are primarily intended to move traffic and have less emphasis on land access than local roads. In contrast, local roads are primarily intended to provide access to land as illustrated above. As indicated in Figure 4-2 below, a functional roadway system facilitates a progressive transition in the flow of traffic from the provision of access to the provision of movement. Freeways and arterial facilities primarily provide the function of moving vehicles while collector and local streets concentrate more on providing access to property.

Figure 4-2: Roadway Functional Class System

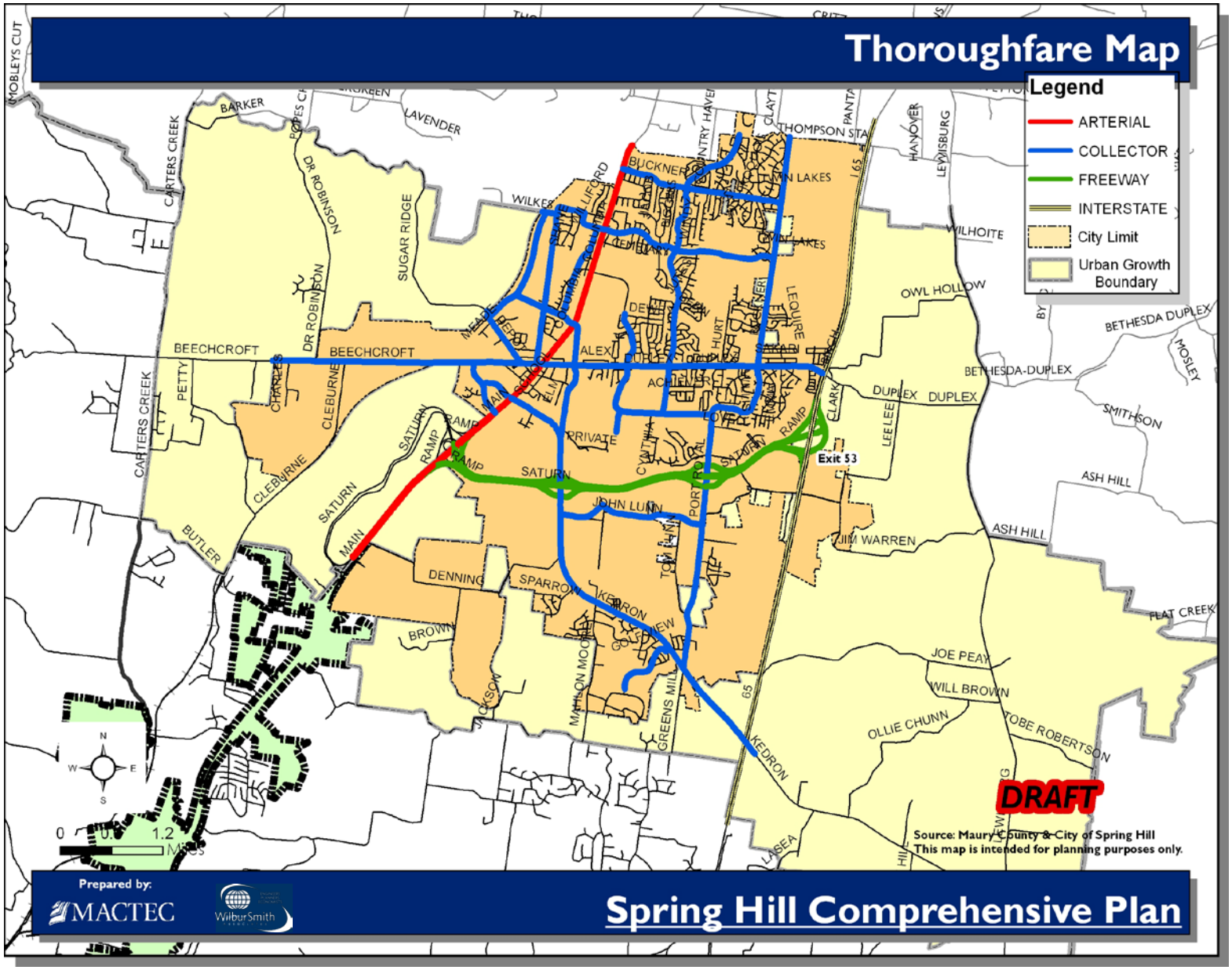


A list of Spring Hill's existing roadway functional class and their existing number of lanes is provided in Table 4-1. Figure 4-3 illustrates Spring Hill's functionally classified roadways.

Table 4-1: Existing Roadway Functional Class & Number of Lanes

SPRING HILL ROADS		
ROUTE	**FUNCITONAL CLASS**	**NUMBER OF LANES**
I-65	Interstate	4
SR 396 / Saturn Parkway	Freeway	4
SR 6 / US Hwy 31 / Main Street / Columbia Pike	Arterial	3 Lanes from county Line to Kedron Road
SR 6 / US Hwy 31 / Main Street / Columbia Pike	Arterial	4 Lanes from Kedron Road to SR 99/US 412
SR 247 / Beechcroft Road / Duplex Road	Collector	2
Buckner Lane	Collector	2
Buckner Road	Collector	2
Campbell Station Parkway / Stewart Campbell Point	Collector	2
Commonwealth Drive	Collector	2
Depot Street	Collector	2
John Lunn Road / Royal Park Boulevard	Collector	2
Kedron Parkway	Collector	2
Meadow View Drive	Collector	2
New Port Royal Road	Collector	2
Old Kedron Road	Collector	2
Old Military Road	Collector	2
Port Royal Road	Collector	4
Ray Williams Drive	Collector	2
Stephen Yokich Parkway / Town Center Parkway	Collector	2
Sunflower Drive	Collector	2
Wilkes Lane	Collector	2

Figure 4-3: Existing Roadway Functional Class Map



Traffic Volumes

Spring Hill's traffic history is provided by the Tennessee Department of Transportation (TDOT) and the City of Spring Hill's Public Works Department. Each year, TDOT publishes Annual Average Daily Traffic (AADT) counts for every county in the state of Tennessee. The counts are supplied by traffic count stations positioned along roadways throughout the state. The location of each station is determined by TDOT. There are currently 19 TDOT traffic counting stations located in the Spring Hill study area with traffic data through 2008. The City also collects traffic counts for 17 different locations throughout Spring Hill. The city's traffic data is available from 2003 through August 2009. Tables 4-6 and 4-7 list each count station within the study area and its respective traffic counts.

Spring Hill and TDOT traffic counts indicate that Interstate 65, Saturn Parkway, and SR-6/US-31 are the most traveled roadways in Spring Hill. Interstate 65 travels north and south through the eastern portion of the study area and connects Spring Hill to the cities of Franklin and Nashville, Tennessee to the north and Columbia, Tennessee to the south. Saturn Parkway provides an east-west connection from I-65 to SR-6/US-31, and SR-6/US-31 provides a north-south connection from the City of Columbia to the City of Franklin. Buckner Road, Kedron Road, and Port Royal Road are also heavily traveled.

The traffic count tables in the appendix also show the percentage of growth in traffic each year for all count stations. A summary of the roads that have seen the greatest increases and decreases in traffic are presented in Tables 4-2 and 4-3 below. Again, some stations have older data available than other locations. As Table 4-2 indicates, Port Royal Road, Kedron Road, and Jim Warren Road have seen the greatest increases in traffic in the last few years with 30.4 and 26 percent average annual growth rates, respectively. US 31 and SR 247 (Beechcroft Road and Duplex Road) have also seen large increases in traffic from 2000 to 2008.

Table 4-3 lists the roads that have seen the greatest decreases in traffic. While Interstate 65, Saturn Parkway, and Kedron Road experience significant amounts of daily traffic, the amount of traffic these routes experience has remained consistent and even decreased from 2000 to 2008 in some instances.

Table 4-2: Top 10 Traffic Growth Rates

Station Number	Route	Location	Annual Average Daily Traffic Volumes (vehicles per day) &Annual Traffic Growth Rates (%)										Avg. Annual Traffic Growth Rate (%)
			2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	
			-	59.7%	-7.3%	32.2%	6.3%	20.0%	13.1%	-	-	-	30.4%
SH Count		PORT ROYAL ROAD SOUTH OF HAYNES CROSSING	12522	7840	8457	6395	6018	5013	4432	-	-	-	
			-	-3.0%	56.8%	-	-	-	-	-	-	-	26.0%
SH Count		KEDRON ROAD 1 SOUTH OF PORT ROYAL	3414	3521	2245	-	-	-	-	-	-	-	
			-	26.0%	-	-	-	-	-	-	-	-	26.0%
SH Count		JIM WARREN ROAD @ PORT ROYAL	6899	5474	-	-	-	-	-	-	-	-	
			-	24.1%	12.0%	21.8%	10.4%	8.3%	19.0%	-	-	-	23.5%
SH Count		PORT ROYAL 1 @ WATER PLANT	4242	3419	3052	2506	2269	2095	1760	-	-	-	
			-	-	3.00%	9.1%	3.0%	10.8%	73.2%	-14.1%	16.7%	24.0%	22.0%
000010	SR247	DUPLEX ROAD EAST OF SPRING HILL	-	6681	6681	6126	5948	5369	3100	3607	3091	2493	
			-	-	-1.30%	14.7%	9.6%	62.1%	4.6%	4.5%	5.2%	1.3%	16.8%
000170	01907	KEDRON ROAD NEAR WILLIAMSON CO LINE	-	5934	6010	5239	4781	2950	2819	2697	2564	2531	
			-		-2.90%	8.6%	-4.1%	96.2%	11.3%	-3.8%	-2.7%	12.3%	16.5%
000006	SR247	BEECHCROFT - SPRING HILL	-	4591	4729	4353	4541	2314	2079	2162	2222	1978	
			-		-27.40%	35.6%	5.3%	96.1%	3.0%	16.4%	14.7%	-19.6%	15.6%
000126	SR247	DUPLEX ROAD NEAR MAURY CO LINE	-	4647	6399	4718	4482	2286	2219	1906	1662	2067	
			-	25.0%	10.3%	-5.6%	30.5%	6.1%	3.4%	-	-	-	14.4%
SH Count		DUPLEX ROAD @ CHAPMANS RETREAT	5222	4177	3788	4014	3077	2899	2805	-	-	-	
			-	-	-3.50%	8.8%	78.8%	4.7%	0.9%	11.5%	-2.0%	-1.1%	14.3%
000116	SR247	NEAR MARSHALL CO LINE	-	2330	2414	2219	1241	1185	1174	1053	1075	1087	

Source: Tennessee Department of Transportation and City of Spring Hill

Table 4-3: Bottom 5 Traffic Growth Rates

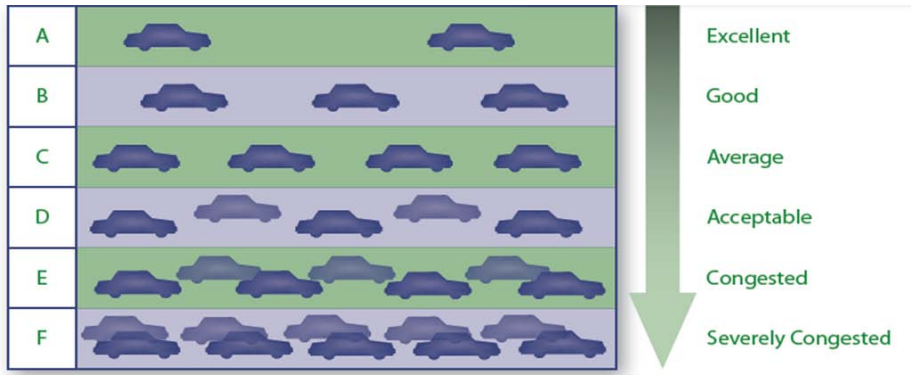
Station Number	Route	Location	Annual Average Daily Traffic Volumes (vehicles per day) &Annual Traffic Growth Rates (%)										Avg. Annual Traffic Growth Rate (%)
			2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	
			-	-4.7%	13.4%	-10.8%	-	-	-	-	-	-	-1.2%
SH Count		DENNING LANE AT KEDRON ROAD	242	254	224	251	-	-	-	-	-	-	
			-	-	-18.00%	-1.9%	6.3%	-2.8%	4.8%	0.5%	-7.3%	13.2%	-1.0%
000195	I0065	I-65 - SOUTH OF SATURN PKWY	-	24794	30221	30795	28970	29809	28433	28301	30539	26986	
			-	12.7%	-11.3%	-10.8%	11.3%	6.8%	-5.9%	-	-	-	-0.1%
SH Count		KEDRON ROAD AT ROYAL PARK ROAD	9850	8741	9860	11054	9936	9303	9885	-	-	-	
			-	-	-10.30%	7.4%	-7.7%	8.8%	3.6%	3.8%	-	-	0.7%
000237		KEDRON RD	-	1854	2067	1924	2085	1916	1849	1782	-	-	
			-	-	-16.60%	3.3%	8.2%	-1.1%	3.7%	3.4%	11.8%	2.0%	1.6%
000196	SR396	SATURN PKWY - E. OF KEDRON RD.	-	23877	28631	27704	25594	25880	24946	24135	21580	21152	
			-	-	14.50%	5.4%	-11.6%	10.9%	4.4%	-6.8%	-5.2%	9.0%	2.3%
000007	SR006	U.S. 31 - SOUTHWEST SPRING HILL	-	17634	15407	14621	16544	14920	14298	15343	16180	14847	
			-	-	3.60%	0.9%	0.5%	5.4%	2.3%	6.8%	0.3%	-	3.1%
000222	SR396	SATURN PKWY - E. OF PORT ROYAL RD.	-	29233	28212	27972	27826	26389	25792	24151	24076	-	
			-	-	-10.00%	5.8%	8.1%	-4.5%	5.7%	7.4%	10.6%	-	3.4%
000202	I0065	SOUTH OF SR-840	-	50001	55582	52517	48572	50836	48087	44753	40469	-	
			-	-31.1%	4.0%	29.1%	11.7%	1.8%	18.6%	-	-	-	4.1%
SH Count		DUPLEX ROAD - WEST OF MILES JOHNSON	5963	8655	8319	6446	5773	5671	4781	-	-	-	
			-	-	-4.90%	13.9%	0.6%	-1.6%	3.0%	13.8%	15.3%	-8.3%	4.1%
000072	SR106	U.S. 431 - SOUTH OF DUPLEX ROAD NEAR MARSHALL CO LINE	-	3878	4076	3579	3559	3618	3513	3087	2677	2919	
			-	-10.3%	33.8%	-6.0%	-	-	-	-	-	-	4.2%
SH Count		U.S. 31 - SOUTH MAIN @ TARGET SOUTH	9445	10534	7874	8378	-	-	-	-	-	-	

Source: Tennessee Department of Transportation and City of Spring Hill

Level of Service

Level of Service (LOS) is a term that is used to describe how well traffic operates on a roadway segment or at an intersection, and is based on the roadway's capacity and traffic volumes. Roadway capacity is defined by the functional class and number of lanes on a particular roadway. Volume is the actual number of vehicles on a roadway. LOS utilizes a letter system to indicate how well a roadway operates with letters ranging from "A" to "F" – "A" being excellent and "F" failing (see diagram). LOS C is generally acceptable for typical roadway function while LOS D is typically considered to be the minimum acceptable LOS in an urbanized area. Figure 4-4 is a graphic depiction of the Level of Service Concept:

Figure 4-4: Roadway Level of Service Concept



The Highway Capacity Manual generally describes each LOS as follows:

- A=Free flow
- B=Reasonably free flow
- C=Stable flow
- D=Approaching unstable flow
- E=Unstable flow
- F=Forced or breakdown flow

For comparison purposes, Table 4-4 lists the typical traffic volumes that can be accommodated for each LOS based on the roadway functional classification and number of travel lanes.

Table 4-4: Level of Service Threshold by Functional Classification

Typical Daily Service Volumes Related to LOS					
Road Type	**LOS A**	**LOS B**	**LOS C**	**LOS D**	**LOS E**
4 Lane Freeway	31,700	45,300	56,200	68,000	90,700
2 Lane Arterial Urban	6,500	9,400	11,600	14,000	18,700
3 Lane Arterial Urban	8,200	11,600	14,400	17,500	23,300
4 Lane Arterial Urban	10,700	15,400	19,000	23,000	30,700
5 Lane Arterial Urban	12,400	17,600	21,900	26,500	35,300
2 Lane Arterial Rural	8,400	12,000	14,900	18,000	24,000
3 Lane Arterial Rural	10,500	15,000	18,600	22,500	30,000
2 Lane Collector Urban	5,100	7,400	9,100	11,000	14,700

Typical Daily Service Volumes Related to LOS					
Road Type	LOS A	LOS B	LOS C	LOS D	LOS E
3 Lane Collector Urban	6,400	9,200	11,300	13,700	18,300
4 Lane Collector Urban	8,400	12,000	14,900	18,000	24,000
5 Lane Collector Urban	10,700	15,400	19,000	23,000	30,700
2 Lane Collector Rural	6,500	9,400	11,600	14,000	18,700
3 Lane Collector Rural	8,200	11,600	14,500	17,500	23,300

Most of Spring Hill's roadways are operating at a LOS C or better with the exception of US 31 at count station nine near the Duplex Road intersection, which operates at a level of service E. Buckner Road at Main Street and Kedron Road at Port Royal Road operate at levels of service D. A portion of US 31 at count station 7, just north of the Saturn Parkway interchange, I-65 north of the Duplex Road intersection, Kedron Road at the Battlefield, and Port Royal Road south of Hayne's Crossing operate at LOS C. All other roadways operate at LOS B and A. While LOS C is considered acceptable, the segments of US 31 operating at LOS C and worse are a concern as traffic continues to increase almost daily with the completion of new housing and commercial developments. Table 4-5 below provides current LOS data for each count station in the study area.

Table 4-5: Existing Level of Service Data

EXISTING MAURY COUNTY LEVELS OF SERVICE				
Route	TDOT Count Station	2008 AADT	2009 AADT	LOS
I-65	195	24,794	-	A
I-65	202	50,001	-	C
Kedron Rd	237	1,854	-	A
Kedron Rd	90	7,224	-	B
Kedron Rd	170	5,934	-	B
SR 247/Beechcroft Rd/Duplex Rd	6	4,591	-	A
SR 247/Beechcroft Rd/Duplex Rd	10	6,881	-	B
SR 247/Beechcroft Rd/Duplex Rd	116	2,330	-	A
SR 247/Beechcroft Rd/Duplex Rd	126	4,647	-	A
SR 247/Beechcroft Rd/Duplex Rd	169	2,387	-	A
SR 396/Saturn Parkway	196	23,877	-	A
SR 396/Saturn Parkway	222	29,233	-	A
SR 6/US Hwy 31/Main St/Columbia Pk	7	17,634	-	C
SR 6/US Hwy 31/Main St/Columbia Pk	9	19,258	-	E
SR 106/US Hwy 431/Lewisburg Pk	65 (North of Duplex)	5,168	-	A
SR 106/US Hwy 431/Lewisburg Pk	72 (South of Duplex)	3,878	-	A
SR 106/US Hwy 431/Lewisburg Pk	221	3,391	-	A
SR 106/US Hwy 431/Lewisburg Pk	236	3,657	-	A
SR 246/Carters Creek Pk	144	2,378	-	A
SR 246/Carters Creek Pk	4	2,329	-	A
Beechcroft Road at Railroad	-	-	5,033	A
Buckner Lane at Cameron Farms	-	-	6,755	B
Buckner Road at Main Street	-	-	10,403	D
Denning Ln at Kedron	-	-	242	-
Duplex Road at Chapman Retreat	-	-	5,222	B

EXISTING MAURY COUNTY LEVELS OF SERVICE				
Route	TDOT Count Station	2008 AADT	2009 AADT	LOS
Duplex Road west of Miles Johnson Pkwy	-	-	5,963	B
Greens Mill Road at Kedron Road	-	-	3,261	-
Jim Warren Road at Port Royal	-	-	6,899	-
Kedron Road at Battlefield	-	-	7,931	C
Kedron Road at Royal Park Road	-	-	9,850	D
Kedron Road at Water Treatment Plant	-	-	3,784	A
Kedron Road south of Port Royal	-	-	3,414	A
Mahlon Moore at Kedron Road	-	-	3,033	-
North Main at Target north	-	-	9,926	B
Miles Johnson Pkwy south of Duplex	-	-	1,723	-
Miles Johnson Pkwy north of Duplex	-	-	2,282	-
Miles Johnson Pkwy at Main Street	-	-	2,869	-
Port Royal south of Hayne's Crossing	-	-	12,522	C
Port Royal at Water Treatment Plant	-	-	4,242	A
South Main at Target south	-	-	9,445	B

Safety

Safety is a primary goal of all modes of transportation. The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) promotes more efficient and effective Federal surface transportation programs throughout the United States and established a new core Highway Safety Improvement Program (HSIP) that is structured and funded to make significant progress in reducing highway fatalities, incapacitating injuries, and crashes in general. Every year TDOT develops lists to help identify potential improvement projects that meet the intent of the HSIP requirements. One of these lists is an inventory of High Risk Rural Roads (HRRR). The HRRR list identifies sections of rural roads that are functionally classified as local, minor collector, or major collector that have experienced high numbers of severe crashes. HRRR improvements are generally lower cost projects, some of which can be repeated along relatively long sections of highway. There are no roadways in Spring Hill listed on the 2007 HRRR list.

AIR/RAIL

There is no air transport in the Spring Hill study area, and rail service in Spring Hill is strictly for freight transportation and not used for public transportation.

CSX Transportation is the only Class I railroad within Spring Hill. There is one primary rail yard in Spring Hill and it is located at the General Motors plant. CSX has a mainline rail that travels south from Nashville, paralleling US 31, and ends in Columbia, TN. At that point it connects to a short line operated by Tennessee Southern Railroad (TSRR). TSRR operates two tracks that travel south from Columbia. The western line leads from Columbia to a port facility in Florence, Alabama. The eastern line leads from Columbia to Pulaski, Tennessee.

Maury Regional Airport is the closest general aviation airport facility located in Maury County. It is located in Mt. Pleasant so is not within the study area. The airport has two runways, one that is approximately 6,000 feet long by 100 feet wide, and another that is approximately 2,000 feet long by 200 feet wide. It offers charter service for passengers and freight, aircraft maintenance, and car rental and limousine services. There are approximately 30 aircraft based at the airport and an average of nearly 80 aircraft takeoffs and landings per day.

BICYCLE/PEDESTRIAN FACILITIES

Bicycling and walking are becoming increasingly important modes of transportation for the City of Spring Hill as transportation costs continue to rise and alternative modes off transportation become increasingly important. To address this need, this plan is intended to help create a comprehensive, multi-modal strategy that includes bicycling and walking as integral parts of the transportation infrastructure. This section provides policy recommendations to take advantage of the many benefits that bicycling and walking can offer, such as greater mobility, less traffic congestion, cleaner air, and lower transportation costs.

Benefits of Bicycling and Walking

Bicycle and pedestrian facilities are great assets to any community. Not only do they enhance the aesthetics of an area, but they also serve as places where people can exercise, spend time with their family, and congregate to get to know their neighbors. The presence of these facilities alone helps to encourage community activity, which, in turn, enhances the safety and security of the community. In addition to these quality-of-life issues, bicycle and pedestrian facilities help meet some of the community's basic transportation needs. There is a growing population (such as children, senior citizens, the poor, the physically active, and the environmentally concerned) that either cannot or chooses not to drive and must rely on other forms of transportation. Spring Hill's population, in particular, is composed of relatively young residents with 11.4 percent under 5 years of age and 10.9 percent age 25 to 29 years.[3] Sidewalks and bikeways can provide safe, convenient, and free travel options for this population, as well as for the rest of the community. Other benefits of bicycling and walking are outlined below.

Greater Mobility

Every trip, regardless of mode, involves some form of pedestrian travel, whether it is walking from home to the grocery store, walking from a parked vehicle to the grocery store, or walking from the bus stop to the grocery store. Many of these types of trips are made out of necessity, so it is important that all citizens are able to access these essential locations even if they do not own an automobile. In fact, according the 2001 National Household Travel Survey (NHTS) one in 12 U.S. households does not own an automobile, and 12 percent Americans 15 years of age and older cannot, or do not, drive.[4] According the Bureau of Transportation, next to the automobile, bicycling is the second-most preferred form of transportation.[5] Providing safe, convenient, and attractive bicycle and pedestrian facilities provides desirable transportation alternatives to the automobile, thereby encouraging these types of trips and meeting the community's basic transportation needs.

Less Traffic Congestion

Traffic congestion is becoming an increasing concern for most communities. Traffic congestion results when the traffic demand on a street or roadway network is greater than the amount of traffic that that street or roadway network was designed to efficiently carry. In addition to interfering with mobility, traffic congestion results in driver frustration, wasted time, wasted energy, and pollution. Traffic congestion, as well as its negative impacts, can be reduced by incorporating bicycle and pedestrian facilities into the transportation network and by encouraging these alternative modes of travel. Converting a portion of motorized trips to bicycling and walking trips is a very realistic goal, especially when one considers that 40% of all trips are less than two miles in length.[6] This distance represents a ten-minute bike ride or a 30-minute walk for most people.

[3] Source: U.S. Census Bureau, 2005-2007 American Community Survey (http://factfinder.census.gov/servlet/STTable?_bm=y&-geo_id=16000US4770580&-qr_name=ACS_2007_3YR_G00_S0101&-ds_name=ACS_2007_3YR_G00_)
[4] http://www.bicyclinginfo.org/why/benefits_transportation.cfm
[5] http://www.bikeleague.org/resources/why/environment.php
[6] http://www.bikeleague.org/resources/why/environment.php

Cleaner Air

Approximately 60% of the pollution created by automobile emissions happens in the first few minutes of vehicle operation, before pollution control devices can work effectively. Because of this, shorter automobile trips are actually more polluting than longer trips on a per-mile basis. By converting a four mile round trip to bicycling, approximately 15 pounds of pollutants can be kept out of the air. These pollutants, which include carbon dioxide, carbon monoxide, and nitrogen oxides, are contributors to respiratory problems, cardiovascular problems, smog, and acid rain.[7]

Lower Transportation Costs

Owning and maintaining an automobile can be very expensive. According to the American Automobile Association (AAA, Your Driving Costs), the average cost of operating a sedan for one year is about $7,800. In contrast, the cost of operating a bicycle for one year is only about $120 (American League of Bicyclists), and walking is free.[8] By converting some automobile trips to bicycling and walking, families can eliminate the need for a car or, at least, a second car.

In addition to saving families money, bicycling and walking can also reduce transportation-related costs for communities. Bicycling and walking trips cause little, if any, wear and tear on roadways, and the infrastructure supporting these travel modes can usually be provided with less impact and at a lower cost than infrastructure for motorized travel. Bicycling and walking also require less space per trip than motorized travel. Converting automobile trips to bicycling and walking can reduce traffic congestion and postpone, or even eliminate, the need for roadway widening and construction projects.

Current Bicycle and Pedestrian Facilities and Planning Efforts

Currently, Spring Hill's bicycle and pedestrian facilities consist of sidewalks, multi-use trails in the City's parks and neighborhoods, and the roadway network. Each of these facility types are briefly described below.

Existing Sidewalks

Spring Hill's *Subdivision Regulations* require that five-foot wide sidewalks be constructed on at least one side of new streets that have 50-foot wide right-of-ways and on both sides of streets that have right-of-ways wider than 50 feet. This practice has resulted in sidewalks being constructed on at least one side of most streets in the City's newer developments. Because the sidewalks are localized within the individual developments, as opposed to connecting to other sidewalk systems, the existing sidewalk network primarily serves recreational users and is primarily intended for pedestrian use. The roadway design guidelines presented in the city's Major Thoroughfare Plan also recommend a five-foot sidewalk for all urban local, collector, and arterial street cross sections. Due to the differences in the traveling speeds of bicyclists and pedestrians, bicyclists should be discouraged from riding on sidewalks.

[7] http://www.bikeleague.org/resources/why/environment.php
[8] http://www.bikeleague.org/resources/why/environment.php

Existing Multi-Use Trails

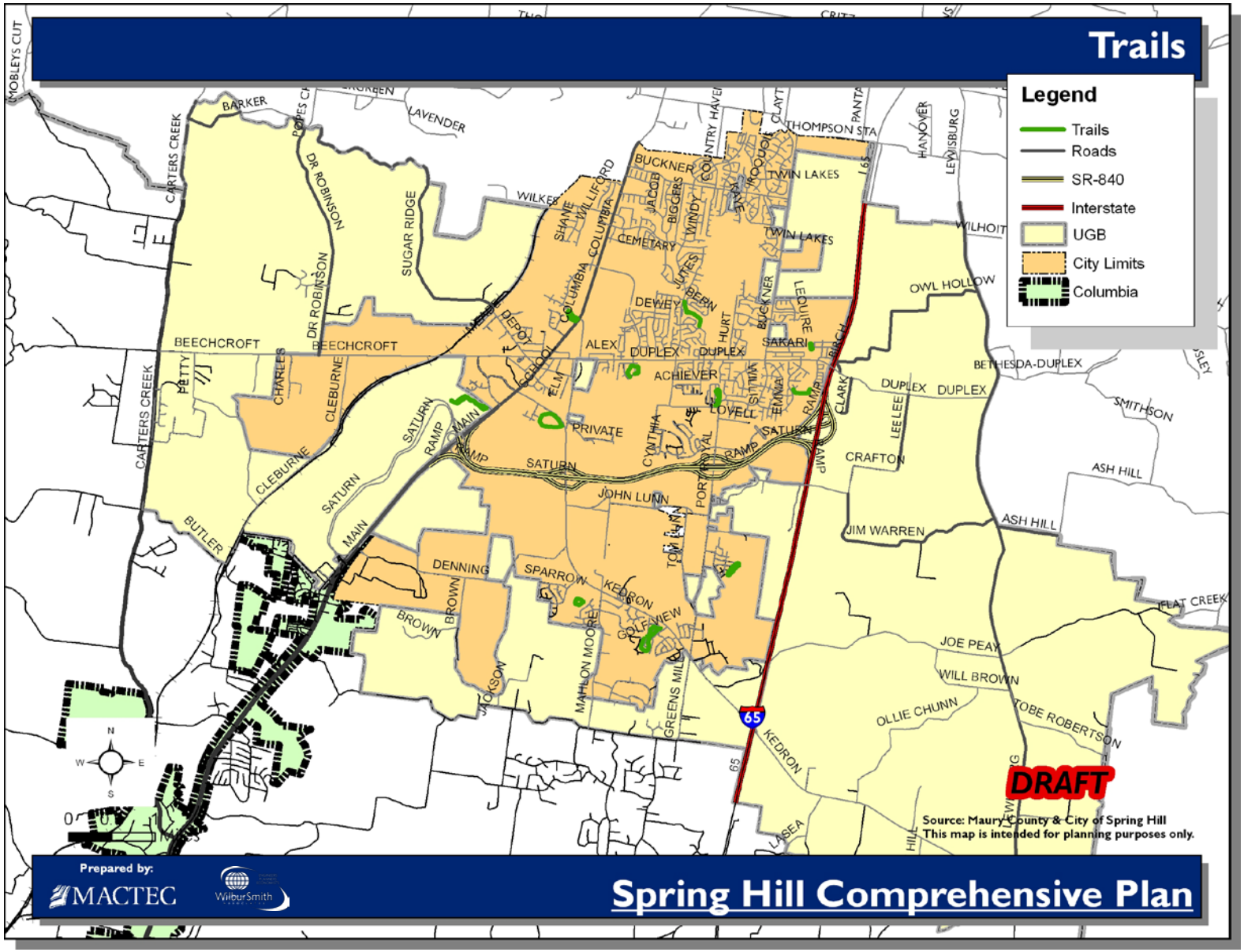
The City of Spring Hill has a significant acreage of parks and open space, and some of these areas include multi-use trails that can be used by bicyclists, pedestrians, and other non-motorized users. Although multi-use trails are excellent for recreational users and novice bicyclists, the City's trails are limited. Also, because the parks are primarily concentrated along US-31 instead of being embedded within the City's residential neighborhoods, many of the trail users must drive to the parks in order to use the trails. This lack of convenience can deter would-be trail users.

Existing Roadway Network

Although the City of Spring Hill does not have any designated on-street bicycle facilities, the area's roadways can provide safe, convenient, and direct routes for bicyclists. Typically, intermediate and expert cyclists prefer riding on roads instead of trails since these routes are more direct and since the movements of roadway users are more predictable than the movements of trail users. However, without dedicated on-road bicycle facilities, motorists may be less likely to share the road, and this safety concern may discourage some people from bicycling for transportation. Also, other safety issues, such as debris on the streets or inlet grates that are not bicycle-friendly, may discourage on-road bicycling.

Because the presence of well-designed bicycle and pedestrian facilities influences the decision to bike or walk for transport, these facilities help stimulate single-mode trips (such as a biking trip or a walking trip) as well as multi-modal trips (such as walking to a transit stop and then riding the bus for the remainder of the trip). As the recommended roadway projects move toward implementation, it is essential that bicycle and pedestrian facilities be considered as part of those projects in order to provide multiple modes of transportation for people in Spring Hill. It is also important that interconnectivity between residential and commercial areas becomes more prominent. The roadway design guidelines presented in the city's Major Thoroughfare Plan provide cross-section recommendations for four-foot wide dedicated bike lanes for urban collectors, rural collectors, and rural arterials.

Figure 4-5: Existing Trails



Bicycle and Pedestrian Needs

As Spring Hill's population continues to grow, so will its need for a connective network of bicycle and pedestrian facilities. To be proactive in this regard, it is recommended that the City of Spring Hill develop a bicycle and pedestrian plan for the area located within the City's Urban Growth Boundary and that this plan be coordinated with neighboring communities and jurisdictions. This plan should focus on providing connections between destinations, such as connecting residential developments, employment centers, retail centers, parks, and other activity centers.

The pedestrian plan should include recommendations for sidewalks and multi-use trails and should also consider providing safe street crossings that are compliant with the *American's with Disabilities Act*. Pedestrian support facilities, such as benches, pedestrian-scaled lighting, water fountains, restrooms, and information kiosks, should also be addressed in the plan, as well as sidewalk design considerations

The bicycle plan should include recommendations for both on-street facilities (such as bike lanes/shoulders, wide outside lanes, and bike routes) and off-street facilities (such as multi-use trails). Bicycle support facilities, such as bike racks and lockers, showers, lighting, and directional signage, should also be addressed in the plan, as well as bikeway design considerations.

It is anticipated that many of the recommended bicycle and pedestrian facilities can either be constructed as part of the road improvement projects that are identified in the City's Major Thoroughfare Plan or by private developers as development occurs within the area. For this reason, it is important that the City of Spring Hill establish a bicycle and pedestrian plan. Without an adopted plan, it may be difficult to incorporate bicycle and pedestrian facilities in future projects. The bicycle and pedestrian plan is intended to be used as a guide by local and state officials, as well as private developers, in planning and implementing sidewalks and bikeways within the City.

Table 4-6: Spring Hill Traffic Counts

TDOT TRAFFIC COUNTS

Station Number	Route	Location	Annual Average Daily Traffic Volumes (vehicles per day) &Annual Traffic Growth Rates (%)									Avg. Annual Traffic Growth Rate (%)
			2008	2007	2006	2005	2004	2003	2002	2001	2000	
				7.30%	10.30%	4.20%	21.80%	3.00%	9.90%	4.70%	-6.10%	11.2%
000004	SR246	NORTH OF JAMESON	2329	2171	1968	1889	1551	1506	1370	1308	1393	
				-2.90%	8.6%	-4.1%	96.2%	11.3%	-3.8%	-2.7%	12.3%	16.5%
000006	SR247	BEECHCROFT - SPRING HILL	4591	4729	4353	4541	2314	2079	2162	2222	1978	
				14.50%	5.4%	-11.6%	10.9%	4.4%	-6.8%	-5.2%	9.0%	2.3%
000007	SR006	SOUTHWEST SPRING HILL	17634	15407	14621	16544	14920	14298	15343	16180	14847	
				2.30%	4.6%	3.0%	31.3%	3.0%	8.0%	-7.0%	29.9%	11.8%
000009	SR006	NORTHEAST SPRING HILL	19258	18832	18007	17483	13311	12924	11965	12862	9902	
				3.00%	9.1%	3.0%	10.8%	73.2%	-14.1%	16.7%	24.0%	22.0%
000010	SR247	EAST OF SPRING HILL	6881	6681	6126	5948	5369	3100	3607	3091	2493	
				2.90%	0.6%	6.7%	10.9%	1.2%	6.5%	-7.3%	17.6%	5.5%
000065	SR106	N OF DUPLEX	5168	5021	4992	4680	4220	4170	3916	4226	3595	
				-4.9%	13.9%	0.6%	-1.6%	3.0%	13.8%	15.3%	-8.3%	4.1%
000072	SR106	SOUTH OF DUPLEX NEAR MARSHALL CO LINE	3878	4076	3579	3559	3618	3513	3087	2677	2919	
				-5.0%	7.9%	27.7%	3.0%	-6.2%	5.3%	6.0%	8.8%	6.7%
000090	01907	SOUTHEAST OF SPRING HILL	7244	7624	7068	5533	5372	5727	5437	5127	4714	
				-3.50%	8.8%	78.8%	4.7%	0.9%	11.5%	-2.0%	-1.1%	14.3%

Station Number	Route	Location	Annual Average Daily Traffic Volumes (vehicles per day) &Annual Traffic Growth Rates (%)									Avg. Annual Traffic Growth Rate (%)
			2008	2007	2006	2005	2004	2003	2002	2001	2000	
000116	SR247	NEAR MARSHALL CO LINE	2330	2414	2219	1241	1185	1174	1053	1075	1087	
				-27.40%	35.6%	5.3%	96.1%	3.0%	16.4%	14.7%	-19.6%	15.6%
000126	SR247	NEAR MAURY CO LINE	4647	6399	4718	4482	2286	2219	1906	1662	2067	
				5.40%	9.5%	6.0%	12.3%	1.7%	8.2%	-36.1%	47.7%	5.3%
000144	SR246	NEAR WILLIAMSON CO LINE	2378	2257	2062	1945	1732	1703	1574	2464	1668	
				11.20%	-8.1%	-0.6%	18.4%	1.0%	11.8%	6.7%	5.6%	6.6%
000169	SR247	NEAR WILLIAMSON CO LINE	2387	2146	2334	2347	1983	1964	1756	1646	1559	
				-1.30%	14.7%	9.6%	62.1%	4.6%	4.5%	5.2%	1.3%	16.8%
000170	01907	NEAR WILLIAMSON CO LINE	5934	6010	5239	4781	2950	2819	2697	2564	2531	
				-18.00%	-1.9%	6.3%	-2.8%	4.8%	0.5%	-7.3%	13.2%	-1.0%
000195	I0065	SOUTH OF SATURN PKWY	24794	30221	30795	28970	29809	28433	28301	30539	26986	
				-16.60%	3.3%	8.2%	-1.1%	3.7%	3.4%	11.8%	2.0%	1.6%
000196	SR396	SATURN PKWY - E. OF KEDRON RD.	23877	28631	27704	25594	25880	24946	24135	21580	21152	
				-10.00%	5.8%	8.1%	-4.5%	5.7%	7.4%	10.6%		3.4%
000202	I0065	SOUTH OF SR-840	50001	55582	52517	48572	50836	48087	44753	40469	0	
				0.233	0.03	0.073	-0.043	-0.108	0.349	-0.051		7.0%
000221		NEAR MARSHALL CO LINE	3391	2750	2670	2489	2601	2915	2161	2276	0	
				3.60%	0.9%	0.5%	5.4%	2.3%	6.8%	0.3%		3.1%
000222	SR396	SATURN PKWY - E. OF PORT ROYAL RD.	29233	28212	27972	27826	26389	25792	24151	24076	0	

Station Number	Route	Location	Annual Average Daily Traffic Volumes (vehicles per day) &Annual Traffic Growth Rates (%)									Avg. Annual Traffic Growth Rate (%)
			2008	2007	2006	2005	2004	2003	2002	2001	2000	
000236		S. OF WILLIAMSON CO		6.80%	22.9%	3.0%	-21.3%	7.3%	24.6%			7.1%
			3657	3423	2785	2704	3435	3202	2569	0	0	
000237		KEDRON RD		-10.30%	7.4%	-7.7%	8.8%	3.6%	3.8%			0.7%
			1854	2067	1924	2085	1916	1849	1782	0	0	

Table 4-7: Spring Hill Traffic Counts

Location		Annual Average Daily Traffic Volumes (vehicles per day) &Annual Traffic Growth Rates (%)							Avg. Annual Traffic Growth Rate (%)
		2009	2008	2007	2006	2005	2004	2003	
BUCKNER LANE @ CAMERON FARMS	Growth rate		27.9%	-27.2%	35.3%	-3.9%	-3.8%	8.6%	4.4%
	ADT	6755	5282	7260	5364	5584	5807	5347	
BUCKNER ROAD @ MAIN STREET	Growth rate		5.2%	29.0%	-10.4%	0.5%	32.3%	0.5%	10.4%
	ADT	10403	9885	7660	8545	8503	6425	6394	
DUPLEX ROAD @ CHAPMANS RETREAT	Growth rate		25.0%	10.3%	-5.6%	30.5%	6.1%	3.4%	14.4%
	ADT	5222	4177	3788	4014	3077	2899	2805	
BEECHCROFT ROAD @ RAILROAD	Growth rate		4.9%	0.5%	19.7%	-6.1%	6.9%	-0.7%	4.3%
	ADT	5033	4800	4778	3992	4251	3977	4005	
KEDRON ROAD @ BATTLEFIELD	Growth rate		-5.2%	25.2%	4.5%	25.0%	2.3%	2.0%	10.3%
	ADT	7931	8367	6681	6392	5115	4999	4899	
KEDRON ROAD @ ROYAL PARK ROAD	Growth rate		12.7%	-11.3%	-10.8%	11.3%	6.8%	-5.9%	-0.1%
	ADT	9850	8741	9860	11054	9936	9303	9885	
KEDRON ROAD 3 @ WATER PLANT	Growth rate		-20.8%	30.0%	3.7%	12.8%	-7.5%	15.6%	4.8%
	ADT	3784	4778	3674	3542	3139	3392	2933	
PORT ROYAL SOUTH OF HAYNES CROSSING	Growth rate		59.7%	-7.3%	32.2%	6.3%	20.0%	13.1%	30.4%
	ADT	12522	7840	8457	6395	6018	5013	4432	
PORT ROYAL 1 @ WATER PLANT	Growth rate		24.1%	12.0%	21.8%	10.4%	8.3%	19.0%	23.5%
	ADT	4242	3419	3052	2506	2269	2095	1760	
MAHLON MOORE @ KEDRON ROAD	Growth rate		-4.0%	0.0%	18.0%	2.8%	1.0%	9.2%	4.7%
	ADT	3033	3161	3162	2680	2607	2580	2363	
DENNING LANE @ KEDRON ROAD	Growth rate		-4.7%	13.4%	-10.8%				-1.2%
	ADT	242	254	224	251				
GREENS MILL ROAD @ KEDRON ROAD	Growth rate		12.2%	6.3%					9.6%
	ADT	3261	2906	2735					

	Growth rate		-3.0%	56.8%					26.0%
KEDRON ROAD 1 SOUTH OF PORT ROYAL	ADT	3414	3521	2245					
	Growth rate		-6.9%	22.9%	5.5%				6.9%
NORTH MAIN @ TARGET NORTH	ADT	9926	10667	8678	8222				
	Growth rate		-10.3%	33.8%	-6.0%				4.2%
SOUTH MAIN @ TARGET SOUTH	ADT	9445	10534	7874	8378				
	Growth rate		26.0%						26.0%
JIM WARREN ROAD @ PORT ROYAL	ADT	6899	5474						
	Growth rate		-31.1%	4.0%	29.1%	11.7%	1.8%	18.6%	4.1%
DUPLEX ROAD WEST OF MILES JOHNSON	ADT	5963	8655	8319	6446	5773	5671	4781	

Future Conditions

This section identifies future levels of service based on capacity analysis and provides proposed improvements for roadways in the Spring Hill study area. Improvements to the city of Spring Hill's transportation system will help to accommodate forthcoming increases in traffic and offer a safe and connected transportation system. The short and long-term transportation improvements presented in this section will work in conjunction with the comprehensive land use plan recommendations to meet the present and future needs for mobility and access as the city continues to grow.

FUTURE STREET AND HIGHWAY SYSTEM

This section provides an overview of the future roadway network for Spring Hill's Urban Growth Boundary (UGB), including a discussion of future traffic volumes and levels of service. Historic traffic volumes obtained from the Tennessee Department of Transportation (TDOT) and the City of Spring Hill provided the basis for the existing conditions analysis and helped identify roadway deficiencies. These deficiencies led to the development of transportation projects meant to address congestion and mobility issues. The future conditions analysis was conducted for all functionally classified roads within the study area.

Future Traffic Volumes

Spring Hill's traffic history is presented in the existing transportation section above and contains traffic counts from 19 TDOT traffic counting stations in the Spring Hill study area and 17 Spring Hill count stations. This information provides the basis for the traffic projections presented in this chapter (see Tables 4-12 and 4-13). Future year traffic volumes were derived out to the year 2030 by assuming an average annual growth rate from 2000 and 2001 to 2030. Annual growth rate values varied between .15 and 2 percent and assume a maximum 2 percent growth rate. Historic traffic counts from 2000 to 2008 are presented in Chapter X. Appendix X provides a traffic projections table that lists all of the count stations in the study area and the respective traffic counts showing the interim years of 2010, 2015, 2020, and 2025. This table also shows the percentage of growth in traffic projected each year to 2030. The roads that are projected to experience the greatest increases in traffic by 2030, based on the projected average annual traffic growth rate, are listed in Table 4-8 below.

SR 247, Port Royal Road, Kedron Road, and Jim Warren Road are expected to experience the greatest increases in traffic by 2030, with expected percent increases of 2.0 percent. This is a similar pattern to the historic traffic counts and suggests continued growth in these areas. Table 4-9 lists the roads that are projected to see the smallest increases in traffic – no routes were expected to see a decrease in traffic. Again, like the historic traffic counts indicate, even though Interstate 65, Saturn Parkway, and Kedron Road experience significant amounts of daily traffic, the amount of traffic these routes are expected to experience is projected to remain consistent through 2030.

Table 4-8: Top 10 Spring Hill Projected Traffic Growth Rates

Station Number	Route	Location	Projected Annual Average Daily Traffic Volumes (vehicles per day)							Projected Avg. Annual Traffic Growth Rate (%)
			2009	2008	2010	2015	2020	2025	2030	
000126	SR 247	NEAR MAURY CO LINE	- -	4647	4835	5338	5894	6507	7184	2.00%
SH Count		PORT ROYAL SOUTH OF HAYNES CROSSING	12522	- -	12772	14102	15570	17190	18979	2.00%
SH Count		PORT ROYAL 1 @ WATER PLANT	4242	- -	4327	4777	5274	5823	6429	2.00%
SH Count		KEDRON ROAD 1 SOUTH OF PORT ROYAL	3414	- -	3482	3845	4245	4687	5174	2.00%
SH Count		JIM WARREN ROAD @ PORT ROYAL	6899	- -	7037	7769	8578	9471	10457	2.00%
000006	SR 247	BEECHCROFT - SPRING HILL	- -	4591	4772	5256	5788	6375	7021	1.95%
000010	SR 247	EAST OF SPRING HILL	- -	6881	7152	7877	8676	9555	10524	1.95%
000116	SR 247	NEAR MARSHALL CO LINE	- -	2330	2422	2667	2938	3235	3563	1.95%
000170	1907	NEAR WILLIAMSON CO LINE	- -	5934	6168	6793	7482	8240	9075	1.95%
SH Count		BUCKNER ROAD @ MAIN STREET	10403	- -	10601	11647	12796	14059	15446	1.90%
SH Count		DUPLEX ROAD @ CHAPMANS RETREAT	5222	- -	5321	5846	6423	7057	7753	1.90%
SH Count		KEDRON ROAD @ BATTLEFIELD	7931	- -	8082	8879	9755	10718	11776	1.90%
000004	SR 246	NORTH OF JAMESON	- -	2329	2418	2657	2919	3207	3524	1.90%

Source: Tennessee Department of Transportation and City of Spring Hill

Table 4-9: Bottom 10 Spring Hill Projected Traffic Growth Rates

Station Number	Route	Location	Projected Annual Average Daily Traffic Volumes (vehicles per day)							Projected Avg. Annual Traffic Growth Rate (%)
			2009	2008	2010	2015	2020	2025	2030	
000195	I-65	SOUTH OF SATURN PKWY	- -	24794	24842	24964	25085	25208	25331	.10%
SH Count		DENNING LANE @ KEDRON ROAD	242	- -	242	244	246	248	250	.15%
000144	SR 246	NEAR WILLIAMSON CO LINE	- -	- 2378	2387	2408	2430	2452	2475	.18%
000222	SR 396	SATURN PKWY - E. OF PORT ROYAL RD.	- -	29233	29934	31761	33700	35757	37939	.19%
SH Count		KEDRON ROAD @ ROYAL PARK ROAD	9850	- -	9869	9967	10065	10164	10264	.20%
000237		KEDRON RD	- -	- 1854	1870	1910	1951	1992	2035	.42%
000007	SR 6	SOUTHWEST SPRING HILL	- -	17634	17852	18409	18983	19574	20185	.62%
000196	SR 396	SATURN PKWY - E. OF KEDRON RD.	- -	23877	24203	25037	25900	26793	27716	.68%
000065	SR 106	N OF DUPLEX	- -	5168	5295	5627	5980	6355	6754	1.22%
000202	I-65	SOUTH OF SR-840	- -	50001	51297	54687	58301	62153	66260	1.29%

Source: Tennessee Department of Transportation and City of Spring Hill

Level of Service

Level of Service (LOS) describes how well traffic operates on a roadway segment or at an intersection, and is based on the roadway's capacity and traffic volumes. Based on 2030 projections, four routes will fall to Level of Service (LOS) D or worse. These are in addition to the routes that will remain at these levels, as discussed in the existing conditions section. Interstate 65, north of the Saturn Parkway interchange, will fall from a current LOS C to LOS D in 2030. A portion of US 31will fall from a current LOS C to LOS D while its current LOS D will fall to LOS F. Kedron Road and Port Royal Road will both fall from a current LOS C to LOS E in 2030. This is all due, in large part, to the growth in the Spring Hill area. In some instances, only a slight increase in traffic is projected, but the current LOS for some routes is nearly LOS D. Therefore, even a small amount of growth in traffic will result in a LOS D. Table 4-10 below provides projected LOS data for all of the functionally classified routes in Spring Hill based on projected traffic counts.

Table 4-10: Projected Level of Service Data

PROJECTED SPRING HILL LEVELS OF SERVICE			
Route	**TDOT Count Station**	**Projected 2030 AADT**	**LOS**
I-65	195	25,331	A
I-65	202	66,260	D
Kedron Rd	237	1,854	A
Kedron Rd	90	10,842	C
Kedron Rd	170	9,075	C
SR 247/Beechcroft Rd/Duplex Rd	6	7,021	B
SR 247/Beechcroft Rd/Duplex Rd	10	6,881	B
SR 247/Beechcroft Rd/Duplex Rd	116	3,563	A
SR 247/Beechcroft Rd/Duplex Rd	126	7,184	B
SR 247/Beechcroft Rd/Duplex Rd	169	3,573	A
SR 396/Saturn Parkway	196	27,716	A
SR 396/Saturn Parkway	222	37,939	B
SR 6/US Hwy 31/Main St/Columbia Pk	7	20,185	D
SR 6/US Hwy 31/Main St/Columbia Pk	9	28,824	F
SR 106/US Hwy 431/Lewisburg Pk	65 (North of Duplex)	6,754	B
SR 106/US Hwy 431/Lewisburg Pk	72 (South of Duplex)	5,804	A
SR 106/US Hwy 431/Lewisburg Pk	221	5,075	A
SR 106/US Hwy 431/Lewisburg Pk	236	5,474	A
SR 246/Carters Creek Pk	144	2,475	A
SR 246/Carters Creek Pk	4	3,524	A
Beechcroft Road at Railroad	-	6,989	B
Buckner Lane at Cameron Farms	-	9,443	B
Buckner Road at Main Street	-	15,446	F
Denning Ln at Kedron	-	250	-
Duplex Road at Chapman Retreat	-	7,753	B
Duplex Road west of Miles Johnson Pkwy	-	8,172	C
Greens Mill Road at Kedron Road	-	4,792	-
Jim Warren Road at Port Royal	-	10,457	-
Kedron Road at Battlefield	-	11,776	E
Kedron Road at Royal Park Road	-	10,264	D

PROJECTED SPRING HILL LEVELS OF SERVICE			
Route	**TDOT Count Station**	**Projected 2030 AADT**	**LOS**
Kedron Road at Water Treatment Plant	-	5,431	B
Kedron Road south of Port Royal	-	5,174	B
Mahlon Moore at Kedron Road	-	4,325	-
North Main at Target north	-	14,587	B
Port Royal south of Hayne's Crossing	-	18,979	E
Port Royal at Water Treatment Plant	-	6,429	A
South Main at Target south	-	13,030	B

By 2030, many of Spring Hill's roadways are still operating at a LOS C or better. However, there are a few routes that are projected to function poorly. The following routes and portions of these routes are projected to operate at LOS D, E, or F by 2030:

- I-65 north of Saturn Parkway
- SR 6/US 31
- Buckner Road at Main Street
- Kedron Road
- Port Royal Road

The next section provides recommendations to improve these poorly operating segments of roadway among other transportation improvements.

Recommended Improvements

The information presented in the existing transportation section of this document helped determine the future year 2030 traffic projections and Level of Service for the roadways within the Spring Hill study area. Using this information along with the existing roadway functional classification and laneage, as well as input from the public charrettes, locations for future improvements have been identified. In addition, each proposed project has been assigned a priority of either long term or short term. Short term projects are projects to be constructed within 0 to 10 years, and long term projects are to be built within a timeframe of 10 or more years. Because the presence of well-designed bicycle and pedestrian facilities influences the decision to bike or walk for transport, it is important that as these recommended roadway projects move toward implementation, that bicycle and pedestrian facilities be considered as part of these projects. Table 4-11 below is a list of proposed transportation projects for Spring Hill. Exhibit X provides a graphical depiction of these projects.

Table 4-11: Spring Hill Proposed Transportation Improvements

Spring Hill Proposed Transportation Improvements						
Project Number	Location	Termini From	Termini To	Length in miles	Recommended Improvement	Priority
1	I-65	SR-840	SR-396/ Saturn Pkwy.	2.68	Widen from 4 to 8 lanes	Short-Term
2	SR-6/US-31	Kedron Rd.	Miles Johnson Pkwy	1.12	Reconstruct existing 3 lanes including streetscape improvements	Short-Term
3	SR-6/US-31	Miles Johnson Pkwy.	Buckner Rd.	1.88	Widen to 4 lane median divided roadway	Short-Term
4	Duplex Rd.	SR-6/US-31	I-65	3.33	Widen from 2 to 3 lanes and correct vertical alignment issues	Short-Term
5	John Lunn Rd./ Royal Park Blvd.	Kedron Rd.	Port Royal Rd.	1.71	Reconstruct to provide 3 lanes and correct horizontal and vertical alignment issues	Short-Term
6	Port Royal Rd.	Saturn Pkwy.	Kedron Rd.	2.13	Widen to provide a standard 2-lane cross-section with turn lanes at warranted locations	Short-Term
7	Buckner Ln.	Duplex Rd.	Thompson Station Rd.	2.65	Widen from 2 to 3 lanes	Short-Term
8	Buckner Rd.	SR-6/US-31	Buckner Ln.	1.94	Widen from 2 to 3 lanes	Short-Term
9	Buckner Rd. Ext.	Buckner Ln.	Just west of I-65	0.86	Extend as 3-lane road	Short-Term
10	Buckner Rd. Ext./ Thompson Station Rd. Connector	Buckner Rd. extension	Thompson Station Rd.	0.75	Construct new 2-lane road with turn lanes at warranted locations	Short-Term
11	Reserves Blvd. Ext.	SR-6/US-31 north of Saturn Pkwy.	Kedron Rd.	1.23	Construct new 3-lane road	Short-Term
12	Common-wealth Dr. Ext. N.	SR-6/US-31	Duplex Rd.	1.45	Extend as 2-lane road with turn lanes at warranted locations	Short-Term
13	Kedron Rd.	SR-6/US-31	Port Royal Rd.	4.12	Widen from 2 to 3 lanes	Short-Term

Spring Hill Proposed Transportation Improvements						
Project Number	Location	Termini From	Termini To	Length in miles	Recommended Improvement	Priority
14	Miles Johnson Pkwy.	SR-6/US-31	Duplex Rd.	0.49	Construct new 2-lane road with turn lanes at warranted locations	Short-Term
15	Commonwealth Dr. Ext. S.	Southern terminus	Port Royal Rd./ Commonwealth Ext. (P.25)	0.84	Extend as 2-lane road with turn lanes at warranted locations	Short-Term
16	Port Royal Rd./ Reserves Pkwy. Conection	Port Royal Rd.	Reserves Pkwy.	0.67	Construct new 2-lane road with turn lanes at warranted locations	Short-Term
17	New Port Royal Rd. Ext.	Northern terminus	Thompson Station Rd.	0.25	Extend as 2-lane road with turn lanes at warranted locations	Short-Term
18	Campbell Station Blvd.	Eastern terminus	Buckner Ln.	0.66	Extend as 2-lane road with turn lanes at warranted locations	Short-Term
19	Hurt Rd.	Duplex Rd.	Bunbury Dr.	1.61	Extend as 2-lane road with turn lanes at warranted locations	Short-Term
20	Miles Johnson Pkwy. Ext. N.	Northern terminus	Wilkes Ln.	1.07	Construct new 2-lane road with turn lanes at warranted locations	Short-Term
21	Wilkes Ln.	Western terminus	SR-6/US-31	0.62	Widen to provide a standard 2-lane cross-section with turn lanes at warranted locations	Short-Term
22	Port Royal Rd.	Saturn Pkwy.	Duplex Rd.	1.69	Widen from 2 to 3 lanes and correct horizontal and vertical alignment issues	Short-Term
23	Long Hunter Chase Dr.	Port Royal Rd.	Derryberry Ln./ Kedron Rd. Connection (P24)	0.78	Construct new 2-lane road with turn lanes at warranted locations	Short-Term
24	Rice Road	Jim Warren Rd.	Rice Rd.	2.44	Construct new 2-lane road with turn lanes at warranted locations	Short-Term
25	Miles Johnson Pkwy/Port Royal Connection	Miles Johnson Pkwy	Port Royal Rd.	1.31	Construct new 2-lane road with turn lanes at warranted locations	Short-Term

Spring Hill Proposed Transportation Improvements						
Project Number	Location	Termini From	Termini To	Length in miles	Recommended Improvement	Priority
26	Crossings Circle Ext.	Current terminus at Crossings Circle	Reserves Blvd. Ext. (P11)	.74	Construct new 3-lane road	Short-Term
27	Tom Lunn Road Ext.	Port Royal Rd.	Rice Rd.	.75	Construct new 3-lane road	Short-Term
28	Beechcroft Rail Crossing	Rail Crossing		N/A	Construct bridge over CSX railway	Mid-Term
29	SR-247/ Beechcroft Rd. E.	Dr. Robinson Rd.	SR-6/US-31	2.65	Widen from 2 to 3 lanes and realign the intersection of Beechcroft Rd. and SR-6/US-31 with Duplex Rd.	Mid-Term
30	Duplex Rd. E.	I-65	US-431/ Lewisburg Pk.	1.91	Widen from 2 to 3 lanes and correct horizontal and vertical alignment issues	Mid-Term
31	Duplex Rd. Interchange	I-65	I-65	N/A	Construct interchange at I-65 and Duplex Rd.	Mid-Term
32	Denning Ln.	SR-6/US-31	Kedron Rd.	2.80	Widen to provide a standard 2-lane cross-section and correct horizontal and vertical alignment issues	Mid-Term
33	Buckner Rd. Ext. 2	Just west of I-65	US-431/ Lewisburg Pk.	1.15 +inter-change	Extend as 3-lane road and construct interchange at I-65 and Buckner Rd.	Mid-Term
34	I-65	SR-396/ Saturn Pkwy.	Kedron Rd.	3.62	Widen from 4 to 6 lanes	Mid-Term
35	SR-247/ Beechcroft Rd. W.	Carters Creek Pk.	Dr. Robinson Rd.	1.86	Widen to provide a standard 2-lane cross-section with turn lanes at warranted locations.	Mid-Term

Spring Hill Proposed Transportation Improvements						
Project Number	Location	Termini From	Termini To	Length in miles	Recommended Improvement	Priority
36	Rice Rd. Ext.	Port Royal Rd.	Derryberry/ Kedron Rd. Connection (P.24)	0.78	Extend as a 2-lane road with turn lanes at warranted locations	Mid-Term
37	Cleburne Rd.	Beechcroft Rd.	Petty Ln.	2.17	Widen to provide a standard 2-lane cross-section with turn lanes at warranted locations and correct horizontal and vertical alignment issues	Mid-Term
38	Petty Rd.	Beechcroft Rd.	Cleburne Rd.	2.20	Widen to provide a standard 2-lane cross-section with turn lanes at warranted locations and correct horizontal and vertical alignment issues	Mid-Term
39	Kedron Rd.	Port Royal Rd.	US-431/ Lewisburg Pk.	4.71 +inter-change	Widen from 2 to 3 lanes and construct interchange at I-65 and Kedron Rd.	Long-Term
40	Kedron Rd. Connection	Buckner Rd. extension east of I-65	Kedron Rd. east of I-65	6.90	Construct new 3-lane road	Long-Term
41	SR-396/ Saturn Pkwy. Ext.	I-65	US-431/ Lewisburg Pk.	1.75	Extend as 4-lane freeway & construct interchange at SR-396/Saturn Pkwy. and US-431/Lewisburg Pk.	Long-Term
42	Town Center Pkwy. Ext.	Beechcroft Rd.	Buckner Rd.	3.50	Extend as a 2-lane road with turn lanes at warranted locations	Long-Term

Figure 4-6: Spring Hill Proposed Transportation Improvements

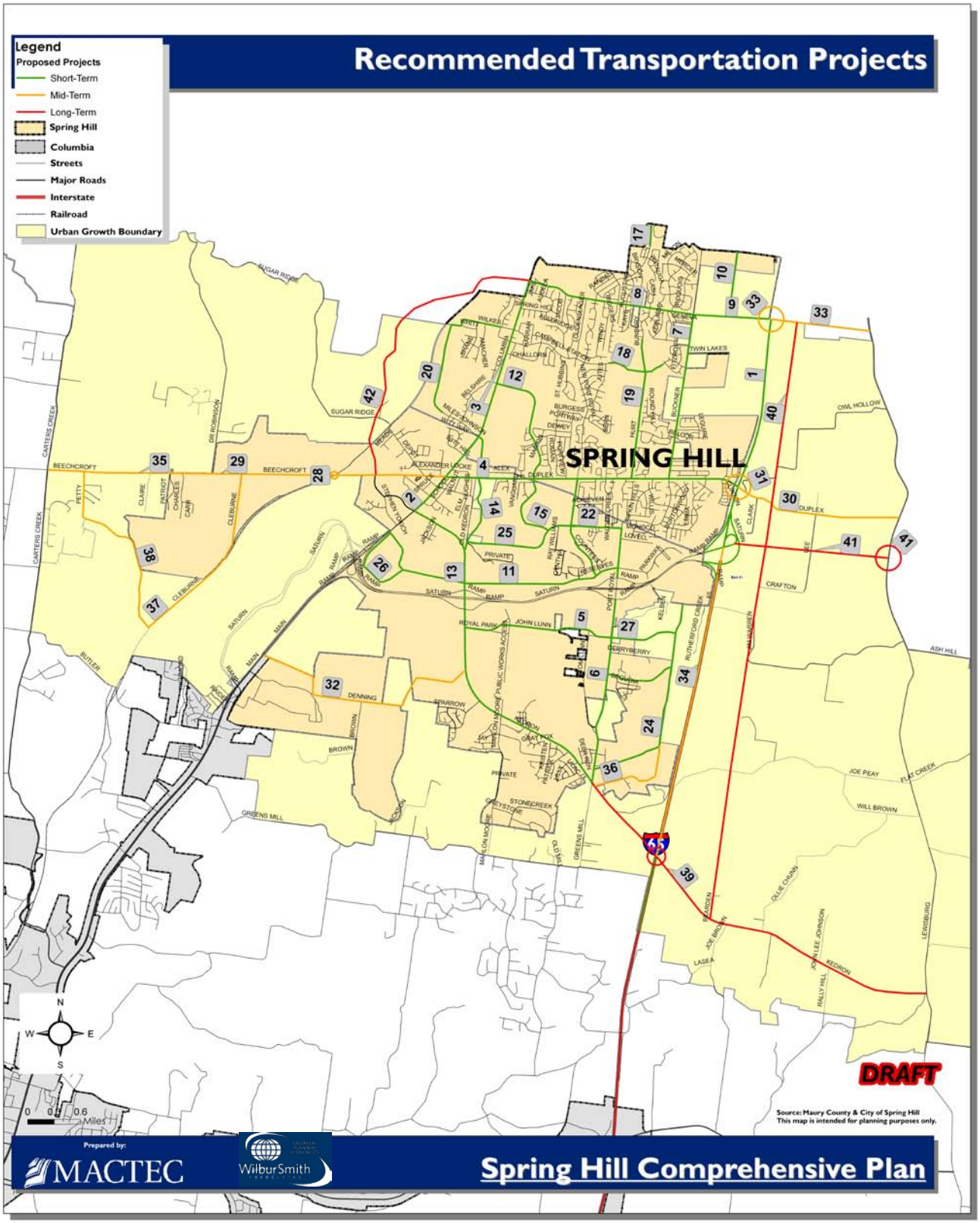


Table 4-12: Spring Hill Traffic Counts, Projected

Station Number	Route	Location	Projected Avg. Annual Traffic Growth Rate (%)		2008	2010	2015	2020	2025	2030
000004	SR246	NORTH OF JAMESON	Growth rate	1.90%						
			ADT		2329	2418	2657	2919	3207	3524
000006	SR 247	BEECHCROFT - SPRING HILL	Growth rate	1.95%						
			ADT		4591	4772	5256	5788	6375	7021
000007	SR 6	SOUTHWEST SPRING HILL	Growth rate	0.62%						
			ADT		17634	17852	18409	18983	19574	20185
000009	SR 6	NORTHEAST SPRING HILL	Growth rate	1.85%						
			ADT		19258	19977	21895	23996	26300	28824
000010	SR 247	EAST OF SPRING HILL	Growth rate	1.95%						
			ADT		6881	7152	7877	8676	9555	10524
000065	SR 106	N OF DUPLEX	Growth rate	1.22%						
			ADT		5168	5295	5627	5980	6355	6754
000072	SR 106	SOUTH OF DUPLEX NEAR MARSHALL CO LINE	Growth rate	1.85%						
			ADT		3878	4023	4409	4832	5296	5804
000090	1907	NEAR MAURY CO LINE	Growth rate	1.85%						
			ADT		7244	7515	8236	9026	9893	10842
000116	SR 247	NEAR MARSHALL CO LINE	Growth rate	1.95%						
			ADT		2330	2422	2667	2938	3235	3563
000126	SR 247	NEAR MAURY CO LINE	Growth rate	2.00%						
			ADT		4647	4835	5338	5894	6507	7184
000144	SR 246	NEAR WILLIAMSON CO LINE	Growth rate	0.18%						
			ADT		2378	2387	2408	2430	2452	2475

000169	SR 247	NEAR WILLIAMSON CO LINE	Growth rate	1.85%						
			ADT		2387	2476	2714	2974	3260	3573
000170	1907	NEAR WILLIAMSON CO LINE	Growth rate	1.95%						
			ADT		5934	6168	6793	7482	8240	9075
000195	I-65	SOUTH OF SATURN PKWY	Growth rate	0.10%						
			ADT		24794	24842	24964	25085	25208	25331
000196	SR 396	SATURN PKWY - E. OF KEDRON RD.	Growth rate	0.68%						
			ADT		23877	24203	25037	25900	26793	27716
000202	I-65	SOUTH OF SR-840	Growth rate	1.29%						
			ADT		50001	51297	54687	58301	62153	66260
000221		NEAR MARSHALL CO LINE	Growth rate	1.85%						
			ADT		3391	3518	3855	4225	4631	5075
000222	SR 396	SATURN PKWY - E. OF PORT ROYAL RD.	Growth rate	1.19%						
			ADT		29233	29934	31761	33700	35757	37939
000236		S. OF WILLIAMSON CO	Growth rate	1.85%						
			ADT		3657	3794	4158	4557	4994	5474
000237		KEDRON RD	Growth rate	0.42%						
			ADT		1854	1870	1910	1951	1992	2035

Table 4-13: Spring Hill Traffic Counts, Projected

Location		Projected Avg. Annual Traffic Growth Rate (%)	2009	2010	2015	2020	2025	2030
BUCKNER LANE @ CAMERON FARMS	Growth rate	1.61%						
	ADT		6755	6864	7433	8051	8719	9443
BUCKNER ROAD @ MAIN STREET	Growth rate	1.90%						
	ADT		10403	10601	11647	12796	14059	15446
DUPLEX ROAD @ CHAPMANS RETREAT	Growth rate	1.90%						
	ADT		5222	5321	5846	6423	7057	7753
BEECHCROFT ROAD @ RAILROAD	Growth rate	1.58%						
	ADT		5033	5112	5528	5978	6464	6989
KEDRON ROAD @ BATTLEFIELD	Growth rate	1.90%						
	ADT		7931	8082	8879	9755	10718	11776
KEDRON ROAD @ ROYAL PARK ROAD	Growth rate	0.20%						
	ADT		9850	9869	9967	10065	10164	10264
KEDRON ROAD 3 @ WATER PLANT	Growth rate	1.74%						
	ADT		3784	3850	4196	4573	4984	5431
PORT ROYAL SOUTH OF HAYNES CROSSING	Growth rate	2.00%						
	ADT		12522	12772	14102	15570	17190	18979
PORT ROYAL 1 @ WATER PLANT	Growth rate	2.00%						
	ADT		4242	4327	4777	5274	5823	6429
MAHLON MOORE @ KEDRON ROAD	Growth rate	1.70%						
	ADT		3033	3085	3357	3653	3974	4325
DENNING LANE @ KEDRON ROAD	Growth rate	0.15%						
	ADT		242	242	244	246	248	250
	Growth rate	1.85%						

GREENS MILL ROAD @ KEDRON ROAD	ADT		3261	3321	3640	3990	4372	4792
KEDRON ROAD 1 SOUTH OF PORT ROYAL	Growth rate	2.00%						
	ADT		3414	3482	3845	4245	4687	5174
NORTH MAIN @ TARGET NORTH	Growth rate	1.85%						
	ADT		9926	10110	11080	12144	13309	14587
SOUTH MAIN @ TARGET SOUTH	Growth rate	1.54%						
	ADT		9445	9591	10354	11179	12069	13030
JIM WARREN ROAD @ PORT ROYAL	Growth rate	2.00%						
	ADT		6899	7037	7769	8578	9471	10457
DUPLEX ROAD WEST OF MILES JOHNSON	Growth rate	1.51%						
	ADT		5963	6053	6525	7033	7581	8172

TRAFFIC IMPACT STUDY

FOR

PROJECT SKYLAR
THOMPSON'S STATION, TENNESSEE

March 25, 2011

Prepared for:

Private Client

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2010-062 / 9213

PROJECT SKYLAR

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I. INTRODUCTION

The purpose of this study is to analyze the transportation related impacts due to the proposed Project Skylar development to be located in Thompson's Station, Tennessee. The site is located in the southeast quadrant of the State Route 840 and Columbia Pike (U.S. Highway 31/State Route 6) interchange just north of Critz Lane. The Project Skylar development will consist of 315,000 square feet of office and 190,000 square feet of support and associated uses. This study has been requested by the Town of Thompson's Station in order to address transportation impacts and mitigating measures as part of the site plan review process.

In order to evaluate and quantify the impacts of this development, an inventory of the existing transportation system was carried out, along with an assessment of its adequacy. Based on the project schedule, design years were established, and system-wide growth rates were applied to existing traffic volumes. Specific developments in the project vicinity were accounted for along with site related traffic. Capacity analyses were performed in order to assess any site or non-site related impacts on the system. Finally, recommendations for roadway improvements and/or transportation system improvements were offered.

II. EXISTING CONDITIONS

A. Existing Land Use

As shown in Figure 1, the parcel to be developed is located on Columbia Pike between State Route 840 and Critz Lane. The site is made up of one tract of land: Parcel 3 shown on Tax Map 145 in Williamson County. The site is currently undeveloped and the land character generally consists of rolling terrain.

The existing zoning of the property is High Intensity (HI). A zone change to Specific Plan (SP) will be necessary over the entire 86 acres according to the Project Skylar campus plan. The surrounding land use is primarily agricultural and residential. Independence High School is located immediately north of State Route 840 on the west side of Columbia Pike.

B. Existing Transportation System

The existing transportation system in the area is made up of arterials, collectors and local roadways which provide regional and local access to the site. Columbia Pike will provide primary access to the site. The following roadways will comprise the study area for consideration of the Project Skylar development.

- **Columbia Pike (U.S. Highway 31/State Route 6)** in the study area is shown as a rural minor arterial on TDOT's Rural Functional Classification System map for Williamson County. Columbia Pike includes five lanes in the vicinity of State Route 840 and two lanes to the north and south of State Route 840. The posted speed on Columbia Pike is 45 mph.

- **Critz Lane** in the study area is a local road based upon its absence from TDOT's Rural Functional Classification System map for Williamson County. Critz Lane includes two lanes and creates a link between Columbia Pike and Lewisburg Pike. The posted speed on Critz Lane is 30 mph.

- **State Route 840** in the study area is shown as a rural principal arterial on TDOT's Rural Functional Classification System map for Williamson County. State Route 840 is currently open to traffic east of Columbia Pike. However, west of Columbia Pike, State Route 840 is under construction and not yet open to traffic. The estimated completion date for State Route 840 west of Columbia Pike is October 2012.

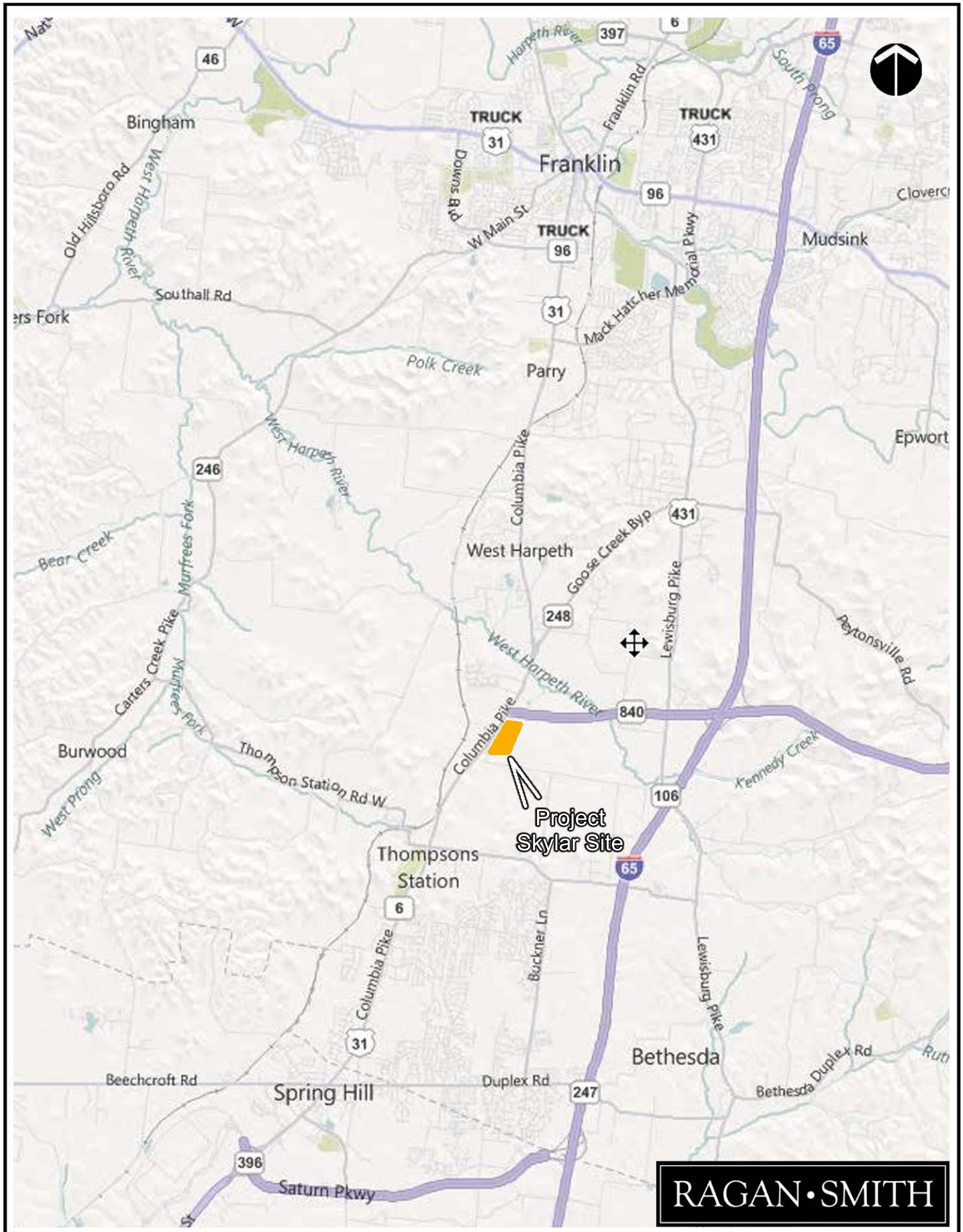
In order to assess the adequacy of the local transportation system, an evaluation of current operational quality of intersections and roadways within the study area was required. Typical peak periods for office developments generally coincide with the peak commuter patterns of adjacent streets; therefore, the peak of the adjacent street traffic should overlap the peak of the development.

In order to identify the peak hour for analysis, traffic counts were conducted at the following intersection:

- Columbia Pike at Critz Lane

According to the traffic counts, the peak hours for analysis are ***6:45 a.m. - 7:45 a.m.*** and ***4:45 p.m. - 5:45 p.m.***

Existing traffic volumes are shown in Figure 2.



Project Skylar
Location Map

Figure
1

Project Skylar
2011 Existing Traffic Volumes

Figure
2

III. FORECASTED BACKGROUND TRAFFIC

A. Introduction

Based upon the proposed development schedule, the year 2013 will be used to analyze the traffic impact of the Project Skylar development. The year 2013 established as full build-out of the development.

Before any impacts to the study area can be addressed, some estimate of background traffic volumes for the year 2013 must be established. Background traffic volumes were established by segregating potential growth into two categories:

- Specific approved development within the immediate area which can be more accurately quantified; and
- Growth due to unexpected small scale development and/or general population growth within the area.

B. Specific Non-Site Development

According to presently available information, the Fields of Canterbury development will contribute traffic to the study area before the projected build-out of the Project Skylar development. It is anticipated that by the build-out year of 2013, the Fields of Canterbury development will contain approximately 100 single family residential units and no commercial buildings.

Table 1 shows trip generation volumes for each of these developments.

TABLE 1

SPECIFIC NON-SITE DEVELOPMENT

TRIP GENERATION

Description	Land Use	Units	Daily	A.M. Peak Hour			P.M. Peak Hour		
				Enter	Exit	Total	Enter	Exit	Total
Fields of Canterbury	Single Family	100	1,040	20	59	79	67	40	107

Traffic was generated and assigned to the system in order to develop background traffic for the year 2013.

C. Annual Growth

To establish background traffic volumes, TDOT historical traffic was obtained for four traffic count stations along Columbia Pike, State Route 840, and the Goose Creek Bypass in the general study area. Table 2 below shows the traffic data for the years 2005 to present.

TABLE 2				
TDOT HISTORICAL COUNT DATA				
Year	**Williamson Co. Station 67 (1)**	**Williamson Co. Station 94 (2)**	**Williamson Co. Station 210 (3)**	**Williamson Co. Station 95 (4)**
2010	17,900	11,976	10,002	4,411
2009	18,342	11,170	9,202	9,199
2008	19,891	11,593	8,860	8,932
2007	20,488	13,345	8,838	9,065
2006	21,645	12,646	4,258	8,447
2005	15,480	10,816	-	9,804

(1) On Columbia Pike south of Critz Lane
(2) On Columbia Pike north of State Route 840
(3) On State Route 840 east of Columbia Pike
(4) On Goose Creek Bypass east of Columbia Pike

As shown in the table above, traffic on Columbia Pike was decreased each year during the period from 2006 to 2010. However, based upon linear regression analysis of the data above, we will use a ***4 percent annual growth rate*** for the period from 2011 to 2013 as the base growth rate for the study. This growth rate is in general agreement with the previous five years from 2005 to 2010.

D. Background Traffic

For the year 2013 background traffic was compiled based on the following:

- 2011 existing traffic volumes
- Specific non-development volumes - Fields of Canterbury
- 4% annual growth for the period from 2011 to 2013

Background traffic for the year 2013 is shown in Figure 3.

Project Skylar
2013 Background Traffic Volumes

Figure
3

IV. PROPOSED CONDITIONS

A. Proposed Land Use

The current master development plan for Project Skylar includes five buildings which will include office and other special uses related to research and development. Since the project will be open in 2013, only one horizon year will be analyzed.

B. Proposed Transportation System

Within the study area, TDOT is currently planning to extend the five lane section of Columbia Pike to the south approximately 2,000 feet. In conjunction with the improved laneage on Columbia Pike, the Town of Thompson's Station is seeking to construct a new alignment for Critz Lane at the intersection of Columbia Pike. There are currently two alternatives being considered by the Town of Thompson's Station for the new alignment of Critz Lane. The first would intersect Columbia Pike approximately 500 feet south of the existing Columbia Pike and Critz Lane intersection. The second would intersect Columbia Pike approximately 1,000 feet south of the existing Columbia Pike and Critz Lane intersection. These improvements are currently being coordinated between TDOT and Town of Thompson's Station staff and will be considered to be complete in the future year analysis of this study.

C. Site Trip Generation

In order to quantify site related impacts within the study area, some estimates of site traffic generation and trip assignment would have to be established. Trip generation rates for the development were established using information for the weekday a.m. and p.m. peak hour of the adjacent street as shown in the ITE ***Trip Generation*** Report, 8th *Edition*. Unadjusted trip generation for Project Skylar is shown in Table 3 below.

TABLE 3

PROJECT SKYLAR

UNADJUSTED TRIP GENERATION [(1)]

Land Use	Total Units	Daily	A.M. Peak Hour			P.M. Peak Hour		
			Enter	Exit	Total	Enter	Exit	Total
Office	315,000	3,228	414	56	470	62	300	362

[(1)] Institute of Transportation Engineers, Trip Generation, 8th Edition, 2008.

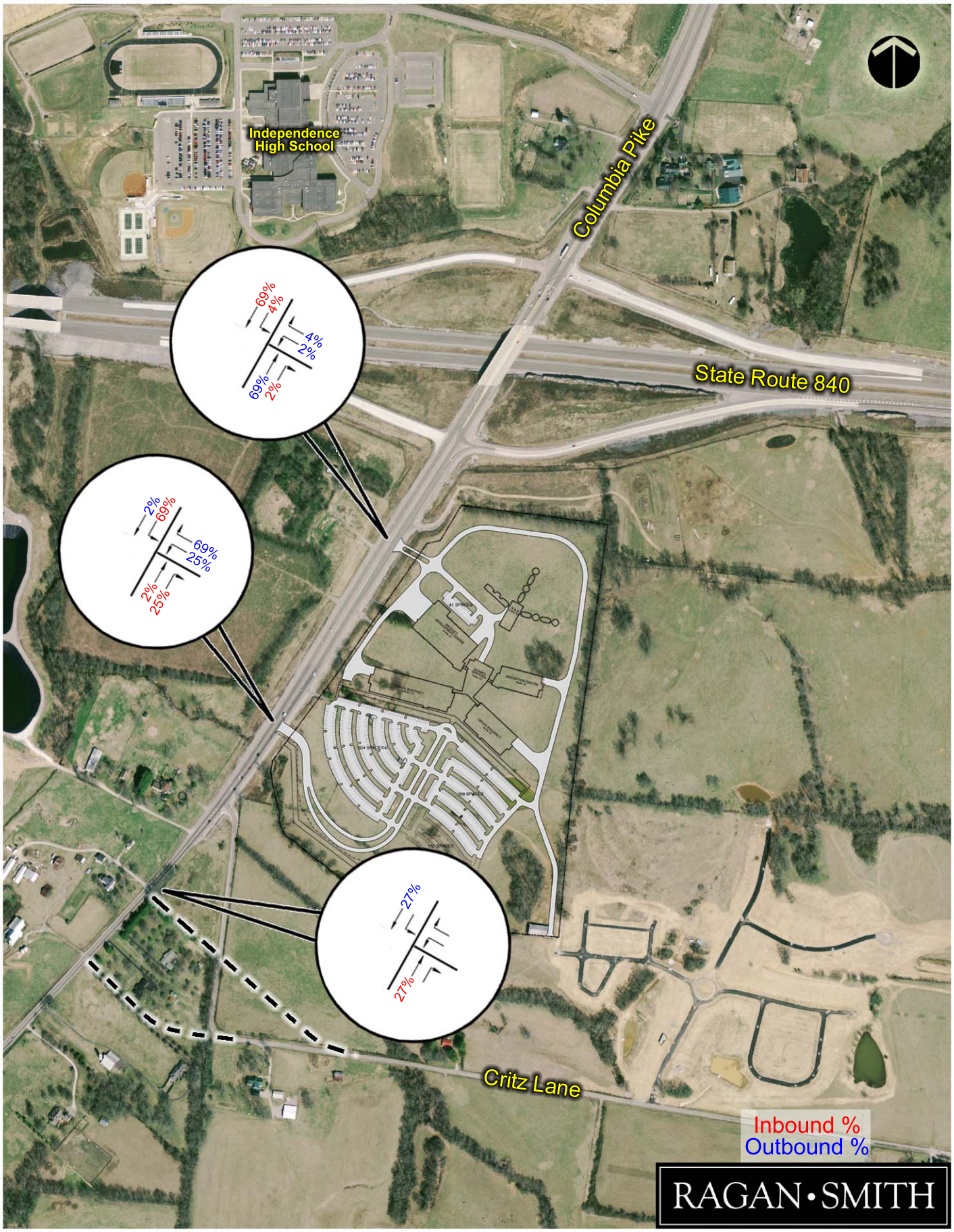
In most cases, the ITE Trip Generation data is used to determine the future trips of a new development. However, in this case, employee and shift data provided by the developer is ideal for the establishment of a trip generation rate. Project-specific trip generation for Project Skylar is shown in Table 4 below.

TABLE 4								
PROJECT SKYLAR								
PROJECT-SPECIFIC TRIP GENERATION [1]								
Land Use	Total Employees	Daily	A.M. Peak Hour			P.M. Peak Hour		
			Enter	Exit	Total	Enter	Exit	Total
Project Skylar	800	-	494	59	553	55	443	498
[1] Derived from employment and shift data provided by client. See Appendix for detailed derivation								

D. Site Trip Distribution and Assignment

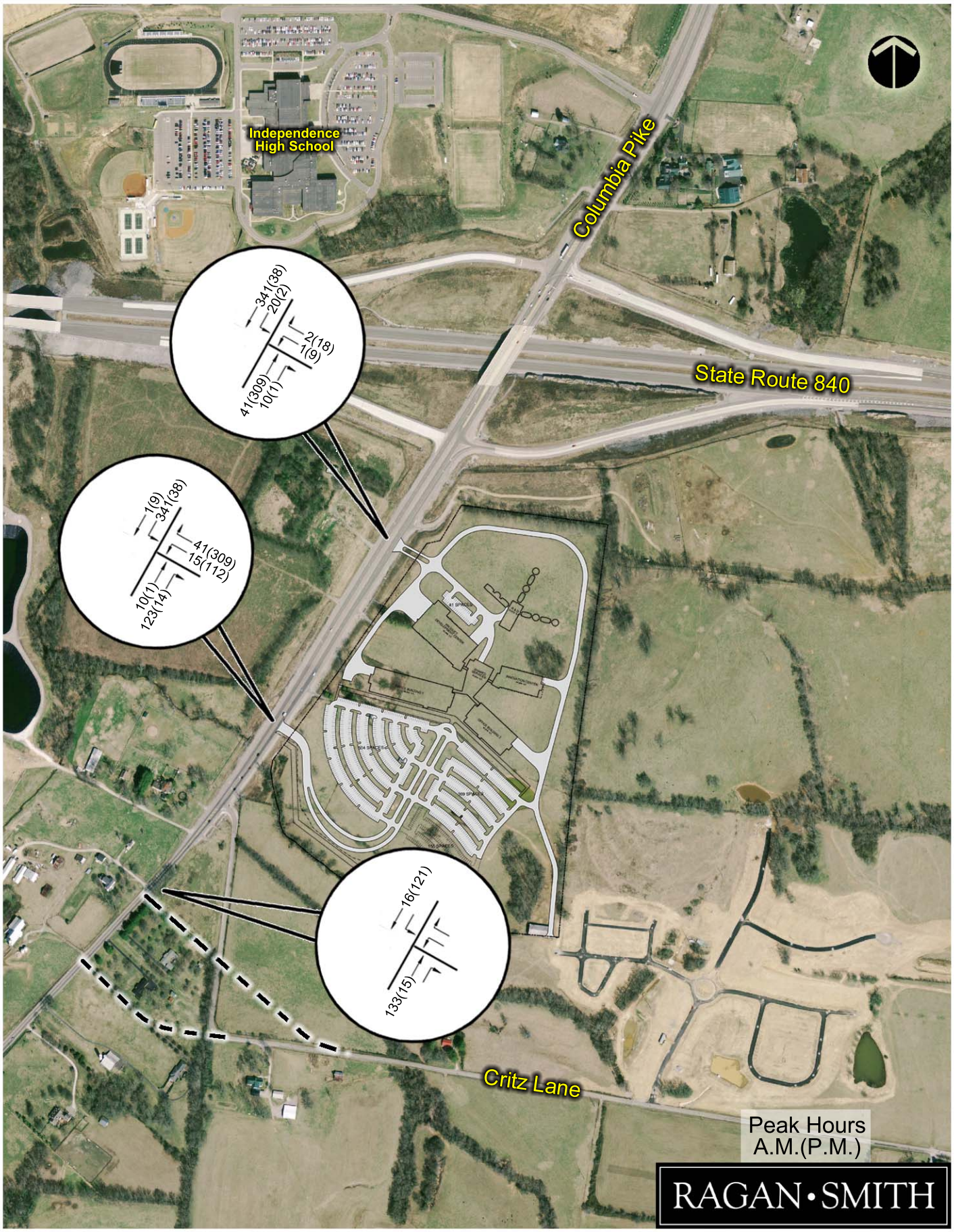
In an office development, the majority of trips during the peak hours are home-to-work based trips. Therefore, site trips were distributed based primarily upon access to the region from residential areas and the prevalent traffic patterns on major roadways in the area. Figure 4 shows the site trip distribution.

The total site traffic volumes for 2013 are shown in Figure 5. The final accumulation of all traffic on the system for the year 2013 is shown in Figure 6.



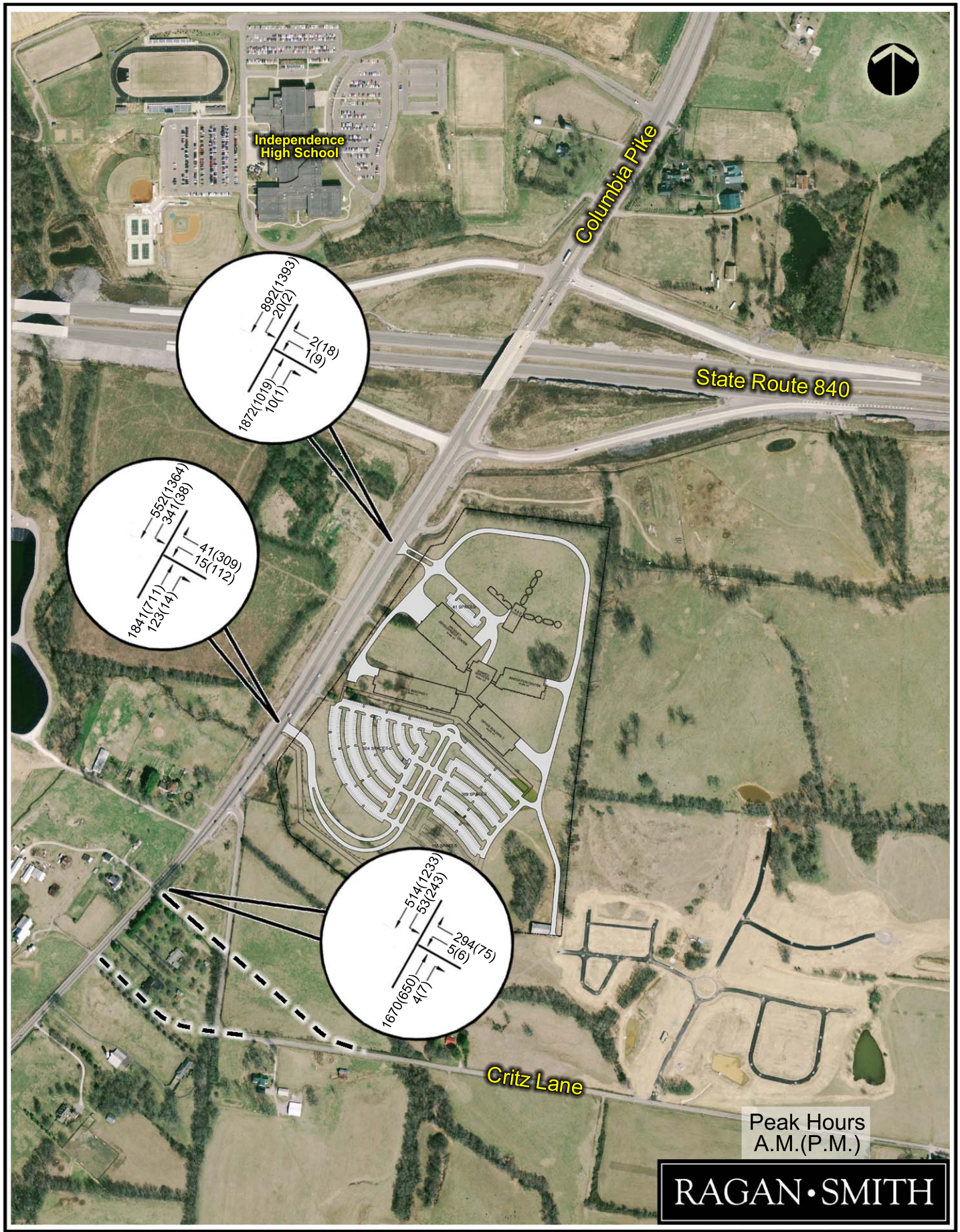
Project Skylar
Site Trip Distribution

Figure
4



Project Skylar
2013 Site Traffic Volumes

Figure
5



Project Skylar
2013 Total Traffic Volumes

Figure
6

V. TRAFFIC ANALYSIS

A. Introduction

In order to gauge the site impact and identify capacity deficient locations, capacity analyses were conducted at critical roadway intersections within the study area. Capacity analyses were conducted according to the methodology and procedures outlined in the *Highway Capacity Manual*, 2000, published by the Transportation Research Board.

In the study area, critical intersections were analyzed for capacity deficiencies and geometric improvements for the a.m. and p.m. peak hours for existing and future conditions. Analysis considered the transportation system with and without the site. The following intersections were analyzed:

- Columbia Pike at Critz Lane
- Columbia Pike at Project Skylar Access "A"
- Columbia Pike at Project Skylar Access "B"

Capacity analysis results are shown below in Table 5.

TABLE 5

PROJECT SKYLAR

CAPACITY ANALYSIS RESULTS

Location	Year	Dev. Cond.	Control	Transportation Improvement	Level-of-Service	
					A.M.	P.M.
Columbia Pike at Critz Lane	2011	Exist.	Unsig.	None	B/F[1]	A/C[1]
	2013	Back.	Unsig.	5-lane	C/F/F[2]	B/F/B[2]
	2013	Total	Unsig.	5-lane	C/F/F[2]	B/F/B[2]
Columbia Pike at Project Skylar Access "A"	2013	Total	Unsig.	None	F/F/C[2]	A/E/C[2]
	2013	Total	Signal	5-lane	C[3]	B[4]
	2013	Total	Signal	5-lane with double turn lane southbound	C[5]	B[6]
Columbia Pike at Project Skylar Access "B"	2013	Total	Unsig.	None	C/F/C[2]	B/D/B[2]

[1] SB L / WB LR
[2] SB L / WB L / WB R
[3] SB single left is LOS "F"
[4] SB single left is LOS "A"
[5] SB double left is LOS "D"
[6] SB double left is LOS "C"

Level of service criteria for unsignalized intersections is shown in Table 6.

TABLE 6		
DESCRIPTIONS OF LEVEL OF SERVICE FOR UNSIGNALIZED INTERSECTIONS		
Level of Service	**Description**	**Avg. Total Delay (sec./veh.)**
A	Little or no delay	0 - 10
B	Short traffic delay	> 10 and ≤ 15
C	Average traffic delay	> 15 and ≤ 25
D	Long delay	> 25 and ≤ 35
E	Very long delay - long queues for side street left turns	> 35 and ≤ 50
F	Insufficient gaps of suitable size to allow a side street demand to cross a major traffic stream	> 50

Level of service criteria for signalized intersections is shown in Table 7.

TABLE 7		
DESCRIPTIONS OF LEVEL OF SERVICE FOR SIGNALIZED INTERSECTIONS		
Level of Service	**Description**	**Stopped Delay per Vehicle (Sec)**
A	Operations with very low delay. This occurs when progression is extremely favorable. Most vehicles do not stop at all.	< 10
B	Operations with stable flows. This generally occurs with good progression and/or short cycle lengths. More vehicles stop than for LOS A causing higher levels of average delay.	10.1 - 20.0
C	Operations with stable flow. Occurs with fair progression and/or longer cycle lengths. The number of vehicles stopping is significant, although many still pass thru intersection without stopping.	20.1 - 35
D	Approaching unstable flow. The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high V/C ratios. Many vehicles stop.	35.1 - 55

TABLE 7		
DESCRIPTIONS OF LEVEL OF SERVICE FOR SIGNALIZED INTERSECTIONS		
Level of Service	**Description**	**Stopped Delay per Vehicle (Sec)**
E	Unstable flow. This is considered to be the limit for acceptable delay. These high delays generally indicate poor progression, long cycle lengths, and high V/C ratios.	55.1 - 80
F	Unacceptable delay. This condition often occurs with over saturation or with high V/C ratios. Poor progression and long cycle lengths may also cause such delay levels.	> 80.0
Source: Highway Capacity Manual, HCM 2000		

Given that Project Skylar experiences high peak hour traffic volumes, it is expected that the unsignalized left turns from side streets or driveways will operate at LOS "E" or "F". In the majority of these cases, the analysis indicates an unrealistically poor level of service. In some cases, the actual capacity of the movement is not exceeded, but the main street flows provide insufficient gaps of a suitable size to service the minor street left turns without experiencing significant delay. The level of service criteria is more restrictive in terms of delay given the dynamics of unsignalized intersections. Any movement which experiences delay in the range of 50 seconds per vehicle is considered to operate at LOS "F". By contrast, LOS "F" at a signalized intersection is characterized by delay in the range of 80 seconds per vehicle. It is important to note that a LOS of "F" should not be considered a de-facto warrant for the installation of a traffic signal or a turn lane. In all likelihood, actual delay measurements in the field will be much less than the analysis indicates. In some cases, left turners will utilize smaller gaps, gaps will be provided by adjacent signalized intersections, or drivers will modify their driving characteristics to make the delay more tolerable. Also, since Columbia Pike has a continuous center left turn lane, many drivers turn left out of side streets in two-steps, therefore reducing the necessary gap significantly. Average delays are therefore also significantly reduced.

B. Turn Lane Warrants

Since capacity calculations indicate an unacceptable level of service for the unsignalized intersections on Columbia Pike at site access drives and Critz Lane, the need for turn lanes should be checked against specific warrants. Tables 8 and 9 below detail pertinent right and left turn warrant information for the concerned intersections.

TABLE 8					
RIGHT TURN LANE WARRANTS					
Intersection	**Time Period**	**V_A**	**V_R**	**Speed**	**Turn Lane Recom-mendation**
Columbia Pike at Critz Lane	2011 Existing a.m.	1,423	2	45	No
	2011 Existing p.m.	563	5	45	No
	2013 Background a.m.	1,541	4	45	No
	2013 Background p.m.	642	7	45	No
	2013 Total a.m.	1,674	4	45	No
	2013 Total p.m.	662	7	45	No
Columbia Pike at Project Skylar Access "A"	2013 Total a.m.	1,964	123	45	Yes
	2013 Total p.m.	725	14	45	No
Columbia Pike at Project Skylar Access "B"	2013 Total a.m.	1,882	10	45	Yes
	2013 Total p.m.	1,020	1	45	No
(1) Evaluating Intersection Improvements: An Engineering Study Guide, NCHRP Report 457 Transportation Research Board, pg 21-23					

TABLE 9						
LEFT TURN LANE WARRANTS						
Intersection	**Period**	**V_A**	**V_O**	**L%**	**Speed**	**Turn Lane Recom-mendation**
Columbia Pike at Critz Lane	2011 Existing a.m.	493	1,423	7	45	Yes
	2011 Existing p.m.	1,193	563	14	45	Yes
	2013 Background a.m.	551	1,541	10	45	Yes
	2013 Background p.m.	1,355	642	18	45	Yes
	2013 Total a.m.	567	1,674	9	45	Yes
	2013 Total p.m.	1,476	657	16	45	Yes
Columbia Pike at Project Skylar Access "A"	2013 Total a.m.	893	1,964	38	45	Yes
	2013 Total p.m.	1,402	725	3	45	Yes
Columbia Pike at Project Skylar Access "B"	2013 Total a.m.	912	1,882	2	45	Yes
	2013 Total p.m.	1,395	1,020	0	45	No
(1) Evaluating Intersection Improvements: An Engineering Study Guide, NCHRP Report 457 Transportation Research Board, pg 21-23						

VI. CONCLUSIONS AND RECOMMENDATIONS

A. Introduction

At full build-out, Project Skylar will contribute approximately 500 trips during the a.m. and p.m. peak hours to the local roadway network. For a development of this magnitude, some access and/or roadway improvements may be necessary to provide acceptable traffic operations during peak periods of site traffic. The Institute of Transportation Engineers (ITE) Proposed Recommended Practice for Transportation Impact Analysis of Site Development suggests that an acceptable preferred level of service threshold be “D” or better during the peak traffic hour of the roadway system.

Based upon a review of the existing and future proposed conditions within the study area, we offer the recommendations below. These recommendations have been developed to provide efficient movement of traffic to Project Skylar while minimizing the impact to non-site trips on the roadway network.

B. Columbia Pike at Critz Lane

The intersection of Columbia Pike and Critz Lane is currently unsignalized with the left turns onto and off of Critz Lane characterized by levels of service “B” and “F” during the a.m. peak hour and “A” and “C” during the p.m. peak hour, respectively. As discussed previously, the Town of Thompson’s Station is seeking to construct a new alignment for Critz Lane at the intersection of Columbia Pike. When the new alignment is complete and after background traffic and Project Skylar site traffic are added to this intersection, operations of the unsignalized left turns onto and off of Critz Lane will be characterized by levels of service “C” and “F” during the a.m. peak hour and “B” and “F” during the p.m. peak hour, respectively.

Based upon a review of the existing and future conditions at this intersection, we offer the following recommendations:

- TDOT and the Town of Thompson's Station should continue to coordinate the improvement of Columbia Pike and the realignment of Critz Lane. It would be beneficial for both improvement projects to be completed at the same time.

- Critz Lane, when on the new alignment, should include three lanes at the intersection with Columbia Pike. One lane will serve eastbound traffic leaving the intersection and separate left and right turn lanes will serve westbound traffic entering the intersection.

- TDOT and the Town of Thompson's Station should monitor traffic volumes on Critz Lane as growth in the area continues. Peak hour traffic volumes on Critz Lane are heavy and may satisfy peak hour traffic signal warrants. As the phasing of Fields of Canterbury becomes more well defined, the Town should evaluate signal installation and timing. Any traffic signal at this location should be coordinated with the signal at Project Skylar Access “A”.

C. Columbia Pike at Project Skylar Access "A"

Primary access to the site will be located approximately 1,600 feet south of State Route 840 on Columbia Pike. This access will be the main employee entrance and exit on the site. Based upon the Project Skylar trip generation and 2013 traffic projections for Columbia Pike, left and right turn lanes will be necessary to provide ingress/egress for Project Skylar. Additionally, the trip generation for Project Skylar indicates that a traffic signal will be necessary in order to provide level of service “C” or better during the a.m. and p.m. peak hours at this intersection.

Based upon a review of the future access needs of Project Skylar, we offer the following recommendations:

- A double left turn lane should be installed on Columbia Pike southbound at this intersection to accommodate the Project Skylar site traffic during the a.m. peak hour. The southbound left turn lanes should each contain 375 feet of storage with bay and departure tapers per TDOT guidelines.

- A right turn lane should be installed on Columbia Pike northbound at this intersection to accommodate the Project Skylar site traffic during the a.m. peak hour. The northbound right turn lane should contain 175 feet of storage and 175 feet of taper.

- A traffic signal should be installed at this intersection based upon the peak hour volumes on Columbia Pike and the peak hour traffic generated by Project Skylar. Additionally, a traffic signal will be necessary to provide intersection traffic control to the southbound double left turn lane on Columbia Pike. It is assumed that this improvement will be made part of the TDOT widening project.

- The Project Skylar Access Drive should contain, at a minimum, four travel lanes. Two eastbound travel lanes will be necessary to accept Project Skylar traffic from the southbound double left turn lanes on Columbia Pike. Westbound traffic exiting the Project Skylar site should be served by a left turn lane and a right turn lane.

D. Columbia Pike at Project Skylar Access "B"

Secondary access to the site will be located approximately 575 feet south of State Route 840 on Columbia Pike. This access will be used by trucks and a small number of employees for the research and development facility adjacent to the Project Skylar office buildings. Based upon the Project Skylar trip generation and 2013 traffic projections for Columbia Pike, left and right turn lanes will be necessary to provide ingress/egress for Project Skylar.

Based upon a review of the future access needs of Project Skylar, we offer the following recommendations:

- A right turn lane should be installed on Columbia Pike northbound at this intersection to accommodate the Project Skylar site traffic during the a.m. peak hour. The northbound right turn lane should contain 175 feet of storage and 175 feet of taper.

- The Project Skylar Access Drive should contain, at a minimum, three travel lanes. One eastbound travel lane will be necessary to accept Project Skylar traffic from Columbia Pike. Westbound traffic exiting the Project Skylar site should be served by a left turn lane and a right turn lane.

- It is not recommended that this intersection be signalized as part of this project.

E. Other Transportation-Related Topics

1. State Route 840 Intersections

At this time, the State Route 840 interchange is only partially open. At such time as the interchange is opened and traffic is fully developed on the State Route 840 corridor, the Town should review traffic signal timing at intersections on Columbia Pike, particularly if ramp terminal intersections are signalized.

2. Columbia Pike Intersections

Previous development plans on the west side of Columbia Pike, for which approval has now expired, proposed access to Columbia Pike. In the future, new development plans for the property on the west side of Columbia Pike should include proposed access locations that align with the Project Skylar access drives. The additional development traffic on Columbia Pike may increase the possibility that traffic signal warrants will be satisfied at Critz Lane or at the Project Skylar Access “B” intersections. The Town of Thompson’s Station should request a traffic impact study for any proposed development located at the property on the west side of Columbia Pike near Project Skylar to assess the impacts to Columbia Pike and the possible need for additional turn lanes and/or traffic signals based upon the traffic generated by the future development. Since Columbia Pike is a state route, the need for and the approval of additional traffic signals should be coordinated with the Tennessee Department of Transportation.

SR 6 TPR EXECUTIVE SUMMARY

This Transportation Planning Report (TPR) examines the improvements listed in the Nashville Area Metropolitan Planning Organization's (MPO) Long Range Transportation Plan (LRTP) for 10.87 miles of State Route 6 (SR 6) from the City of Spring Hill to the southern limits of the City of Franklin in south-central Tennessee. The project limits also include the Town of Thompson's Station. Widening SR 6 through the City of Spring Hill's CBD or through Thompson's Station Town Limits is not supported by local officials. This TPR was initiated by request of the MPO on behalf of Williamson County. Coordination with local agencies, including the Nashville Area MPO, Williamson County, the City of Spring Hill, the Town of Thompson's Station, and the City of Franklin was conducted throughout the development of this report.

Purpose for Improvements

The purpose for improvements to SR 6 is to provide a transportation facility that will improve regional mobility, reduce congestion, meet the changing social demands of the area, and improve safety by addressing existing roadway deficiencies. The following options are included in the TPR:

No Build Option

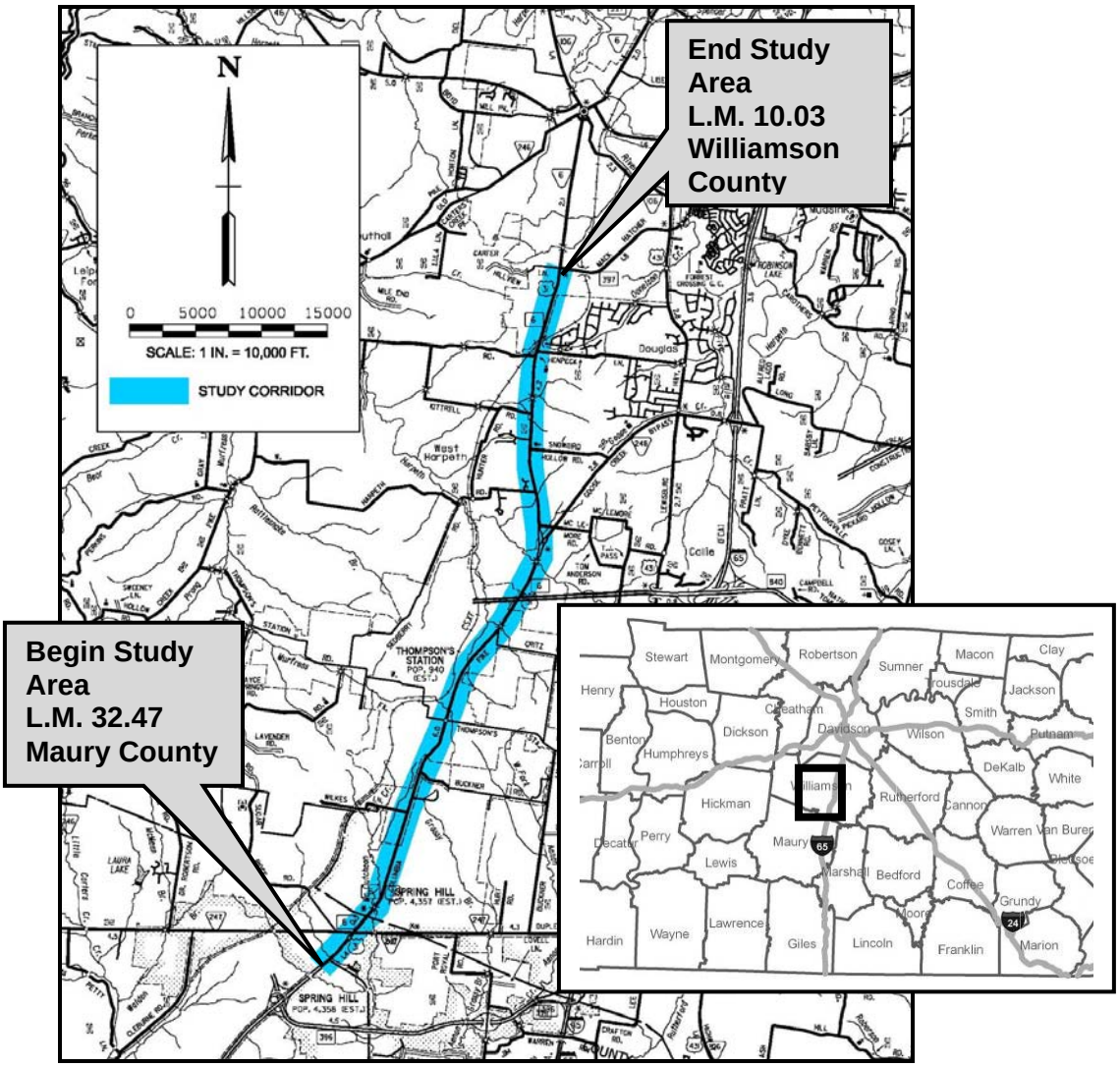
The No Build Option provides no improvements and serves as a baseline option against which all other options are compared. No improvement costs are associated with the No Build Option. All local officials contacted for this TPR acknowledge a need for improvements and therefore do not support a No Build Option.

Widen Along the Existing Alignment Option

This option is similar to the improvements listed in the MPO's LRTP and widens the existing route from two (2) travel lanes to four (4) travel lanes. The cost for corridor wide improvements is estimated to range between $90 and $103 million in year 2014 dollars.

Additional Options

Due to the lack of support by local officials for the Widen Along the Existing Alignment Option, several additional options were studied, including bypass options, reduced travel lane options, and spot improvements. Many of these options, including the bypass options, are significantly different from the improvements listed in the LRTP. These options need additional coordination with the MPO's planning process. Furthermore, the additional options, in their current form, do not meet the purpose and need of the project. Further refinement of these additional options through the MPO's planning process could lead to them becoming viable improvement options. The additional improvement options studied are assessed in the **Options Requiring Additional Study Appendix**.


End Study Area
L.M. 10.03
Williamson County
Begin Study Area
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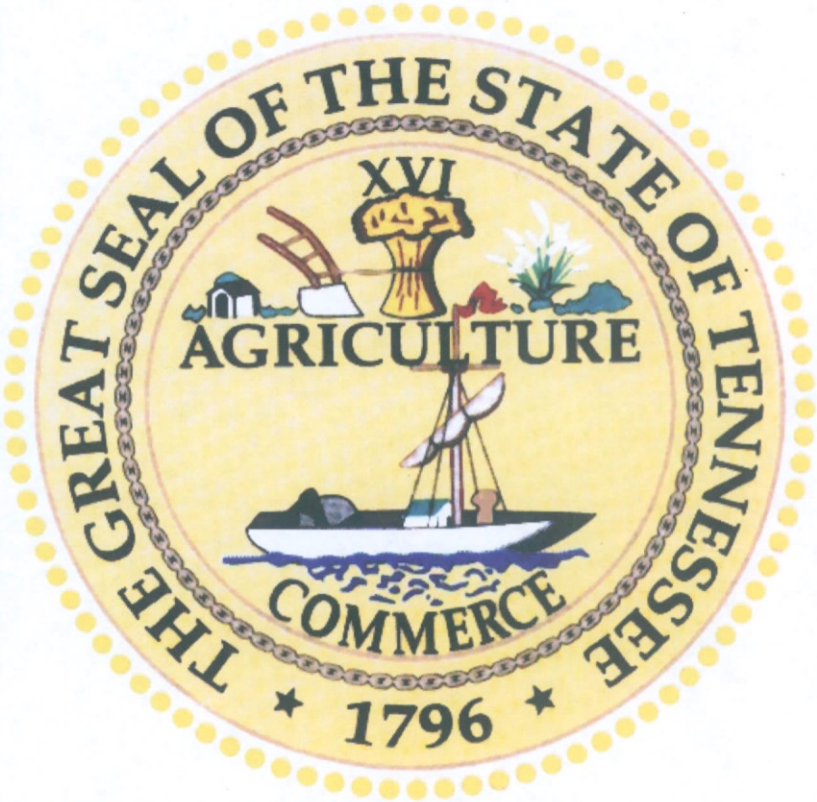
Maury County
N
0 5000 10000 15000
SCALE: 1 IN. = 10,000 FT.
STUDY CORRIDOR
Stewart
Montgomery
Robertson
Sumner
Macon
Clay
Henry
Houston
Trousdale
Jackson
Cheatham
Smith
Dickson
Davidson
Wilson
Putnam
Benton
Humphreys
DeKalb
White
Hickman
Rutherford
Cannon
Warren
Perry
Maury
Lewis
Marshall
Bedford
Coffee
Grundy
Hardin
Wayne
Lawrence
Giles
Lincoln
Franklin
Marion

TRANSPORTATION PLANNING REPORT

STATE ROUTE 6 (US 31)

FROM KEDRON ROAD TO MACK HATCHER PARKWAY
MAURY AND WILLIAMSON COUNTIES
PIN 111040.00



PREPARED BY
FLORENCE & HUTCHESON
For the
NASHVILLE AREA METROPOLITAN PLANNING ORGANIZATION
and the
TENNESSEE DEPARTMENT OF TRANSPORTATION
PROJECT PLANNING DIVISION

Recommended by:	Signature	DATE
CHIEF OF ENVIRONMENT AND PLANNING	K. Joel Carpenter Jr	6/14/10
TRANSPORTATION DIRECTOR PROJECT PLANNING DIVISION	Steve Allen	6-14-10
TRANSPORTATION MANAGER 2 PROJECT PLANNING DIVISION	Bill Hart	6/9/10

This document is covered by 23 USC § 409 and its production pursuant to fulfilling public planning requirements does not waive the provisions of § 409.

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1.0 PURPOSE OF THE TPR

This Transportation Planning Report (TPR) examines the improvements listed in the Nashville Area Metropolitan Planning Organization's (MPO) Long Range Transportation Plan (LRTP) for 10.87 miles of State Route 6 (SR 6) from the City of Spring Hill to the southern limits of the City of Franklin in south-central Tennessee. The improvements widen the existing route from two (2) travel lanes to four (4) travel lanes. A No Build Option was also studied. This TPR was initiated by request of the MPO on behalf of Williamson County. Coordination with local agencies, including the Nashville Area MPO, Williamson County, the City of Spring Hill, the Town of Thompson's Station, and the City of Franklin was conducted throughout the development of this report.

It should be noted that the options presented in this TPR are part of a planning process, and not a design process. The corridor improvement options are presented as 2000 foot wide study areas to allow flexibility when specific alignments are developed in the future. Specific alignments will be developed in future planning documents as the National Environmental Policy Act (NEPA) process continues.

2.0 HISTORY & BACKGROUND

2.1 PROJECT STUDY AREA

The project study area extends from the City of Spring Hill to the southern limits of the City of Franklin, in south-central Tennessee. Please refer to **Figure 2.1.1 Area Vicinity Map**, **Figure 2.1.2 Project Location Map**, or the **Conceptual Plan Sheets** for visual representations of the study area.

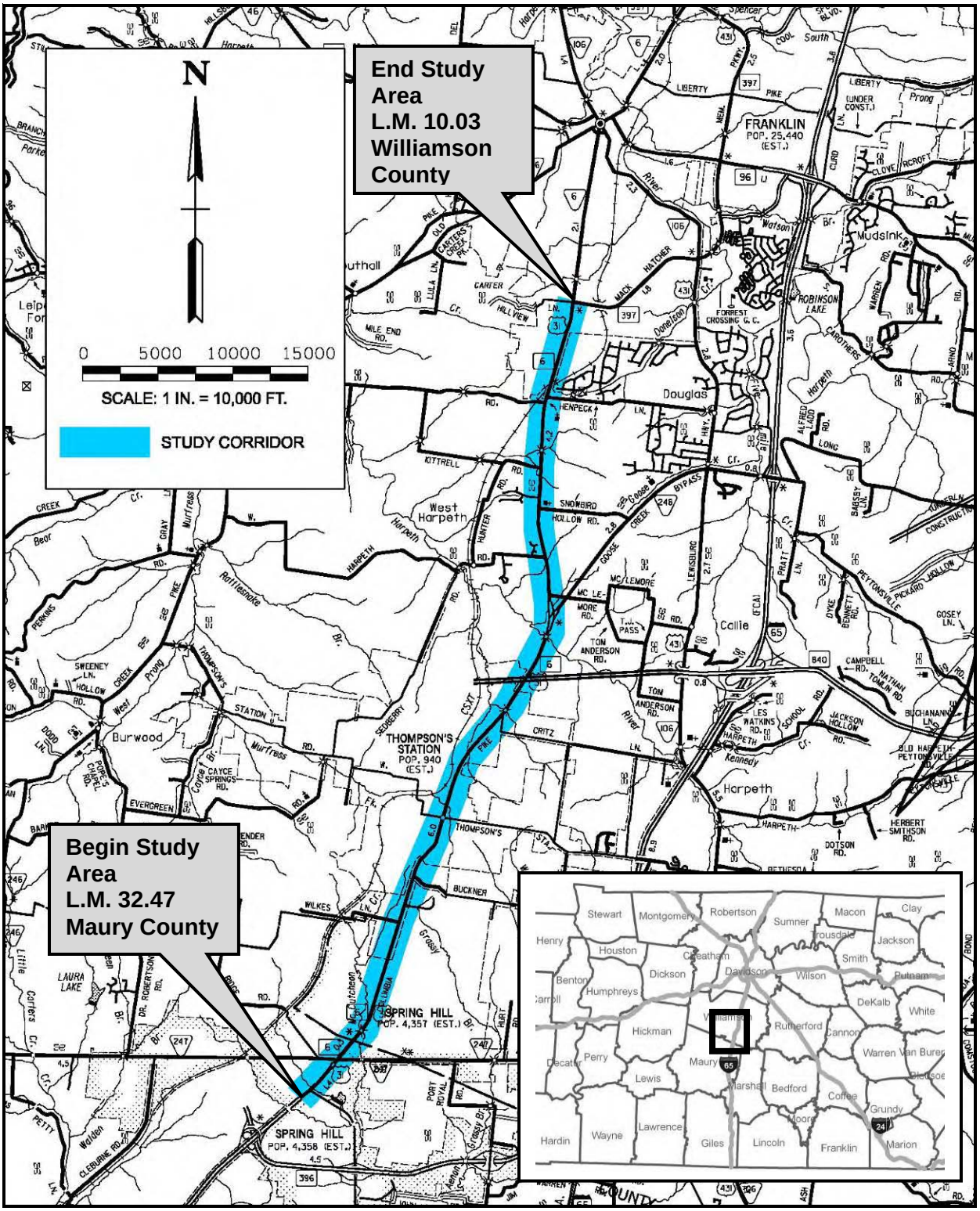


FIGURE 2.1.1 VICINITY MAP

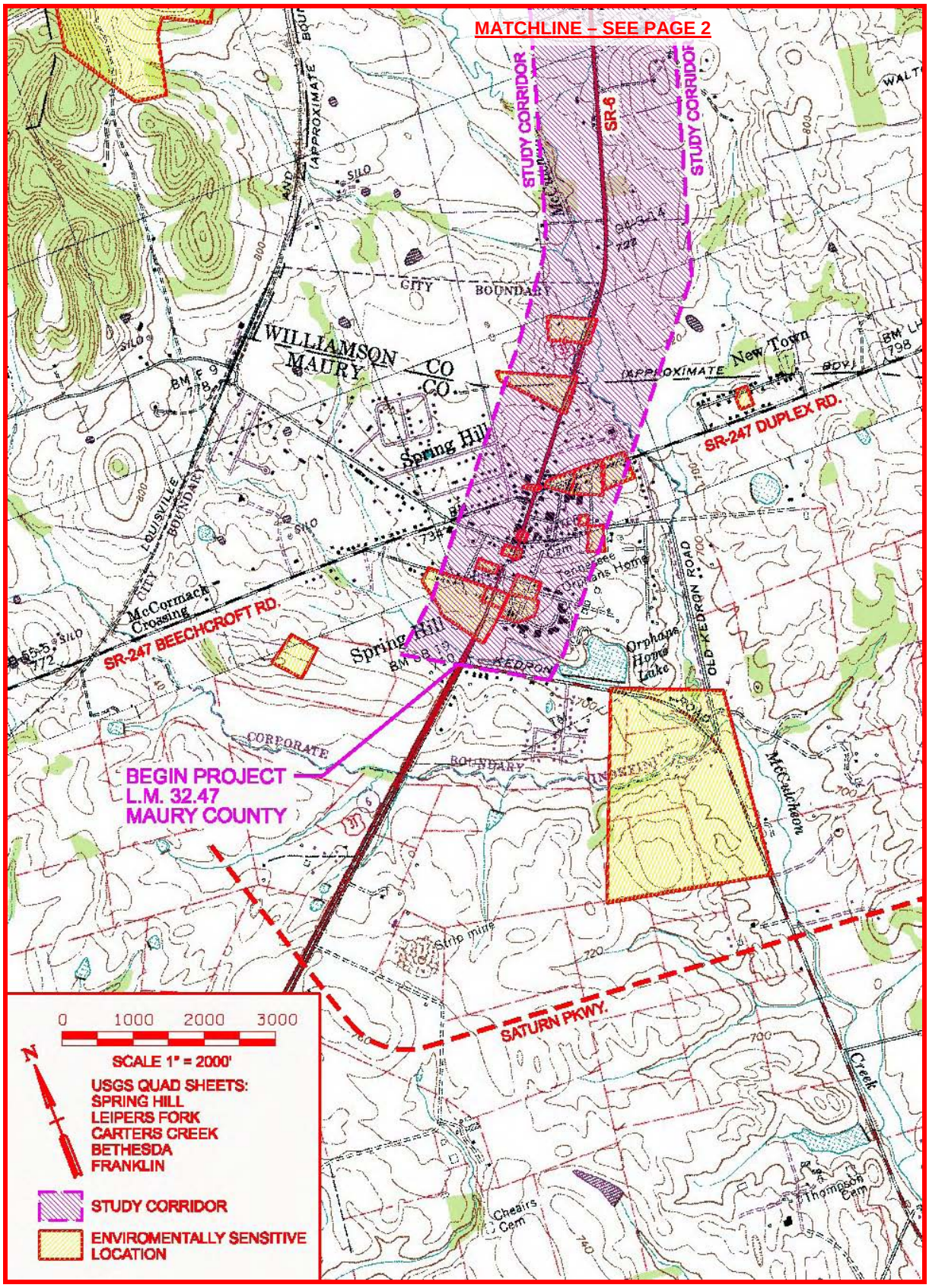


FIGURE 2.1.2 PROJECT LOCATION MAP (1 OF 4)

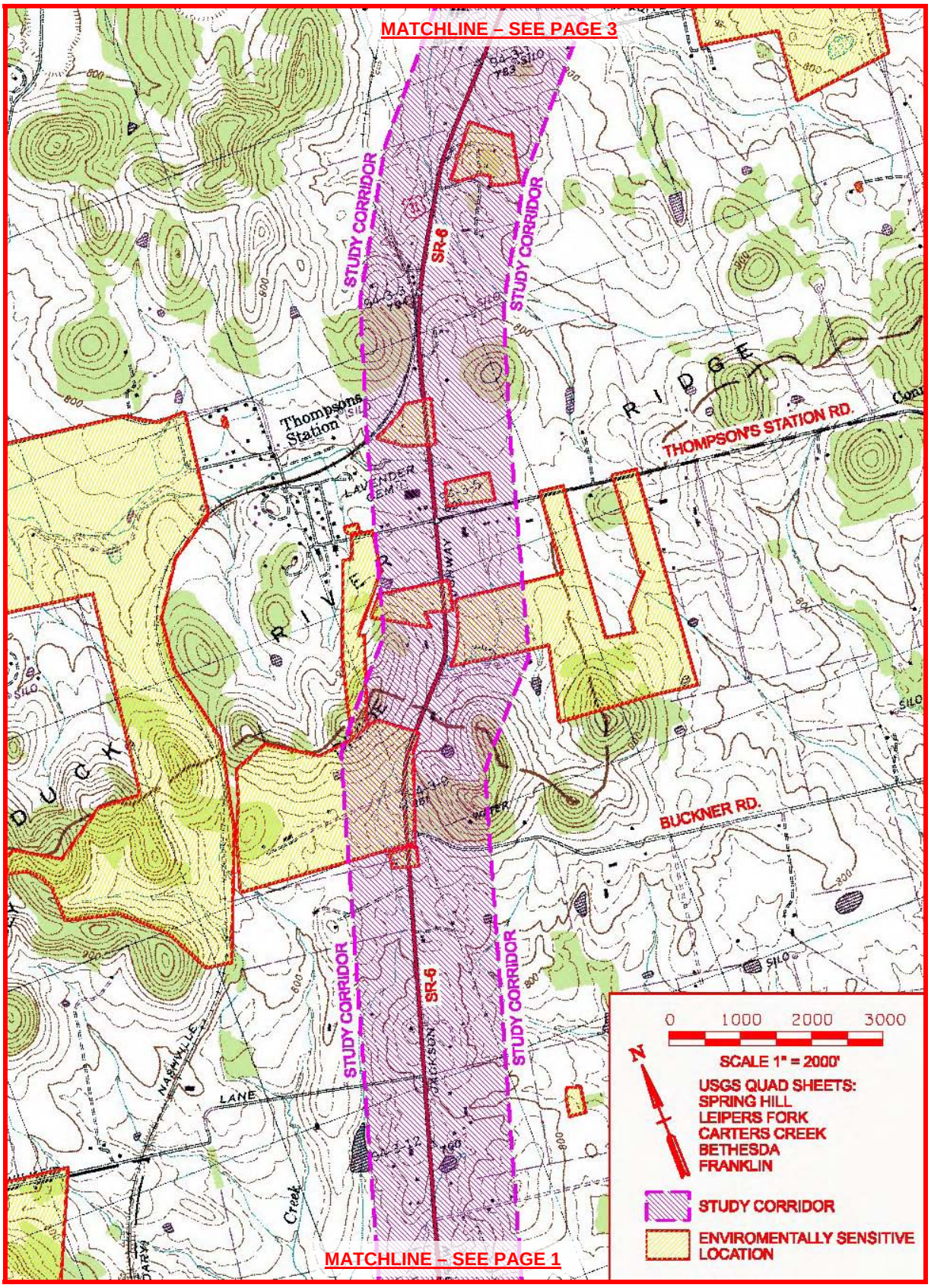


FIGURE 2.1.2 PROJECT LOCATION MAP (2 OF 4)

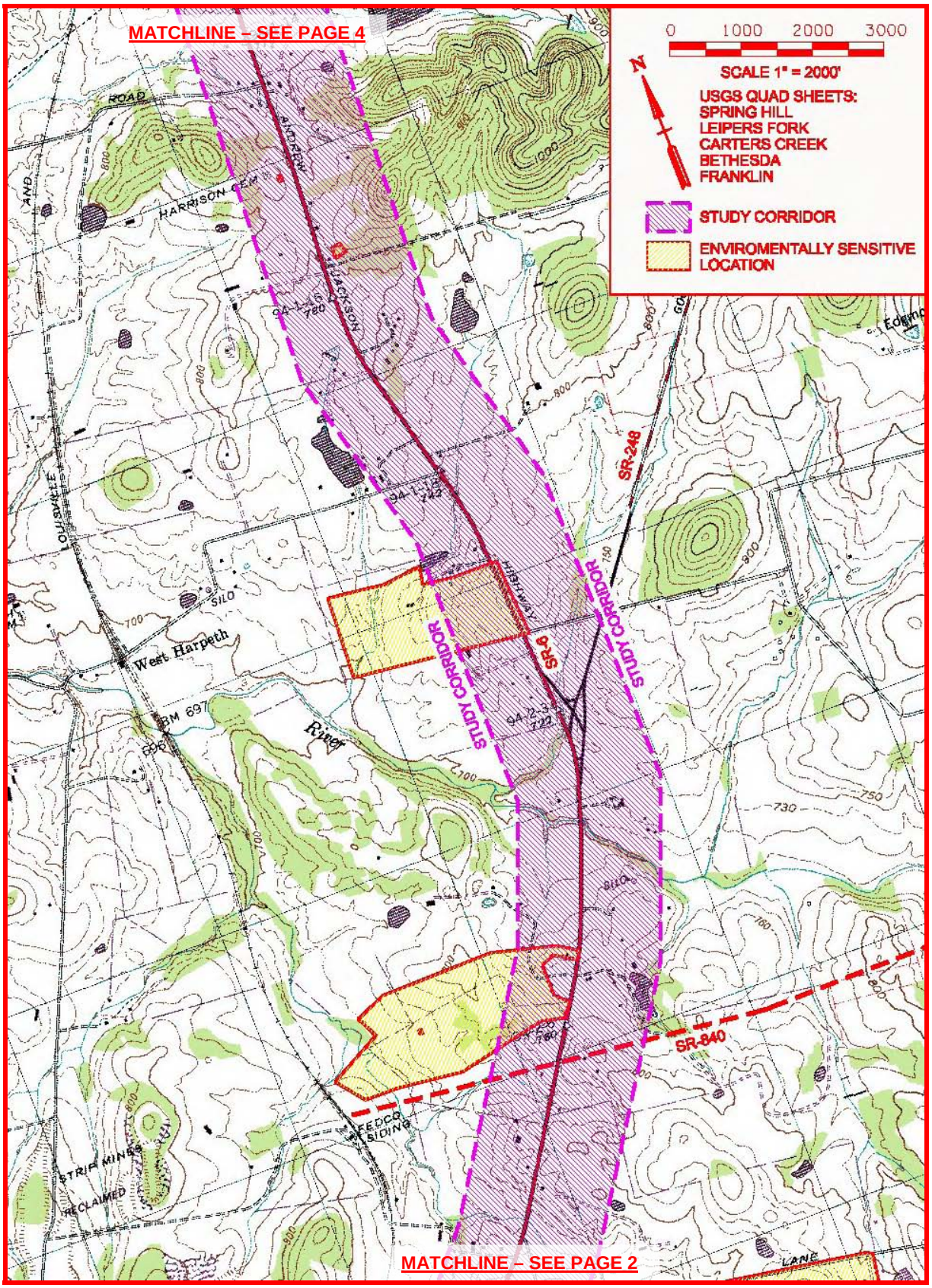


FIGURE 2.1.2 PROJECT LOCATION MAP (3 OF 4)

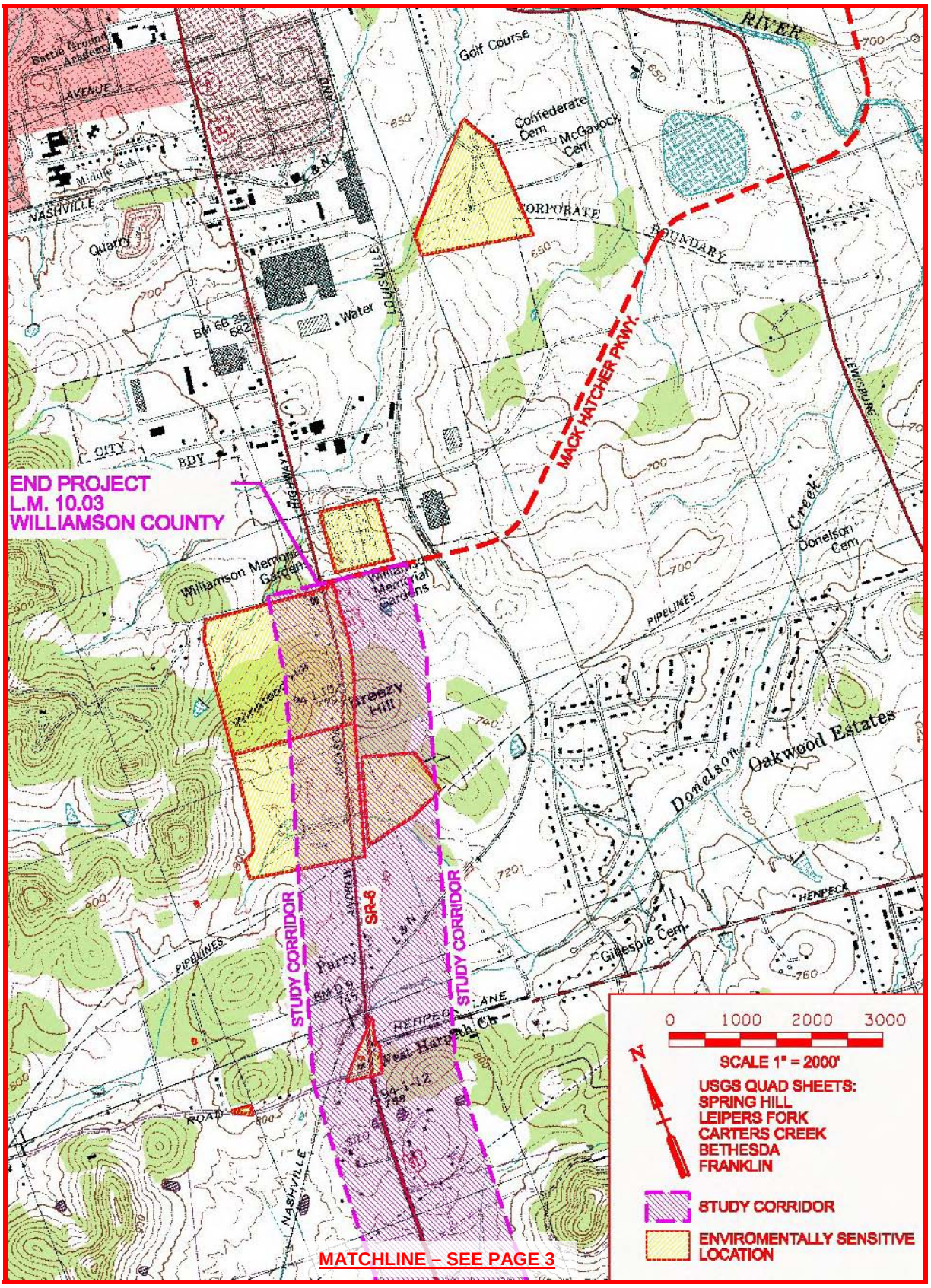


FIGURE 2.1.2 PROJECT LOCATION MAP (4 OF 4)

2.2 PROJECT HISTORY

This TPR is a continuation of several previous studies and meetings. A summary of previous activity concerning this project is provided in **Table 2.2 Project History**. Correspondence concerning this project, including minutes from the previous meetings, is provided in the **Appendix**.

TABLE 2.2 PROJECT HISTORY

Date	Activity
April 4, 2008	Mr. Michael Skipper, Executive Director for the Nashville Area Metropolitan Planning Organization (MPO), issued a letter to TDOT requesting a Transportation Planning Report (TPR) be completed for SR 6 from Old Kedron Road to Mack Hatcher Memorial Parkway. Improvements along SR 6 are listed in the MPO's 2030 Long Range Transportation Plan Update with a horizon year of 2016. A copy of the letter is provided in the **Appendix**.
May 2008	Florence & Hutcheson, Inc. was retained by TDOT's Project Planning Division to produce a Transportation Planning Report (TPR) to examine improvements along SR 6 from Old Kedron Road in Spring Hill to Mack Hatcher Memorial Parkway in Franklin.
August 29, 2008	A site visit was held to gain input from local stakeholders along the route. Thirteen (13) people were in attendance representing the City of Franklin, the Nashville Area MPO, TDOT, the Town of Thompson's Station, and Williamson County. The meeting began with a short discussion of the project limits and the status of the study. The meeting was then opened up for questions, comments, recommendations for improvements (including spot improvements), and closed with a field reconnaissance. Minutes of this meeting are provided in the **Appendix**.

TABLE 2.2 PROJECT HISTORY (CONT.)

Date	Activity
September 10, 2008	A meeting was held with the City of Spring Hill to gain input from local stakeholders. Six (6) people were in attendance. The meeting began with a discussion of what occurred at the Site Visit on 8/29/08. The meeting was then opened up for questions, comments, and recommendations for improvements (including spot improvements). A copy of the City's Major Thoroughfare Plan was provided to Florence & Hutcheson. Minutes of this meeting are provided in the **Appendix**.
January 28, 2009	A meeting was held with TDOT and the MPO to discuss the SR 6 TPR Draft. The primary focus of the meeting was to determine if the options included in the TPR should be strictly limited by what is listed in the MPO's LRTP, or if additional options requested by local agencies should also be included. The Draft SR 6 TPR at that time included bypass options and spot improvements, in addition to an option to widen along the existing alignment. The LRTP only lists widening along the existing alignment. Additional discrepancies between the LRTP and the options presented in the TPR were discussed. It was determined to proceed with submitting the SR 6 TPR with the Bypass Options. Minutes of this meeting are provided in the **Appendix**.
October 21, 2009 & November 2, 2009	Meetings were held with TDOT that followed an MPO retreat. The role of a TPR in relation to the LRTP was discussed at the retreat. It was determined that a TPR can include reasonable options not listed in the LRTP. However, the additional options must meet TDOT's requirements, including meeting access control issues, meeting the Purpose and Need for improvements, geometric standards, and regional significance. Direction to proceed with this TPR was provided, which included investigating if the additional options met these requirements. Minutes of these meetings are provided in the **Appendix**.

TABLE 2.2 PROJECT HISTORY (CONT.)

Date	Activity
March 4, 2010	A meeting was held with TDOT to discuss the revised Draft SR 6 TPR. At this meeting, it was decided to limit the TPR to a No Build Option and an option resembling the improvements listed in the LRTP. This was decided due to the additional options studied not meeting the Purpose and Need for the project. The additional options are also significant alterations to the LRTP, and have not been included in the MPO's planning process. The additional options investigated are included in the **Appendix**, as they may be modified with further study to meet the Purpose and Need of the project. Significant alterations to the project should originate through the MPO Planning Process.

2.3 PLANNED AND RECENT IMPROVEMENTS

2.3.1 Planned Improvements

Williamson and part of Maury County are part of the Nashville Area Metropolitan Planning Organization (MPO). The Nashville Area MPO leads in the development of the region's Long Range Transportation Plan (LRTP) and short-range Transportation Improvement Program (TIP). The goal of the Nashville Area MPO is to provide leadership in planning a comprehensive, multi-modal regional transportation system that promotes economic vitality and encourages sustainable land development to protect community and natural resources. The current TIP is for fiscal years 2008 – 2011. The current LRTP Update (amended November 14, 2007) covers a twenty five (25) year planning horizon through the year 2030.

Numerous transportation improvements are planned within the study area that will directly affect traffic operations along SR 6. Tables **2.3.1 MPO 2008-2011 TIP Projects** and **2.3.2 MPO 2030 LRTP Projects** provide a list of the proposed improvements in their respective current plans. The projects listed in these tables are either along SR 6, intersect SR 6, or provide improvements to a parallel facility. Improvements along a parallel facility are listed because utilization of these routes may decrease congestion along SR 6.

MPO's are established through federal legislation and exist throughout the United States in urbanized areas of more than 50,000 people. It is through MPOs that local communities prioritize state and federal funds for various transportation projects and programs. Each MPO is comprised of representatives from:

- City and County governments
- Their respective State Department of Transportation
- The Federal Highway Administration
- The Federal Transit Administration
- Other local or regional transportation-related agencies such as transit authorities and airports.

The improvements for SR 6 listed in the Nashville Area MPO's 2030 LRTP are to widen SR 6 from the existing two (2) travel lanes to four (4) travel lanes. Specifically, the LRTP promotes widening SR 6 from the existing two (2) lanes to five (5) lanes between Old Kedron Road and Buckner Road (MPO LRTP Project #6001, Horizon Year 2016). The LRTP also specifies widening SR 6 from the existing two (2) lanes to four (4) or five (5) lanes between Buckner Road and Henpeck Lane (MPO LRTP Project #6022, Horizon Year 2016). The LRTP specifies SR 6 will be five (5) lanes within Spring Hill's City Limits and four (4) lanes in Williamson County. Spring Hill's City Limits end approximately one-quarter (¼) of a mile north of Buckner Road. Thompson's Station's Town Limits are not mentioned in the LRTP. Thompson's Station's Town Limits border Spring Hill's City Limits and end approximately 3.2 miles before Franklin's City Limits begin. Also of note, Old Kedron Road does not intersect SR 6. Kedron Road intersects SR 6. The existing five (5) lane section of SR 6 south of Spring Hill transitions to three (3) lanes at Kedron Road. The logical terminus of Kedron Road is the southern limit of this TPR's study area.

It should be noted that the northern terminus for improvements to SR 6 listed in the LRTP extend only to Henpeck Lane. The study limits of this TPR extend from Kedron Road to Mack Hatcher Parkway. Therefore, improvements to the 1.25 mile section of SR 6 from Henpeck Lane to Mack Hatcher Parkway are not in the LRTP. In discussions with a representative of the MPO, it was noted that this section will need to be adopted into the LRTP. As part of the Nashville Area MPO's planning process, a Tier 2 report will also need to be performed by the MPO for this segment of SR 6. Tier 2 reports are necessary to comply with the Nashville Area MPO's Congestion Management Process. Ending the project at Henpeck Lane is not a logical terminus. The City of Franklin is improving SR 6 to five (5) lanes north of Mack Hatcher. Terminating this project at Henpeck Lane would leave a two (2) travel lane segment between these four (4) travel lane segments.

Other than improvements to SR 6, significant highway improvements planned in the area include widening Interstate 65 and completion of the southern loop of SR 840. Interstate 65 is planned to be improved from four (4) travel lanes to eight (8) travel lanes (including high occupancy vehicle lanes) between SR 840 and SR 96.

SR 840 was initiated in 1986 as part of the state's Better Roads Program to provide economic growth by improving access to communities in Middle Tennessee. On the 78 mile route, 57.1 miles are open to traffic, with 20.9 miles remaining in some phase of construction or development. The entire route is scheduled to be open to traffic by 2012. Completion of SR 840 can be expected to impact traffic patterns within the study area.

The traffic data utilized in this report was generated in conjunction with the MPO's travel demand model. This model incorporates future improvements as programmed in the LRTP. Therefore, the traffic data utilized in this report incorporates the effects on travel patterns created by the highway improvements listed in the LRTP and TIP. The traffic generation calculations are provided in the **Appendix**.

In addition to the MPO planning data, the Major Thoroughfare Plans of the City of Spring Hill and the City of Franklin were examined. The City of Franklin is currently in the planning stages to widen SR 6 to five (5) lanes north of Mack Hatcher Parkway, at the northern terminus of this TPR. This will provide a logical terminus for the improvements discussed in this TPR.

The Town of Thompson's Station was consulted for this TPR. The town is developing a greenway plan. The greenway locations are not currently known. However, it is anticipated

greenways will eventually cross SR 6. The town has requested that the greenways and SR 6 be grade separated. This could be accomplished by providing oversized culverts or bridge spans where these structures are needed. The design of improvements along SR 6 should therefore be coordinated with the Town, especially concerning the development of their greenway plan.

TABLE 2.3.1 MPO 2008-2011 TIP PROJECTS

Description	Horizon Year	Cost
Widen SR 247 from SR 6 to near Interstate 65 from two (2) lanes to three (3) lanes.	2008 (PE)	$15,580,000
Construct new four (4) lane segment of SR 840 from west of Bending Chestnut Road to east of Thompson's Station Road	2008 (ROW)	$75,000,000
Coordinate the signal timing of six (6) existing intersections along SR 6 between Stephen P. Yokich Parkway and Buckner Road.	2008	$540,000
Construct new four (4) lane segment of SR 840 from southeast of SR 100 to west of Bending Chestnut Road	2008	72,500,000
Construct new four (4) lane segment of SR 840 from west of Bending Chestnut Road to west of Leipers Creek Road (SR 46)	2009	$70,000,000
Construct new four (4) lane segment of SR 840 from west of Leipers Creek Road (SR 46) to west of Carters Creek Pike (SR 246)	2009	$41,900,000
Improve the intersection of SR 6 at Duplex/Beechcroft Road.	2011	$740,000
Widen Interstate 65 from south of SR 840 to SR 96, including the interchange with Peytonsville Rd, from four (4) lanes to eight (8) lanes. The interchange may be improved to a single point urban design.	2011	$84,549,392
Total Improvements:		**$360,809,392**

TABLE 2.3.2 MPO 2030 LRTP PROJECTS

Description	Horizon Year	Cost
Widen SR 6 from Buckner Lane to Henpeck Lane from two (2) lanes to four (4) lanes in the County and from two (2) lanes to five (5) lanes through the City of Spring Hill. Project #6022.	2016	$29,000,000
Widen SR 6 from Old Kedron Road to Buckner Road from two (2) lanes to five (5) lanes. Project #6001.	2016	$7,200,000
Widen SR 6 from Mack Hatcher Parkway (SR 397) to Downs Boulevard from three (3) lanes to five (5) lanes, with bike lanes, sidewalk, and curb and gutter. Project #6027	2016	$9,251,500
Widen Goose Creek Bypass (SR 248) from SR 106 (Lewisburg Pike) to Interstate 65 from two (2) lanes to four (4) lanes with a median and bike lanes. Project #6034.	2016	$2,450,000
Widen SR 106 (Lewisburg Pike) from Henpeck Lane to Mack Hatcher Parkway (SR 397) from two (2) lanes to four (4) lanes with bike lanes. Project #6032.	2016	$15,000,000
Widen SR 106 (Lewisburg Pike) from Critz Lane to Goose Creek Bypass (SR 248) from two (2) lanes to four (4) lanes. Project #6021	2020	$15,000,000
Widen Goose Creek Bypass (SR 248) from SR 6 to SR 106 (Lewisburg Pike) from two (2) lanes to three (3) lanes. Project #6038.	2025	$11,000,000
Construct an interchange at Interstate 65 and Thompson's Station Road. Project #6046.	2030	$6,500,000
Total Improvements:		**$95,401,500**

2.3.2 Recent Improvements

In addition to the planned improvements previously discussed, the City of Spring Hill has recently constructed Miles Johnson Parkway. The southern terminus of Miles Johnson Parkway is located at an intersection with Duplex Road (SR 247) approximately 0.4 miles east of SR 6. The City's Major Thoroughfare Plan lists a project to extend Miles Johnson Parkway south approximately 0.2 miles to Old Kedron Road. Miles Johnson Parkway's northern terminus is at an intersection with SR 6 approximately 0.6 miles north of Spring Hill's Central Business District (CBD). Miles Johnson Parkway should reduce traffic in the CBD by providing access between numerous new subdivisions located along Duplex Road and destinations to the north. Additionally, when the extension to Kedron Road is complete, Miles Johnson Parkway will provide improved access to an interchange on Saturn Parkway (SR 396), which will further enhance this route as an alternate to SR 6 through the CBD. It is unknown when funding for the 0.2 mile long Miles Johnson Parkway extension will be available.

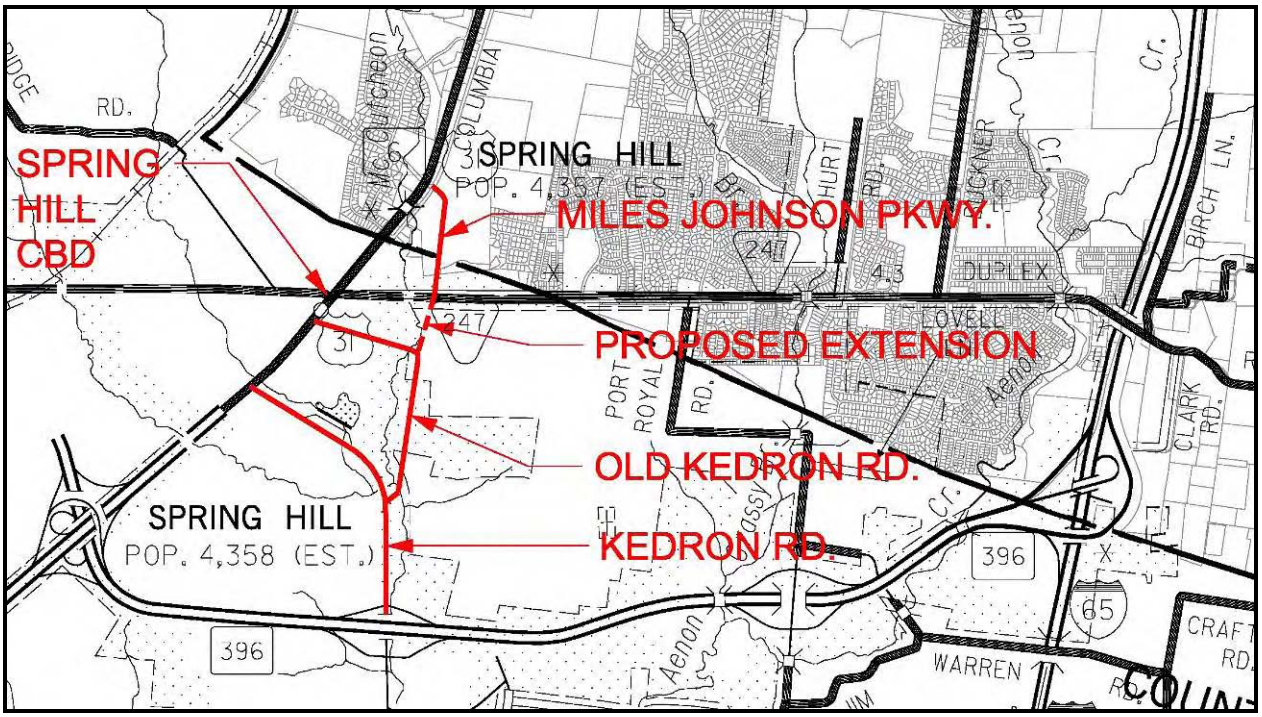


FIGURE 2.3 MILES JOHNSON PARKWAY DETAIL

3.0 PURPOSE AND NEED FOR IMPROVEMENTS

3.1 PURPOSE FOR IMPROVEMENTS

The purpose for improvements to SR 6 is to provide a transportation facility that will improve regional mobility, reduce congestion, meet the changing social demands of the area, and improve safety by addressing existing roadway deficiencies. This TPR was initiated by request of the Nashville Area MPO on behalf of Williamson County. The MPO's 2030 Long Range Transportation Plan (LRTP) calls for widening SR 6 from the existing two (2) travel lanes to four (4) travel lanes.

3.2 NEED FOR IMPROVEMENTS

3.2.1 Improve Regional Mobility

Improvements to the transportation system are needed to improve regional mobility. SR 6 is a critical arterial in south-central Tennessee. Within the study limits of this TPR, SR 6 runs parallel to Interstate 65 and serves regional travel demand between Columbia, Spring Hill, Thompson's Station, and Franklin. Considerable commuter driving patterns occur between these cities, creating congestion during peak travel times. The Nashville Area MPO reports that twelve percent (12%) of Maury County residents commute to work in Williamson County and nine percent (9%) commute to Davidson County. SR 6, along with Interstate 65 and SR 106 (Lewisburg Pike) are the primary north-south routes in the region. When traffic incidents occur on Interstate 65, SR 6 is a primary detour route.

3.2.2 Reduce Congestion

Improvements to the transportation system are needed to reduce congestion. As mandated by federal transportation regulations, a Congestion Management Process (CMP) has been implemented in the Nashville MPO Area. A CMP is required due to the MPO Area having a population over 200,000 people and therefore being a Transportation Management Area (TMA). Projects must comply with the CMP prior to approval in the LRTP. The MPO's 2030 LRTP calls for widening SR 6 from the existing two (2) travel lanes to four (4) travel lanes. Therefore, the Nashville Area MPO's planning process indicates SR 6 is congested and that travel demand reduction strategies outlined in the CMP Document can not address the congestion. Local officials and field observations verify congestion limits mobility along SR 6 during AM and PM peak travel times.

3.2.3 Meet Changing Social Demands

Improvements to the transportation system are needed to meet the changing social demands of the area. The population of Williamson County grew by 56.3% from 1990 to 2000, and was the fastest growing county in Tennessee. The population of Maury County grew by 26.8% from 1990 to 2000. The City of Spring Hill has seen extraordinary growth since 2000. There are several major regional employers located within or near the study limits of this TPR, including the newly relocated North American Headquarters of Nissan in the Cool Springs area of

Franklin. This formerly rural area has seen extensive changes in population and land use in recent years and the existing transportation system does not meet the demand.

3.2.4 Improve Safety

Improvements to SR 6 are needed to improve safety by addressing existing roadway deficiencies. The segment of SR 6 through the City of Spring Hill's CBD has a crash rate that is approximately one and a half (1.5) times higher than the statewide rate for similar roadways. High crash rates are also reported between Campbell Station Parkway and Thompson's Station Road, at the Goose Creek Bypass Intersection, and at the Mack Hatcher Parkway Intersection. The primary deficiency along the route is poor traffic operations.

4.0 EXISTING CONDITIONS

4.1 COMMUNITY DESCRIPTION

Over ninety percent (90%) of the project's limits are located in Williamson County, with the remainder being located in Maury County. Williamson and Maury Counties are located in Southern Middle Tennessee. Williamson and part of Maury County are part of the Nashville Area MPO. There are ninety-five (95) counties in Tennessee. Williamson and Maury County are the eleventh (11th) and seventeenth (17th) largest counties by population, with populations of 126,638 and 69,498 respectively (2000 US Census). The population of Williamson County grew by 56.3% from 1990 to 2000, and was the fastest growing county in Tennessee. The population of Maury County grew by 26.8% from 1990 to 2000.

Williamson County is:
- The wealthiest county in TN
- The fastest growing county in TN
- Has numerous historic sites

Williamson County is the sixteenth (16th) largest County by land area in Tennessee with an area of 583 square miles. Williamson County is the wealthiest county in Tennessee and ranked as one of the wealthiest counties in the country. In 2004, the median household income was $79,692 with a per capita income of $44,298. Williamson County also had the lowest unemployment rate in the State in 2006 at 3.5%. This is below the 2006 unemployment rate for Tennessee of 5.2%.

Maury County is the tenth (10th) largest County by land area in Tennessee with an area of 613 square miles. In 2004, the median household income for the county was $43,116 with a per capita income of $28,126. Maury County had the twenty-ninth (29th) highest unemployment rate in the state in 2006 at 5.4%. The Nashville Area MPO reports that twelve percent (12%) of Maury County residents commute to work in Williamson County and nine percent (9%) commute to Davidson County. SR 6 is a primary commuting route between Maury County and southern Williamson County.

The Project corridor crosses the following communities:
- Spring Hill
- Thompson's Station
- Franklin

Within the study limits, the land use is varied and includes commercial, industrial, agricultural and residential development. The study area crosses the Central Business District (CBD) of Spring Hill, Thompson's Station, and the southern urbanized area of Franklin, along with unincorporated areas of Williamson County. In the unincorporated areas, Williamson County zoning

specifies a maximum residential building density of one (1) residential dwelling unit per acre, with no zoning for commercial development. The terrain in the study area is rolling. A map of Williamson County's land use zones is provided in **Figure 4.1.1 Land Use Zones**.

The City of Franklin is the county seat of Williamson County and is the most populous city with a population of 41,842 (2000 US Census). Franklin is located approximately nineteen (19) miles south of Nashville. The median household income in Franklin is $65,506 with a per capita income of $32,160. The northern terminus of the study corridor is located at Franklin's southern city limits. The land use in this area has a moderate building density with residential, public, and commercial developments.

Thompson's Station is located in Williamson County and is approximately twenty-five (25) miles south of Nashville, just south of the City of Franklin. Thompson's Station has a population of 1,283 (2000 US Census). The median household income is $66,875 with a per capita income of $24,143.

The portion of Thompson's Station adjacent to the study area has a moderate building density. The land use is generally residential, with some minor commercial development, including a service station. The Town's land use and zoning policy is designed to spur development on the east side of town, between SR 6 and Interstate 65. The Town's zoning calls for more condensed development along SR 6, residential development east of SR 6, and agricultural development west of the CSX Corporation rail line. Development along Critz Lane, which extends from SR 6 east to SR 106 (Lewisburg Avenue), is expected to see significant residential growth in the near future. Several large residential developments were zoned in this area, but are currently stalled due to current economic conditions. It is anticipated these areas will see growth when the economy rebounds.

The City of Spring Hill is located along the Maury and Williamson county border approximately thirty (30) miles south of Nashville. The City had a population of 7,715 in the 2000 US Census. The City has seen extraordinary growth since 2000. The median household income is $60,872, with a per capita income of $21,688.

The CBD of Spring Hill has a compact building density and includes numerous historic properties. SR 6 bisects this urban environment with a narrow sixty (60) feet of existing right-of-way. Further north, the land use within Spring Hill's City Limits is predominantly residential or commercial with varying land use densities. Numerous commercial properties are located along SR 6. Many of these developments have features, including parking lots, retaining walls, and detention ponds, located adjacent to the existing right-of-way.

There are several major regional employers located within or near the study limits of this TPR. Industries that employee fifty (50) or more employees within the study area are listed in **Table 4.1.1**. These industries are mapped in **Figure 4.1.2**.

After the economic data discussed above was collected, the nation experienced an economic recession. During this economic downturn, Tennessee's unemployment rate increased and the GM (Saturn) automotive plant was idled. This plant is located just south of the study corridor in Spring Hill. There are currently no known plans to resume the assembly of automobiles at the plant. Until the production of automobiles is resumed there will be a considerable negative economic impact on Spring Hill and the adjacent communities.

Several Utilities are located within the study area. The utility service providers are listed in **Table 4.1.2**.

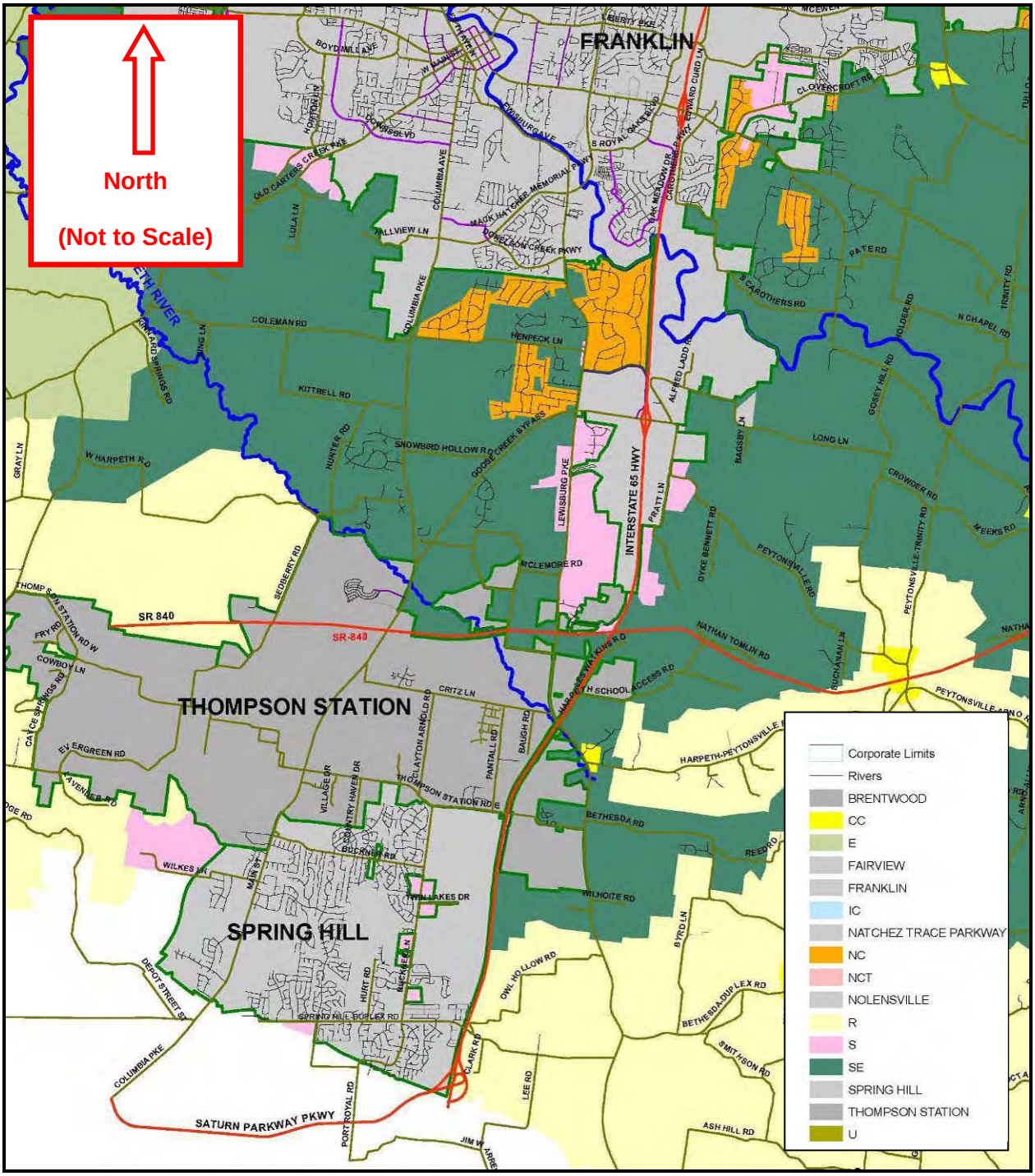


FIGURE 4.1.1 LAND USE ZONES

TABLE 4.1.1 MAJOR INDUSTRIES

ID	Name	Product	Number of Employees
I1*	GM – Saturn*	Automobile Manufacturer*	4,295*
I2	Nissan – North American	Automobile Manufacturer Headquarters	1,600
I3	Healthways	Corporate Headquarters	1,000
I4	AIM Healthcare	Healthcare Industry	815
I5	Progeny Marketing Innovations	Marketing and Insurance	550
I6	Civil Constructors, Inc.	Construction Contractor	500
I7	Mars Petcare US	Pet Food Manufacturer Headquarters	500
I8	Affinion Group	Marketing	470
I9	LDM Technologies	Automotive Supplier	400
I10	CIMplify	Medical Computer Information Management	370
I11	Lasko Metal Products	Fans, Humidifiers, and Heaters	350
I12	DA Vita	Dialysis Treatments	350
I13	Apcom, Inc.	Divisional Headquarters	350
I14	Plastech Engineered Products, Inc.	Plastic Injection Molding	230
I15	Essex Group, Inc.	Magnet Wire	209
I16	Husky Truss & Building Supplies	Wooden Floor Trusses	100
I17	Premier Mfg. Support Services	Janitorial Services	80
I18	US Engineering Company	Mechanical Contractors	79
I19	Spandeck, Inc.	Hydraulic Cranes	75
I20	Pioneer Manufacturing	Loading Dock Equipment	60
I21	Phoenix Metals	Specialty Metals	54
I22	Haley Tool & Stamping, Inc.	Metal Stamping, Tool & Die	50
I23	Prime Colorants, Inc	Additives for Plastics	50

∗ The GM automobile plant was idled in 2009. There are currently no known plans to resume the assembly of automobiles at the plant.

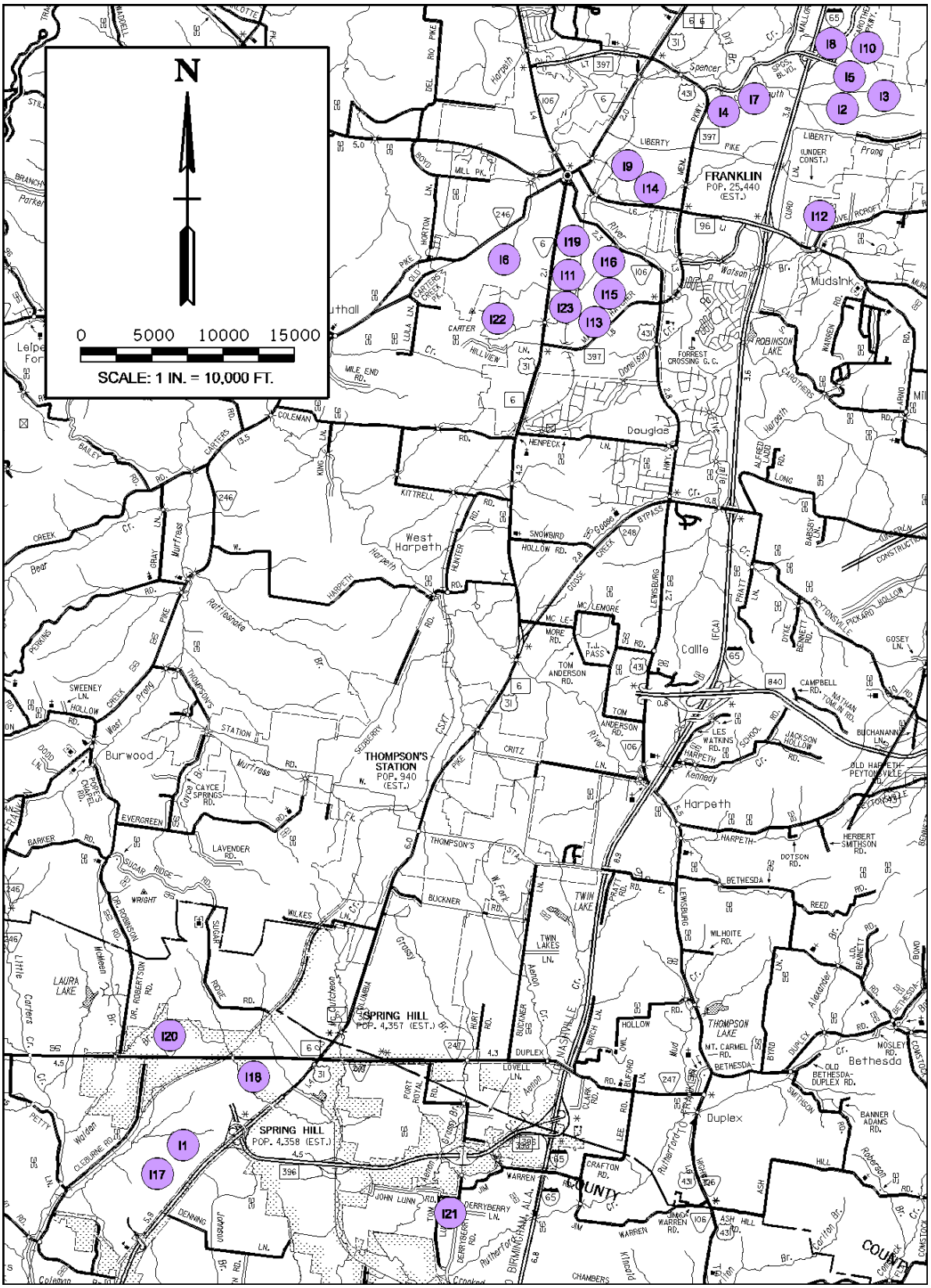


FIGURE 4.1.2 MAJOR INDUSTRIES MAP

TABLE 4.1.2 UTILITY SERVICE PROVIDERS

Name	Utility Service	Source/Company
Middle Tennessee Electric Membership Corporation	Electricity	TVA
Duck River Electric Membership Corporation	Electricity	TVA
Columbia Power Systems	Electricity	TVA
City of Franklin	Water	Harpeth Valley Utility District/Harpeth River
City of Spring Hill	Water	Duck River
Harpeth Valley Utility District	Water	Harpeth River
Columbia Water Systems	Water	Duck River
Hillsboro, Burwood & Thompson's Station (H.B. & T.S.) Utilities	Water	Duck and Cumberland Rivers
City of Franklin	Sewer	n/a
City of Spring Hill	Sewer	n/a
Harpeth Valley Utility District	Sewer	n/a
Columbia Wastewater Systems	Sewer	n/a
Town of Thompson's Station	Sewer	n/a
Atmos Energy	Natural Gas	Natural & Columbia Gulf Transmission, Texas Eastern, Columbia Gulf
AT&T	Telephone	n/a
Comcast	Cable	n/a

4.2 ENVIRONMENTAL SITES

Williamson and Maury County are rich in history and were the location of several major Civil War battles including the Battles of Brentwood, Spring Hill, Thompson's Station, and Franklin. Williamson County has more properties on the National Register of Historic Places than any other County outside of the State of Virginia. Therefore, several environmentally sensitive locations and community resources are located within the study area. In addition to historic places, these areas include churches, cemeteries, schools, environmental sites, parks, major streams, utilities, and railroads. The environmentally sensitive locations were determined through an Early Environmental Screening and a Desktop Environmental Scan. The known environmentally sensitive locations along the study corridor are listed in **Table 4.2 Environmental and Community Resources** and mapped in **Figure 4.2 Environmentally Sensitive Locations.** Additionally, the locations are labeled in the **Conceptual Plans**.

4.2.1 Early Environmental Screening (EES)

In preparation of Transportation Planning Reports (TPR), the Tennessee Department of Transportation (TDOT) has introduced an Early Environmental Screening (EES) process for the project study area. By screening the latest available Geographic Information Systems (GIS) environmental data during the early stages of project planning, TDOT and the public will be better prepared to anticipate potential environmental issues and mitigation requirements. This screening process involves using GIS to assess environmental data as it spatially relates to the project's Area of Potential Effect (APE). In broad terms, the GIS environmental data reviewed in this TPR include the following layers:

- Archaeological/Historic Architecture – Historic properties and cemetery sites;
- Community Impacts – Sensitive community populations;
- Ecology – Scenic Waterways, Natural Areas, large wetlands, protected species (bat, aquatic, terrestrial, plants);
- Hazardous Substances/Geology – Hazardous substance sites, pyritic rock/geotechnical, caves; and,
- Parks & Public Land – parks (federal/state/local), public land/buildings, railroads, wildlife management areas.
- As of the publication of this document, the GIS data within each layer was up to date relevant to date of its publication. This data will be updated as part of the ongoing project development process.

The TDOT EES Maps are provided in the **Appendix**.

4.2.2 Desktop Environmental Scan

In addition to TDOT's GIS based EES, a desktop environmental/community resources scan was performed as part of this TPR. Sources utilized in this environmental/community resources scan include the following: Environmental Protection Agency Envirofacts, United States Geological Survey Topographic Mapping (Spring Hill, Leipers Fork, Carters Creek, Bethesda, and Franklin) aerial photography, TDOT maps, and the National Register of Historic Places.

TABLE 4.2 ENVIRONMENTAL AND COMMUNITY RESOURCES

Churches	
Name	**Location**
Spring Hill Church of Christ	5351 Main Street, Spring Hill, TN, 37174
Spring Hill Presbyterian Church	5344 Main Street, Spring Hill, TN 37174
Grace Episcopal Church	5291 Main Street, Spring Hill TN 37174
Spring Hill United Methodist Church	5286 Main Street, Spring Hill, TN 37174
Mt. Hope Baptist Church	5276 Main Street, Spring Hill, TN 37174
Wesley Chapel United Methodist Church	511 McClemore Avenue, Spring Hill, TN 37174
New Town Church of Christ	2615 Duplex Road, Spring Hill, TN 37174
First Baptist Church	5219 Main Street, Spring Hill, TN 37174
Jehovah's Witness Church	4002 O'Hallorn Drive, Spring Hill, TN 37174
St. Mark United Primitive Baptist Church	518 Maury Hill Street, Spring Hill, TN 37174
Faith Lutheran Church	4738 Columbia Pike, Thompson's Station, TN 37179
Thompson's Station Baptist Church	2604 Thompson's Station Road, Thompson's Station, TN 37179
Thompson's Station Church of Christ	4721 Columbia Pike, Thompson's Station, TN 37179
Spring Meadow Baptist Church	4256 Columbia Pike, Franklin, TN 37064
New Birth Seventh Day Adventist Church	1336 Coleman Road, Franklin, TN 37064
West Harpeth Primitive Baptist Church	4141 Columbia Pike, Franklin, TN 37064

Cemeteries	
Name	**Location**
Spring Hill Memorial Park	5239 Main Street, Spring Hill, TN 37174
Williamson Memorial Gardens	3009 Columbia Pike, Franklin TN, 37064
Patton Cemetery	Thompson's Station Road W, Thompson's Station, TN 37179
Evergreen Cemetery	Evergreen Road, Spring Hill, TN 37174
Buford Cemetery	Columbia Pike, Thompson's Station, TN 37179 (south of Critz Lane)
Dodson Cemetery	Clayton Arnold Road, Thompson's Station, TN 37179
Baugh Cemetery	Columbia Pike, Franklin, TN 37064
Harrison Cemetery	Columbia Pike, Franklin, TN 37064
Hood Cemetery	Snowbird Hollow Road, Franklin, TN 37064
Turner Cemetery	Coleman Road, Franklin, TN 37064
Harrison Cemetery	Coleman Road, Franklin, TN 37064
Mathis Cemetery	Henpeck Lane, Franklin, TN 37064
Sweeney Cemetery	Columbia Pike, Franklin, TN 37064

Schools	
Name	**Location**
Spring Hill Elementary	5359 Main Street, Spring Hill TN, 37174
Heritage Middle School	4803 Columbia Pike, Thompson's Station, TN 37179
Heritage Elementary School	4801 Columbia Pike, Thompson's Station, TN 37179
Independence High School	1776 Declaration Way, Thompson's Station, TN 37179
Winstead Elementary School	4080 Columbia Pike, Franklin, TN 37064

Environmental Sites	
Name	**Location**
Ryder Truck Rental (EPA Hazardous Waste)	3639 Royal Park Boulevard, Spring Hill, TN 37174
Spring Hill Water Treatment Plant (EPA Water Discharger)	199 Town Center Parkway, Spring Hill, TN 37174
Jimmy's Custom Cleaners and Alterations (EPA Air Emissions)	5317 Main Street, Spring Hill, TN 37174
CVS (EPA Hazardous Waste)	4805 Columbia Pike, Thompson's Station, TN 37179
Henry P. Minton Family Trust/Batey Property (EPA Hazardous Waste)	2762 Critz Lane, Thompson's Station Road, Thompson's Station, TN 37179

Parks & Recreation	
Name	**Location**
Thompson's Station Park	Thompson's Station Road W, Thompson's Station, TN 37179
Winstead Hill Park	US 31, Franklin, TN 37064 (across from Mack Hatcher Parkway)

Historic Places	
Name	**Location**
Ferguson Hall (aka Tennessee Orphan's Home, Martin Cheairs House, Branham and Hughes Military Academy)	5350 Main Street, Spring Hill, TN 37174
Spring Hill High School	Spring Hill
Cleburne Jersey Farm (aka Campbell Farm)	2319 Sugar Ridge Road, Spring Hill, TN 37174
Ewell Farm	Depot Lane, Spring Hill, TN 37174 (1 mile west of US 31)
Grace Episcopal Church	5291 Main Street, Spring Hill, TN 37174
Rippavilla	5700 Main Street, Spring Hill, TN 37174
Ritter-Morton House	McLemore Ave, Spring Hill, TN 37174
Spring Hill Battlefield	Junction of Kedron and Old Kedron Roads, Spring Hill, TN 37174
Spring Hill Presbyterian Church	5344 Main Street, Spring Hill, TN 37174
St. Mark United Primitive Baptist Church	518 Maury Hill Street, Spring Hill, TN 37174
White Hall	2536 Duplex Road, Spring Hill, TN 37174
Buford Spencer House	US 31, Thompson's Station, TN 37179 (1/2 mile south of Critz Lane)
Thomas Critz House	Critz Lane, Thompson's Station, TN 37179 (1 mile east of US 31)
Franklin Battlefield	South of Franklin along US 31
Harrison House	US 31, Franklin TN, 37064 (between railroad and Mack Hatcher, west side, with a red roof)
Homestead Manor	US 31, Thompson's Station, TN 37179 (south of SR 840 where the railroads splits from US 31)
James P Johnson House	US 31, Thompson's Station, TN 37179 (3/10 of a mile south of W. Harpeth Road)
Henry Pointer House	US 31, Thompson's Station, TN 37179
Thompson's Station Bank	Thompson' Station Road, Thompson's Station, TN 37179
James Giddens House	Thompson's Station, TN 37179
Winstead Hill	US 31, Franklin, TN 37064

Utilities	
Name	**Location**
Columbia Gulf Pipeline	Crosses US 31 south of Franklin

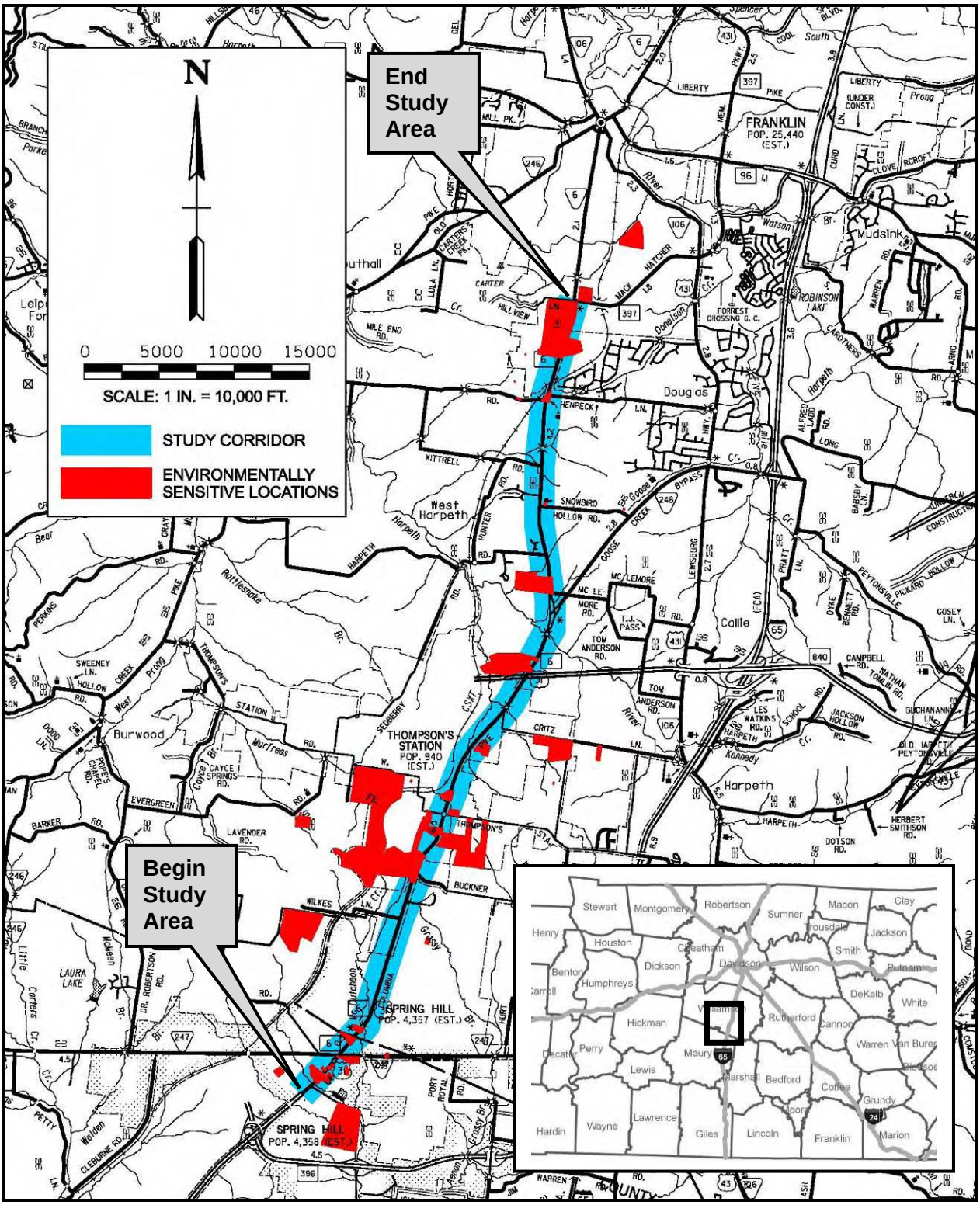


FIGURE 4.2 ENVIRONMENTALLY SENSITIVE LOCATIONS

4.3 EXISTING TRANSPORTATION CONDITIONS

SR 6 is a critical arterial in south central Tennessee. Within the study limits of this TPR, SR 6 runs parallel to Interstate 65 and serves regional travel demand between Columbia, Spring Hill, Thompson's Station, and Franklin. Considerable commuter driving patterns occur between these cities, creating congestion during peak travel times. SR 6, along with Interstate 65 and SR 106 (Lewisburg Pike) are the primary north-south routes in the region. When traffic incidents occur on Interstate 65, SR 6 is a primary detour route.

SR 6 is the primary north-south arterial through the City of Spring Hill and Town of Thompson's Station, and one of the primary routes through the City of Franklin. The speed limit varies between 35 and 55 mph and the cross section varies from two (2) lanes to five (5) lanes along the route. There are nine (9) traffic signals and four (4) school zones located within the study area. The primary deficiency along the route is congested traffic operations. The existing geometric conditions and deficiencies of SR 6 are discussed in more detail on the following pages. The roadway segments are discussed from south to north and are based upon the cross section and functional classification of SR 6 within the study area. Photos along the route are provided in **Figures 4.3.1** through **4.3.6**. The existing geometric conditions of SR 6, along with the Segment ID's, are mapped in **Figure 4.3.7 Existing Geometric Conditions**. The segment ID's are also labeled in the **Conceptual Plan Sheets**.

<u>Segment ID #1, Three (3) Lane Urban Other Principal Arterial, L.M. 32.47 to L.M. 33.31 Maury County</u>

The City of Spring Hill's CBD is located in this 0.84 mile long segment of SR 6. This segment extends from Kedron Road to the Williamson/Maury County Line, near Witt Hill Drive. The speed limit of this segment is 35 mph. The 15 mph Spring Hill Elementary School Zone is located in this segment. Three (3) traffic signals are located in this segment. The entire segment is three (3) lanes wide and includes two (2) travel lanes and a center two way left turn lane (TWLTL).

The school zone and numerous private and commercial entrances adversely impact traffic operations in this area. The offset intersection created by SR 6 with Duplex Road (SR 247) and Beechcroft Road (SR 247) also affects traffic operations in this segment.

L.M. 32.44 SR 6 at Kedron Road

L.M. 32.97 SR 6 at Duplex/Beechcroft Rd.

FIGURE 4.3.1 SEGMENT ID #1 PHOTOS (JULY 2007)

Segment ID #2, Two (2) Lane Urban Other Principal Arterial, L.M. 0 to L.M. 2.49 Williamson County

This 2.49 mile long segment of SR 6 is within Spring Hill's City Limits and includes rural and dense suburban development, including commercial development. This segment extends from the Williamson/Maury County Line, near Witt Hill Drive, to Thompson's Station's City Limits, north of Buckner Road. The speed limit of this segment is 45 mph. The 20 mph Heritage Elementary and Middle School Zone is located in this segment. Two (2) traffic signals are located in this segment. The cross section is primarily two (2) lanes wide, with left turn lanes at most major intersections or developments. The 0.9 mile-long section between Cemetery Road/O'Hallorn Drive and Buckner Road is effectively a three (3) lane section, as the left turn lanes are continuous through this commercial area.

The school zone adversely impacts traffic operations in this area. Representatives of the City of Spring Hill also noted that the intersections of SR 6 with Miles Johnson Parkway and Bellshire Way need to be signalized. It was also noted that turn lane improvements were needed at the intersections of SR 6 with Campbell Station Parkway and Buckner Road.

L.M. 0.43 SR 6

L.M. 1.35 SR 6 Near Campbell Sta. Pkwy.

L.M. 1.79

FIGURE 4.3.2 SEGMENT ID #2 PHOTOS (JULY 2007)

Segment ID #3, Two (2) Lane Rural Minor Arterial, L.M. 2.5 to L.M. 4.75 Williamson County

This 2.25 mile-long segment of SR 6 is within the Town of Thompson's Station's Urban Growth Boundary. This segment extends from Thompson's Station's City Limits, north of Buckner Road, to south of SR 840, north of Critz Lane. The development along the route is primarily rural, with small commercial developments located adjacent to the intersection with Thompson's Station Road. The speed limit of this section is 45 mph. One (1) traffic signal is located in this segment. The cross section is two (2) lanes wide, with left turn lanes located at the intersection of SR 6 with Thompson's Station Road.

Representatives of the Town of Thompson's Station noted that turn lane improvements are needed at the intersection of SR 6 with Thompson's Station Road to improve traffic operations. Another geometric deficiency noted by the Town is the intersection of SR 6 with Critz Lane. Critz Lane meets SR 6 at a sharp skew. It is desired to realign Critz Lane to improve the skew.

L.M. 3.04 SR 6 at Thompson's Station Rd.

L.M. 4.41 SR 6

FIGURE 4.3.3 SEGMENT ID #3 PHOTOS (JULY 2007)

Segment ID #4, Five (5) Lane Rural Minor Arterial, L.M. 4.76 to L.M. 5.55 Williamson County

This 0.79 mile-long segment of SR 6 primarily consists of the functional area of the interchange of SR 6 with SR 840. This segment extends from south of SR 840, north of Critz Lane, to Tollgate Road. The development along the route is a mix of rural and high density residential. The speed limit of this section is 45 mph. The 20 mph Independence High School Zone is located in this segment. One (1) traffic signal is located in this segment. The cross section is five (5) lanes wide, with a two way center left turn lane (TWLTL). There are no observed geometric deficiencies in this segment. However, the school zone does adversely impact traffic operations during AM peak periods.

L.M. 4.97 SR 6 at SR 840

FIGURE 4.3.4 SEGMENT ID #4 PHOTO (JULY 2007)

Segment ID #5, Two (2) Lane Rural Minor Arterial, L.M. 5.56 to L.M. 8.67 Williamson County

This 3.11 mile-long segment of SR 6 is rural with low density residential developments. This segment extends from Tollgate Road to south of Coleman Road. The Goose Creek Bypass Intersection is located in this segment. The northern end of this segment is at Nashville's urban boundary near Franklin's City Limits. The speed limit of this section varies from 45 to 55 miles per hour. No traffic signals are located in this segment. The cross section is two (2) lanes wide.

Local officials noted the bridge over the West Harpeth River has limited sight distance. This bridge is located just south of the Goose Creek Bypass Intersection with SR 6. Local officials also noted the odd configuration of the Goose Creek Bypass intersection with SR 6 adversely affects safety and traffic operations in the area.

L.M. 5.79 SR 6 at Goose Creek Bypass

L.M. 6.69 SR 6

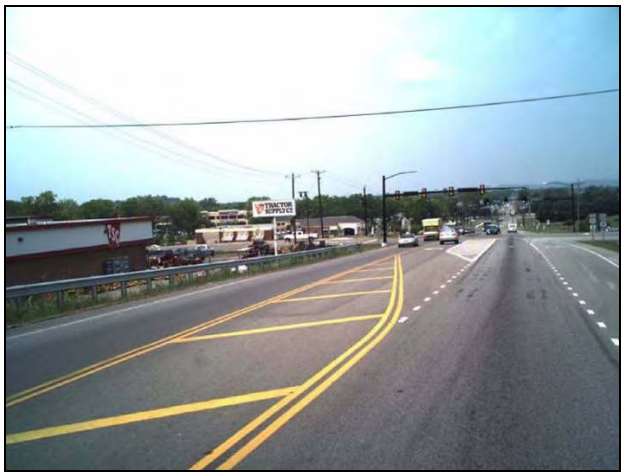
FIGURE 4.3.5 SEGMENT ID #5 PHOTOS (JULY 2007)

Segment ID #6, Two (2) Lane Urban Other Principal Arterial, L.M. 8.68 to L.M. 10.03 Williamson County

This 1.35 mile-long segment of SR 6 is primarily rural with low density residential developments. This segment extends from south of Coleman Road to Mack Hatcher Parkway. The speed limit of this section is 40 miles per hour. The 20 mph Winstead Elementary School Zone is located in this segment. One (1) traffic signal is located in this segment. The cross section is two (2) lanes wide. SR 6 bridges over the CSX Railroad tracks in this segment. This bridge has a sharp vertical curve and limited shoulders.

The school zone adversely impacts traffic operations in this area during AM peak periods. The offset intersection created by SR 6 with Coleman Road and Henpeck Lane also affects traffic operations in this segment. It was noted by local officials that the right turn lane along SR 6 northbound approaching Mack Hatcher Parkway is deficient in length.

L.M. 8.79 SR 6 over CSX Railroad



L.M. 9.96 SR 6 at Mack Hatcher Pkwy.

FIGURE 4.3.6 SEGMENT ID #6 PHOTOS (JUNE 2008)

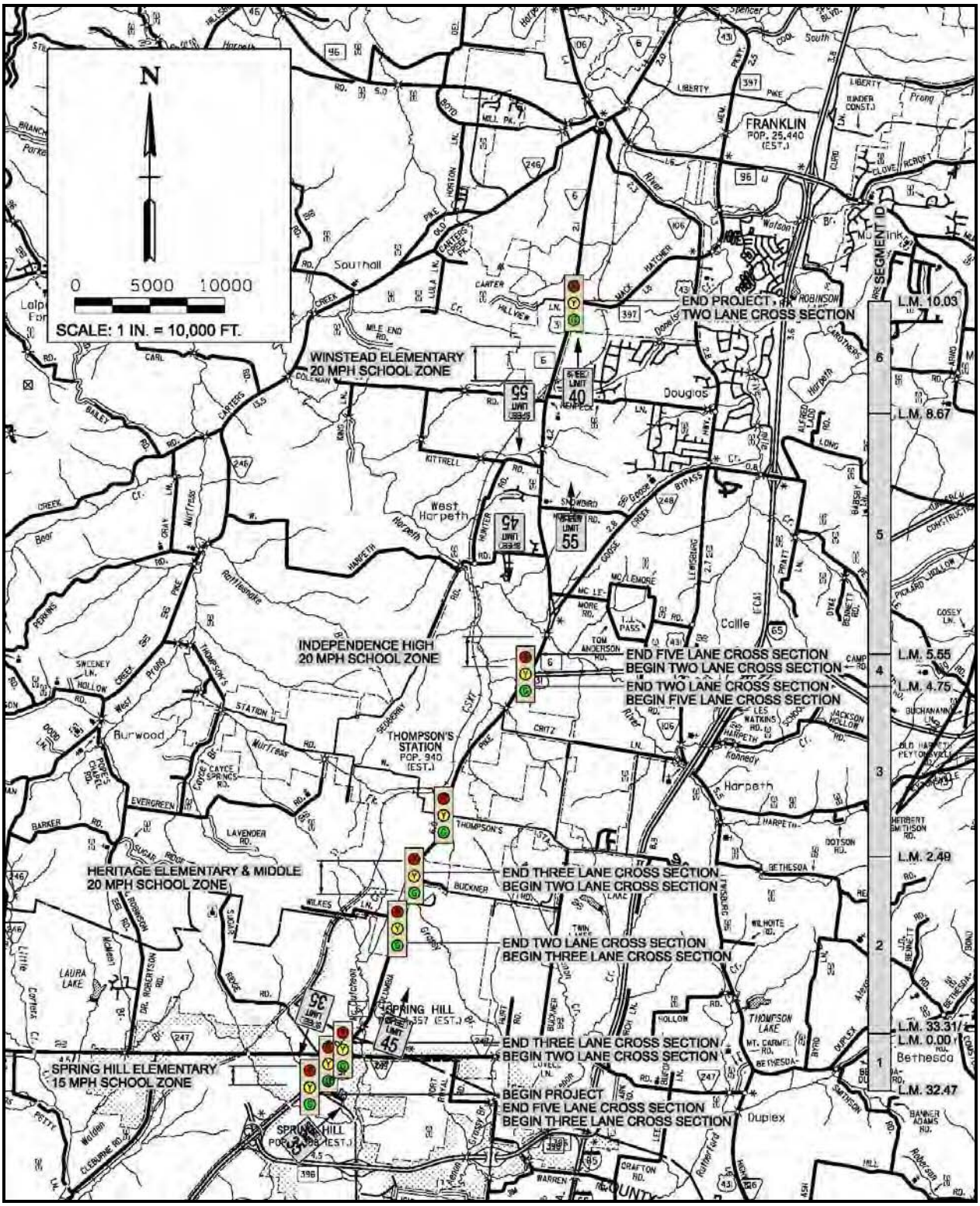


FIGURE 4.3.7 EXISTING GEOMETRIC CONDITIONS

4.4 CRASH HISTORY

SR 6 crash rates were provided by TDOT from crash data for the years 2002 through 2006. **Table 4.4 SR 6 Crash Data for 2002-2006** tabulates the crash data and **Figure 4.4 SR 6 Cumulative Crashes vs. Location** provides a visual representation of where the crashes are occurring. SR 6 is classified as an Urban Principal Arterial and as a Rural Minor Arterial within the study area. The crash data is summarized based upon the same roadway classification and cross section characteristics identified in Section **4.3 Existing Transportation Conditions**, and compared to the statewide crash rates for similar roadway segments.

As can be seen in **Table 4.4**, the actual crash rate along SR 6 from Kedron Road to the Williamson County Line is higher than the statewide crash rate, indicating a safety concern. This segment includes the central business district (CBD) of Spring Hill. While the remaining segments of the study area have actual crash rates below the statewide crash rates for similar roadway segments, **Figure 4.4** indicates areas within those segments with safety concerns. The limits of these areas are as follows:

> The crash rate in Spring Hill's CBD is 1.5 times higher than the statewide average rate.
>
> 61% of the crashes along the study corridor are rear end crashes, which may indicate congestion as a cause of many crashes

- Campbell Station Parkway to Thompson's Station Road
- The Goose Creek Bypass Area
- The intersection of SR 6 with Mack Hatcher Parkway

The crash data shows that 61% of the crashes along SR 6 are rear end crashes. This may indicate congestion as a cause of many crashes due to stop and go traffic. No other significant crash patterns were observed. Pavement conditions do not appear to have a significant impact on crashes, as 87% of the crashes occurred in fair weather conditions.

TABLE 4.4 SR 6 CRASH DATA FOR 2002-2006

ID	Location/ Description	Roadway Classification	State-Wide Crash Rate	Actual Crash Rate
1	From Kedron Rd. to Maury/Williamson County Line (L.M. 32.47 to 33.31)	3-Lane Urban Other Principal Arterial	**2.65**	**4.02**
2	From Maury/Williamson County Line to Thompson's Station City Limits (L.M. 0 to 2.49)	2-Lane Urban Other Principal Arterial	2.34	1.77
3	From Thompson's Station City Limits to south of SR-840 (L.M. 2.5 to 4.75)	2-Lane Rural Minor Arterial	1.70	1.24
4	From south of SR-840 to Tollgate Rd. (L.M. 4.76 to 5.55)	5-Lane Rural Minor Arterial	1.05	0.95
5	From Tollgate Rd. to Nashville Urban Boundary (L.M. 5.56 to 8.67)	2-Lane Rural Minor Arterial	1.70	1.26
6	From Nashville Urban Boundary to SR-397 (Mack Hatcher Pkwy.) (L.M. 8.68 to 10.03)	2-Lane Urban Other Principal Arterial	2.34	2.06

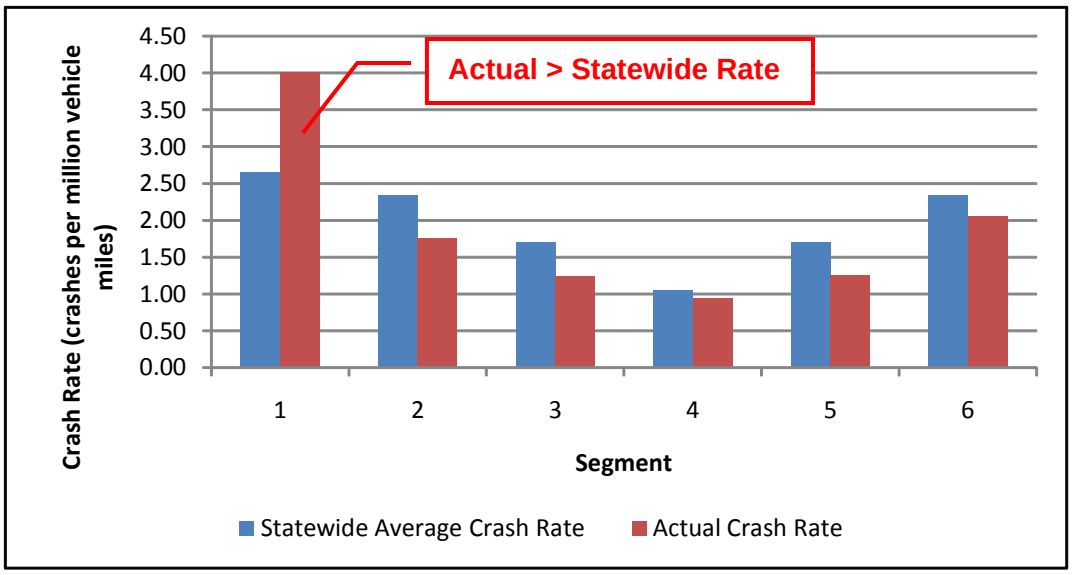
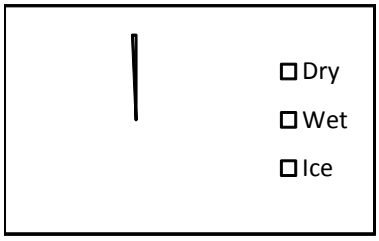


TABLE 4.4 SR 6 CRASH DATA FOR 2002-2006 (CONTINUED)

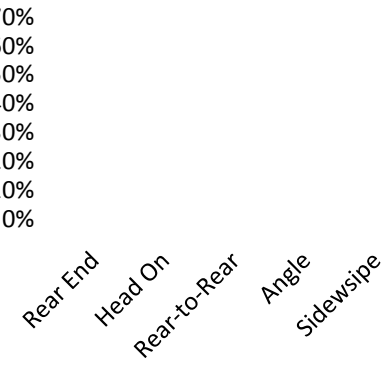
ID	Location/ Description	Length of Segment (Miles)	Total Crashes	Fatal Crashes	Injury Crashes	Property Damage Only Crashes
1	From Kedron Rd. to Maury/Williamson County Line (L.M. 32.47 to 33.31)	0.84	103	1	25	77
2	From Maury/Williamson County Line to Thompson's Station City Limits (L.M. 0 to 2.49)	2.49	151	0	51	100
3	From Thompson's Station City Limits to south of SR-840 (L.M. 2.5 to 4.75)	2.25	102	3	19	80
4	From south of SR-840 to Tollgate Rd. (L.M. 4.76 to 5.55)	0.79	28	0	10	18
5	From Tollgate Rd. to Nashville Urban Boundary (L.M. 5.56 to 8.67)	3.11	110	1	40	69
6	From Nashville Urban Boundary to SR-397 (Mack Hatcher Pkwy.) (L.M. 8.68 to 10.03)	1.35	88	1	31	56
Total			**582**	**6**	**176**	**400**
Percentage				**1%**	**30%**	**69%**

TABLE 4.4 SR 6 CRASH DATA FOR 2002-2006 (CONTINUED)

Road Condition	
Dry	87%
Wet	13%
Ice	1%



Type of Crash	
Rear End	61%
Head On	5%
Rear-to-Rear	0%
Angle	27%
Sidewsipe	7%



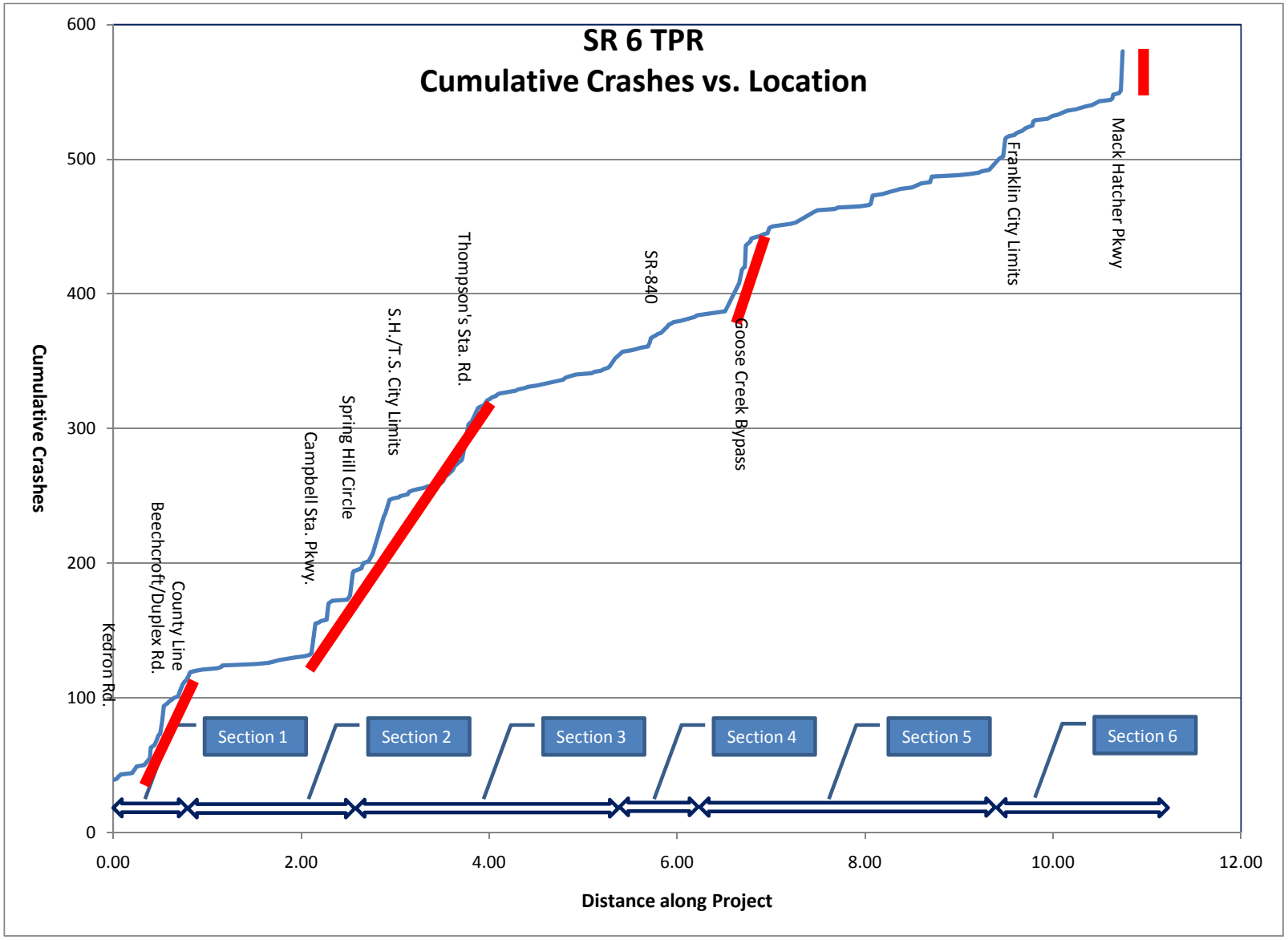


FIGURE 4.4 SR 6 CRASH DATA FOR 2002-2006

4.5 MULTIMODAL FACILITIES

Sidewalks are present along SR 6 in Spring Hill's CBD. Sidewalks are not present elsewhere along SR 6 in the study area. Bike lanes are not present along SR 6. Thompson's Station and Spring Hill are developing greenways near the study area.

Several transit agencies and other modal options offer services in or near the study area. The services are described below.

Franklin Transit Authority (FTA): Trolley services are offered in Franklin's CBD between 8 am and 6 pm Monday through Friday and Saturday from 9 am to 6:30 pm. Fares are typically one dollar ($1) per trip.

Transportation Management Association (TMA) Group: The TMA Group is a public-private partnership committed to providing environmentally friendly, affordable, reliable, and safe mobility options for Middle Tennesseans. Services offered include a van pool program.

Regional Transportation Authority (RTA): The mission of RTA is to offer the citizens of Middle Tennessee choices and alternatives on how they commute to work each day and to coordinate local regional transportation services. Services offered include rideshare and vanpool programs and commuter bus service from Spring Hill and Franklin to Nashville.

South Central TN Development District (SCTDD) Rural Public Transportation: SCTDD offers rural public transportation in Maury County.

Mid-Cumberland Human Resource Agency (MCHRA) Rural Transit System: MCHRA offers curb-to-curb rural public transportation service between Williamson and Davidson County for a fare of six dollars ($6) each way.

CSX Corporation Rail: CSX Corporation railroad tracks are located parallel to SR 6 throughout the study corridor. The line offers freight service. It is desired by local officials for the rail line to eventually provide commuter rail service. There are currently no plans for this to occur. The Radnor Yard railroad yard, located in south Nashville, creates an impediment to commuter rail utilizing this track to Nashville's CBD.

Airports: The Maury Regional Airport is located approximately twenty (20) miles southwest of the southern terminus of the study area in Mount Pleasant, TN. Charter services for both passengers and freight are available at this airport. The nearest commercial airline services are available at Nashville International Airport, approximately thirty (30) miles northeast of the northern terminus of the study area.

5.0 PROPOSED IMPROVEMENTS

Two improvement options are included in this TPR, the No Build Option and the Widen Along the Existing Alignment Option. The No Build Option provides no improvements and serves as a baseline option against which other options are compared. The Widen Along the Existing Alignment Option will improve the existing route from two (2) travel lanes to four (4) travel lanes. A center two way left turn lane (TWLTL) is anticipated along the majority of the route. This option resembles the improvements listed in the Nashville Area MPO's Long Range Transportation Plan (LRTP).

In discussions with the MPO and local officials, it is not desired for the exact improvements along SR 6 listed in the LRTP to be constructed. Different median options, travel lane options, and termini should be considered to limit impacts to environmentally sensitive areas along the route and to achieve logical termini. The MPO noted that new options are welcome. Several additional options were therefore studied as part of this TPR, including bypass options, reduced travel lane options, and spot improvements. Many of these options, including the bypass options, are significantly different from the improvements listed in the LRTP. These options need additional coordination with the MPO's planning process, which may include being subject to public review and comment. Furthermore, the additional options, in their current form, do not meet the purpose and need of the project. Further refinement of these additional options through the MPO's planning process could lead to them becoming viable improvement options. The additional improvement options studied are assessed in the **Options Requiring Additional Study Appendix**.

5.1 MEASURES OF EFFECTIVENESS

Several measures of effectiveness are utilized in this TPR to assess the operational conditions of SR 6 for both the existing and proposed conditions. These measures of effectiveness are level of service, volume to capacity ratio, average travel speed, and travel time. A definition of these measures is provided in the following text.

5.1.1 Level of Service

Level of Service (LOS) is a qualitative measure describing operational conditions within a traffic stream, generally in terms of such service measures as speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience. LOS range from A to F, with LOS A representing the best operating conditions and LOS F the worst. Each LOS represents a range of operating conditions and the driver's perception of those conditions. Please refer to **Table 5.1 LOS Table** for a description of each LOS.

The LOS of SR 6 was assessed utilizing the methodology outlined in the *Highway Capacity Manual 2000* (HCM) *Urban Streets, Two-Lane Highways,* and *Multilane Highways* Chapters. The calculations were performed with the Highway

It should be noted that the future use of the GM (Saturn) automotive plant will significantly alter traffic volumes in the area. The plant, which is located just south of the study corridor, was idled at the end of 2009. The traffic projections utilized in this report were performed prior to the opening of Miles Johnson Parkway and the idling of the GM plant.

Capacity Software (HCS+T7F Version 5.3). HCS+ is developed and maintained as an implementation of the HCM procedures. HCS+ calculations assign a LOS along route segments with similar geometric and traffic characteristics.

The *Arterials Planning Level Analysis* routine in the HCS+ software was utilized to analyze SR 6 between Kedron Road and Thompson's Station's City Limits (Segments 1 and 2). This routine was chosen for these segments due to their urban nature, their low posted speed limit, and the presence of several traffic signals. The *Two-Lane Highway* or *Multilane Highway Operational Analysis* routines were utilized to analyze the remainder of the route (Segments 3 through 6). These highway routines were chosen for these remaining segments due to their more rural nature, higher posted speed limits, and fewer traffic signals. The segments are labeled in the **Conceptual Plan Sheets**. The *Arterials* and *Highway* routines have different inputs, including the existence of turn lanes and passing zones, and assign LOS differently. Therefore, the LOS are not consistent between Segments 2 and 3 because of the different HCS+ routines utilized. This is not an error and can be attributed to the HCS+ assigning different driver expectancies between the urban and more rural areas.

TABLE 5.1 LOS TABLE

LOS	Traffic Flow Conditions	Representative Photo
A	Free flow operations. Vehicles are almost completely unimpeded in their ability to maneuver with the traffic stream. The general level of physical and psychological comfort provided to the driver is high.	
B	Reasonable free flow operations. The ability to maneuver within the traffic stream is only slightly restricted and the general level of physical and psychological comfort provided to the driver is still high.	
C	Flow with speeds at or near free flow speeds. Freedom to maneuver within the traffic stream is noticeably restricted and lane changes require more vigilance on the part of the driver. The driver notices an increase in tension.	
D	Speeds decline with increasing traffic. Freedom to maneuver within the traffic stream is more noticeably limited. The driver experiences reduced physical and psychological comfort levels.	
E	At lower boundary, the facility is at capacity. Operations are volatile because there are virtually no gaps in the traffic stream. There is little room to maneuver. The driver experiences poor levels of physical and psychological comfort.	
F	Breakdowns in traffic flow. The number of vehicles entering the highway section exceed the capacity or ability of the highway to accommodate that number of vehicles. There is little room to maneuver. The driver experiences poor levels of physical and psychological comfort.	

5.1.2 Volume to Capacity Ratio & Congestion Reduction

Unlike LOS, which is a qualitative measure, the volume to capacity ratio (v/c) is a quantitative measure. The v/c ratio is reported to demonstrate the magnitude of congestion for the options included in this TPR. The v/c ratio demonstrates how much reserve capacity along a roadway segment is available, or how much the segment is overcapacity. A v/c ratio near or above "1" indicates a roadway experiences congestion.

5.1.3 Average Travel Speed

Average travel speed is calculated in the LOS analysis. Speed, or its reciprocal travel time, is an important measure of congestion and the quality of the traffic service provided to the motorist.

5.1.4 Travel Time

The travel time along a route can be calculated by dividing the distance of the route by the average travel speed. As discussed above, travel time is an important measure of the quality of the traffic service provided to the motorist. In addition to the travel speed improvements associated with reduced congestion, travel time demonstrates the time savings of shorter route options.

5.2 NO BUILD OPTION

The No Build Option provides no improvements and serves as a baseline option against which all other options are compared. For a description of the geometric conditions associated with the No Build Option, please refer to Section **4.3 Existing Transportation Conditions**. Because improvements are not being constructed, there is no cost associated with the No Build Option. All local officials contacted for this TPR along the route acknowledge a need for improvements and therefore do not support a No Build Option.

For the No Build Option, the HCS's analysis calculates LOS ranging from A to F along SR 6 through the year 2014 and from B to F through the year 2034. The LOS calculations do not take into effect the diminished traffic operations caused by the four (4) school zones along the route. A summary of the LOS calculations for the No Build Option is provided in schematic form in **Figures 5.2.1** and **5.2.2** and in table form in **Table 5.2**. The LOS are reported for the years 2014 and 2034.

> The analysis indicates that the existing one (1) travel lane in each direction is generally not adequate for the projected traffic volumes.

For the No Build Option in the year 2014, the volume to capacity ratio (v/c) of SR 6 is calculated to range from 0.40 to 1.02, with a weighted average of 0.69. In 2034, the v/c ranges from 0.57 to 1.58 with a weighted average of 0.91. The average was weighted based upon the length of each segment analyzed. A v/c ratio near or above "1" indicates a roadway experiences congestion. Therefore, the volume to capacity ratios reported indicates that the existing one (1) travel lane in each direction is generally not adequate for the projected volumes. A summary of

the v/c calculations for the No Build Option is provided in table form in **Table 5.2**. The v/c are reported for the years 2014 and 2034.

The posted speed limit ranges from 35 to 55 mph along SR 6 within the study area. For the No Build Option in the year 2014, travel speeds along the route are calculated by the HCS to range from 14.6 mph to 46.0 mph, with a weighted average of 27.0 mph. In 2034, the travel speed ranges from 3.5 mph to 46.0 mph with a weighted average of 15.8 mph. The average was weighted based upon the length of each segment analyzed. The weighted average of the speed limit along the route is 45.5 mph. The calculated average route speed is 59% and 35% of the posted speed limit in the years 2014 and 2034, respectively. The Nashville Area MPO's Congestion Management Process notes that if the average route speed is 70% or less of the free flow speed, the roadway is congested. Therefore, for the No Build Option, SR 6 is congested in both 2014 and 2034. A summary of the travel speed calculations for the No Build Option is provided in table form in **Table 5.2**. The travel speeds are reported for the years 2014 and 2034.

The existing SR 6 Corridor (No Build Option) between Kedron Road to the south and Mack Hatcher Parkway to the north is 10.9 miles in length. For the No Build Option in the year 2014, the travel time along SR 6 is calculated to be 24.1 minutes. In 2034, the travel time is calculated to be 41.3 minutes.

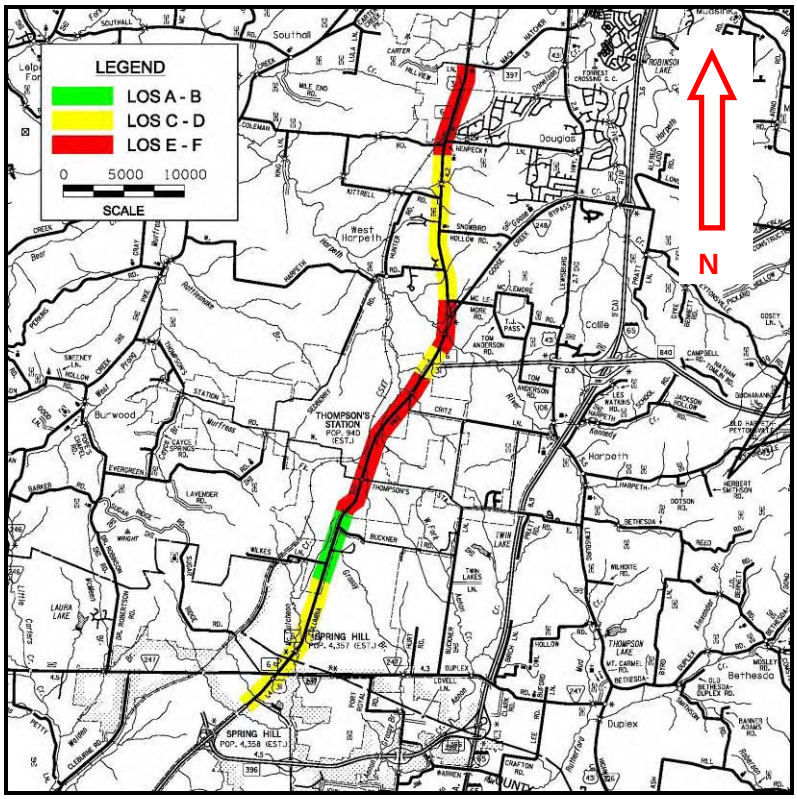


FIGURE 5.2.1 NO BUILD OPTION 2014 LOS

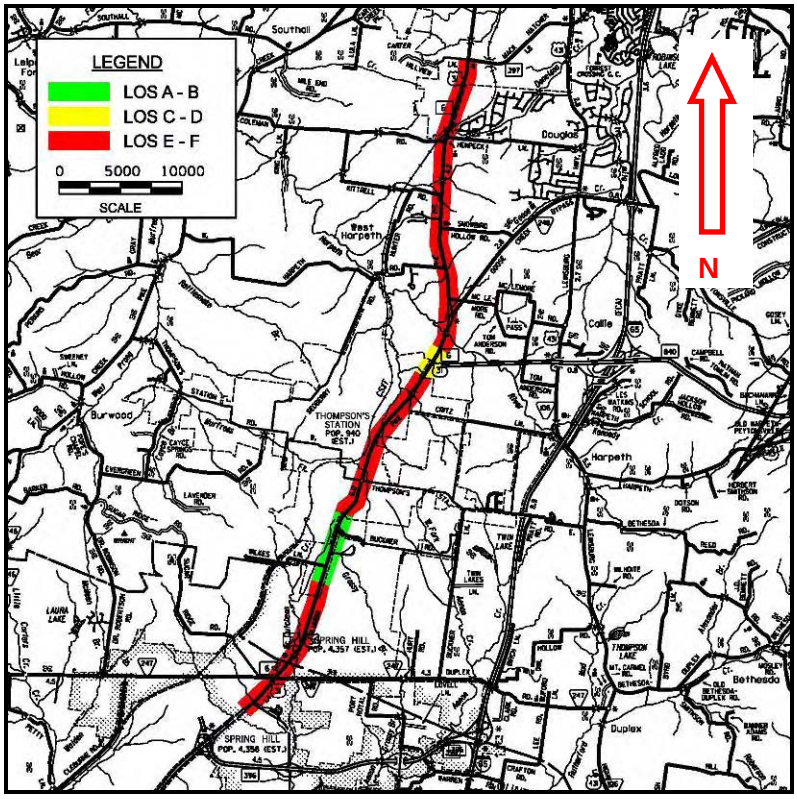


FIGURE 5.2.2 NO BUILD OPTION 2034 LOS

TABLE 5.2 NO BUILD OPTION LOS TABLE

ID	From		To		Dist.	Roadway Data			2014					2034				
	L.M.	Description	L.M.	Description	(mi)	Posted Speed (mph)	# of Signals	Cross-Section Type	ADT (vpd)	LOS	v/c	Calc. Speed (mph)	Travel Time (min.)	ADT (vpd)	LOS	v/c	Calc. Speed (mph)	Travel Time (min.)
1	32.47	Kedron Road	33.31	County Line	0.84	35	3	3-Lane	22,400	D	0.92	14.6	3.5	36,700	F	1.50	3.5	14.4
2A	0.00	County Line	1.30	Cemetery Road	1.30	45	2	2-Lane	25,000	C	1.02	26.4	3.0	36,700	F	1.58	11.4	6.8
2B	1.30	Cemetery Road	2.17	Buckner Road	0.87	45		3-Lane	25,000	A	0.51	35.5	1.5	36,700	B	0.75	34.1	1.5
2C	2.17	Buckner Road	2.49	Thompson's Station City Limits	0.32	45		2-Lane	25,000	A	0.54	35.4	0.5	36,700	B	0.79	33.8	0.6
3	2.49	Thompson's Station City Limits	4.75	Between Critz Lane and SR-840	2.26	45	1	2-Lane	34,000	F	0.92	21.1	6.4	36,700	F	0.99	19.4	7.0
4	4.75	Between Critz Lane and SR-840	5.55	Tollgate Road	0.80	45	1	5-Lane	34,000	C	0.52	46.0	1.0	36,700	C	0.57	46.0	1.0
5A	5.55	Tollgate Road	6.60	near McLemore Road	1.05	45	0	2-Lane	24,000	E	0.65	29.5	2.1	27,600	E	0.74	27.1	2.3
5B	6.60	near McLemore Road	8.67	near Coleman Road	2.07	55	0	2-Lane	15,000	D	0.40	44.7	2.8	18,300	E	0.49	42.9	2.9
6	8.67	near Coleman Road	10.03	Mack Hatcher Parkway	1.36	40	1	2-Lane	20,800	E	0.56	24.5	3.3	32,200	F	0.87	17.2	4.7
				Σ =	10.87					Avg=	0.69	Σ =	24.1		Avg=	0.91	Σ =	41.3

Notes: Sections 1 & 2 analyzed with HCS+ Arterials Planning Analysis
Sections 3-6 analyzed with HCS+ Two Lane and Multi Lane Highway Analysis

Average Speed:	27.0	Average Speed:	15.8
Avg. Post. Spd.:	45.5	Avg. Post. Spd.:	45.5
% Spd vs Post.:	59%	% Spd vs Post.:	35%

5.3 WIDEN ALONG THE EXISTING ALIGNMENT OPTION

Widening SR 6 through Spring Hill's CBD does not have the support of local officials due to how it would negatively impact:

- numerous religious properties
- historic properties
- commercial properties
- Impact their walkable community

This option will improve the existing route from two (2) travel lanes to four (4) travel lanes between Kedron Road and Mack Hatcher Parkway. A center two-way left turn lane (TWLTL) is desired along the majority of the route. This option is similar to the improvements listed in the Nashville Area MPO's LRTP. The termini are altered slightly from the LRTP's termini of Old Kedron Road to the south and Henpeck Lane to the north. The termini are altered for clarification to the south and to form a logical terminus at Mack Hatcher Parkway to the north. Additionally, the LRTP calls for a five (5) lane cross section within the City of Spring Hill's City Limits and a four (4) lane cross section outside of Spring Hill's City Limits. As noted previously, a center TWLTL is desired where feasible along the majority of the route by local officials.

TABLE 5.3.1 WIDEN ALONG THE EXISTING ALIGNMENT OPTION VS. LRTP IMPROVEMENTS

Feature	Widen Along the Existing Alignment Option	Improvements as listed in the LRTP (Project #'s 6001 and 6022)	Reason for Modification
Northern Terminus	Mack Hatcher Parkway	Henpeck Lane	The LRTP's northern terminus at Henpeck Lane is not logical. It would create a 1.25 mile long two (2) travel lane cross section between Henpeck Lane and Mack Hatcher Parkway.
Southern Terminus	Kedron Road	Old Kedron Road	The LRTP's southern terminus of Old Kedron Road is likely a misprint. Old Kedron Road does not intersect SR 6. The existing four (4) travel lane cross section ends at Kedron Road, and is therefore a logical terminus.
Cross Section	Allow for flexibility in location of a TWLTL.	Notes five lanes inside Spring Hill's City Limits and four lanes outside Spring Hill's City Limits.	Modified to allow local stakeholders and the NEPA process to provide input on the location of a TWLTL.

In addition to improving SR 6 from two (2) travel lanes to four (4) travel lanes, the following improvements are recommended to be incorporated into the Widen Along the Existing Alignment Option. These improvements were determined through coordination with local officials.

- Realign the following offset intersections with SR 6 to form traditional four (4) legged intersections:
  - SR 247 (Duplex Road and Beechcroft Road) located in Spring Hill
  - Coleman Road and Henpeck Lane located just south of Franklin
- Construct turn lane improvements at the following locations:
  - Campbell Station Road located in Spring Hill
  - Thompson's Station Road located in Thompson's Station
  - Mack Hatcher Parkway located in Franklin
- Signalize warranted intersections along SR 6
- Realign Critz Lane at its intersection with SR-6 located in Thompson's Station
- Improve sight distance along SR 6 at the bridge over the West Harpeth River located between SR 840 and the Goose Creek Bypass (SR 248). This can be accomplished by improving the shoulders on the bridge.
- Investigate a roundabout at the Goose Creek Bypass (SR 248) intersection with SR 6.
- Improve the grade and shoulders of the SR 6 Bridge over the CSX Corporation Railroad Tracks located just south of Franklin.

The Widen Along the Existing Alignment Option does not have the support of the City of Spring Hill due to the impact to their central business district (CBD). The existing R.O.W. within the CBD of Spring Hill is approximately sixty (60) feet wide. Improvements to SR 6 within the CBD will require impacts to numerous religious, historic, and commercial properties. Furthermore, the City wishes to revitalize their downtown and maintain their walkable community. They envision a future streetscape project that will maintain the existing three (3) lane cross section.

Example photographs of the development within Spring Hill's CBD are provided in **Figures 5.3.1** and **5.3.2**. A conceptual plan view of the CBD with a five (5) lane cross section is provided in **Figure 5.3.3**. The conceptual plan utilizes a five (5) lane cross section with twelve (12) foot wide lanes and five (5) foot wide sidewalks. This cross section is modeled after TDOT Standard Drawing RD01-TS-6A. This example cross section has no provisions for bicycle lanes and does not show the potential impacts of slope easements. The proposed R.O.W. is shown one (1) foot behind the sidewalks.

FIGURE 5.3.1 SR 6 APPROACHING MCLEMORE AVE./ DEPOT ST.

FIGURE 5.3.2 SR 6 APPROACHING SR 247

Additionally, the Widen Along the Existing Alignment Option does not have the support of the Town of Thompson's Station. A representative of the Town notes that future improvements along Interstate 65 may alleviate congestion along SR 6 within their town limits, and therefore eliminate the need to widen SR 6 to four (4) travel lanes within the town limits. Concern was expressed that widening SR 6 without improvements to Interstate 65 would increase traffic volumes through the town.

The existing R.O.W. outside of Spring Hill's CBD is approximately sixty-six (66) feet wide, except where it expands at the SR 840 Interchange and Goose Creek Bypass. The narrow R.O.W. will create difficulties for improvements just north of the CBD of Spring Hill, where the land use is heavily developed commercial property, and wherever environmentally sensitive sites are located adjacent to the R.O.W.

The Widen Along the Existing Alignment Option is estimated to cost between $90 and $103 million in year 2014 dollars. The estimated cost was calculated to a planning level utilizing cost per mile data. The cost estimate summary is provided in **Table 5.3.2**. The cost estimate calculations are provided in the **Appendix**.

For the Widen Along the Existing Alignment Option, the HCS's analysis calculates LOS ranging from A to D along SR 6 through the year 2034. The LOS calculations do not take into effect the diminished traffic operations caused by the four (4) school zones along the route. The LOS calculations utilize the cross section specified in the LRTP, which includes a five (5) lane cross section within Spring Hill's City Limits and a four (4) lane cross section outside of Spring Hill's City Limits. As noted previously, a center TWLTL is desired where feasible along the majority of the route by local officials. Due to the uncertainty of where a TWLTL is feasible or appropriate, the LRTP Cross Section was utilized in the calculations. A summary of the LOS calculations for the Widen Along the Existing Alignment Option is provided in schematic form in **Figures 5.3.4** and **5.3.5** and in table form in **Table 5.3.3**. The LOS are reported for the years 2014 and 2034.

For the Widen Along the Existing Alignment Option in the year 2014, the volume to capacity ratio (v/c) of SR 6 is calculated to range from 0.26 to 0.54, with a weighted average of 0.40. In 2034, the v/c ranges from 0.38 to 0.79 with a weighted average of 0.51. The average was weighted based upon the length of each segment analyzed. The volume to capacity ratios reported indicates that the proposed two (2) travel lanes in each direction are generally

adequate for the projected volumes. A summary of the v/c calculations for the Widen Along the Existing Alignment Option is provided in table form in **Table 5.3.3**. The v/c are reported for the years 2014 and 2034.

The posted speed limit ranges from 35 to 55 mph along SR 6 within the study area. For the Widen Along the Existing Alignment Option in the year 2014, travel speeds along the route are calculated by the HCS to range from 17.7 mph to 54.5 mph, with a weighted average of 38.7 mph. In 2034, the travel speed ranges from 16.3 mph to 54.4 mph with a weighted average of 37.9 mph. The average was weighted based upon the length of each segment analyzed. The weighted average of the speed limit along the route is 45.5 mph. The calculated average route speed is 85% and 83% of the posted speed limit in the years 2014 and 2034, respectively. The Nashville Area MPO's Congestion Management Process notes that if the average route speed is 70% or less of the free flow speed, the roadway is congested. Therefore, for the Widen Along the Existing Alignment Option, SR 6 is not considered congested for both 2014 and 2034. A summary of the travel speed calculations for the Widen Along the Existing Alignment Option is provided in table form in **Table 5.3.3**. The travel speeds are reported for the years 2014 and 2034.

The existing SR 6 Corridor (Widen Along the Existing Alignment Option) between Kedron Road to the south and Mack Hatcher Parkway to the north is 10.9 miles in length. For the Widen along the Existing Alignment Option in the year 2014, the travel time along SR 6 is calculated to be 16.8 minutes. In 2034, the travel time is calculated to be 17.2 minutes.

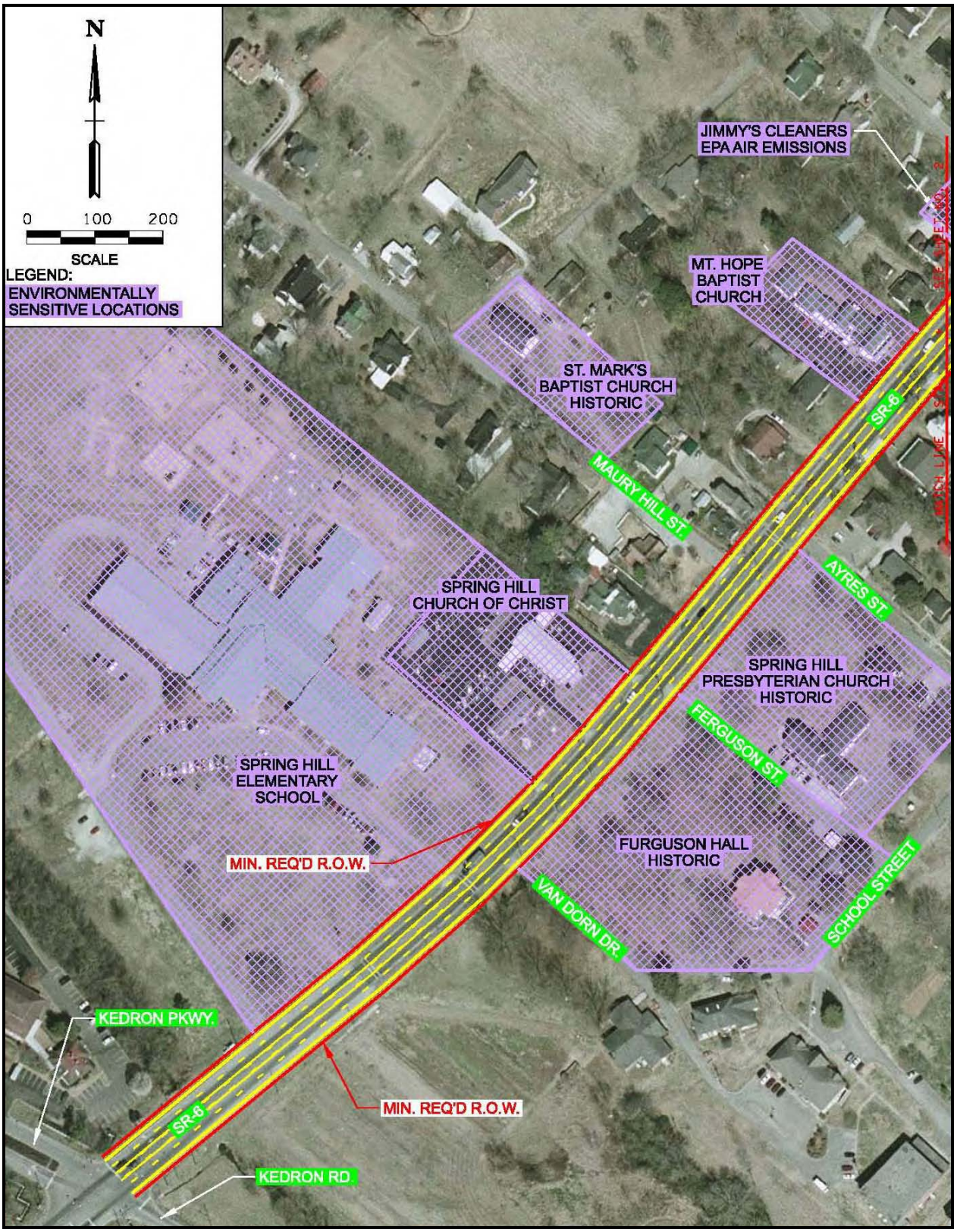


FIGURE 5.3.3 SPRING HILL CBD DETAIL (1 OF 2)

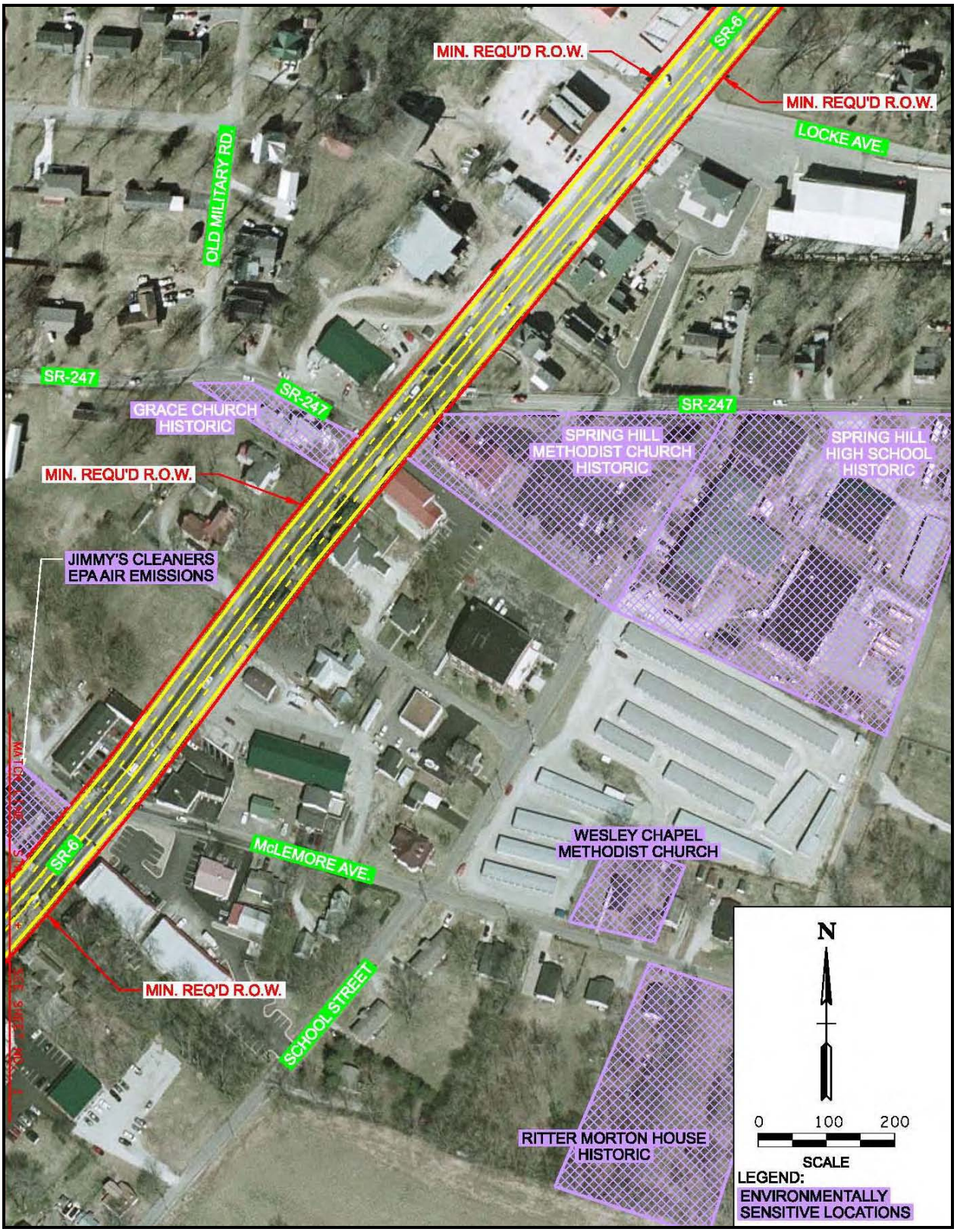


FIGURE 5.3.3 SPRING HILL CBD DETAIL (2 OF 2)

TABLE 5.3.2 WIDEN ALONG THE EXISTING ALIGNMENT COST ESTIMATE

ID	Location/ Description	Existing Roadway Classification	Proposed Roadway Classification	Length of Const. (Miles)	Estimated Low Cost	Estimated High Cost
1	SR-6 from Kedron Rd. to Maury/Williamson County Line (L.M. 32.47 to 33.31)	3-Lane Urban Other Principal Arterial	4-Travel Lane Urban Other Principal Arterial	0.84	$ 13,003,200	$ 16,405,200
2	SR-6 from Maury/Williamson County Line to Thompson's Station City Limits (L.M. 0 to 2.49)	2-Lane Urban Other Principal Arterial	4 Travel-Lane Urban Other Principal Arterial	2.49	$ 19,571,400	$ 23,630,100
3	SR-6 from Thompson's Station City Limits to south of SR-840 (L.M. 2.5 to 4.75)	2-Lane Rural Minor Arterial	4 Travel-Lane Rural Minor Arterial	2.26	$ 15,413,200	$ 17,424,600
4	SR-6 from south of SR-840 to Tollgate Rd. (L.M. 4.76 to 5.55)	5-Lane Rural Minor Arterial	5-Lane Rural Minor Arterial	0.80	$ -	$ -
5	SR-6 from Tollgate Rd. to Nashville Urban Boundary (L.M. 5.56 to 8.67)	2-Lane Rural Minor Arterial	4 Travel-Lane Rural Minor Arterial	3.12	$ 25,989,600	$ 28,766,400
6	SR-6 from Nashville Urban Boundary to SR-397 (Mack Hatcher Pkwy.) (L.M. 8.68 to 10.03)	2-Lane Urban Other Principal Arterial	4 Travel-Lane Urban Other Principal Arterial	1.36	$ 15,572,000	$ 17,122,400
Total				10.87	$ 89,550,000	$103,350,000

Notes: Low estimate utilizes 4-lane rural cross-section, high estimate utilizes 5-lane urban cross-section.
Total route length is equal to the construction length of 10.9 miles.

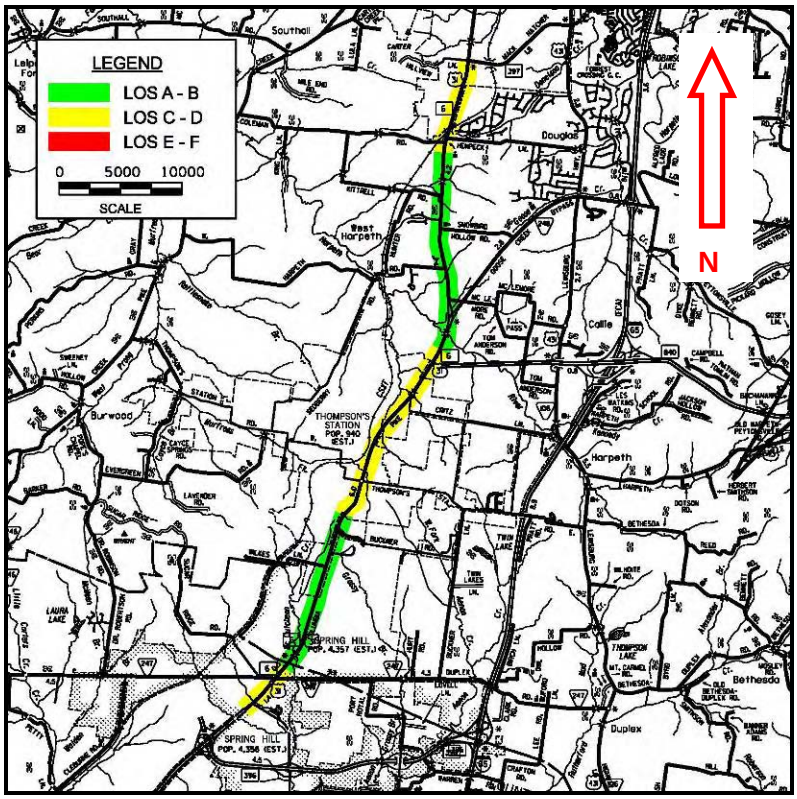


FIGURE 5.3.4 WIDEN ALONG THE EXISTING ALIGNMENT OPTION 2014 LOS

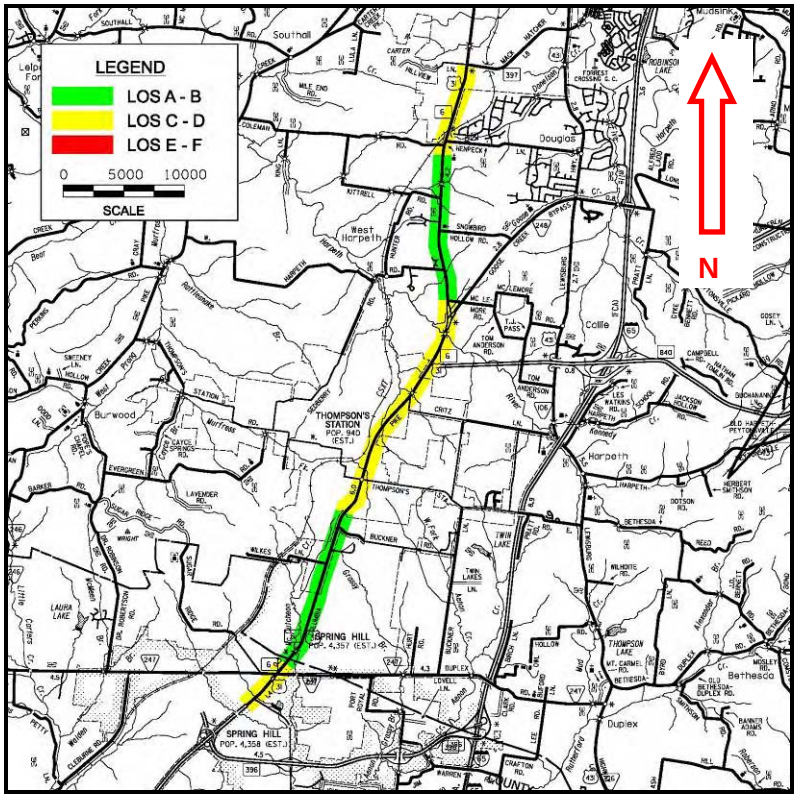


FIGURE 5.3.5 WIDEN ALONG THE EXISTING ALIGNMENT OPTION 2034 LOS

TABLE 5.3.3 WIDEN ALONG THE EXISTING ALIGNMENT OPTION LOS TABLE

ID	From		To		Dist.	Roadway Data			2014					2034				
	L.M.	Description	L.M.	Description	(mi)	Posted Speed (mph)	# of Signals	Cross-Section Type	ADT (vpd)	LOS	v/c	Calc. Speed (mph)	Travel Time (min.)	ADT (vpd)	LOS	v/c	Calc. Speed (mph)	Travel Time (min.)
1	32.47	Kedron Road	33.31	County Line	0.84	35	3	5-Lane	22,400	D	0.46	17.7	2.8	36,700	D	0.75	16.3	3.1
2A	0.00	County Line	1.30	Cemetery Road	1.30	45	2	5-Lane	25,000	A	0.54	35.7	2.2	36,700	B	0.79	34.4	2.3
2B	1.30	Cemetery Road	2.17	Buckner Road	0.87	45		5-Lane	25,000	A	0.26	36.9	1.4	36,700	A	0.38	36.4	1.4
2C	2.17	Buckner Road	2.49	Thompson's Station City Limits	0.32	45		5-Lane	25,000	A	0.27	36.8	0.5	36,700	A	0.40	36.3	0.5
3	2.49	Thompson's Station City Limits	4.75	Between Critz Lane and SR-840	2.26	45	1	4-Lane	34,000	C	0.52	44.4	3.1	36,700	C	0.57	44.4	3.1
4	4.75	Between Critz Lane and SR-840	5.55	Tollgate Road	0.80	45	1	5-Lane	34,000	C	0.52	46.0	1.0	36,700	C	0.57	46.0	1.0
5A	5.55	Tollgate Road	6.60	near McLemore Road	1.05	45	0	4-Lane	24,000	B	0.37	44.4	1.4	27,600	C	0.43	44.4	1.4
5B	6.60	near McLemore Road	8.67	near Coleman Road	2.07	55	0	4-Lane	15,000	A	0.23	54.5	2.3	18,300	A	0.28	54.4	2.3
6	8.67	near Coleman Road	10.03	Mack Hatcher Parkway	1.36	40	1	4-Lane	20,800	C	0.32	39.4	2.1	32,200	C	0.50	39.4	2.1
				Σ =	10.87					Avg=	0.40	Σ =	16.8		Avg=	0.51	Σ =	17.2

Notes: Sections 1 & 2 analyzed with HCS+ Arterials Planning Analysis
Sections 3-6 analyzed with HCS+ Multi Lane Highway Analysis
Proposed cross section type as described in the LRTP

Average Speed:	38.7	Average Speed:	37.9
Avg. Post. Spd.:	45.5	Avg. Post. Spd.:	45.5
% Spd vs Post.:	85%	% Spd vs Post.:	83%

6.0 ASSESSMENT OF OPTIONS

6.1 TDOT'S SEVEN GUIDING PRINCIPLES

The Tennessee Department of Transportation (TDOT) has adopted seven guiding principles against which all transportation projects are to be evaluated. These guiding principles address concerns for system management, mobility, economic growth, safety, community, environmental stewardship, and fiscal responsibility. These guiding principles are discussed in the following paragraphs as they relate to the options discussed **Section 5.0 Proposed Improvements**.

6.1.1 Guiding Principle 1: Preserve and Manage the Existing Transportation System

The Widen Along the Existing Alignment Option will reduce congestion and optimize service and operational efficiency along SR 6. It will improve the integration of the highway network in South Central Tennessee by providing an alternate route for Interstate 65 to serve sub-regional travel demand between Columbia, Spring Hill, Thompson's Station, and Franklin. Improvements along this route will preserve and manage the existing transportation system by providing a functional route with improved safety.

6.1.2 Guiding Principle 2: Move a Growing, Diverse, and Active Population

The Widen Along the Existing Alignment Option will reduce congestion and optimize service and operational efficiency along SR 6. SR 6 is utilized by a diverse constituency, including commuters, industrial, agricultural, and commercial interests. Within the study limits of this TPR, SR 6 runs parallel to Interstate 65 and serves sub-regional travel demand between Columbia, Spring Hill, Thompson's Station, and Franklin. When traffic incidents occur on Interstate 65, SR 6 is a primary detour route. This interrelation with Interstate 65 supports transportation technology advances through the use of Intelligent Transportation Systems (ITS) by providing an alternate route to Interstate 65.

6.1.3 Guiding Principle 3: Support the State's Economy

Improvements to SR 6 are needed to meet the changing social demands of the area. The population of the study area has seen extraordinary growth since 1990. There are several major regional employers located within or near the study limits of this TPR, including the newly relocated North American Headquarters of Nissan in the Cool Springs area of Franklin. This formerly rural area has seen extensive changes in population and land use in recent years and the existing transportation system does not meet the demand.

6.1.4 Guiding Principle 4: Maximize Safety and Security

Improvements to SR 6 are needed to improve safety by addressing existing roadway deficiencies along the route. The segment of SR 6 through the City of Spring Hill's CBD has a crash rate that is approximately 1.5 times higher than the statewide rate for similar roadways. High crash rates are also reported between Campbell Station Parkway and Thompson's Station Road, at the Goose Creek Bypass Intersection, and at the Mack Hatcher Parkway Intersection. The crash data shows that 61% of the crashes along SR 6 are rear end crashes. This may

indicate congestion as a cause of many crashes due to stop and go traffic. Improving traffic flow through the corridor by providing additional travel lanes may therefore improve the safety of the route. Additionally, several locations noted by local officials should be improved while widening SR 6. These locations are discussed in Section **5.3 Widen Along the Existing Alignment Option** and include realigning offset intersections, realigning skewed intersections, and improving sight distance at specific locations. Each of these measures should improve safety along SR 6.

6.1.5 Guiding Principle 5: Build Partnerships for Livable Communities

Throughout the development of this TPR, TDOT staff has coordinated with local leaders and the Nashville Area MPO to identify their concerns and objectives. Through this coordination it was determined that the improvements listed in the LRTP, which including widening SR 6 through the CBD of Spring Hill and the Town Limits of Thompson's Station, are not desired by local officials. Additional options to the improvements listed in the MPO's LRTP were therefore investigated to address local stakeholder's concerns. These additional options are included in the **Appendix**. Unfortunately, these additional options, in their current form, do not meet the purpose and need for improvements. Additional study is needed to determine a feasible option with limited impacts to environmentally sensitive sites that addresses local stakeholder's concerns. The public involvement process will continue as mandated by the provisions of the National Environmental Policy Act (NEPA).

6.1.6 Guiding Principle 6: Promote Stewardship of the Environment

Several environmentally sensitive locations and community resources within the study area should be avoided, if possible. Those that cannot be avoided should have their impact mitigated. These areas include communities, churches, cemeteries, environmental sites (including landfills), historic places, parks, schools, major streams, utilities, and railroads. The locations are discussed in Section **4.2 Environmental Sites**. Additional Options to the improvements listed in the MPO's LRTP were investigated to address local stakeholder's concerns. Additional study is needed to determine a feasible option with limited impacts to environmentally sensitive sites that addresses local stakeholder's concerns.

6.1.7 Guiding Principle 7: Promote Financial Responsibility

The need for improvements along SR 6 was determined through Tennessee's statewide long-range multi-modal transportation planning process. This process includes extensive interaction with citizens, local government officials, and the Metropolitan Planning Organizations and the Rural Planning Organizations.

This TPR was initiated by request of the Nashville Area MPO on behalf of Williamson County. The need for improvements was developed through coordination with local agencies, including the Nashville Area MPO, Williamson County, the City of Spring Hill, the Town of Thompson's Station, and the City of Franklin in concurrence with the MPO's planning process. The planning process has demonstrated a need for improvements along this corridor. Preliminary construction cost estimates were prepared. Improvements along the corridor will be evaluated for cost, among other criteria, during the NEPA process. The costs are discussed in Sections **5.0 Proposed Improvements** and **6.2 Summary of Proposed Options**.

6.2 SUMMARY OF PROPOSED OPTIONS

Criteria for choosing an improvement option should incorporate the purpose and need discussed in Section **3.0 Purpose and Need for Improvements** and should address TDOT's Seven Guiding Principles against which all transportation projects are to be evaluated. A summary of the No Build Option and Widen Along the Existing Alignment Option is provided in **Table 6.2. Summary of Proposed Options**. Key measures of effectiveness (MOE) for each option are listed. For a detailed discussion of each option, please refer to Section **5.0 Proposed Improvements**. The cost for corridor wide improvements is estimated to range between $90 and $103 million in year 2014 dollars.

TABLE 6.2 SUMMARY OF PROPOSED OPTIONS

Criteria	No Build	Widen Along Existing Alignment
TDOT's Seven Guiding Principles		
Preserve and Manage the Existing Transportation System	No	Yes
Move a Growing , Diverse, and Active Population	No	Yes
Support the State's Economy	No	Yes
Maximize Safety and Security	No	Yes
Build Partnerships for Livable Communities	No	No[1]
Promote Stewardship of the Environment	No	No[1]
Promote Financial Responsibility	No	Yes
Purpose and Need Criteria		
Improve Regional Mobility	No	Yes
Reduce Congestion	No	Yes
Meet Changing Social Demands	No	Yes
Improve Safety	No	Yes
Additional Criteria		
Length of route (miles)	10.9	10.9
Low estimated cost of improvements (millions) - year 2014 dollars	$ -	$ 90
High estimated cost of improvements (millions) - year 2014 dollars	$ -	$ 103
Year 2034 LOS range	B to F	A to D
Year 2034 average v/c ratio	0.91	0.51
Year 2034 average v/c ratio improvement or congestion reduction (%)	n/a	78%
Year 2034 average travel speed (mph)	15.8	37.9
Year 2034 travel time (minutes)	41.3	17.2
Year 2034 travel time (minutes) reduction (%)	n/a	58%
Is the route considered congested in 2034?	Yes	No

1. Throughout the development of this TPR, TDOT staff has coordinated with local leaders and the Nashville Area MPO to identify their concerns and objectives. Through this coordination it was determined that the improvements listed in the LRTP are not desired by local officials. Additional study is needed to determine a feasible option with limited impacts to environmentally sensitive sites that addresses local stakeholder's concerns.

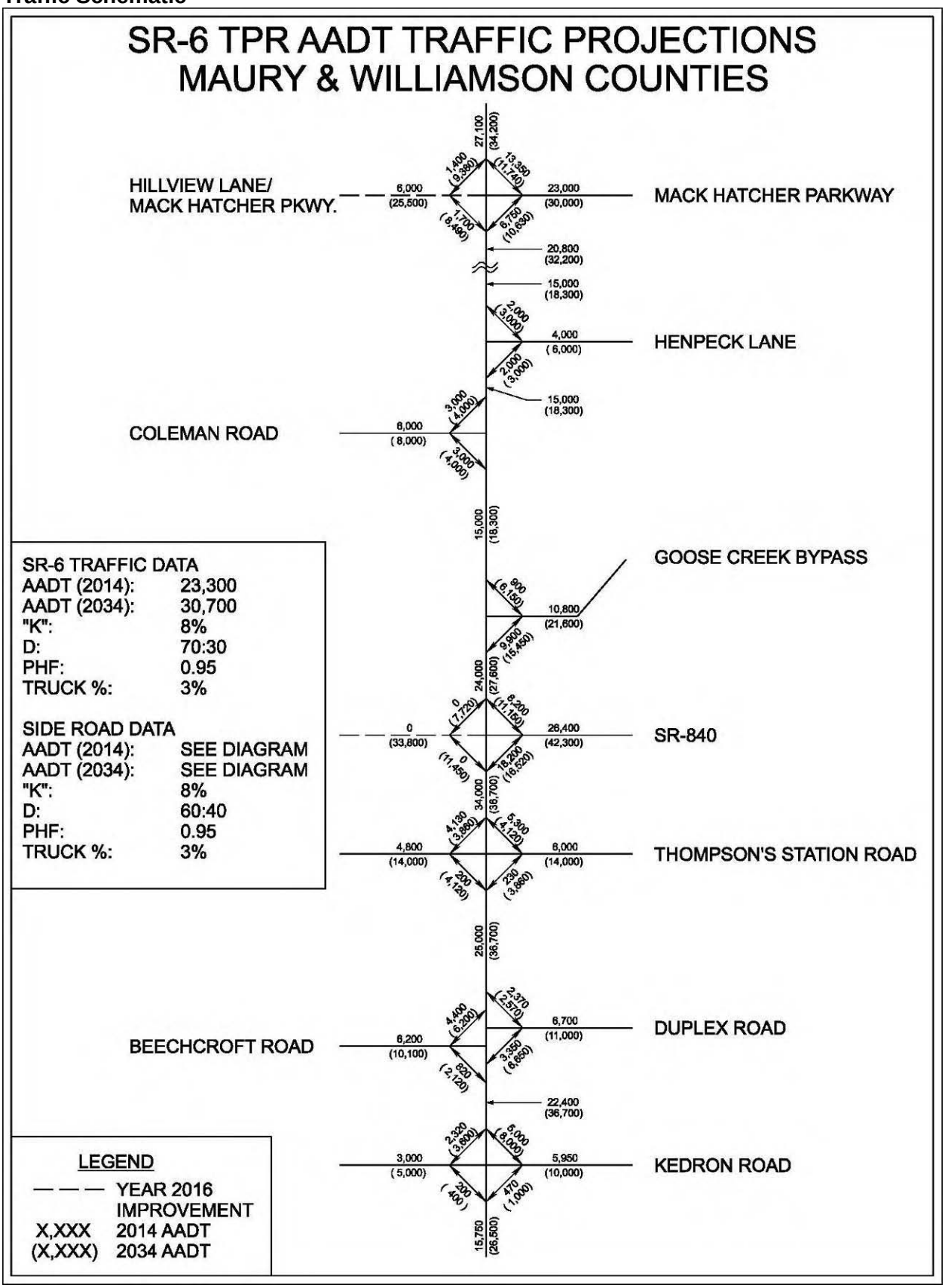
Checklist of Determinants for Location Study

Location: SR 6, Maury and Williamson Counties

If preliminary field reviews indicate the presence of any of the following facilities or ESE categories, place an "X" in the blank opposite the item. Where more than one alternate is to be considered, place its letter designation in the blank.

1. Agricultural land usage……X
2. Airport (existing or proposed)……..
3. Commercial area, shopping center……X
4. Floodplains……
5. Forested Land……X
6. Historical, archaeological, cultural, or natural landmark or cemeteries……X
7. Industrial park, factory……..
8. Institutional usage's
   a. School or other educational institution……X
   b. Church or other religious institution……X
   c. Hospital or other medical facility……
   d. Public building, e.g., fire station……X
   e. Defense Installation…….....
9. Recreational Usage's
   a. Park or recreational area, State Natural Area……X
   b. Wildlife refuge or wildlife management area……
10. Residential Establishment……X
11. Urban area, town, city or community……X
    Title 6, low income/minority community……
12. Waterway, lake, pond, river, stream, spring, wetland……X
    Permit required: Coast Guard……
    Section 404……... X
    Section 10……...
    TVA Section 26a review……...X
    NPDES……X
    Aquatic Resource Alteration Permit……X
    Class V Injection Wells…….....…
13. Location coordinated with local officials……X
14. Railroad Crossings…….....
15. Hazardous Material Site…….....
    Underground Storage Tanks – U.S.T.)……X
16. Other…….....

Traffic Schematic



Tennessee Department of Transportation

Design Criteria for Location and Design Phase

Route:	SR 6	Option:	N/A
Section:	1, L.M. 32.47 to L.M. 33.31	Region:	3
County:	Maury	Project #	

Location

From:	Kedron Road
To:	Williamson County Line

Parameter	**Criteria**
2014 AADT	22,400
2034 AADT	36,700
Percent Trucks (DHV)	3%
DHV (8% AADT 2034)	2,940
Functional Classification	Urban Other Principal Arterial
Minimum Design Speed	40 mph
Access Control	N/A
Minimum Radius	565 ft.
Maximum Grade	7%
Minimum Stopping Sight Distance	305 ft.
Surface Width	To be determined in the NEPA Process
Number of Lanes	To be determined in the NEPA Process – between three and five total lanes.
Usable Shoulder Width	To be determined in the NEPA Process – dependent upon rural or urban cross section.
Median Width	To be determined in the NEPA Process – dependent upon utilization of a center two-way left turn lane.
Minimum R.O.W.	To be determined in the NEPA Process – dependent upon cross section selection
Signalization	Yes

Tennessee Department of Transportation

Design Criteria for Location and Design Phase

Route:	SR 6	Option:	N/A
Section:	2, L.M. 0 to 2.49	Region:	3
County:	Williamson	Project #	

Location

From:	Maury County Line
To:	Thompson's Station City Limits

Parameter	**Criteria**
2014 AADT	22,400
2034 AADT	36,700
Percent Trucks (DHV)	3%
DHV (8% AADT 2034)	2,940
Functional Classification	Urban Other Principal Arterial
Minimum Design Speed	45 mph/50 mph To be determined in the NEPA Process – dependent upon rural or urban cross section.
Access Control	N/A
Minimum Radius	730 ft./930 ft.
Maximum Grade	6%
Minimum Stopping Sight Distance	360 ft./425 ft.
Surface Width	To be determined in the NEPA Process
Number of Lanes	To be determined in the NEPA Process – between three and five total lanes.
Usable Shoulder Width	To be determined in the NEPA Process – dependent upon rural or urban cross section.
Median Width	To be determined in the NEPA Process – dependent upon utilization of a center two-way left turn lane.
Minimum R.O.W.	To be determined in the NEPA Process – dependent upon cross section selection
Signalization	Yes

Tennessee Department of Transportation

Design Criteria for Location and Design Phase

Route:	SR 6	Option:	N/A
Section:	3, L.M. 2.5 to L.M. 4.75	Region:	3
County:	Williamson	Project #	

Location

From:	Thompson's Station City Limits
To:	South of SR 840

Parameter	**Criteria**
2014 AADT	34,000
2034 AADT	36,700
Percent Trucks (DHV)	3%
DHV (8% AADT 2034)	2,940
Functional Classification	Rural Minor Arterial
Minimum Design Speed	45 mph/60 mph To be determined in the NEPA Process – dependent upon rural or urban cross section.
Access Control	N/A
Minimum Radius	660 ft/1340 ft.
Maximum Grade	5%/4%
Minimum Stopping Sight Distance	360 ft./570 ft.
Surface Width	To be determined in the NEPA Process
Number of Lanes	To be determined in the NEPA Process – between three and five total lanes.
Usable Shoulder Width	To be determined in the NEPA Process – dependent upon rural or urban cross section.
Median Width	To be determined in the NEPA Process – dependent upon utilization of a center two-way left turn lane.
Minimum R.O.W.	To be determined in the NEPA Process – dependent upon cross section selection
Signalization	Yes

Tennessee Department of Transportation

Design Criteria for Location and Design Phase

Route:	SR 6	Option:	N/A
Section:	4, L.M. 4.76 to L.M. 5.55	Region:	3
County:	Williamson	Project #	

Location

From:	South of SR 840
To:	Tollgate Road

Parameter	**Criteria**
2014 AADT	34,000
2034 AADT	36,700
Percent Trucks (DHV)	3%
DHV (8% AADT 2034)	2,940
Functional Classification	Rural Minor Arterial
Minimum Design Speed	60 mph Estimated – utilize existing
Access Control	N/A
Minimum Radius	1340 ft.
Maximum Grade	4%
Minimum Stopping Sight Distance	570 ft.
Surface Width	Varies – utilize existing
Number of Lanes	Four travel lanes – utilize existing
Usable Shoulder Width	Varies – utilize existing
Median Width	Varies – utilize existing
Minimum R.O.W.	Varies – utilize existing
Signalization	Yes

Note: No improvements needed in this section

Tennessee Department of Transportation

Design Criteria for Location and Design Phase

Route:	SR 6	Option:	N/A
Section:	5, L.M. 5.56 to L.M. 8.67	Region:	3
County:	Williamson	Project #	

Location

From:	Tollgate Road
To:	Nashville Urban Boundary

Parameter	**Criteria**
2014 AADT	24,000
2034 AADT	27,600
Percent Trucks (DHV)	3%
DHV (8% AADT 2034)	2,210
Functional Classification	Rural Minor Arterial
Minimum Design Speed	45 mph/60 mph To be determined in the NEPA Process – dependent upon rural or urban cross section.
Access Control	N/A
Minimum Radius	660 ft/1340 ft.
Maximum Grade	5%/4%
Minimum Stopping Sight Distance	360 ft./570 ft.
Surface Width	To be determined in the NEPA Process
Number of Lanes	Four travel lanes
Usable Shoulder Width	To be determined in the NEPA Process – dependent upon rural or urban cross section.
Median Width	To be determined in the NEPA Process – dependent upon utilization of a center two-way left turn lane.
Minimum R.O.W.	To be determined in the NEPA Process – dependent upon cross section selection
Signalization	N/A

Tennessee Department of Transportation

Design Criteria for Location and Design Phase

Route:	SR 6	Option:	N/A
Section:	6, L.M. 8.68 to L.M. 10.03	Region:	3
County:	Williamson	Project #	

Location

From:	Nashville Urban Boundary
To:	Mack Hatcher Parkway

Parameter	**Criteria**
2014 AADT	20,800
2034 AADT	32,200
Percent Trucks (DHV)	3%
DHV (8% AADT 2034)	2,580
Functional Classification	Urban Other Principal Arterial
Minimum Design Speed	45 mph
Access Control	N/A
Minimum Radius	730 ft.
Maximum Grade	6%
Minimum Stopping Sight Distance	360 ft.
Surface Width	To be determined in the NEPA Process
Number of Lanes	Four travel lanes
Usable Shoulder Width	To be determined in the NEPA Process – dependent upon rural or urban cross section.
Median Width	To be determined in the NEPA Process – dependent upon utilization of a center two-way left turn lane.
Minimum R.O.W.	To be determined in the NEPA Process – dependent upon cross section selection
Signalization	Yes

TENNESSEE D.O.T.
DESIGN DIVISION
FILE NO.

TYPE	YEAR	PROJECT NO.	SHEET NO.
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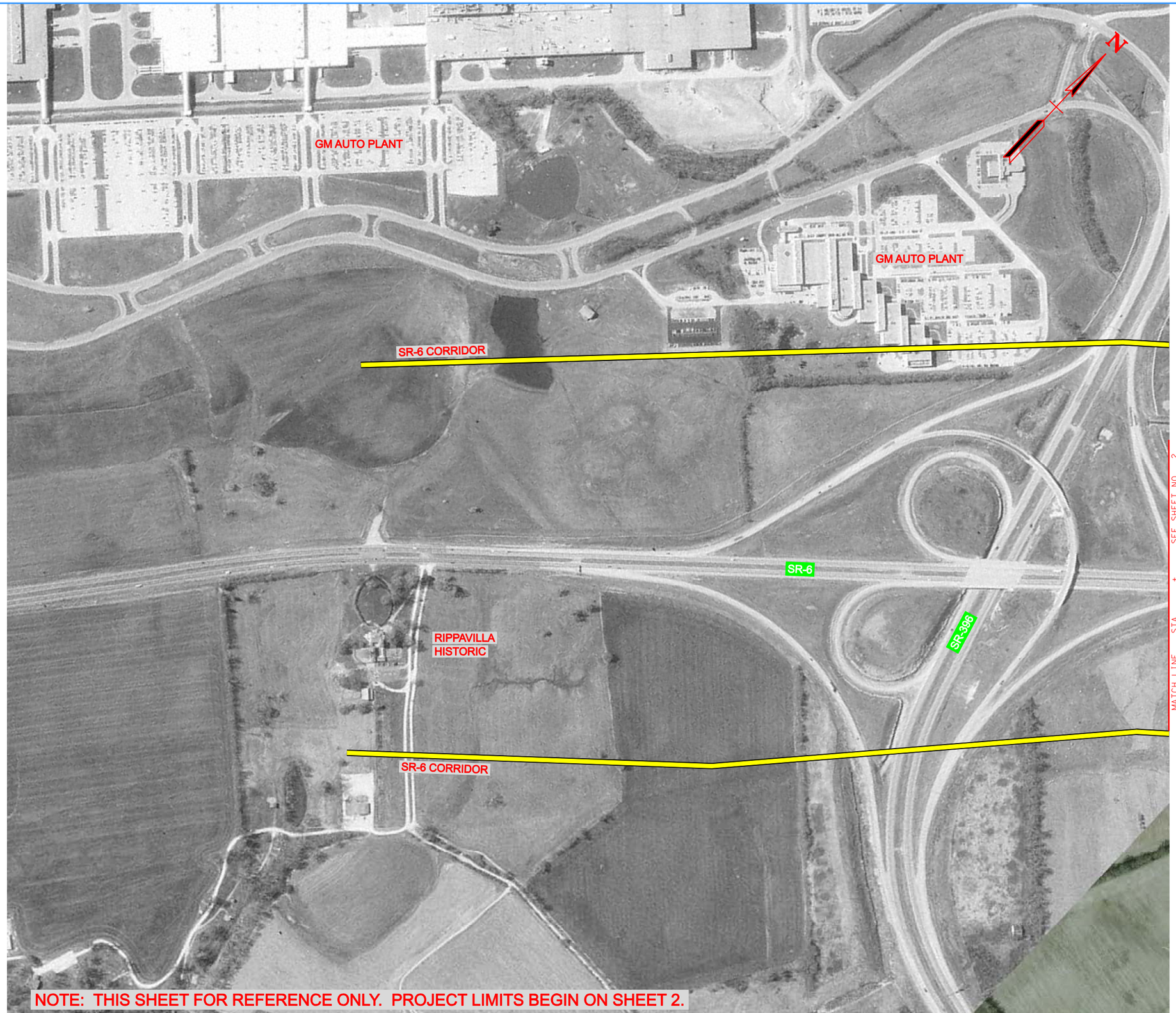

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STUDY CORRIDOR

ENVIRONMENTAL SITES

PROPERTY LINES

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STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

CONCEPTUAL LAYOUT

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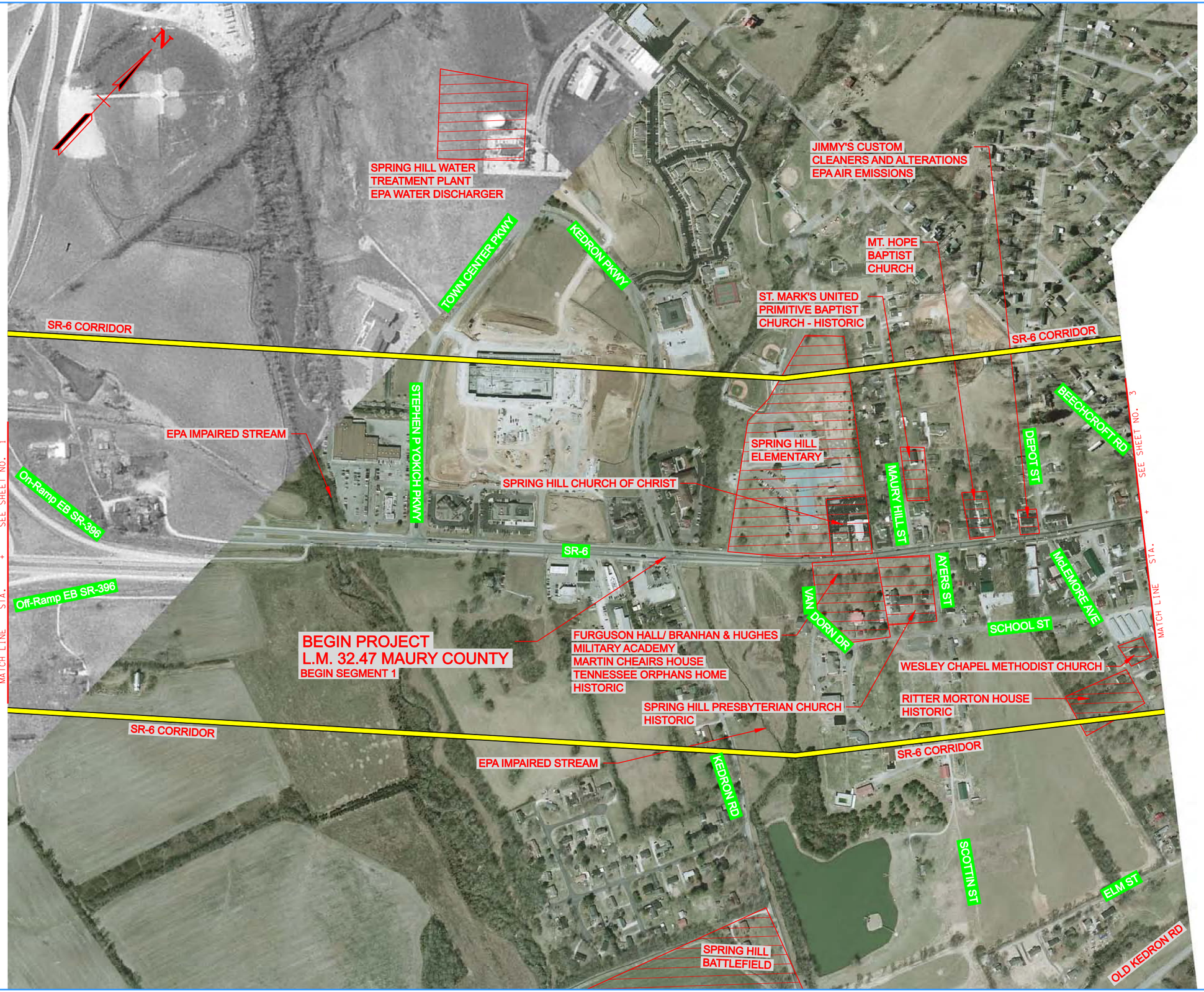

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- STUDY CORRIDOR
- ENVIRONMENTAL SITES
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STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

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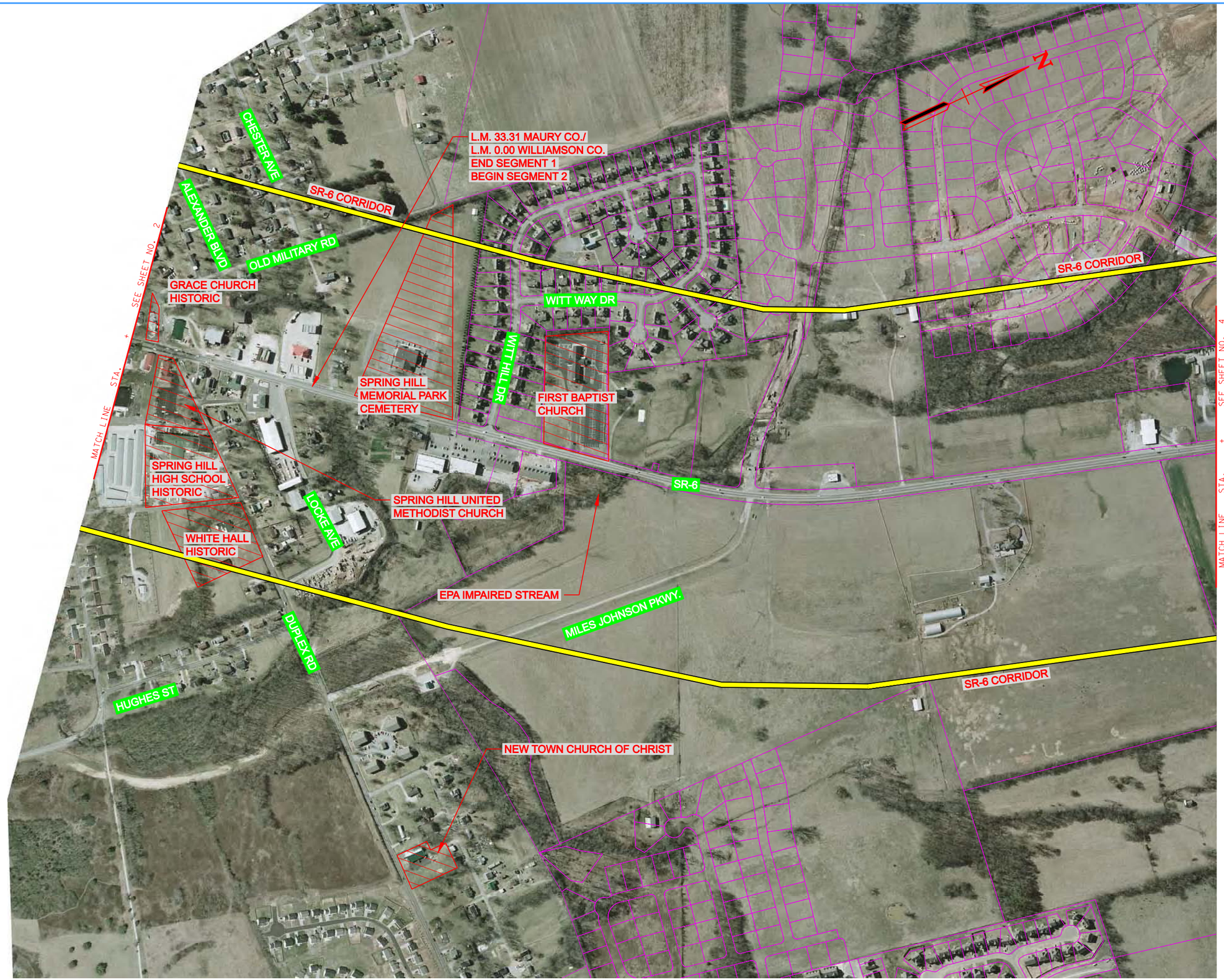

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STUDY CORRIDOR

ENVIRONMENTAL SITES

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STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

CONCEPTUAL LAYOUT

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TENNESSEE D.O.T.
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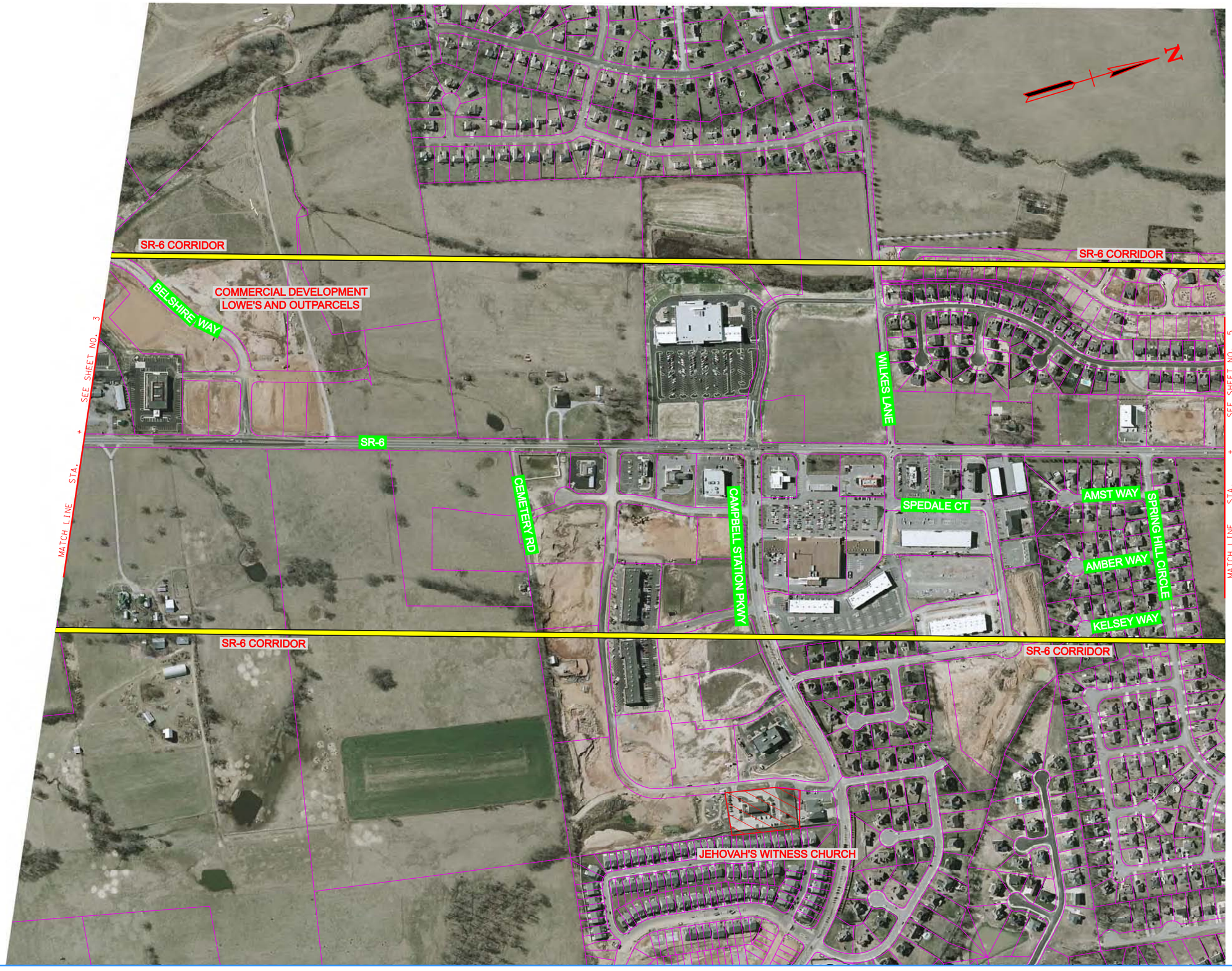

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- ENVIRONMENTAL SITES
- PROPERTY LINES

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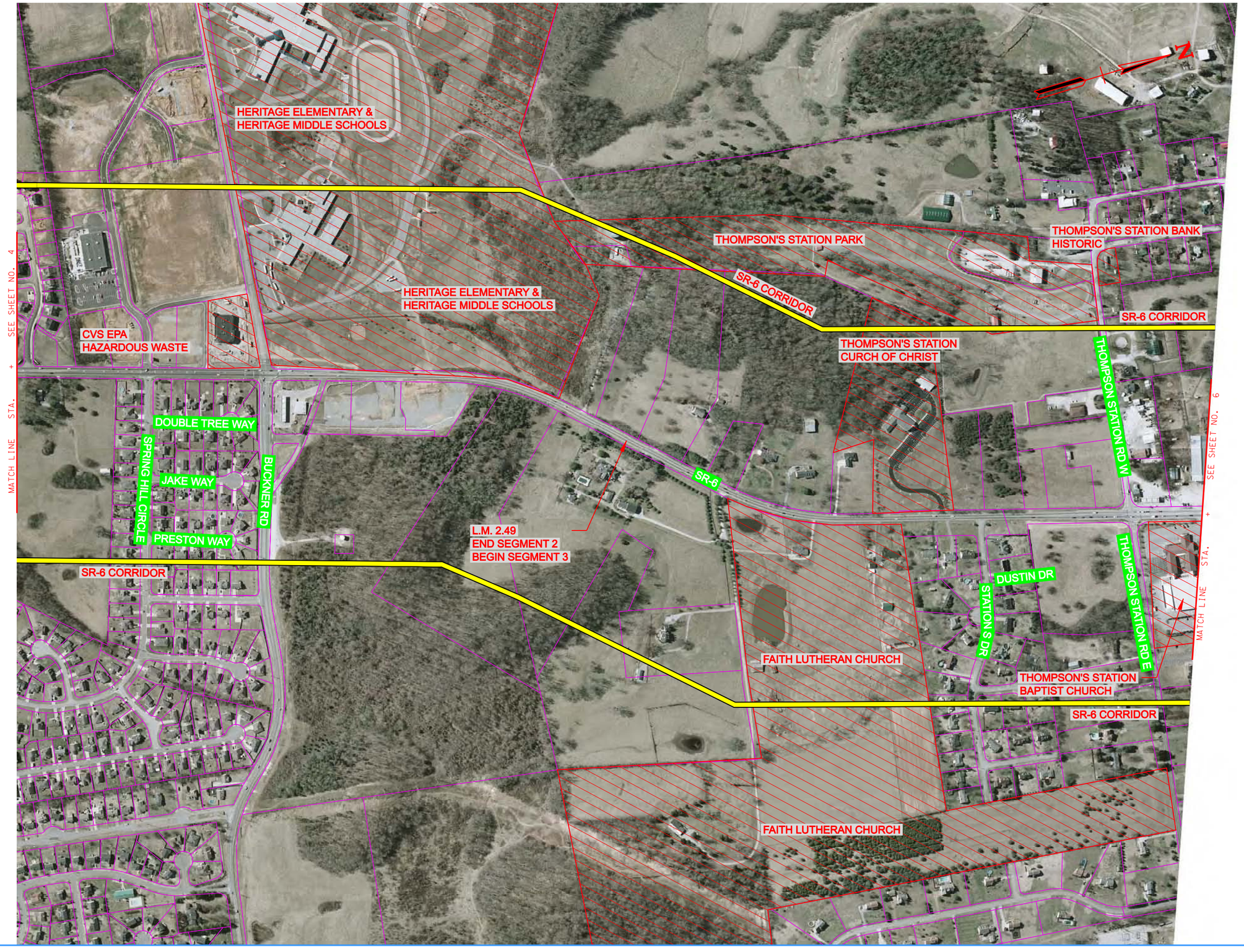

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STUDY CORRIDOR

ENVIRONMENTAL SITES

PROPERTY LINES

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SCALE: 1" = 500'

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

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TENNESSEE D.O.T.
DESIGN DIVISION
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TYPE	YEAR	PROJECT NO.	SHEET NO.
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LEGEND

- STUDY CORRIDOR
- ENVIRONMENTAL SITES
- PROPERTY LINES

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SCALE: 1" = 500'

STATE OF TENNESSEE
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TENNESSEE D.O.T.
DESIGN DIVISION
FILE NO.

TYPE	YEAR	PROJECT NO.	SHEET NO.
CONCEPT.	08		7

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- STUDY CORRIDOR
- ENVIRONMENTAL SITES
- PROPERTY LINES

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STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

CONCEPTUAL LAYOUT

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TENNESSEE D.O.T.
DESIGN DIVISION
FILE NO.

TYPE	YEAR	PROJECT NO.	SHEET NO.
CONCEPT.	08		8

LEGEND

STUDY CORRIDOR

ENVIRONMENTAL SITES

PROPERTY LINES

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SCALE: 1" = 500'

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

CONCEPTUAL LAYOUT

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TENNESSEE D.O.T.
DESIGN DIVISION
FILE NO.

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LEGEND

- STUDY CORRIDOR
- ENVIRONMENTAL SITES
- PROPERTY LINES

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STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

CONCEPTUAL LAYOUT

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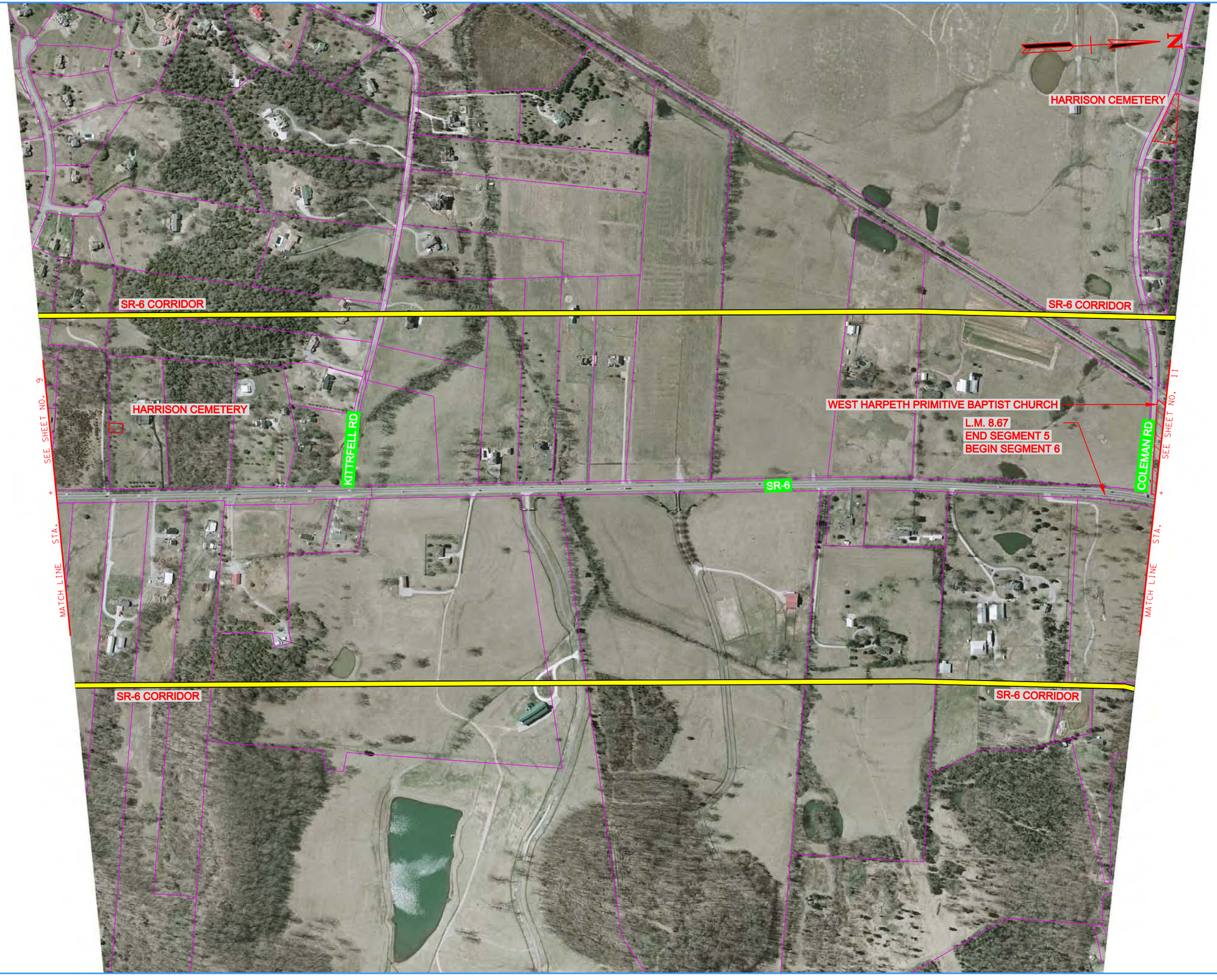

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STUDY CORRIDOR

ENVIRONMENTAL SITES

PROPERTY LINES

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SCALE: 1" = 500'

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

CONCEPTUAL LAYOUT

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TENNESSEE D.O.T.
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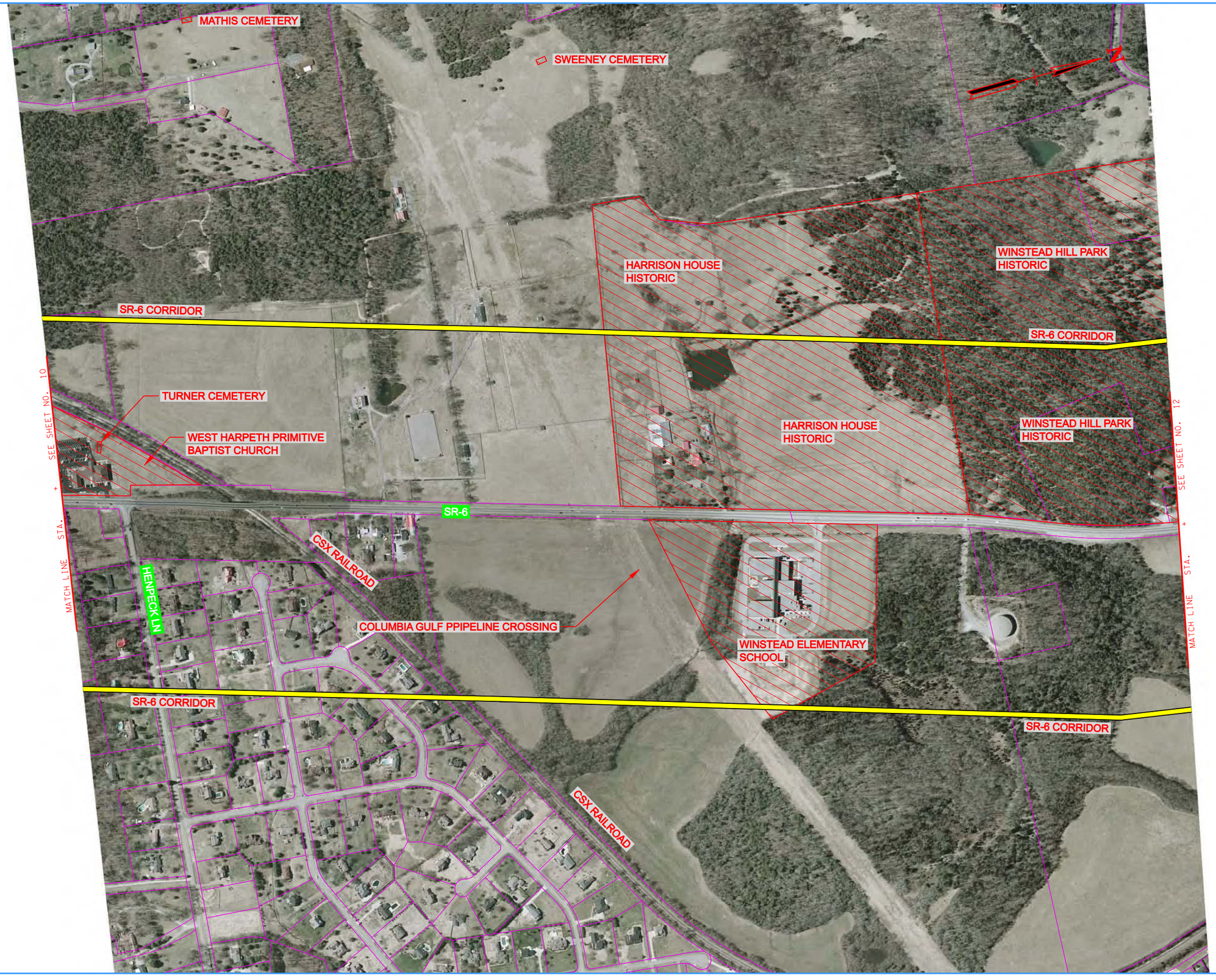

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STUDY CORRIDOR

ENVIRONMENTAL SITES

PROPERTY LINES

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SCALE: 1" = 500'

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

CONCEPTUAL LAYOUT

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TENNESSEE D.O.T.
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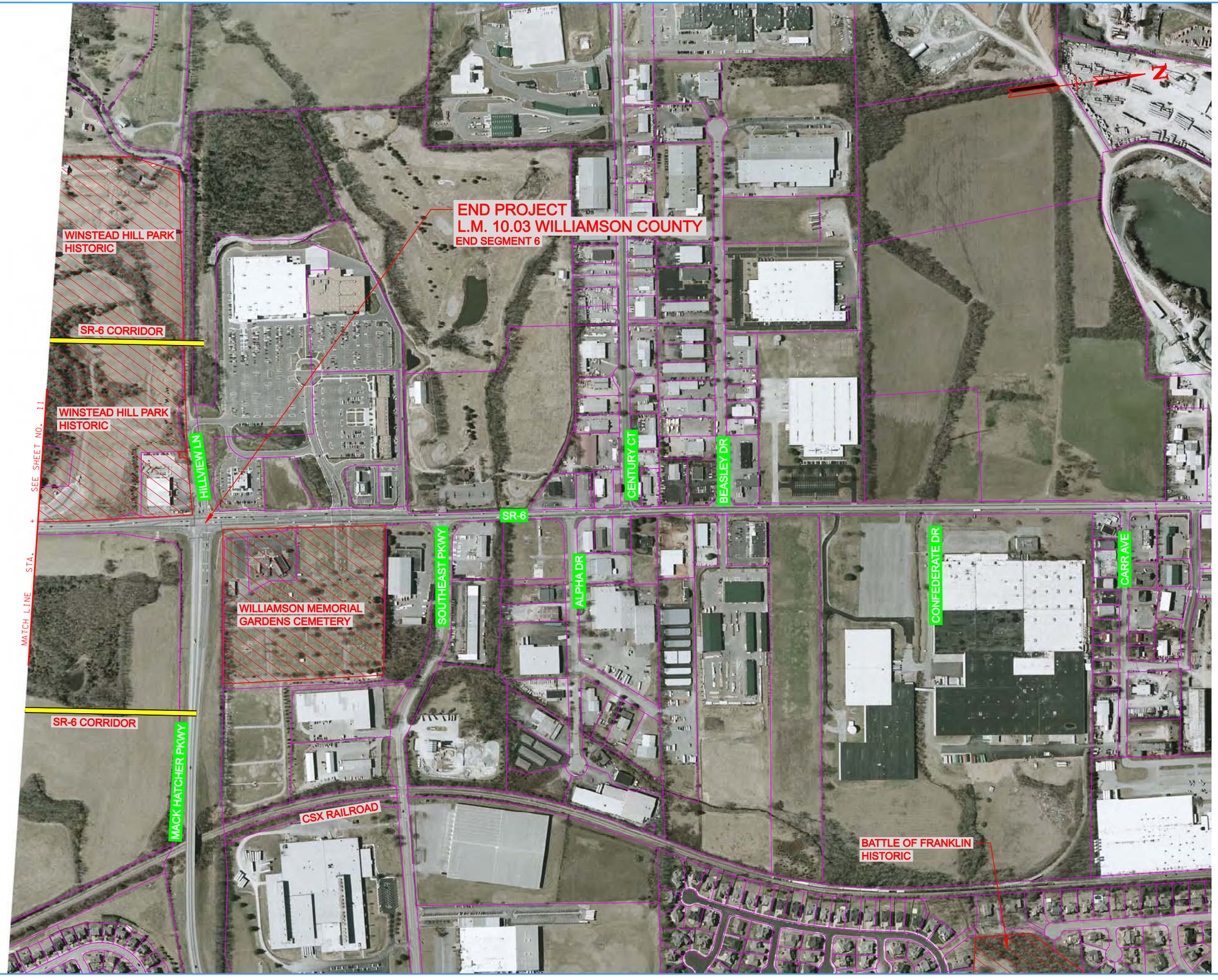

LEGEND

STUDY CORRIDOR

ENVIRONMENTAL SITES

PROPERTY LINES

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SCALE: 1" = 500'

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

CONCEPTUAL LAYOUT

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APPENDIX

CORRESPONDENCE

OPTIONS REQUIRING ADDITIONAL STUDY

COST ESTIMATES

Cost calculation summaries
Cost per mile calculations
Construction and engineering cost per mile calculations
Construction item cost per mile calculations
Structures calculations
Utility calculations
R.O.W. calculations
Paving cost calculations

TRAFFIC CALCULATIONS

TDOT EES MAPS

HCS+ CALCULATIONS

No Build Option
Widen Along the Existing Alignment Option
Three Lane Spring Hill Option
Three Lane Thompson's Station Option

CORRESPONDENCE

800 Second Avenue South | Nashville, Tennessee 37201 | (615) 862-7204 | www.nashvillempo.org
Mayor Ernest Burgess, Chairman

April 4, 2008

Ms. Angie Midgett
Long Range Planning Division
Tennessee Department of Transportation
505 Deaderick Street, Suite 1000
James K. Polk State Office Building
Nashville, TN 37243-0334

Dear Ms. Midgett:

On behalf of Williamson County Government and the Executive Board of the Nashville Area MPO, I am requesting that the Tennessee Department of Transportation complete a Transportation Planning Report for State Route 6, from Old Kedron Road to Mack Hatcher Memorial Parkway. Per TDOT guidelines, our formal request is included as part of our FY 2008 Unified Planning Work Program, as amended on March 19, 2008. A copy of that request and other project-related information is enclosed with this letter.

Please contact me or Max Baker at the MPO if you need any additional information.

Best,

Michael Skipper
Executive Director

enclosures

CC: Mayor Ernest Burgess, MPO Executive Board Chair
Mr. Joe Horne, MPO Technical Coordinating Committee Chair
Mayor Rogers Anderson, Williamson County

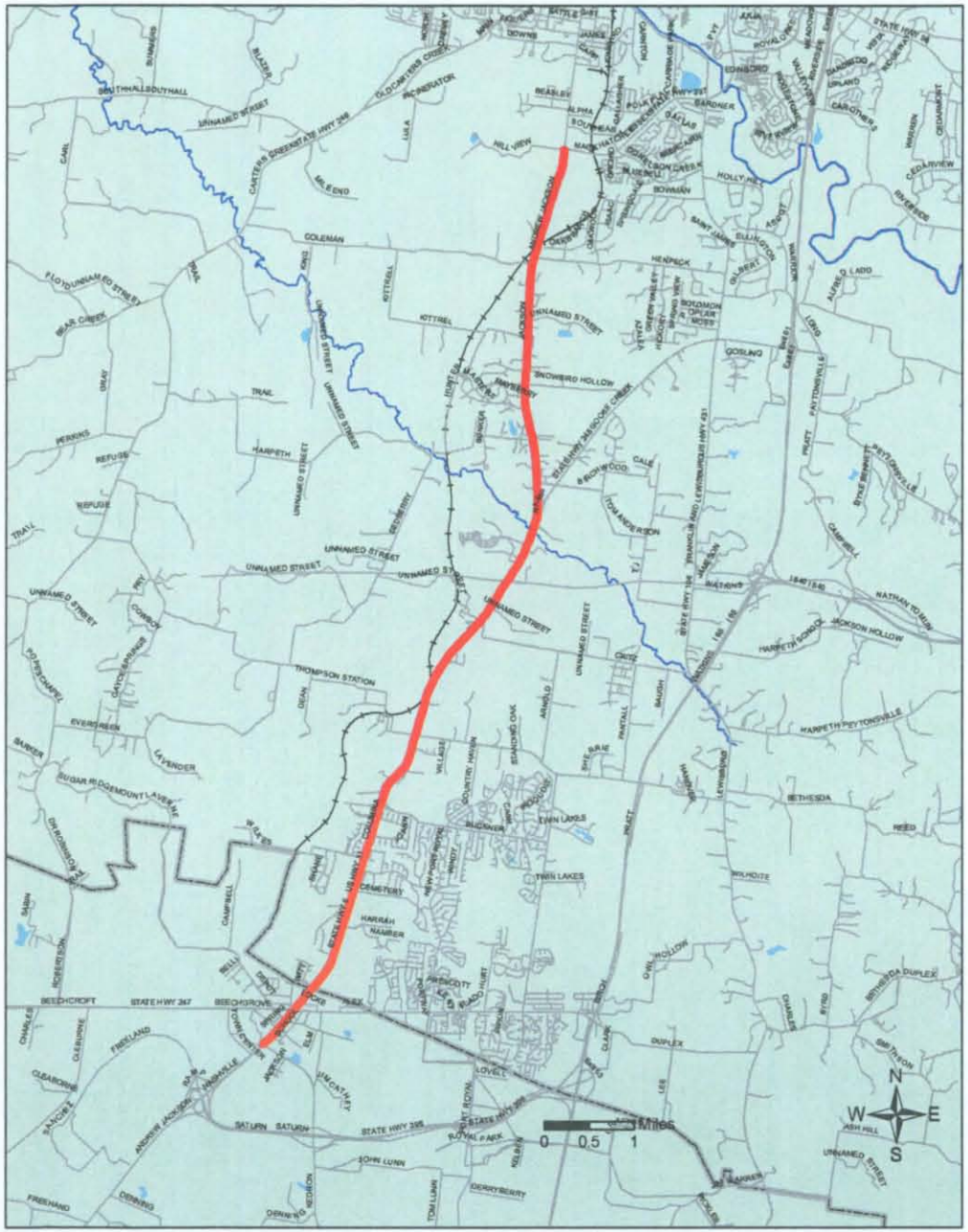
copy

APPENDIX

TPR Requests

#1. On behalf of Williamson County, the Nashville Area MPO requests that the Tennessee Department of Transportation complete a Transportation Planning Report (TPR) for the portion of State Route 6 from South Old Kedron Road to Mack Hatcher Memorial Parkway. Project details follow:

- LRTP#: 6022, 6001
- TIP#: 2008-64-068
- Horizon Year: 2016
- State Route: SR-6
- Termini: South Old Kedron Rd. to Mack Hatcher Memorial Pkwy.
- Length: 14.8 Miles
- Locally Used: US-31, Columbia Pike, Main St., Andrew Jackson
- Local Governments: Williamson County, Maury County
  Cities of Franklin, Thompson Station, and Spring Hill
- Description: Continued high rates of growth and the opening of SR-840 interchange have led to an AADT growth rate is at 7.7% per annum. Thus, the LOS of SR-6 has changed from C to D.



Termini: South Old Kedron Rd. to Mack Hatcher Memorial Pkwy.

Length: 14.8 Miles

State Route: SR-6

Locally Used: US-31, Columbia Pike, Main St., Andrew Jackson

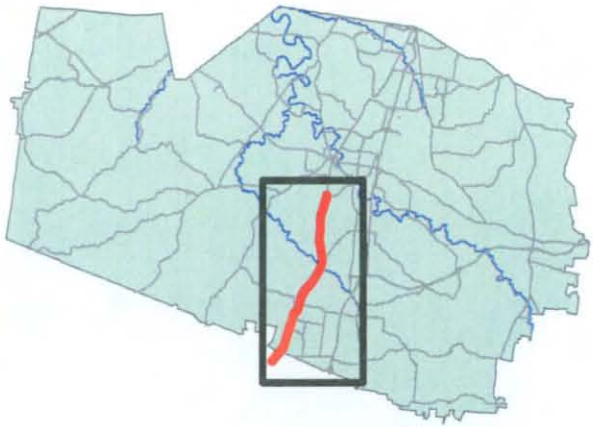
LRTP: 6022, 6001

TIP: 2008-64-068

Horizon Year: 2016

Local Governments: Williamson County, Maury County
Cities of Franklin, Thompson Station, and Spring Hill

Description: Continued high rates of growth and the opening of SR-840 interchange have led to an AADT growth rate is at 7.7% per annum. Thus, the LOS of SR-6 has changed from C to D. About 50% of crashes were rear-ends and about 22% were angle. About 39% of crashes occurred along the roadway.



NASHVILLE AREA MPO
TPR REQUEST
MAP
MARCH 2008

Florence & Hutcheson, Inc.

CONSULTING ENGINEERS

August 29, 2008

Mr. Chris Armstrong
Tennessee Department of Transportation
Project Planning Division
1000 JKP Building
505 Deaderick Street
Nashville, TN 37243-0334

RE: SR-6 TPR Site Visit Meeting Minutes

Dear Mr. Armstrong,

A Site Visit was held Friday 8/29/08 at 10:00, meeting at Winstead Hill Park in Franklin, TN, concerning the SR-6 TPR in Maury and Williamson Counties. The study bisects Williamson County, a portion of Maury County, the City of Spring Hill, the Town of Thompson's Station, and the City of Franklin. The project limits are from Kedron Road to the South to Mack Hatcher Parkway to the north. A handout was provided to those in attendance that listed environmental constraints (including historic properties) along the route and mapped them on USGS Quad Maps. Crashes were also mapped along the route. Aerial photography of the route was included in the handout. The meeting began with a short discussion of the project limits and the status of the study. The meeting was then opened up for questions, comments, recommendations for improvements (including spot improvements), and closed by driving the project. Those in attendance are listed on below:

Attendance List:

Name		Agency	Title/Department	E-mail	Phone
William	Banks	City of Franklin	Engineering	william.banks@franklin-gov.com	615-791-3218
Eric	Gardner	City of Franklin	Engineering Dir.	ericg@franklin-gov.com	615-791-3218
Ben	Worley	City of Franklin	R.O.W.	ben.worley@franklin-gob.com	615-791-3218
Joe	York	City of Franklin	Streets Director	joey@franklin-gov.com	615-791-3254
Jon	Storey	Florence & Hutcheson		jstorey@flohut.com	615-399-9090
Matt	Meservy	Nashville MPO		meservy@nashvillempo.org	615-862-6887
Bob	Allen	TDOT	Environmental	bob.allen@state.tn.us	615-253-2468
Chris	Armstrong	TDOT	Project Planning	christopher.armstrong@state.tn.us	615-741-3216
Holly	Barnett	TDOT	Environmental	holly.barnett@state.tn.us	615-253-2467
Tyler	King	TDOT	Project Planning	tyler.king@state.tn.us	615-253-2781
Greg	Langeliers	Thompson's Station	Town Administrator	glangeliers@thompsonsstation.com	615-794-4333
Floyd	Hefflin	Williamson County	County Engineer	floydh@williamson-tn.org	615-790-5731
Joe	Horne	Williamson County	Community Dev.	joeh@williamson-tn.org	615-790-5725

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Items discussed concerning the SR-6 TPR included:

- No representative from the City of Spring Hill was present. Representatives from the City of Franklin called to see if Spring Hill would be in attendance prior to the meeting starting. Spring Hill had been contacted by e-mail and a voice message prior to the site visit.
- The MPO has a 5-lane cross section for the entire route in the LRTP, but is not opposed to other ideas.
- The Town of Thompson's Station is interested in improved access to I-65, along with improvements to I-65, if this option could reduce the cross section through their town. One idea discussed was a new interchange at Buckner Lane and I-65.
- It was asked if the improvements discussed above could be included in the MPO model for use in the TPR. "What If" scenarios could be included in the MPO model, but would be of limited benefit due to the regional nature of the model. Therefore, the improvements currently in the LRTP that provide improvements along I-65, along with a new interchange between Thompson's Station Road and I-65, are included in the traffic projections, but no further "what-if" scenarios will be performed at this time.
- It was agreed that the Town of Thompson's Station recommendation should be discussed in the TPR without a traffic analysis.
- The extent of what a "spot improvement" could be was discussed.
- All local officials present appeared in agreement that improvements to the Goose Creek bypass intersection with SR-6 should be included as part of a spot improvement.
- A roundabout was discussed at the Goose Creek Bypass intersection with SR-6. This intersection is within Franklin's growth boundary. Franklin was in favor of studying this improvement. They are comfortable with multilane roundabouts along reasonably high speed facilities. They cited a roundabout along Mack Hatcher as an example. Eric Gardner will provide F&H with copies of the plans as a reference.
- Williamson County requested improvements to SR-6 be included in the LRTP to get options "on the table" and address the area's sub regional travel demands. The goal is to get input from Franklin, Thompson's Station, and Spring Hill to find a common solution to the region's traffic issue concerning SR-6.
- Historic properties will be an issue along this route. Williamson County noted that in the past historic groups have requested sizeable setbacks along road improvements to historic properties.
- It was discussed that input from interest groups (in this case historic societies) is generally not solicited during this early TPR stage of a roadway project. Input will be sought as the NEPA process continues and the project enters more formal stages.
- Thompson's Station has plans to realign Critz Lane at SR-6 and would welcome help as a spot improvement. R.O.W. has already been dedicated for this project. It was also noted that the intersection between SR-6 and Thompson's Station Road needs improvement.
- Thompson's Station is in agreement that the segment of SR-6 within their town growth boundary should be 5 lanes between Critz Lane and the Goose Creek Bypass.
- Improvements around Spring Hill are the most challenging segment of this project due to tight R.O.W. and extensive environmental locations.
- It was noted that the City of Spring Hill is currently attempting to construct the Miles Johnson Parkway as a bypass for the City. They may be interested in handing this project over to TDOT to be utilized as a bypass for SR-6. The Miles Johnson Parkway site was driven to investigate its application. The location is adequate from Kedron Road north, but

reconnecting it south to SR-6 will be a challenge due to the Battle of Spring Hill location and the extended project limits south of Kedron Road this will require. It would negate a large segment of 5-lane highway along SR-6. It was agreed that this option should be studied further in the TPR.

- It was discussed to include an option that would proceed to the west along the railroad tracks as a bypass for the City of Spring Hill.
- An option to utilize School Road in Spring Hill as a part of a one-way pair with SR-6 was discussed and will be included as an option. This option was more appealing on aerial mapping than in the field. A children's home/school would be impacted, and School Road is narrow and located in a primarily residential/well developed area. Significant impacts would be expected.
- The City of Franklin would like the extension of the right turn lane along SR-6 approaching Mack Hatcher Parkway included as a spot improvement in the study.
- The City of Franklin would like the realignment of the intersection between Coleman and Henpeck Lanes included as a spot improvement. These intersections are currently offset.
- It was discussed that the intersection of Duplex Road and Beechcroft Road should also be included as a spot improvement. These intersections are currently offset. A farmer's COOP would likely be impacted by this improvement.

Action Items

- Coordination between F&H and the City of Spring Hill to gain their input.
- Coordination between F&H and Eric Gardner for multilane roundabout plans.
- Coordination between F&H and the MPO to determine if the southern limit of study can be extended to allow connection of a bypass option around Spring Hill to SR-6.

As always, if you have any questions or comments, please do not hesitate to call or e-mail.

Thank you,

Florence & Hutcheson, Inc.

Jon Storey, P.E.

Florence & Hutcheson, Inc.

CONSULTING ENGINEERS

September 10, 2008

Mr. Chris Armstrong
Tennessee Department of Transportation
Project Planning Division
1000 JKP Building
505 Deaderick Street
Nashville, TN 37243-0334

RE: SR-6 TPR Spring Hill Meeting Minutes

Dear Mr. Armstrong,

A meeting was held with the City of Spring Hill Wednesday 9/10/08 at 11:00, meeting at Spring Hill's City Hall, concerning the SR-6 TPR in Maury and Williamson Counties. This meeting was held to gain input from the City concerning the study. The study bisects Williamson County, a portion of Maury County, the City of Spring Hill, the Town of Thompson's Station, and the City of Franklin. The project limits are from Kedron Road to the South to Mack Hatcher Parkway to the north. A handout was provided to those in attendance that listed environmental constraints (including historic properties) along the route and mapped them on USGS Quad Maps. Crashes were also mapped along the route. Aerial photography of the route was included in the handout. The meeting began with a short discussion of what occurred at the Site Visit on 8/29/08. The meeting was then opened up for questions, comments, recommendations for improvements (including spot improvements). Those in attendance are listed on below:

Attendance List:

Name		Agency	Title/Department	E-mail	Phone
Chris	Armstrong	TDOT	Project Planning	christopher.armstrong@state.tn.us	615-741-3216
Danny	Leverette	Spring Hill	Mayor		931-384-0500
John	McCord	Spring Hill	Director of Public Works		931-486-1265
Jamie	Pierce	Spring Hill	Deputy Director of Public Works		931-384-0640
Jon	Storey	Florence & Hutcheson		jstorey@flohut.com	615-399-9090
Ken	Weaver	Spring Hill	City Administrator		931-797-4447

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Items discussed concerning the SR-6 TPR included:

- The city is concerned with widening SR-6/US-31 through the city and does not support this option. They wish to revitalize downtown and maintain a walkable community. It appears a streetscape is desired in the future. A 5-lane section is not desirable. The existing 3-lane section is what they envision through the city.
- The City would like the LRTP amended to show a 3-lane segment through the city.
- They are currently studying a signal coordination system through the city and were curious how this study could affect this. It was not believed the TPR would affect their current signal coordination efforts.
- The historic locations along the route and crashes were discussed.
- Improvements to the existing route, an east, and a west bypass option were discussed.
- If a bypass is chosen, ownership of existing SR-6 was discussed. It was noted it would likely become their responsibility. This did not appear to be a major hurdle as it may allow them more flexibility with improving the aesthetics of the route and more freedom in the design. It was noted that prior to turning over the route TDOT would perform needed maintenance, likely including an overlay. The financial aspect of SR-6 becoming local responsibility in the future was discussed as a minus, but was not a deal breaker.
- The city has some issues with the Saturn Parkway Interchange with SR-6. It appears the flyover ramp from Saturn Pkwy to SR-6 Southbound has a history of crashes and should possibly be improved to 2 lanes.
- If no bypass is built, the city would like to see 5 lanes extended along the south terminus of the project to Spring Hill Elementary, then tapered to 3 lanes. The three lanes would continue north until just south of a bridge that is located south of Miles Johnson Parkway. The 5 lanes would continue throughout the city's growth boundary.
- The City is receptive to studying a bypass along Miles Johnson Parkway (an east bypass). The bypass would follow existing Saturn Parkway, exit at what is currently Kedron Parkway and continue north along Miles Johnson Parkway until tying back into existing SR-6. With this option, the city would like to see improvements to the Saturn Parkway Interchange with SR-6.
- A 53 bed hospital will be located along the Proposed Miles Johnson Parkway. The City is concerned by the time the SR-6 Bypass would be constructed, the development in the area will no longer be receptive to a wider Bypass footprint, but still would like this option studied.
- There are wetlands around the proposed Miles Johnson Parkway route.
- The City did not appear interested in continuing the Bypass south of Saturn Parkway. It was noted SR-6 already has 5 lanes south of Saturn Parkway and the limits would extend well south of Spring Hill.
- The City was also interested in studying a west bypass as an option. They currently have a line in their Major Thoroughfare Plan for a similar facility. The route would extend from Town Center Parkway (Yockovich Pkwy.) north to Thompson's Ridge Road. This option would extend west of the railroad tracks to avoid existing development. It was discussed

that two issues with this route may be the at-grade intersection and turning movements at Town Center Parkway and the long length of existing SR-6 that would become the responsibility of the City. It was also discussed that Thompson's Station may not like the route tying in close to schools within their growth limits. Another issue not discussed could be the railroad crossings. Grade separation would likely be required.

- Spot improvements were discussed. Spot improvements desired by the City included:
    - Turning lanes are desired at the Buckner Road and Campbell Station Road Intersections.
    - Realignment is desired at the Duplex Road/Beechcroft Road Intersection to align these two routes.
    - Signalization is desired at Miles Johnson Parkway and Bellshire Way.
- F&H was provided a copy of the City's Major Thoroughfare Plan.
- A one-way pair option with existing SR-6 and School Road was briefly discussed. The City does not support this option.
- The City is interested in an interchange between Buckner Road and I-65. The LRTP currently has an interchange at Thompson's Station Road. The City would like this interchange moved to Buckner Road due to a large tract of land that is proposed to be developed into a large retail area.

As always, if you have any questions or comments, please do not hesitate to call or e-mail.

Thank you,

Florence & Hutcheson, Inc.

Jon Storey, P.E.

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Florence & Hutcheson, Inc.
CONSULTING ENGINEERS

January 28, 2009

Mr. Chris Armstrong
Tennessee Department of Transportation
Project Planning Division
1000 JKP Building
505 Deaderick Street
Nashville, TN 37243-0334

RE: SR-6 TPR Meeting

Mr. Armstrong,

A meeting was held on Tuesday 1/27/09, at 2:00 PM in TDOT's 10th floor conference room. Those in attendance included:

Name	Organization/Title	Phone
Steve Allen	TDOT Project Planning Division	741-2208
Chris Armstrong	TDOT Project Planning Division	741-3216
Bill Hart	TDOT Project Planning Division	741-3688
Jeanne Stevens	TDOT Long Range Planning Division	741-3421
Matt Meservy (via teleconference)	Nashville Metropolitan Planning Organization	862-6887
Jon Storey	Florence & Hutcheson, Inc.	399-9090

The primary focus of the meeting was to determine if the options included in the SR-6 TPR should be strictly limited by what is listed in the MPO's LRTP, or if additional options requested by local agencies should also be included. The Draft SR-6 TPR currently includes bypass options in addition to an option to widen along the existing alignment. The LRTP only lists widening along the existing alignment. The discussion proceeded to include the interrelation between the MPO planning process and the TPR process for all projects, not just the SR-6 project. The items listed below were discussed.

- The northern terminus was discussed. The Draft SR-6 TPR utilizes Mack Hatcher Parkway as the northern terminus, but notes that the LRTP projects along SR-6 end at Henpeck Lane. After the meeting, it was confirmed that the LRTP has a discrepancy concerning the 1.25-mile segment between Henpeck Lane and Mack Hatcher Parkway. The LRTP map notes Project Number 6032 along this segment of SR-6. However, the LRTP project list notes that Project Number 6032 is for SR-106 (Lewisburg Pike) from Henpeck Lane to Mack Hatcher Parkway, and includes widening from two lanes to four lanes with bike lanes. Confirmation from the MPO is needed if Project Number 6032 is actually for SR-6 and not SR-106. How to document this in the TPR will be discussed with TDOT.

- The LRTP notes the southern terminus of the project at Old Kedron Road. However, Old Kedron Road does not intersect SR-6. Kedron Road intersects SR-6. The LRTP may need to be revised for this. Also, the bypass options intersect SR-6 south of Kedron Road. The LRTP may need to be revised to account for the extended project limits.

- The LRTP notes the improvements will include 4 lanes along SR-6 in Williamson County and 5 lanes along SR-6 within Spring Hill's City Limits. Stakeholders outside of Spring Hill appear to be in favor of a 5-lane cross section. Stakeholder's in Spring Hill do not want the existing 3-lane cross section widened within their CBD and desire a bypass. Thompson's Station noted they would favor a 3-lane cross section through their city limits instead of 4 lanes. The Draft TPR provides the cross section options noted by the local stakeholders.

- It was understood by F&H that it is acceptable to provide bypass and cross section options in the SR-6 TPR, as currently shown. F&H submitted the Draft TPR on 12/12/08. If the bypass options are acceptable, F&H will await TDOT's review of the draft. F&H will coordinate with the Project Planning Division to determine what revisions are desired. Revisions concerning issues discussed in these meeting minutes are anticipated.

As always, if you have any questions or comments, please do not hesitate to call or e-mail.

Thank you,

Florence & Hutcheson, Inc.

Jon Storey, P.E.

Florence & Hutcheson, Inc.
CONSULTING ENGINEERS

October 21, 2009

Mr. Chris Armstrong
Tennessee Department of Transportation
Project Planning Division
1000 JKP Building
505 Deaderick Street
Nashville, TN 37243

RE: SR-6/US-31 TPR Meeting Minutes

Dear Mr. Armstrong,

A meeting was held today in TDOT's 10th Floor Conference Room. Those in attendance included:

Chris Armstrong	TDOT
Steve Allen	TDOT
Gary Webber	TDOT
Eric Gardner	City of Franklin
Ben Worley	City of Franklin
Gillian Fischbach	Fischbach Transportation Company
Jon Storey	Florence & Hutcheson

Items discussed included:

An MPO retreat was held a week ago concerning the role of a TPR in relation to the LRTP. It was agreed at the MPO retreat that the improvement recommendations in the LRTP are an initial guide, and not set in stone. The TPR can therefore still look at other reasonable options. It must be noted in the executive summary of the TPR where these options deviate from the LRTP. This is especially critical when the termini in the TPR deviate from the termini in the LRTP.

Concerning the SR-6 TPR, TDOT is open to looking at bypass options, but wants to ensure they are options that meet TDOT's needs. It is likely if bypass options are to be included, they will not be the same options currently in the TPR. If no feasible bypass option is available, we may simply discuss widening along the existing centerline and note all the constraints. Chris Armstrong and Jon Storey will coordinate with Bill Hart concerning bypass options and how to proceed with the SR-6 TPR.

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If there are any questions, comments, or omissions concerning these minutes, please do not hesitate to call.

Thank you,

Florence & Hutcheson, Inc.

Jon Storey, P.E.

Florence & Hutcheson, Inc.
CONSULTING ENGINEERS

November 3, 2009

Mr. Chris Armstrong
Tennessee Department of Transportation
Project Planning Division
1000 JKP Building
505 Deaderick Street
Nashville, TN 37243

RE: SR-6/US-31 TPR Meeting Minutes

Dear Mr. Armstrong,

A meeting was held yesterday in TDOT's 10th Floor Conference Room on 11/2/09. Those in attendance included:

Chris Armstrong	TDOT
Steve Allen	TDOT
Bill Hart	TDOT
Jon Storey	Florence & Hutcheson

Items discussed included:

The SR-6 TPR should be revised to include the following options:

1. Widening along the existing corridor as described in the LRTP
2. Reasonable options along the existing corridor taking into account environmental constraints and stakeholder input.
3. The bypass options around Spring Hill will be placed in a section titled "options previously considered but rejected". Why the bypass options are rejected will be discussed, including access control issues, not meeting the State's Purpose and Need or standards for a bypass, the regional significance of a bypass, intersection issues at existing SR-6, and the reallocation of truck traffic through residential areas surrounding the bypass routes.

How the different options affect the project's termini and will be discussed in the TPR and executive summary. Additionally, all options not following the LRTP will be summarized in the executive summary. Also discussed at the meeting was how a city's Major Thoroughfare Plan (MTP) doesn't control the LRTP or options in a TPR. The MTP is to be considered when mutual benefits are achievable, but is not a controlling factor.

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If there are any questions, comments, or omissions concerning these minutes, please do not hesitate to call.

Thank you,

Florence & Hutcheson, Inc.

Jon Storey, P.E.

OPTIONS REQUIRING ADDITIONAL STUDY

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1.0 OPTIONS REQUIRING ADDITIONAL STUDY SUMMARY

This Transportation Planning Report (TPR) examines the improvements listed in the Nashville Area Metropolitan Planning Organization's (MPO) Long Range Transportation Plan (LRTP) for 10.87 miles of State Route 6 (SR 6) from the City of Spring Hill to the southern limits of the City of Franklin in south-central Tennessee. The improvements widen the existing route from two (2) travel lanes to four (4) travel lanes.

The Widen Along the Existing Alignment Option does not have the support of the City of Spring Hill due to the impact to their central business district (CBD). The existing R.O.W. within the CBD of Spring Hill is approximately sixty (60) feet wide. Improvements to SR 6 within the CBD will require impacts to numerous religious, historic, and commercial properties. Furthermore, the City wishes to revitalize their downtown and maintain their walkable community. They envision a future streetscape project that will maintain the existing three (3) lane cross section.

Additionally, the Widen Along the Existing Alignment Option does not have the support of the Town of Thompson's Station. A representative of the Town notes that future improvements along Interstate 65 may alleviate congestion along SR 6 within their town limits, and therefore eliminate the need to widen SR 6 to four (4) travel lanes within the town limits. Concern was expressed that widening SR 6 without improvements to Interstate 65 would increase traffic volumes through the town.

As a result of the lack of support from local officials for the improvements listed in the LRTP, spot improvements, travel lane options, and bypass options were studied to limit impacts to sensitive areas along the route. The MPO noted that new options are welcome. It was noted that changes in the project, especially changes to the project termini, will need to be coordinated with the MPO and incorporated into the LRTP. The additional options studied are summarized as follows:

- Spot Improvements
- Three (3) Lane Spring Hill Option
- Three (3) Lane Thompson's Station Option
- Three (3) Lane Spring Hill and Thompson's Station Option
- Spring Hill One-Way Pair Option
- Eastern Spring Hill Bypass Option
- Western Spring Hill Bypass Option

Each of these options require additional study due to one or more of the following reasons: not meeting the purpose and need of the project, not having the support of local officials; not currently being included in the MPO's planning process; not providing acceptable access control measures; not meeting the regional significance or providing for a continuous route for a bypass; the existence of an existing parallel route (Interstate 65) which, if improved, negates the need for a bypass; impacts to environmentally sensitive locations; and due to the reallocation of truck traffic to residential areas along the option's routes. Therefore, these options were not included in the TPR's main body. It should be noted that further refinement of any of these options through the MPO's planning process may create a viable option to meet the Purpose and Need of the project.

2.0 SPOT IMPROVEMENTS

Due to limited funding and in consideration that corridor wide improvements would have considerable costs, locations for spot improvements were solicited from local officials. These improvements should be considered interim improvements to address the most urgent needs along the route, but they do not meet the Purpose and Need of the project due to their limited ability to improve capacity through the corridor. These improvements can be incorporated into future corridor wide improvement options, including the Widen Along the Existing Alignment Option. The Spot Improvements identified are listed below, from south to north along SR 6.

- Realign the offset intersection of Duplex Road (SR 247) and Beechcroft Road (SR 247) at SR 6 to create a standard four (4) legged intersection. Estimated cost is $740,000.
- Signalization of the intersection of SR 6 with Miles Johnson Parkway. Estimated cost in year 2014 dollars is $150,000.
- Signalization of the intersection of SR 6 with Bellshire Way. Estimated cost in year 2014 dollars is $150,000.
- Turn lane improvements at the intersection of SR 6 with Campbell Station Parkway. Estimated cost in year 2014 dollars is $300,000.
- Turn lane improvements at the intersection of SR 6 with Buckner Road. Estimated cost in year 2014 dollars is $300,000.
- Turn lane improvements at the intersection of SR 6 with Thompson's Station Road. Estimated cost in year 2014 dollars is $300,000.
- Realign Critz Lane at the intersection with SR 6. Estimated cost in year 2014 dollars is $950,000.
- Improve the bridge over a branch of the Harpeth River located just south of the Goose Creek Bypass Intersection with SR 6. Estimated cost in year 2014 dollars is $1,512,000.
- Construct a roundabout at the Goose Creek Bypass intersection with SR 6. Estimated cost in year 2014 dollars is $5,680,000.
- Realign the offset intersection of Coleman Road and Henpeck Lane at SR 6 to create a standard four (4) legged intersection. Estimated cost in year 2014 dollars is $1,950,000.
- Extend the right turn lane of SR 6 Northbound at the intersection with Mack Hatcher Parkway. Estimated cost in year 2014 dollars is $200,000.

No HCS LOS analysis or order of priority analysis was developed for the Spot Improvement Options. These options were developed as a result of feedback received during stakeholder meetings that occurred during the development of this TPR. Analysis of the Spot Improvement Options requires detailed traffic and geometric information that is currently not available. The cost of all eleven (11) Spot Improvement Options is estimated to be $12.2 million in year 2014 dollars. The Spot Improvement Options are mapped in **Figure 2 Spot Improvement Options**.

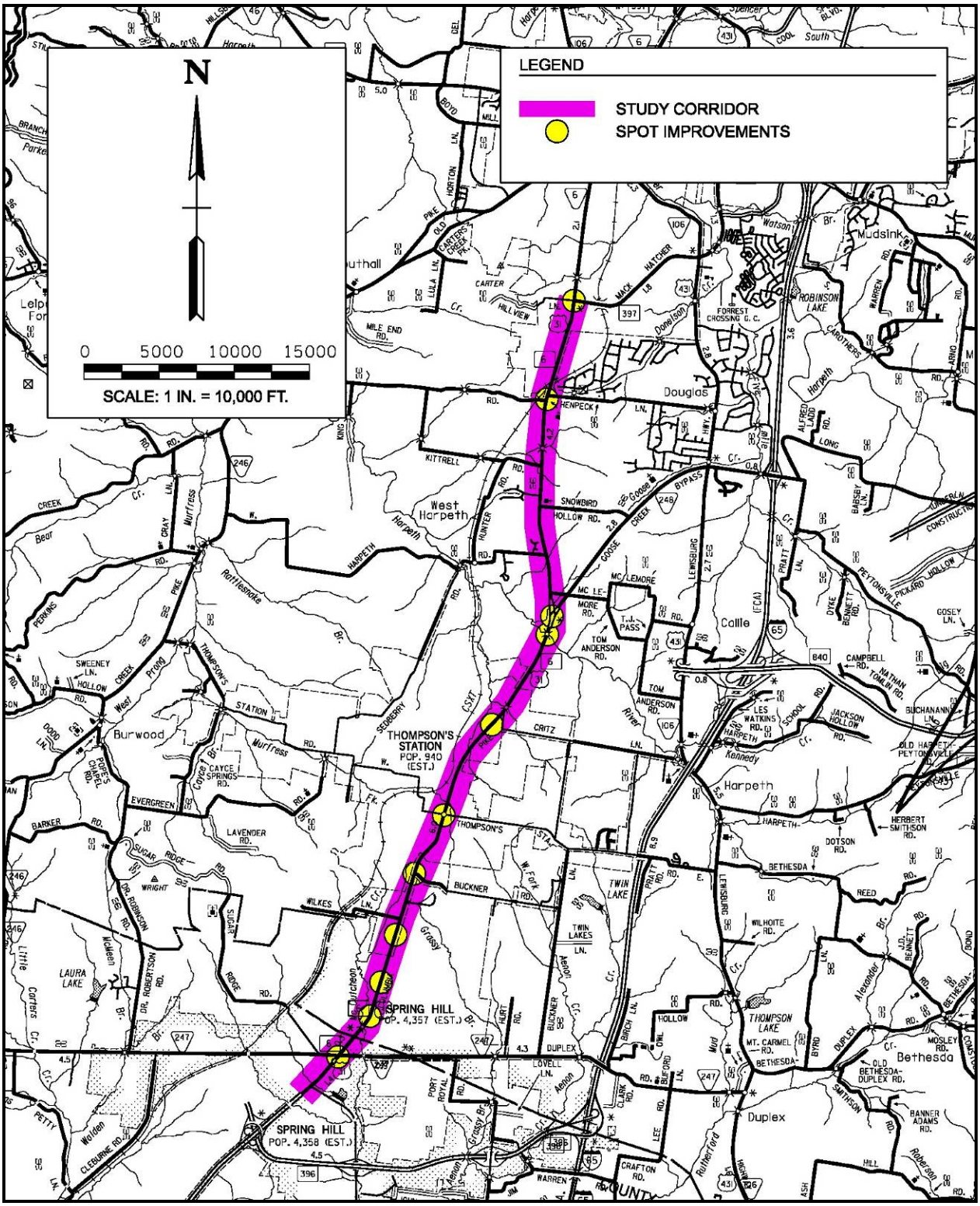


FIGURE 2 SPOT IMPROVEMENT OPTIONS

2.1 SR 6 AT SR 247

This spot improvement will realign the offset intersection of Duplex Road (SR 247) and Beechcroft Road (SR 247) at SR 6 to create a standard four (4) legged intersection. These intersections are signalized and operate with one (1) traffic controller. This option will improve traffic operations along SR 6 by eliminating one (1) signal along the route and simplifying the signal timing within the City of Spring Hill's congested CBD. This improvement will likely require one (1) commercial property to be relocated. This spot improvement is programmed in the MPO's Transportation Improvement Program (TIP) for the year 2011. The estimated cost of the improvements is provided in the TIP to be $740,000.

2.2 SR 6 AT MILES JOHNSON PARKWAY

This spot improvement will provide signalization at the intersection of SR 6 with Miles Johnson Parkway. Although an additional signal along SR 6 will create additional mainline delays, it will improve the operation of the intersection, and possibly improve the safety of the intersection. A signal may also promote use of Miles Johnson Parkway as an alternate route for SR 6 by enabling improved access to the route. A signal warrant analysis will need to be performed prior to signalization of the intersection. The cost of signalizing this intersection is estimated to a planning level to be $150,000.

2.3 SR 6 AT BELLSHIRE WAY

This spot improvement will provide signalization at the intersection of SR 6 with Bellshire Way. Although an additional signal along SR 6 will create additional mainline delays, it will improve the operation of the intersection, and possibly improve the safety of the intersection. A new Lowe's Home Improvement Center, medical office building, and several outparcel commercial developments have recently been constructed at this intersection. A signal warrant analysis will need to be performed prior to signalization of the intersection. The cost of signalizing this intersection is estimated to a planning level to be $150,000.

2.4 SR 6 AT CAMPBELL STATION PARKWAY

This spot improvement will provide turn lane improvements at the intersection of SR 6 with Campbell Station Parkway. This intersection is signalized and each approach includes left turn bays. The surrounding land use is commercial, with a Publix Grocery Store anchoring the development. Local officials noted the need for turn lane improvements. A detailed traffic analysis is needed to determine the need for right turn bays and/or to determine the length to increase the left turn bays. Turn lane improvements could improve operations and safety along SR 6 by reducing or eliminating queued vehicles from the mainline, therefore improving traffic flow. With the limited available information, the cost of providing turn lane improvements is estimated at $300,000.

2.5 SR 6 AT BUCKNER ROAD

This spot improvement will provide turn lane improvements at the intersection of SR 6 with Buckner Road. This intersection is signalized and each approach includes left turn bays. The surrounding land use is commercial, educational, and residential. Local officials noted the need

for turn lane improvements. A detailed traffic analysis is needed to determine the need for right turn bays and/or to determine the length to increase the left turn bays. Turn lane improvements could improve operations and safety along SR 6 by reducing or eliminating queued vehicles from the mainline, therefore improving traffic flow. With the limited available information, the cost of providing turn lane improvements is estimated to be $300,000.

2.6 SR 6 AT THOMPSON'S STATION ROAD

This spot improvement will provide turn lane improvements at the intersection of SR 6 with Thompson's Station Road. This intersection is signalized and each approach includes left turn bays. The surrounding land use is commercial, religious, and residential/vacant. Local officials noted the need for turn lane improvements. A detailed traffic analysis is needed to determine the need for right turn bays and/or to determine the length to increase the left turn bays. Turn lane improvements could improve operations and safety along SR 6 by reducing or eliminating queued vehicles from the mainline, therefore improving traffic flow. With the limited available information, the cost of providing turn lane improvements is estimated to be $300,000.

2.7 SR 6 AT CRITZ LANE

This spot improvement will realign Critz Lane at the intersection with SR 6. Critz Lane currently makes a 90-degree bend 0.2 miles before intersecting SR 6. The intersection of Critz Lane with SR 6 is skewed. Realigning Critz Lane will improve safety by eliminating the 90-degree bend in Critz Lane and improving the skew of the intersection with SR 6. Realigning Critz Lane will also extend the distance from this intersection to the SR 840 Interchange, potentially improving sight distance, safety and traffic operations. R.O.W. has been dedicated for this improvement, but design and construction funds are currently not available. The cost of the improvements is estimated to a planning level to be $950,000.

2.8 HARPETH RIVER BRIDGE

This spot improvement will improve the SR 6 Bridge over The West Harpeth River located just south of the Goose Creek Bypass Intersection with SR 6. The bridge has no shoulders and substandard bridge rails. Sight distance is restricted due to these factors. Replacing the bridge will improve safety by providing shoulders and improving sight distance. The cost to replace the bridge is estimated to a planning level to be $1,512,000. This estimate assumes the bridge would be constructed to accommodate a future five (5) lane cross section with shoulders.

2.9 SR 6 AT THE GOOSE CREEK BYPASS

This spot improvement recommends constructing a roundabout at the Goose Creek Bypass intersection with SR 6. Numerous local officials noted the need for improvements at this intersection due to operational and safety deficiencies. The proposed improvements are within the City of Franklin's Urban Growth Boundary. Officials from the City of Franklin noted their support for a roundabout at this location. The roundabout should be constructed to accommodate two (2) travel lanes within the roundabout. This will enable the roundabout to be modified when SR 6 and/or the Goose Creek Bypass are widened. A roundabout could serve as a "gateway" into Franklin from the south and Thompson's Station from the north. Roundabouts eliminate all left turn movements within the intersection. All approaches will operate under yield condition. Because of this, safety benefits can be anticipated compared to the existing configuration. It is estimated that no additional R.O.W. will be needed to construct a

roundabout. The cost to construct a roundabout is estimated to a planning level to be $5,680,000.

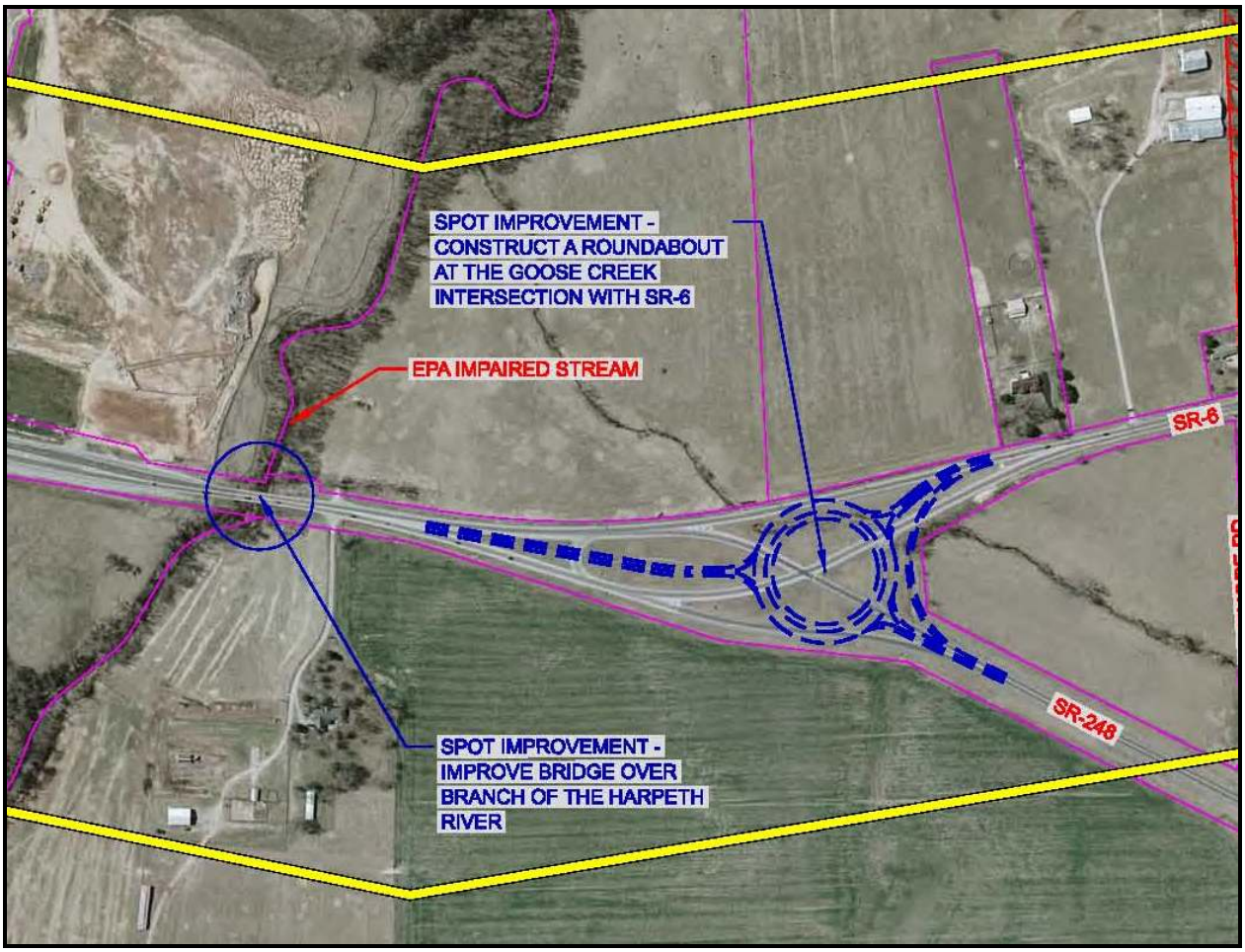


FIGURE 2.9 GOOSE CREEK BYPASS CONCEPT

2.10 SR 6 AT COLEMAN ROAD/HENPECK LANE

This spot improvement will realign the offset intersection of Coleman Road and Henpeck Lane at SR 6 to create a standard four (4) legged intersection. These intersections are unsignalized. This option will improve traffic operations along SR 6 by eliminating one (1) intersection along the route. A church, cemetery, and CSX Railroad are in the study area of the improvements. The cost of the improvements is estimated to a planning level to be $1,950,000. This cost estimate assumes the church and CSX Railroad can be accommodated, and the cemetery can be avoided. The cost will increase significantly if any of these properties cannot be accommodated.

2.11 SR 6 AT MACK HATCHER PARKWAY

This option will extend the length of the right turn lane of SR 6 Northbound at the intersection with Mack Hatcher Parkway. This intersection is signalized. The adjacent land use is vacant. Local officials noted the need for the turn lane improvement. A detailed traffic analysis is needed to determine the length to increase the right turn bay. Extending the right turn lane will improve operations and safety along SR 6 by allowing right turning vehicles to bypass queued vehicles along SR 6 northbound. With the limited available information, the cost of extending the turn lane is estimated to be $200,000.

3.0 THREE (3) LANE SPRING HILL OPTION

This option presents a three (3) lane cross section through the City of Spring Hill's CBD. Numerous historic structures, places of worship, and businesses are located adjacent to the narrow right-of-way in the CBD. SR 6 is currently three (3) lanes in the CBD. Widening the route to add additional lanes does not have the support of the City due to the negative impact to adjacent developments and pedestrians.

Miles Johnson Parkway was recently constructed to the east of SR 6. Miles Johnson Parkway provides an alternate route for SR 6 between Kedron Road, Duplex Road, and SR 6. Additionally, a new interchange at Interstate 65 and Thompson's Station Road is currently in the MPO's LRTP, along with widening Interstate 65 from SR 840 to SR 96. These improvements may alleviate congestion along SR 6, and therefore eliminate the need to widen SR 6 to four (4) travel lanes through Spring Hill's CBD. This option could be implemented as an interim option to investigate the congestion improvements created by the planned and current roadway improvements in the area.

With this option, SR 6 would be improved to four (4) travel lanes outside the CBD. Within the CBD (between Kedron Road and Miles Johnson Parkway), it is desirable to provide pavement and sidewalk rehabilitation along the existing and proposed three (3) lane section. Approximately 1/3 of a mile of roadway between Witt Hill Drive and Miles Johnson Parkway will be improved from a two (2) lane cross section to a three (3) lane cross section. It is also desired by the city to construct 700 feet of roadway improvements from the study corridor's southern terminus at Kedron Road to Spring Hill Elementary School. Providing additional capacity between Spring Hill Elementary School and the existing four (4) travel lane cross section south of the study corridor will mitigate congestion associated with this large traffic generator. It is also desired by the city for this project to rehabilitate the McCutcheon Creek Culvert. This culvert is located approximately 600 feet south of Miles Johnson Parkway. The four (4) travel lane cross section is anticipated to begin at Miles Johnson Parkway due to this being a logical terminus and proceed north. A detail of the area is provided in **Figure 3.1**.

Because the MPO's LRTP currently includes improvements to I-65 and a new interchange along Interstate 65 at Thompson's Station Road, the effects of these improvements are included in the MPO's travel demand model. As directed by TDOT, and as standard practice within MPO areas, the travel demand model was utilized in the traffic projections included in this report. Therefore the LOS calculations performed in this report include the effects of these improvements. However, The traffic projections utilized in this report were performed prior to the opening of Miles Johnson Parkway and the idling of the GM plant, neither of which would have been predicted or included in the MPO's travel demand model.

The Three (3) Lane Spring Hill Option is estimated to cost between $74 and $84 million in year 2014 dollars. The estimated cost was calculated to a planning level utilizing cost per mile data. The cost estimate summary is provided in **Table 3.1**. The cost estimate calculations are provided in the **Appendix**.

For the Three (3) Lane Spring Hill Option, the HCS's analysis calculates LOS ranging from A to D along SR 6 through the year 2014 and A to F through the year 2034. The LOS calculations do not take into effect the diminished traffic operations caused by the four (4) school zones along the route. A summary of the LOS calculations for the Three (3) Lane Spring Hill Option is provided in schematic form in **Figures 3.2** and **3.3** and in table form in **Table 3.2**. The LOS are reported for the years 2014 and 2034. The LOS calculations demonstrate that four (4) travel lanes are necessary along the route. Two travel lanes within Spring Hill's CBD are not adequate to meet the projected design year traffic demand.

For the Three (3) Lane Spring Hill Option in the year 2014, the volume to capacity ratio (v/c) of SR 6 is calculated to range from 0.23 to 1.02, with a weighted average of 0.44. In 2034, the v/c ranges from 0.28 to 1.50 with a weighted average of 0.58. The average was weighted based upon the length of each segment analyzed. A v/c ratio near or above "1" indicates a roadway experiences congestion. The v/c calculations demonstrate that four (4) travel lanes are necessary along the route to meet the projected traffic demand. A summary of the v/c calculations for the Three (3) Lane Spring Hill Option is provided in table form in **Table 3.2**. The v/c are reported for the years 2014 and 2034.

The posted speed limit ranges from 35 to 55 mph along SR 6 within the study area. For the Three (3) Lane Spring Hill Option in the year 2014, travel speeds along the route are calculated by the HCS to range from 14.6 mph to 54.5 mph, with a weighted average of 37.3 mph. In 2034, the travel speed ranges from 3.5 mph to 54.4 mph with a weighted average of 22.4 mph. The average was weighted based upon the length of each segment analyzed. The weighted average of the speed limit along the route is 45.5 mph. The calculated average route speed is 82% and 49% of the posted speed limit in the years 2014 and 2034, respectively. The Nashville Area MPO's Congestion Management Process notes that if the average route speed is 70% or less of the free flow speed, the roadway is congested. Therefore, for the Three (3) Lane Spring Hill Option, SR 6 is congested in 2034. A summary of the travel speed calculations for the Three (3) Lane Thompson's Station Option is provided in table form in **Table 3.2**. The travel speeds are reported for the years 2014 and 2034.

The existing SR 6 Corridor (Three (3) Lane Spring Hill Option) between Kedron Road to the south and Mack Hatcher Parkway to the north is 10.9 miles in length. For the Three (3) Lane Spring Hill Option in the year 2014, the travel time along SR 6 is calculated to be 17.5 minutes. In 2034, the travel time is calculated to be 29.1 minutes.

The traffic analysis demonstrates that four (4) travel lanes are necessary along the route. Two travel lanes within Spring Hill's CBD are not adequate to meet the projected design year traffic demand. Therefore, this option does not adequately address the purpose and need of the project.

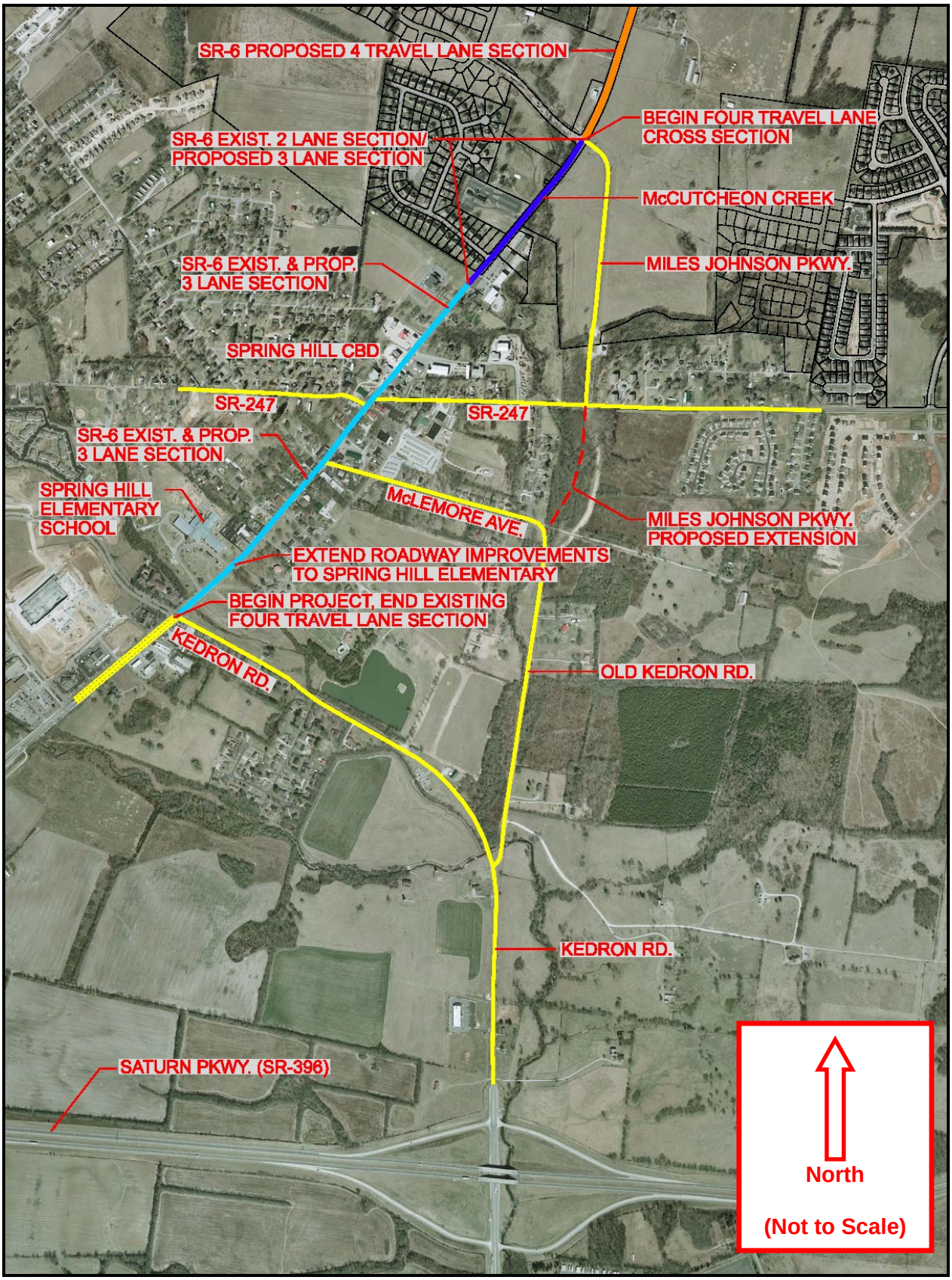


FIGURE 3.1 THREE (3) LANE SPRING HILL OPTION DETAIL

TABLE 3.1 THREE (3) LANE SPRING HILL OPTION COST ESTIMATE

ID	Location/ Description	Existing Roadway Classification	Proposed Roadway Classification	Length of Const. (Miles)	Estimated Low Cost	Estimated High Cost
1	SR-6 from Kedron Rd. to Maury/ Williamson County Line (L.M. 32.47 to 33.31)	3-Lane Urban Other Principal Arterial	3-Lane Urban Other Principal Arterial	0.84	$ 722,400	$ 722,400
2A	SR-6 from Maury/ Williamson County Line to Miles Johnson Pkwy.	2-Lane Urban Other Principal Arterial	3-Lane Urban Other Principal Arterial	0.20	$ -	$ -
2	SR-6 from Miles Johnson Pkwy. to Thompson's Station City Limits (L.M. 0.20 to 2.49)	2-Lane Urban Other Principal Arterial	4 Travel-Lane Urban Other Principal Arterial	2.29	$ 16,281,900	$ 19,991,700
3	SR-6 from Thompson's Station City Limits to south of SR-840 (L.M. 2.5 to 4.75)	2-Lane Rural Minor Arterial	4 Travel-Lane Rural Minor Arterial	2.26	$ 15,413,200	$ 17,424,600
4	SR-6 from south of SR-840 to Tollgate Rd. (L.M. 4.76 to 5.55)	5-Lane Rural Minor Arterial	5-Lane Rural Minor Arterial	0.80	$ -	$ -
5	SR-6 from Tollgate Rd. to Nashville Urban Boundary (L.M. 5.56 to 8.67)	2-Lane Rural Minor Arterial	4 Travel-Lane Rural Minor Arterial	3.12	$ 25,989,600	$ 28,766,400
6	SR-6 from Nashville Urban Boundary to SR-397 (Mack Hatcher Pkwy.) (L.M. 8.68 to 10.03)	2-Lane Urban Other Principal Arterial	4 Travel-Lane Urban Other Principal Arterial	1.36	$ 15,572,000	$ 17,122,400
Total				10.87	$ 73,980,000	$ 84,030,000

Notes: Existing and proposed 3-lane sections are urban x-section. Multilane sections as described below.
Low estimate utilizes 4-lane rural x-section, high estimate utilizes 5-lane urban x-section.
Total route length is equal to the construction length of 10.9 miles.

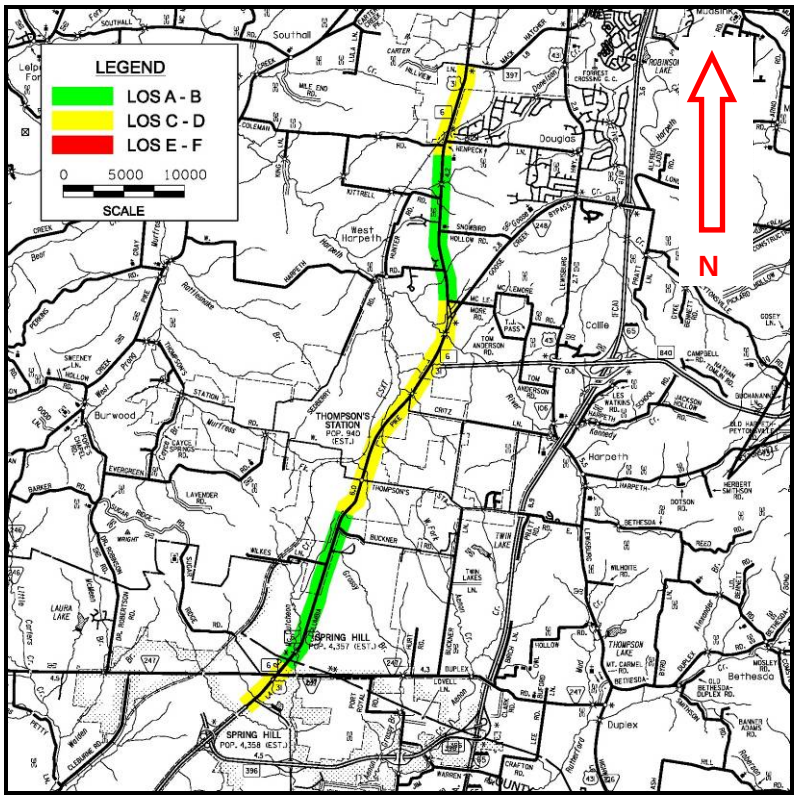


FIGURE 3.2 THREE (3) LANE SPRING HILL OPTION 2014 LOS

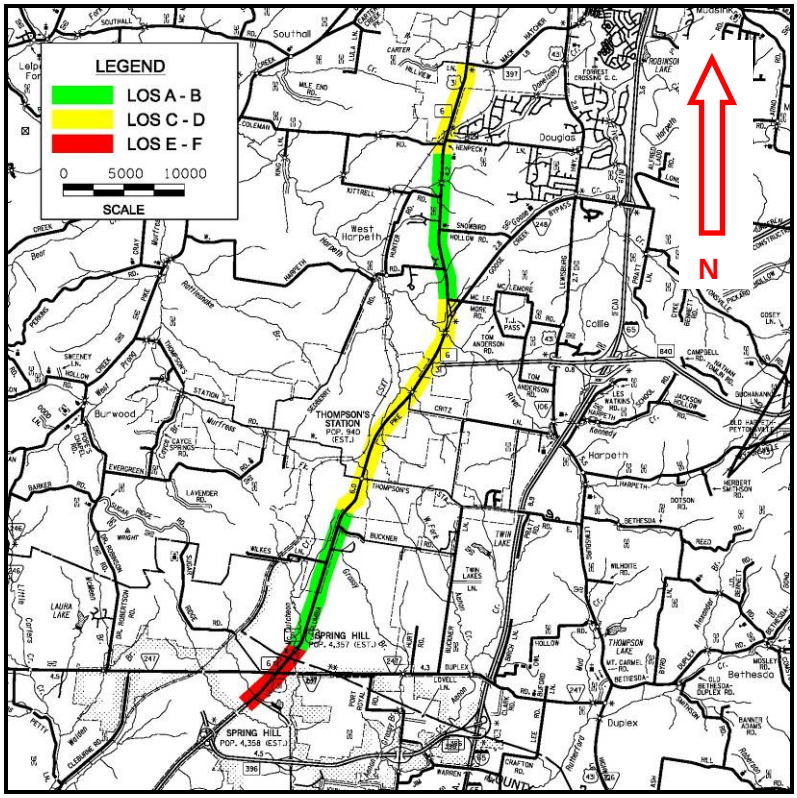


FIGURE 3.3 THREE (3) LANE SPRING HILL OPTION 2034 LOS

TABLE 3.2 THREE (3) LANE SPRING HILL OPTION LOS TABLE

ID	From		To		Dist.	Roadway Data			2014					2034				
	L.M.	Description	L.M.	Description	(mi)	Posted Speed (mph)	# of Signals	Cross-Section Type	ADT (vpd)	LOS	v/c	Calc. Speed (mph)	Travel Time (min.)	ADT (vpd)	LOS	v/c	Calc. Speed (mph)	Travel Time (min.)
1	32.47	Kedron Road	33.31	County Line	0.84	35	3	3-Lane	22,400	D	0.92	14.6	3.5	36,700	F	1.50	3.5	14.4
2A	0.00	County Line	0.20	Miles Johnson	0.20	45	2	3-Lane	25,000	B	1.02	30.3	0.4	36,700	F	1.50	12.5	1.0
2A	0.20	Miles Johnson	1.30	Cemetery Road	1.10	45		5-Lane	25,000	A	0.54	35.7	1.8	36,700	B	0.79	34.4	1.9
2B	1.30	Cemetery Road	2.17	Buckner Road	0.87	45		5-Lane	25,000	A	0.26	36.9	1.4	36,700	A	0.38	36.4	1.4
2C	2.17	Buckner Road	2.49	Thompson's Station City Limits	0.32	45		5-Lane	25,000	A	0.27	36.8	0.5	36,700	A	0.40	36.3	0.5
3	2.49	Thompson's Station City Limits	4.75	Between Critz Lane and SR-840	2.26	45	1	4-Lane	34,000	C	0.52	44.4	3.1	36,700	C	0.57	44.4	3.1
4	4.75	Between Critz Lane and SR-840	5.55	Tollgate Road	0.80	45	1	5-Lane	34,000	C	0.52	46.0	1.0	36,700	C	0.57	46.0	1.0
5A	5.55	Tollgate Road	6.60	near McLemore Road	1.05	45	0	4-Lane	24,000	B	0.37	44.4	1.4	27,600	C	0.43	44.4	1.4
5B	6.60	near McLemore Road	8.67	near Coleman Road	2.07	55	0	4-Lane	15,000	A	0.23	54.5	2.3	18,300	A	0.28	54.4	2.3
6	8.67	near Coleman Road	10.03	Mack Hatcher Parkway	1.36	40	1	4-Lane	20,800	C	0.32	39.4	2.1	32,200	C	0.50	39.4	2.1
				Σ =	10.87					Avg=	0.44	Σ =	17.5		Avg=	0.58	Σ =	29.1

Notes: Sections 1 & 2 analyzed with HCS+ Arterials Planning Analysis
Sections 3-6 analyzed with HCS+ Multi Lane Highway Analysis
Proposed cross section type as described in the LRTP

Average Speed:	37.3	Average Speed:	22.4
Avg. Post. Spd.:	45.5	Avg. Post. Spd.:	45.5
% Spd vs Post.:	82%	% Spd vs Post.:	49%

4.0 THREE (3) LANE THOMPSON'S STATION OPTION

This option presents a three (3) lane cross section through the Town of Thompson's Station. A new interchange at Interstate 65 and Thompson's Station Road is currently in the MPO's LRTP, along with widening Interstate 65 from SR 840 to SR 96. The Town notes that these improvements may alleviate congestion along SR 6, and therefore eliminate the need to widen SR 6 to four (4) travel lanes through Thompson's Station. It is possible the proposed interchange will be relocated to a proposed Buckner Road extension at Interstate 65. It is desired by the town to improve SR 6 to three (3) lanes between either Buckner Road or Thompson's Station Road and Critz Lane. The remainder of SR 6 will be improved to four (4) travel lanes. This option could be implemented as an interim option to investigate the congestion improvements created by the planned improvements along I-65. However, the traffic calculations discussed below demonstrate that a three (3) lane cross section through the Town of Thompson's Station will not meet the projected traffic demand.

Because the MPO's LRTP currently includes improvements to Interstate 65 and a new interchange along Interstate 65 at Thompson's Station Road, the effects of these improvements are included in the MPO's travel demand model. As directed by TDOT, and as standard practice within MPO areas, the travel demand model was utilized in the traffic projections included in this report. Therefore the LOS calculations performed in this report include the effects of these improvements.

The Three (3) Lane Thompson's Station Option is estimated to cost between $88 and $100 million in year 2014 dollars. The cost estimate includes widening along SR 6. The estimate does not include a new interchange or widening along Interstate 65. The costs of these improvements are not included in the estimate since these improvements are currently programmed in separate projects in the LRTP. The estimated cost was calculated to a planning level utilizing cost per mile data. The cost estimate summary is provided in **Table 4.1**. The cost estimate calculations are provided in the **Appendix**.

For the Three (3) Lane Thompson's Station Option, the HCS's analysis calculates LOS ranging from A to F along SR 6 through the year 2034. The LOS calculations do not take into effect the diminished traffic operations caused by the four (4) school zones along the route. A summary of the LOS calculations for the Three (3) Lane Thompson's Station Option is provided in schematic form in **Figures 4.1** and **4.2** and in table form in **Table 4.2**. The LOS are reported for the years 2014 and 2034. The LOS calculations demonstrate that four (4) travel lanes are necessary along the route, and that two (2) travel lanes within Thompson's Station's Town Limits are not adequate to meet the traffic demand.

For the Three (3) Lane Thompson's Station Option in the year 2014, the volume to capacity ratio (v/c) of SR 6 is calculated to range from 0.23 to 0.92, with a weighted average of 0.49. In 2034, the v/c ranges from 0.28 to 0.99 with a weighted average of 0.61. The average was weighted based upon the length of each segment analyzed. A v/c ratio near or above "1" indicates a roadway experiences congestion. The v/c calculations demonstrate that four (4) travel lanes are necessary along the route, and that two (2) travel lanes within Thompson's Station's Town Limits are not adequate to meet the traffic demand. A summary of the v/c calculations for the Three (3) Lane Thompson's Station Option is provided in table form in **Table 4.2**. The v/c are reported for the years 2014 and 2034.

The posted speed limit ranges from 35 to 55 mph along SR 6 within the study area. For the Three (3) Lane Thompson's Station Option in the year 2014, travel speeds along the route are calculated by the HCS to range from 17.7 mph to 54.5 mph, with a weighted average of 32.2 mph. In 2034, the travel speed ranges from 16.3 mph to 54.4 mph with a weighted average of 30.8 mph. The average was weighted based upon the length of each segment analyzed. The weighted average of the speed limit along the route is 45.5 mph. The calculated average route speed is 71% and 68% of the posted speed limit in the years 2014 and 2034, respectively. The Nashville Area MPO's Congestion Management Process notes that if the average route speed is 70% or less of the free flow speed, the roadway is congested. Therefore, for the Three (3) Lane Thompson's Station Option, SR 6 is congested in 2034. A summary of the travel speed calculations for the Three (3) Lane Thompson's Station Option is provided in table form in **Table 5.4.2**. The travel speeds are reported for the years 2014 and 2034.

The existing SR 6 Corridor (Three (3) Lane Thompson's Station Option) between Kedron Road to the south and Mack Hatcher Parkway to the north is 10.9 miles in length. For the Three (3) Lane Thompson's Station Option in the year 2014, the travel time along SR 6 is calculated to be 20.2 minutes. In 2034, the travel time is calculated to be 21.2 minutes.

The traffic analysis demonstrates that four (4) travel lanes are necessary along the route. Two travel lanes within Thompson's Station Town Limits are not adequate to meet the projected design year traffic demand. Therefore, this option does not adequately address the purpose and need of the project.

TABLE 4.1 THREE (3) LANE THOMPSON'S STATION COST ESTIMATE

ID	Location/ Description	Existing Roadway Classification	Proposed Roadway Classification	Length of Const. (Miles)	Estimated Low Cost	Estimated High Cost
1	SR-6 from Kedron Rd. to Maury/ Williamson County Line (L.M. 32.47 to 33.31)	3-Lane Urban Other Principal Arterial	4-Travel Lane Urban Other Principal Arterial	0.84	$ 13,003,200	$ 16,405,200
2	SR-6 from Maury/ Williamson County Line to Thompson's Station City Limits (L.M. 0 to 2.49)	2-Lane Urban Other Principal Arterial	4 Travel-Lane Urban Other Principal Arterial	2.49	$ 19,571,400	$ 23,630,100
3	SR-6 from Thompson's Station City Limits to south of SR-840 (L.M. 2.5 to 4.75)	2-Lane Rural Minor Arterial	3-Lane Rural Minor Arterial	2.26	$ 13,605,200	$ 14,373,600
4	SR-6 from south of SR-840 to Tollgate Rd. (L.M. 4.76 to 5.55)	5-Lane Rural Minor Arterial	5-Lane Rural Minor Arterial	0.80	$ -	$ -
5	SR-6 from Tollgate Rd. to Nashville Urban Boundary (L.M. 5.56 to 8.67)	2-Lane Rural Minor Arterial	4 Travel-Lane Rural Minor Arterial	3.12	$ 25,989,600	$ 28,766,400
6	SR-6 from Nashville Urban Boundary to SR-397 (Mack Hatcher Pkwy.) (L.M. 8.68 to 10.03)	2-Lane Urban Other Principal Arterial	4 Travel-Lane Urban Other Principal Arterial	1.36	$ 15,572,000	$ 17,122,400
Total				10.87	$ 87,740,000	$100,300,000

Notes: Low estimate utilizes 4-lane rural x-section, high estimate utilizes 5-lane urban x-section.
Total route length is equal to the construction length of 10.9 miles.

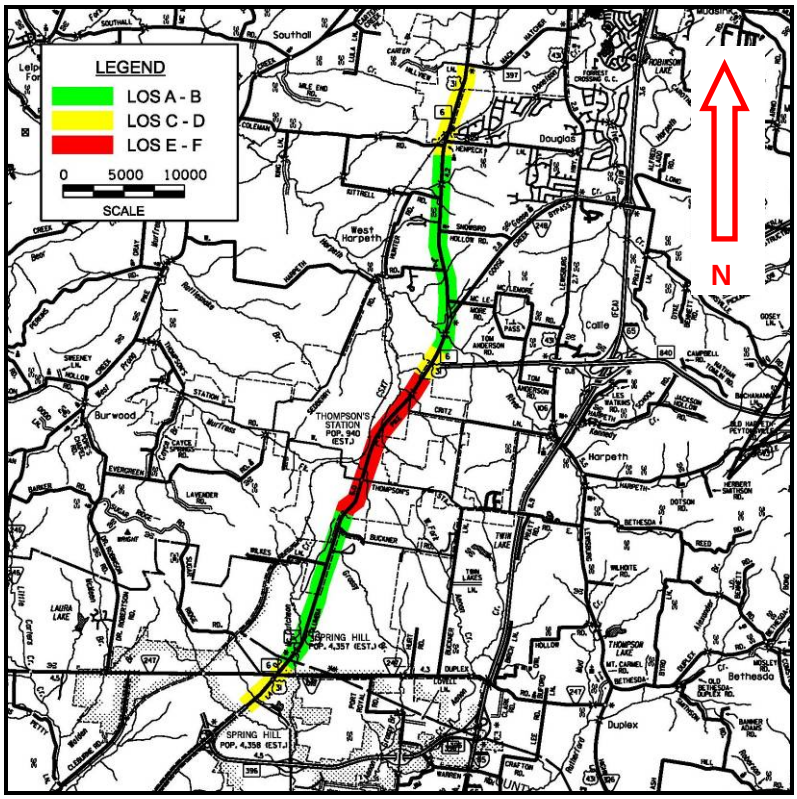


FIGURE 4.1 THREE (3) LANE THOMPSON'S STATION 2014 LOS

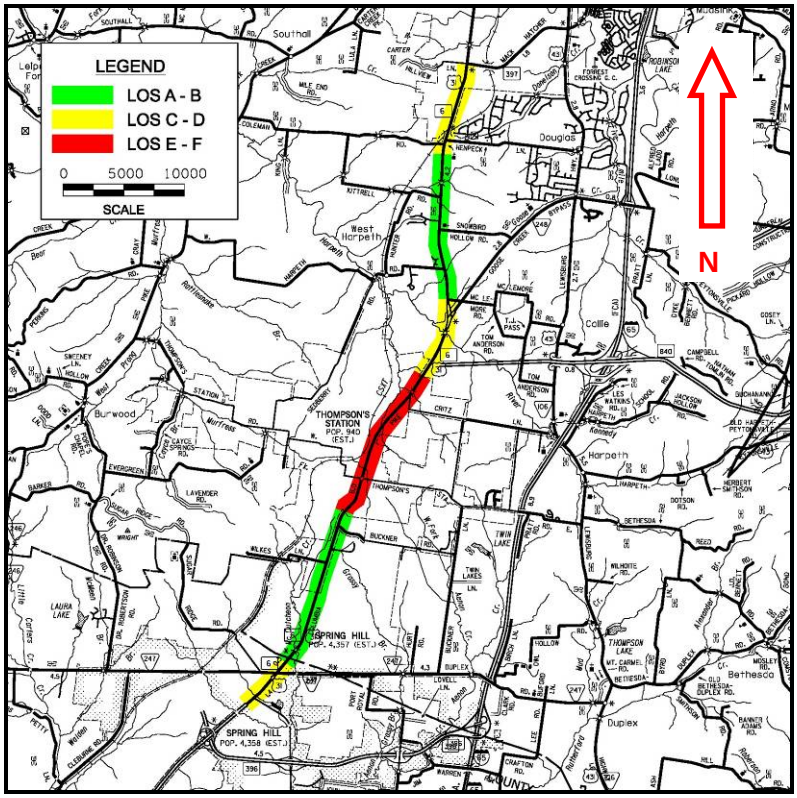


FIGURE 4.2 THREE (3) LANE THOMPSON'S STATION 2034 LOS

TABLE 4.2 THREE (3) LANE THOMPSON'S STATION LOS TABLE

ID	From		To		Dist.	Roadway Data			2014					2034				
	L.M.	Description	L.M.	Description	(mi)	Posted Speed (mph)	# of Signals	Cross-Section Type	ADT (vpd)	LOS	v/c	Calc. Speed (mph)	Travel Time (min.)	ADT (vpd)	LOS	v/c	Calc. Speed (mph)	Travel Time (min.)
1	32.47	Kedron Road	33.31	County Line	0.84	35	3	5-Lane	22,400	D	0.46	17.7	2.8	36,700	D	0.75	16.3	3.1
2A	0.00	County Line	1.30	Cemetery Road	1.30	45	2	5-Lane	25,000	A	0.54	35.7	2.2	36,700	B	0.79	34.4	2.3
2B	1.30	Cemetery Road	2.17	Buckner Road	0.87	45		5-Lane	25,000	A	0.26	36.9	1.4	36,700	A	0.38	36.4	1.4
2C	2.17	Buckner Road	2.49	Thompson's Station City Limits	0.32	45		3-Lane	25,000	A	0.51	35.5	0.5	36,700	B	0.75	34.1	0.6
3	2.49	Thompson's Station City Limits	4.75	Between Critz Lane and SR-840	2.26	45	1	3-Lane	34,000	F	0.92	21.1	6.4	36,700	F	0.99	19.4	7.0
4	4.75	Between Critz Lane and SR-840	5.55	Tollgate Road	0.80	45	1	5-Lane	34,000	C	0.52	46.0	1.0	36,700	C	0.57	46.0	1.0
5A	5.55	Tollgate Road	6.60	near McLemore Road	1.05	45	0	4-Lane	24,000	B	0.37	44.4	1.4	27,600	C	0.43	44.4	1.4
5B	6.60	near McLemore Road	8.67	near Coleman Road	2.07	55	0	4-Lane	15,000	A	0.23	54.5	2.3	18,300	A	0.28	54.4	2.3
6	8.67	near Coleman Road	10.03	Mack Hatcher Parkway	1.36	40	1	4-Lane	20,800	C	0.32	39.4	2.1	32,200	C	0.50	39.4	2.1
				Σ =	10.87					Avg=	0.49	Σ =	20.2		Avg=	0.61	Σ =	21.2

Notes: Sections 1 & 2 analyzed with HCS+ Arterials Planning Analysis
Sections 3-6 analyzed with HCS+ Two Lane and Multi Lane Highway Analysis
Sections 1-2B, 4-6 from Widen the Existing Alignment Option, Section 3 from No Build Option, Section 2C calculated specific to New Access to I-65 Option

Average Speed:	32.2	Average Speed:	30.8
Avg. Post. Spd.:	45.5	Avg. Post. Spd.:	45.5
% Spd vs Post.:	71%	% Spd vs Post.:	68%

5.0 THREE (3) LANE SPRING HILL & THOMPSON'S STATION OPTION

This option combines the Three (3) Lane Spring Hill and Three (3) Lane Thompson's Station Options to present a three (3) lane cross section through the City of Spring Hill's CBD and through the Town of Thompson's Station. The remainder of SR 6 will be improved to four (4) travel lanes. This option could be implemented as an interim option to investigate the congestion improvements created by the planned improvements adjacent to the study corridor.

The Three (3) Lane Spring Hill and Thompson's Station Option is estimated to cost between $77 and $81 million in year 2014 dollars. The estimated cost was calculated to a planning level utilizing cost per mile data. The cost estimate summary is provided in **Table 5.1**. The cost estimate calculations are provided in the **Appendix**.

For the Three (3) Lane Spring Hill and Thompson's Station Option, the HCS's analysis calculates LOS ranging from A to F along SR 6 through the year 2034. The LOS calculations do not take into effect the diminished traffic operations caused by the four (4) school zones along the route. A summary of the LOS calculations for the Three (3) Lane Spring Hill and Thompson's Station Option is provided in schematic form in **Figures 5.1** and **5.2** and in table form in **Table 5.2**. The LOS are reported for the years 2014 and 2034. The LOS calculations demonstrate that four (4) travel lanes are necessary along the route. Two (2) travel lanes within Spring Hill's CBD and the Town of Thompson's Station are not adequate to meet the projected design year traffic demand.

For the Three (3) Lane Spring Hill and Thompson's Station Option in the year 2014, the volume to capacity ratio (v/c) of SR 6 is calculated to range from 0.23 to 1.02, with a weighted average of 0.53. In 2034, the v/c ranges from 0.28 to 1.50 with a weighted average of 0.68. The average was weighted based upon the length of each segment analyzed. A v/c ratio near or above "1" indicates a roadway experiences congestion. The v/c calculations demonstrate that four (4) travel lanes are necessary along the route to meet the projected traffic demand. A summary of the v/c calculations for the Three Lane Spring Hill and Thompson's Station Option is provided in table form in **Table 5.2**. The v/c are reported for the years 2014 and 2034.

The posted speed limit ranges from 35 to 55 mph along SR 6 within the study area. For the Three (3) Lane Spring Hill and Thompson's Station Option in the year 2014, travel speeds along the route are calculated by the HCS to range from 14.6 mph to 54.5 mph, with a weighted average of 31.2 mph. In 2034, the travel speed ranges from 3.5 mph to 54.4 mph with a weighted average of 33.1 mph. The average was weighted based upon the length of each segment analyzed. The weighted average of the speed limit along the route is 45.5 mph. The calculated average route speed is 69% and 43% of the posted speed limit in the years 2014 and 2034, respectively. The Nashville Area MPO's Congestion Management Process notes that if the average route speed is 70% or less of the free flow speed, the roadway is congested. Therefore, for the Three (3) Lane Spring Hill and Thompson's Station Option, SR 6 is congested in 2034. A summary of the travel speed calculations for this option is provided in table form in **Table 5.2**. The travel speeds are reported for the years 2014 and 2034.

The existing SR 6 Corridor (Three (3) Lane Spring Hill and Thompson's Station Option) between Kedron Road to the south and Mack Hatcher Parkway to the north is 10.9 miles in length. For the Three (3) Lane Spring Hill and Thompson's Station Option in the year 2014, the travel time

along SR 6 is calculated to be 20.9 minutes. In 2034, the travel time is calculated to be 33.1 minutes.

The traffic analysis demonstrates that four (4) travel lanes are necessary along the route. Two travel lanes within Spring Hill's City Limits and Thompson's Station Town Limits are not adequate to meet the projected design year traffic demand. Therefore, this option does not adequately address the purpose and need of the project.

TABLE 5.1 THREE (3) LANE SPRING HILL AND THOMPSON'S STATION OPTION COST ESTIMATE

ID	Location/ Description	Existing Roadway Classification	Proposed Roadway Classification	Length of Const. (Miles)	Estimated Low Cost	Estimated High Cost
1	SR-6 from Kedron Rd. to Maury/ Williamson County Line (L.M. 32.47 to 33.31)	3-Lane Urban Other Principal Arterial	3-Lane Urban Other Principal Arterial	0.84	$ 722,400	$ 722,400
2A	SR-6 from Maury/ Williamson County Line to Miles Johnson Pkwy.	2-Lane Urban Other Principal Arterial	3-Lane Urban Other Principal Arterial	0.20	$ -	$ -
2	SR-6 from Miles Johnson Pkwy. to Thompson's Station City Limits (L.M. 0.20 to 2.49)	2-Lane Urban Other Principal Arterial	4 Travel-Lane Urban Other Principal Arterial	2.29	$ 16,281,900	$ 19,991,700
3	SR-6 from Thompson's Station City Limits to south of SR-840 (L.M. 2.5 to 4.75)	2-Lane Rural Minor Arterial	4 Travel-Lane Rural Minor Arterial	2.26	$ 13,605,200	$ 14,373,600
4	SR-6 from south of SR-840 to Tollgate Rd. (L.M. 4.76 to 5.55)	5-Lane Rural Minor Arterial	5-Lane Rural Minor Arterial	0.80	$ -	$ -
5	SR-6 from Tollgate Rd. to Nashville Urban Boundary (L.M. 5.56 to 8.67)	2-Lane Rural Minor Arterial	4 Travel-Lane Rural Minor Arterial	3.12	$ 25,989,600	$ 28,766,400
6	SR-6 from Nashville Urban Boundary to SR-397 (Mack Hatcher Pkwy.) (L.M. 8.68 to 10.03)	2-Lane Urban Other Principal Arterial	4 Travel-Lane Urban Other Principal Arterial	1.36	$ 15,572,000	$ 17,122,400
Total				10.87	$ 72,170,000	$ 80,980,000

Notes: Existing and proposed 3-lane sections are urban x-section. Multilane sections as described below.
Low estimate utilizes 4-lane rural x-section, high estimate utilizes 5-lane urban x-section.
Total route length is equal to the construction length of 10.9 miles.

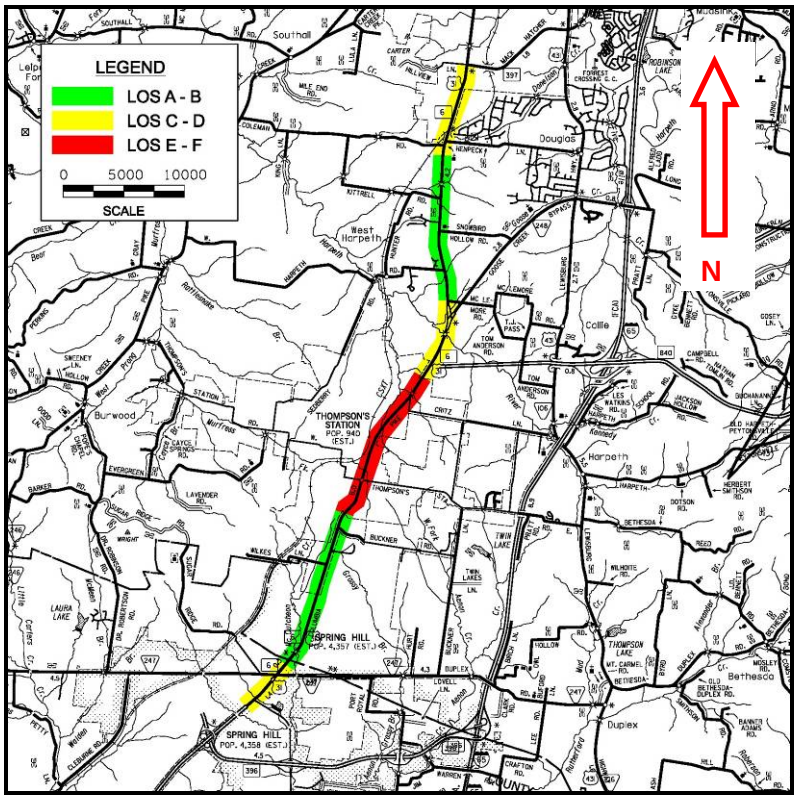


FIGURE 5.1 THREE (3) LANE SPRING HILL AND THOMPSON'S STATION OPTION 2014 LOS

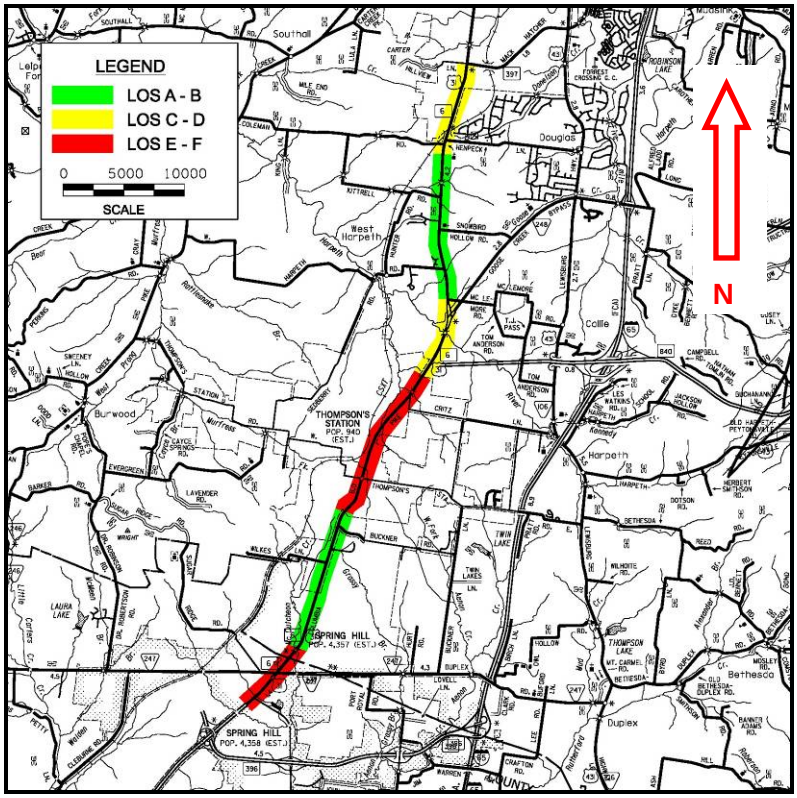


FIGURE 5.2 THREE (3) LANE SPRING HILL AND THOMPSON'S STATION OPTION 2034 LOS

TABLE 5.2 THREE (3) LANE SPRING HILL AND THOMPSON'S STATION OPTION LOS TABLE

ID	From		To		Dist.	Roadway Data			2014					2034				
	L.M.	Description	L.M.	Description	(mi)	Posted Speed (mph)	# of Signals	Cross-Section Type	ADT (vpd)	LOS	v/c	Calc. Speed (mph)	Travel Time (min.)	ADT (vpd)	LOS	v/c	Calc. Speed (mph)	Travel Time (min.)
1	32.47	Kedron Road	33.31	County Line	0.84	35	3	3-Lane	22,400	D	0.92	14.6	3.5	36,700	F	1.50	3.5	14.4
2A	0.00	County Line	0.20	Miles Johnson	0.20	45	2	3-Lane	25,000	B	1.02	30.3	0.4	36,700	F	1.50	12.5	1.0
2A	0.20	Miles Johnson	1.30	Cemetery Road	1.10	45		5-Lane	25,000	A	0.54	35.7	1.8	36,700	B	0.79	34.4	1.9
2B	1.30	Cemetery Road	2.17	Buckner Road	0.87	45		5-Lane	25,000	A	0.26	36.9	1.4	36,700	A	0.38	36.4	1.4
2C	2.17	Buckner Road	2.49	Thompson's Station City Limits	0.32	45		3-Lane	25,000	A	0.51	35.5	0.5	36,700	B	0.75	34.1	0.6
3	2.49	Thompson's Station City Limits	4.75	Between Critz Lane and SR-840	2.26	45	1	3-Lane	34,000	F	0.92	21.1	6.4	36,700	F	0.99	19.4	7.0
4	4.75	Between Critz Lane and SR-840	5.55	Tollgate Road	0.80	45	1	5-Lane	34,000	C	0.52	46.0	1.0	36,700	C	0.57	46.0	1.0
5A	5.55	Tollgate Road	6.60	near McLemore Road	1.05	45	0	4-Lane	24,000	B	0.37	44.4	1.4	27,600	C	0.43	44.4	1.4
5B	6.60	near McLemore Road	8.67	near Coleman Road	2.07	55	0	4-Lane	15,000	A	0.23	54.5	2.3	18,300	A	0.28	54.4	2.3
6	8.67	near Coleman Road	10.03	Mack Hatcher Parkway	1.36	40	1	4-Lane	20,800	C	0.32	39.4	2.1	32,200	C	0.50	39.4	2.1
				Σ =	10.87					**Avg=**	0.53	Σ =	20.9		**Avg=**	0.68	Σ =	33.1

Notes: Sections 1 & 2 analyzed with HCS+ Arterials Planning Analysis
Sections 3-6 analyzed with HCS+ Multi Lane Highway Analysis
Proposed cross section type as described in the LRTP

Average Speed:	31.2	Average Speed:	19.7
Avg. Post. Spd.:	45.5	Avg. Post. Spd.:	45.5
% Spd vs Post.:	69%	% Spd vs Post.:	43%

6.0 SPRING HILL ONE-WAY PAIR OPTION

It was briefly investigated to utilize School Street in a one-way pair configuration with SR 6 through Spring Hill's CBD. Existing SR 6 would provide southern travel lanes and School Street would provide northern travel lanes. This option did not have the support of the City of Spring Hill. Furthermore, upon site inspection, School Street is a poor candidate for improvements. The vertical geometry and the cross-section of the route are poor, being the functional equivalent of an alley. Numerous historic and religious properties are adjacent to the route. A connector to provide access to Existing SR 6 would intersect The Tennessee Orphans home Historic Site. Therefore, this option was not investigated further.

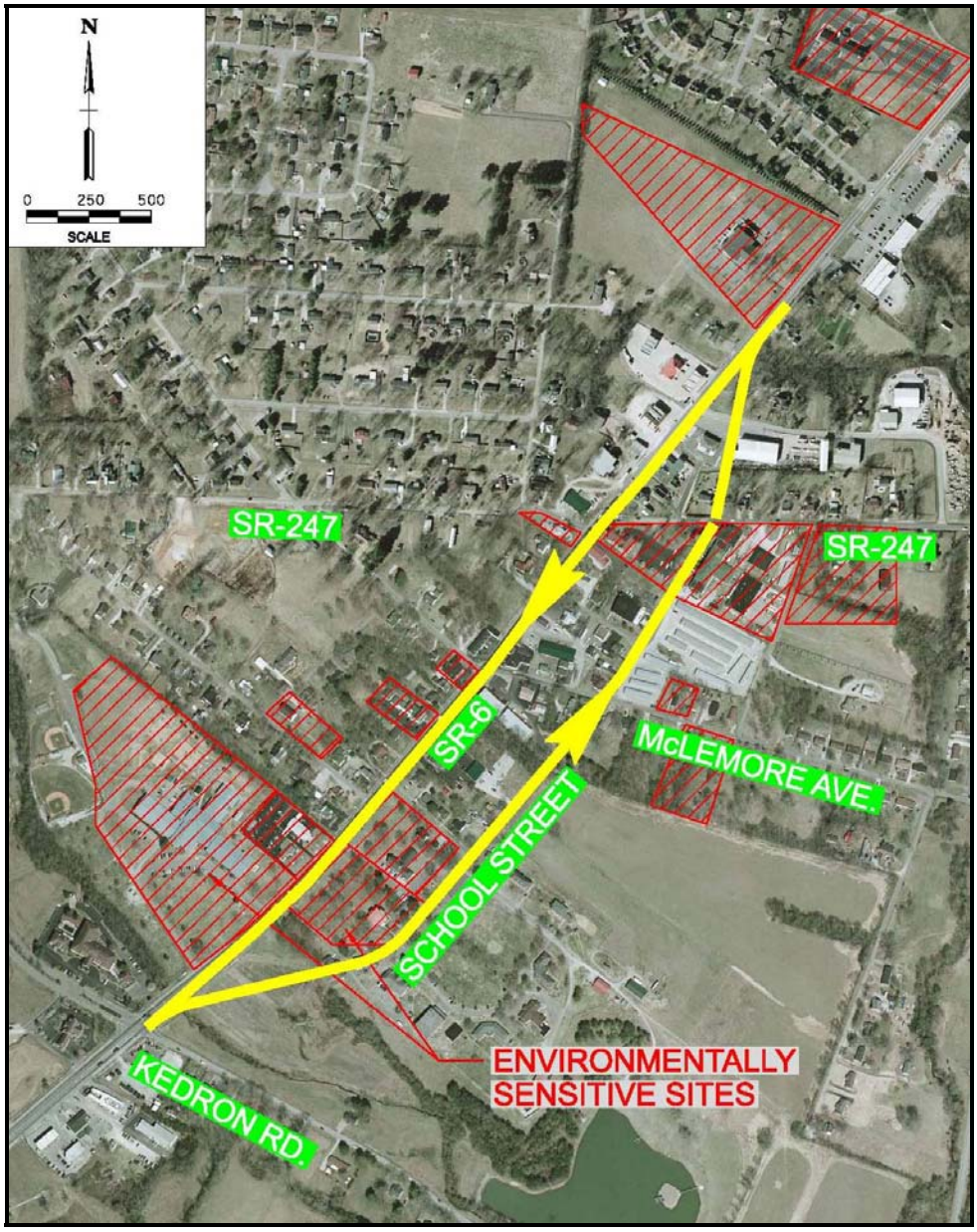


FIGURE 6 ONE-WAY PAIR DETAIL

7.0 SPRING HILL BYPASS OPTIONS

An Eastern and a Western Spring Hill Bypass Option were studied. The Bypass Options were developed through a relatively informal stakeholder's meeting without public participation or input. Significant changes to the project, including a proposed Bypass Option, should originate through the local, county, or MPO planning process. Additionally, there are several functional issues that led to the Bypass options not being included in the TPR, including lack of route continuity and access control issues. It should be noted that further refinement of the Bypass Options through the MPO's planning process may create a viable option to meet the Purpose and Need of the project.

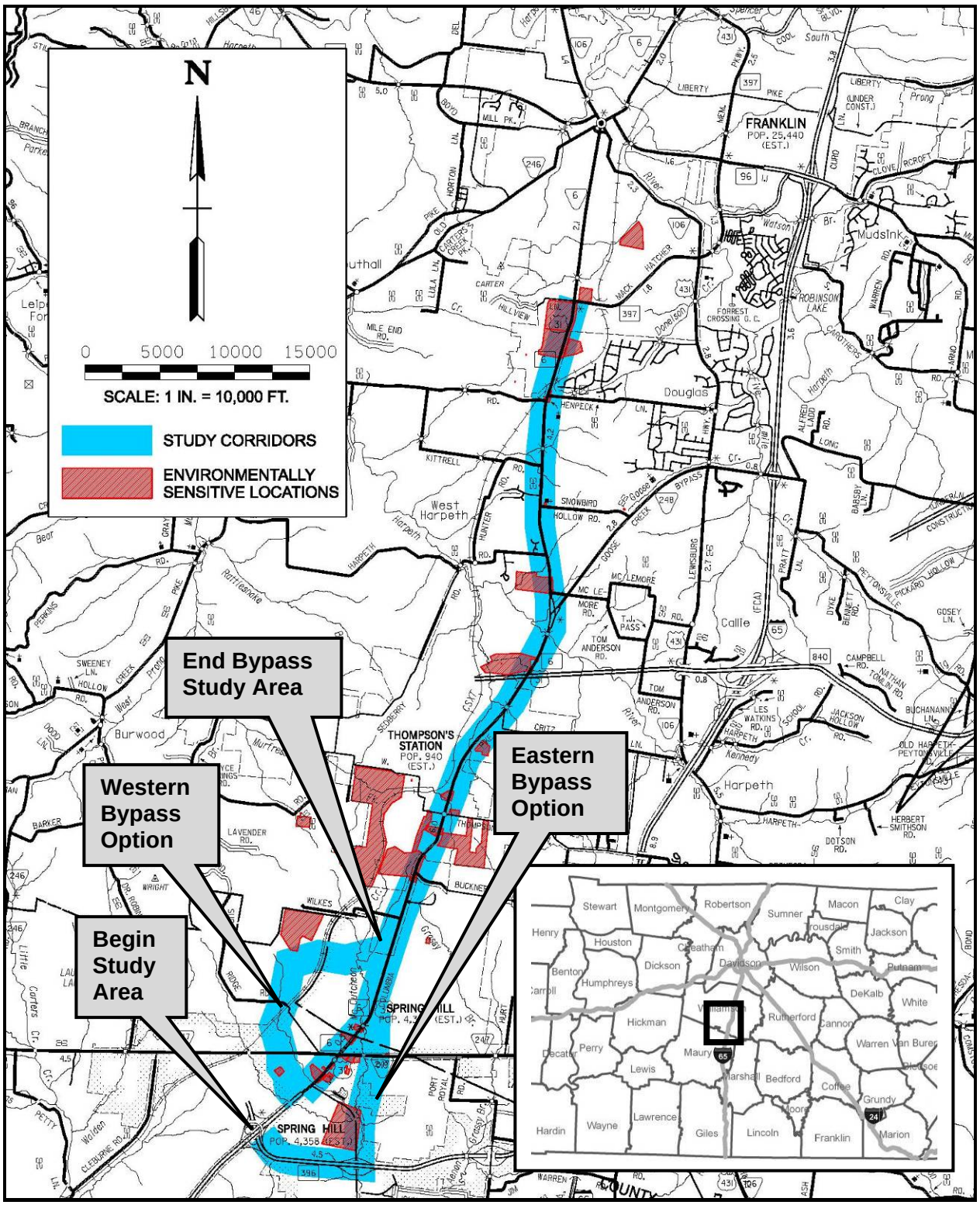


FIGURE 7 BYPASS OPTIONS MAP

7.1 EASTERN SPRING HILL BYPASS OPTION

This option would provide an eastern bypass around the CBD of the City of Spring Hill. The option would originate along SR 6 at the existing five (5) lane cross section south of Saturn Parkway (SR 396). The option would utilize existing Saturn Parkway (SR 396), Kedron Road, Old Kedron Road, and proposed Miles Johnson Parkway to route SR 6 around the CBD. The rejected Eastern Spring Hill Bypass is 3.3 miles long. The distance along existing SR 6 that would be bypassed is 2.1 miles long. This option was developed due to the City of Spring Hill not being in support of widening SR 6 within the CBD. Widening SR 6 within the CBD will require impacts to numerous religious, historic, and commercial properties and harm the City's efforts to create a more walkable downtown community.

The Eastern Spring Hill Bypass Option would improve Kedron Road, Old Kedron Road, and Miles Johnson Parkway to form a continuous route. Saturn Parkway (SR 396) would be utilized without improvements. The existing three (3) lane cross section of SR 6 in the CBD would not be impacted. The remainder of SR 6 would be improved to four (4) travel lanes. This option was developed in coordination with representatives from the City of Spring Hill to eliminate impacts to their CBD.

The option would utilize 1.4 miles of Saturn Parkway (SR 396) from SR 6 to the Kedron Road Interchange. The option would then provide improvements along 1.9 miles of Kedron Road, Old Kedron Road, and proposed Miles Johnson Parkway. The improvements along these three (3) routes would create a continuous route and are estimated to require widening these routes from their existing two (2) travel lanes to four (4) travel lanes. The southern terminus of the bypass would utilize the existing interchange between SR 6 and Saturn Parkway (SR 396). Local officials noted a need to improve the existing flyover ramp from Saturn Parkway (SR 396) Westbound to SR 6 Southbound for safety reasons. Improvements to this ramp are not included in this option and could be investigated in a separate project. The northern terminus of the bypass could be adjusted to create a continuous route between SR 6 to the north and the proposed bypass to the south, or maintain the existing configuration where existing SR 6 is the continuous route. Constructing a roundabout at this intersection is another option. It is anticipated that the existing interchange between Saturn Parkway (SR 396) and Kedron Road could be utilized with only minor improvements at the ramp termini.

Several environmentally sensitive locations and community resources are located, or are planned to be located, within the Eastern Spring Hill Bypass Corridor. A segment of The Spring Hill Civil War Battlefield is located within the Corridor. The battlefield is located north of Saturn Parkway (SR 396) and west and south of Kedron Road. It was also noted by local officials that wetlands are present in the area. A new fifty-three (53) bed hospital will be located within the Eastern Spring Hill Bypass Corridor adjacent to the proposed Miles Johnson Parkway. Additional development in the area is anticipated with construction of the Miles Johnson Parkway.

The Eastern Spring Hill Bypass Option is estimated to cost between $91 and $105 million in year 2014 dollars. The estimated cost was calculated to a planning level utilizing cost per mile data. The cost estimate includes between $17 and $20 million to improve Kedron

Road, Old Kedron Road, and Miles Johnson Parkway to create the bypass; and between $74 and $85 million to widen SR 6 from Miles Johnson Parkway to Mack Hatcher Parkway to four (4) travel lanes. The cost calculations for the improvements to Kedron Road, Old Kedron Road, and proposed Miles Johnson Parkway include widening these roads from their existing two (2) travel lanes to four (4) travel lanes. The cost estimate does not include improvements along Saturn Parkway (SR 396) or improvements at the interchanges between Saturn Parkway (SR 396) and SR 6 and Kedron Road, because improvements are not anticipated to be needed at these locations for adequate traffic operations. The cost estimate summary is provided in **Table 7.1**. The cost estimate calculations are provided in the **Appendix**.

No HCS LOS analysis was performed for the Eastern Spring Hill Bypass Option. This option was developed as a result of feedback received during stakeholder meetings that occurred during the development of this TPR. As discussed in the TPR, representatives of the City of Spring Hill are not in favor of widening SR 6 through the City's CBD. An Eastern Spring Hill Bypass Option is not in the Nashville MPO's LRTP. Therefore, this improvement is not in their Travel Demand Model and traffic projections are not currently available for this option.

This option was not included in the main body of the TPR in part because it is not currently included in the MPO's planning process. The bypass option was developed through a relatively informal stakeholder's meeting without public participation or input. Significant changes to the project, including a proposed bypass option, should originate through the local, county, or MPO planning process. Additionally, there are several functional issues that led to this option being rejected, including route continuity and access control issues. Even with improvements along the bypass corridor, the Eastern Spring Hill Bypass Option would not be continuous, routing SR 6 traffic along Saturn Parkway. It would be infeasible to provide access control measures along the bypass due to the existing development along the proposed route. Additionally, rerouting SR 6 along the existing Kedron Road, Old Kedron Road, and Miles Johnson Parkway corridors would reallocate truck traffic to these primarily residential areas. Several environmentally sensitive locations are also located adjacent to the route. Finally, the existence of I-65 less than 3.5 miles to the east of SR 6 creates questions concerning the regional significance of a bypass at this location. Due to these concerns, the Spring Hill community may be better served by maintaining Kedron Road, Old Kedron Road, and Miles Johnson Parkway as local routes, and not utilizing them as a bypass.

TABLE 7.1 EASTERN SPRING HILL BYPASS COST ESTIMATE

ID	Location/ Description	Existing Roadway Classification	Proposed Roadway Classification	Length of Const. (Miles)	Estimated Low Cost	Estimated High Cost
Byp.	Eastern Bypass from Saturn Parkway (SR-396) to SR-6 at Miles Johnson Parkway	n/a	4-Travel Lane Urban Other Principal Arterial	1.90	$ 16,511,000	$ 19,836,000
1	SR-6 from Kedron Rd. to Maury/ Williamson County Line (L.M. 32.47 to 33.31)	3-Lane Urban Other Principal Arterial	2-Travel Lane Urban Other Principal Arterial	0.00	$ -	$ -
2	SR-6 from Maury/ Williamson County Line to Thompson's Station City Limits (L.M. 0 to 2.49)	2-Lane Urban Other Principal Arterial	2/4 Travel-Lane Urban Other Principal Arterial	2.29	$ 17,999,400	$ 21,732,100
3	SR-6 from Thompson's Station City Limits to south of SR-840 (L.M. 2.5 to 4.75)	2-Lane Rural Minor Arterial	4 Travel-Lane Rural Minor Arterial	2.26	$ 15,413,200	$ 17,424,600
4	SR-6 from south of SR-840 to Tollgate Rd. (L.M. 4.76 to 5.55)	5-Lane Rural Minor Arterial	5-Lane Rural Minor Arterial	0.80	$ -	$ -
5	SR-6 from Tollgate Rd. to Nashville Urban Boundary (L.M. 5.56 to 8.67)	2-Lane Rural Minor Arterial	4 Travel-Lane Rural Minor Arterial	3.12	$ 25,989,600	$ 28,766,400
6	SR-6 from Nashville Urban Boundary to SR-397 (Mack Hatcher Pkwy.) (L.M. 8.68 to 10.03)	2-Lane Urban Other Principal Arterial	4 Travel-Lane Urban Other Principal Arterial	1.36	$ 15,572,000	$ 17,122,400
Total				11.73	$ 91,490,000	$104,880,000

Notes: Low estimate utilizes 4-lane rural x-section, high estimate utilizes 5-lane urban x-section.
Total route length is equal to 13.1 miles. 1.4 miles of existing Saturn Parkway is utilized.

7.2 WESTERN SPRING HILL BYPASS OPTION

This option would provide a western bypass around the CBD of the City of Spring Hill. The option would originate at the intersection of SR 6 with Stephen P. Yokich Parkway/Town Center Parkway. The option would utilize the 0.7 mile long Stephen P. Yokich/Town Center Parkway to its existing terminus with Beechcroft Road (SR 247), then proceed north on new alignment for 2.53 miles, and terminate near the intersection of SR 6 with Cemetery Road. The section of existing SR 6 between Stephen P. Yokich

Parkway/Town Center Parkway and the northern terminus of the bypass would not be improved. The remainder of SR 6 would be improved to four (4) travel lanes.

The proposed Western Spring Hill Bypass is 3.2 miles long. The 3.2-mile long bypass route includes 0.7 miles along existing Stephen P. Yokich Parkway/Town Center Parkway and 2.5 miles along new location. The distance along existing SR 6 that is being bypassed is 2.4 miles long.

As discussed in **Section 5.2**, the City of Spring Hill does not support widening SR 6 within the CBD. Widening SR 6 within the CBD will require impacts to numerous religious, historic, and commercial properties and harm the City's efforts to create a more walkable downtown community.

Stephen P. Yokich Parkway/Town Center Parkway would be utilized as a segment of the proposed Western Spring Hill Bypass. Stephen P. Yokich Parkway/Town Center Parkway is four (4) travel lanes wide with a raised median, curb and gutter, and no shoulders. The existing speed limit of Stephen P. Yokich Parkway/Town Center Parkway is 35 miles per hour.

This option is similar to improvements noted in the City of Spring Hill's Major Thoroughfare Plan (MTP). The route listed in the MTP extends from Stephen P. Yokich Parkway/Town Center Parkway to Buckner Road. This route would bisect the Campbell Farm. The Campbell Farm is listed in the National Register of Historic Places and is a Tennessee Century Farm. The MTP Route would also bisect the historic James Giddens House property and be located adjacent to Heritage Elementary and Middle Schools. Due to these environmentally sensitive locations, the northern terminus of the route in the MTP was modified as shown in this TPR to connect to SR 6 near Cemetery Road, instead of Buckner Road.

The Western Spring Hill Bypass is estimated to require four (4) travel lanes. The intersections created by the termini of the Western Spring Hill Bypass with SR 6 would require improvements to ensure that the anticipated heavy turning movement volumes are addressed. Potential intersection improvements at these locations could include multilane roundabouts.

A couple of environmentally sensitive locations and community resources are located within or adjacent to the Western Spring Hill Bypass Corridor. The Spring Hill Water Treatment Plant is located within the corridor, but will not be impacted due to its location adjacent to the existing segment of Town Center Parkway. The Campbell farm is located adjacent to the corridor. The Belshire Village commercial development, which is anchored by a Lowe's Home Improvement Store, is located within the study corridor at the northern terminus. It is believed the existing commercial developments can be avoided by the proposed bypass. The Western Spring Hill Bypass Corridor crosses the CSX Corporation Railroad in two (2) locations. These locations will need to be grade separated.

The Western Spring Hill Bypass Option is estimated to cost between $114 and $127 million in year 2014 dollars. The estimated cost was calculated to a planning level utilizing cost per mile data. The cost estimate includes between $47 and $52 million to construct the four travel lane Western Spring Hill Bypass on new location and between $67 and $75 million to widen SR 6 from Cemetery Road to Mack Hatcher Parkway to four (4) travel lanes. The cost estimate includes structures to bridge the two (2) CSX Corporation

railroad crossings located along the Western Bypass route. The cost estimate does not include improvements along the existing segment of Stephen P. Yokich/Town Center Parkway that is utilized by the Western Bypass. The cost estimate summary is provided in **Table 7.2**. The cost estimate calculations are provided in the **Appendix**.

No HCS LOS analysis was performed for the Western Spring Hill Bypass Option. This option was developed as a result of feedback received during stakeholder meetings that occurred during the development of this TPR. As discussed in the TPR, representatives of the City of Spring Hill are not in favor of widening SR 6 through the City's CBD. A Western Spring Hill Bypass Option is not in the Nashville MPO's LRTP. Therefore, this improvement is not in their Travel Demand Model and traffic projections are not currently available for this option.

This option was not included in the main body of the TPR in part because it is not currently included in the MPO's planning process. The bypass option was developed through a relatively informal stakeholder's meeting without public participation or input. Significant changes to the project, including a proposed bypass option, should originate through the local, county, or MPO planning process. Additionally, there are several functional issues that led to this option being rejected. SR 6 would not be a continuous route if redirected to this bypass and the pavement design and geometrics of Stephen P. Yokich Parkway/Town Center Parkway to be utilized in the bypass may not be sufficient for a State Route. The intersections formed between the bypass and SR 6 would likely not operate well due to the large turning volumes. A couple of environmentally sensitive locations are also located along the route. Finally, the existence of I-65 less than 3.5 miles to the east of SR 6 creates questions concerning the regional significance of a bypass at this location. Due to these concerns, this option was not included in the main body of the TPR.

TABLE 7.2 WESTERN SPRING HILL BYPASS COST ESTIMATE

ID	Location/ Description	Existing Roadway Classification	Proposed Roadway Classification	Length of Const. (Miles)	Estimated Low Cost	Estimated High Cost
Byp.	Western Bypass from Stephen P. Yokich Parkway/Town Center Parkway to Cemetery Road	n/a	4-Travel Lane Urban Other Principal Arterial	2.53	$ 47,488,100	$ 51,915,600
1	SR-6 from Kedron Rd. to Maury/ Williamson County Line (L.M. 32.47 to 33.31)	3-Lane Urban Other Principal Arterial	2-Travel Lane Urban Other Principal Arterial	0.00	$ -	$ -
2	SR-6 from Maury/ Williamson County Line to Thompson's Station City Limits (L.M. 0 to 2.49)	2-Lane Urban Other Principal Arterial	2/4 Travel-Lane Urban Other Principal Arterial	1.19	$ 9,353,400	$ 11,293,100
3	SR-6 from Thompson's Station City Limits to south of SR-840 (L.M. 2.5 to 4.75)	2-Lane Rural Minor Arterial	4 Travel-Lane Rural Minor Arterial	2.26	$ 15,413,200	$ 17,424,600
4	SR-6 from south of SR-840 to Tollgate Rd. (L.M. 4.76 to 5.55)	5-Lane Rural Minor Arterial	5-Lane Rural Minor Arterial	0.80	$ -	$ -
5	SR-6 from Tollgate Rd. to Nashville Urban Boundary (L.M. 5.56 to 8.67)	2-Lane Rural Minor Arterial	4 Travel-Lane Rural Minor Arterial	3.12	$ 25,989,600	$ 28,766,400
6	SR-6 from Nashville Urban Boundary to SR-397 (Mack Hatcher Pkwy.) (L.M. 8.68 to 10.03)	2-Lane Urban Other Principal Arterial	4 Travel-Lane Urban Other Principal Arterial	1.36	$ 15,572,000	$ 17,122,400
Total				11.26	$113,820,000	$126,520,000

Notes: Low estimate utilizes 4-lane rural x-section, high estimate utilizes 5-lane urban x-section.
Total route length is equal to 11.9 miles. 0.65 miles of existing Town Center Parkway is utilized.

COST ESTIMATES

Cost calculation summaries
Cost per mile calculations
Construction and engineering cost per mile calculations
Construction item cost per mile calculations
Structures calculations
Utility calculations
R.O.W. calculations
Paving cost calculations

Widen Along the Existing Alignment

ID	Location/ Description	Existing Roadway Classification	Proposed Roadway Classification	Length of Const. (Miles)	Estimated Low Cost	Estimated High Cost
1	SR-6 from Kedron Rd. to Williamson County Line (L.M. 32.47 to 33.31)	3-Lane Urban Other Principal Arterial	4-Travel Lane Urban Other Principal Arterial	0.84	$ 13,003,200	$ 16,405,200
2	SR-6 from Maury County Line to Thompson's Station City Limits (L.M. 0 to 2.49)	2-Lane Urban Other Principal Arterial	4 Travel-Lane Urban Other Principal Arterial	2.49	$ 19,571,400	$ 23,630,100
3	SR-6 from Thompson's Station City Limits to south of SR-840 (L.M. 2.5 to 4.75)	2-Lane Rural Minor Arterial	4 Travel-Lane Rural Minor Arterial	2.26	$ 15,413,200	$ 17,424,600
4	SR-6 from south of SR-840 to Tollgate Rd. (L.M. 4.76 to 5.55)	5-Lane Rural Minor Arterial	5-Lane Rural Minor Arterial	0.80	$ -	$ -
5	SR-6 from Tollgate Rd. to Nashville Urban Boundary (L.M. 5.56 to 8.67)	2-Lane Rural Minor Arterial	4 Travel-Lane Rural Minor Arterial	3.12	$ 25,989,600	$ 28,766,400
6	SR-6 from Nashville Urban Boundary to SR-397 (Mack Hatcher Pkwy.) (L.M. 8.68 to 10.03)	2-Lane Urban Other Principal Arterial	4 Travel-Lane Urban Other Principal Arterial	1.36	$ 15,572,000	$ 17,122,400
Total				10.87	$ 89,550,000	$103,350,000

Notes: Low estimate utilizes 4-lane rural x-section, high estimate utilizes 5-lane urban x-section.
Total route length is equal to the construction length of 10.9 miles.

Three Lane Spring Hill Option

ID	Location/ Description	Existing Roadway Classification	Proposed Roadway Classification	Length of Const. (Miles)	Estimated Low Cost	Estimated High Cost
1	SR-6 from Kedron Rd. to Williamson County Line (L.M. 32.47 to 33.31)	3-Lane Urban Other Principal Arterial	3-Lane Urban Other Principal Arterial	0.84	$ 722,400	$ 722,400
2A	SR-6 from Maury County Line to Miles Johnson Pkwy.	2-Lane Urban Other Principal Arterial	3-Lane Urban Other Principal Arterial	0.20	$ -	$ -
2	SR-6 from Miles Johnson Pkwy. to Thompson's Station City Limits (L.M. 0.20 to 2.49)	2-Lane Urban Other Principal Arterial	4 Travel-Lane Urban Other Principal Arterial	2.29	$ 16,281,900	$ 19,991,700
3	SR-6 from Thompson's Station City Limits to south of SR-840 (L.M. 2.5 to 4.75)	2-Lane Rural Minor Arterial	4 Travel-Lane Rural Minor Arterial	2.26	$ 15,413,200	$ 17,424,600
4	SR-6 from south of SR-840 to Tollgate Rd. (L.M. 4.76 to 5.55)	5-Lane Rural Minor Arterial	5-Lane Rural Minor Arterial	0.80	$ -	$ -
5	SR-6 from Tollgate Rd. to Nashville Urban Boundary (L.M. 5.56 to 8.67)	2-Lane Rural Minor Arterial	4 Travel-Lane Rural Minor Arterial	3.12	$ 25,989,600	$ 28,766,400
6	SR-6 from Nashville Urban Boundary to SR-397 (Mack Hatcher Pkwy.) (L.M. 8.68 to 10.03)	2-Lane Urban Other Principal Arterial	4 Travel-Lane Urban Other Principal Arterial	1.36	$ 15,572,000	$ 17,122,400
Total				10.87	$ 73,980,000	$ 84,030,000

Notes: Existing and proposed 3-lane sections are urban x-section. Multilane sections as described below.
Low estimate utilizes 4-lane rural x-section, high estimate utilizes 5-lane urban x-section.
Total route length is equal to the construction length of 10.9 miles.

Three Lane Thompson's Station Option

ID	Location/ Description	Existing Roadway Classification	Proposed Roadway Classification	Length of Const. (Miles)	Estimated Low Cost	Estimated High Cost
1	SR-6 from Kedron Rd. to Williamson County Line (L.M. 32.47 to 33.31)	3-Lane Urban Other Principal Arterial	4-Travel Lane Urban Other Principal Arterial	0.84	$ 13,003,200	$ 16,405,200
2	SR-6 from Maury County Line to Thompson's Station City Limits (L.M. 0 to 2.49)	2-Lane Urban Other Principal Arterial	4 Travel-Lane Urban Other Principal Arterial	2.49	$ 19,571,400	$ 23,630,100
3	SR-6 from Thompson's Station City Limits to south of SR-840 (L.M. 2.5 to 4.75)	2-Lane Rural Minor Arterial	3-Lane Rural Minor Arterial	2.26	$ 13,605,200	$ 14,373,600
4	SR-6 from south of SR-840 to Tollgate Rd. (L.M. 4.76 to 5.55)	5-Lane Rural Minor Arterial	5-Lane Rural Minor Arterial	0.80	$ -	$ -
5	SR-6 from Tollgate Rd. to Nashville Urban Boundary (L.M. 5.56 to 8.67)	2-Lane Rural Minor Arterial	4 Travel-Lane Rural Minor Arterial	3.12	$ 25,989,600	$ 28,766,400
6	SR-6 from Nashville Urban Boundary to SR-397 (Mack Hatcher Pkwy.) (L.M. 8.68 to 10.03)	2-Lane Urban Other Principal Arterial	4 Travel-Lane Urban Other Principal Arterial	1.36	$ 15,572,000	$ 17,122,400
Total				10.87	$ 87,740,000	$100,300,000

Notes: Low estimate utilizes 4-lane rural x-section, high estimate utilizes 5-lane urban x-section.
Total route length is equal to the construction length of 10.9 miles.

Three Lane Spring Hill & Thompson's Station Option

ID	Location/ Description	Existing Roadway Classification	Proposed Roadway Classification	Length of Const. (Miles)	Estimated Low Cost	Estimated High Cost
1	SR-6 from Kedron Rd. to Williamson County Line (L.M. 32.47 to 33.31)	3-Lane Urban Other Principal Arterial	3-Lane Urban Other Principal Arterial	0.84	$ 722,400	$ 722,400
2A	SR-6 from Maury County Line to Miles Johnson Pkwy.	2-Lane Urban Other Principal Arterial	3-Lane Urban Other Principal Arterial	0.20	$ -	$ -
2	SR-6 from Miles Johnson Pkwy. to Thompson's Station City Limits (L.M. 0.20 to 2.49)	2-Lane Urban Other Principal Arterial	4 Travel-Lane Urban Other Principal Arterial	2.29	$ 16,281,900	$ 19,991,700
3	SR-6 from Thompson's Station City Limits to south of SR-840 (L.M. 2.5 to 4.75)	2-Lane Rural Minor Arterial	4 Travel-Lane Rural Minor Arterial	2.26	$ 13,605,200	$ 14,373,600
4	SR-6 from south of SR-840 to Tollgate Rd. (L.M. 4.76 to 5.55)	5-Lane Rural Minor Arterial	5-Lane Rural Minor Arterial	0.80	$ -	$ -
5	SR-6 from Tollgate Rd. to Nashville Urban Boundary (L.M. 5.56 to 8.67)	2-Lane Rural Minor Arterial	4 Travel-Lane Rural Minor Arterial	3.12	$ 25,989,600	$ 28,766,400
6	SR-6 from Nashville Urban Boundary to SR-397 (Mack Hatcher Pkwy.) (L.M. 8.68 to 10.03)	2-Lane Urban Other Principal Arterial	4 Travel-Lane Urban Other Principal Arterial	1.36	$ 15,572,000	$ 17,122,400
Total				10.87	$ 72,170,000	$ 80,980,000

Notes: Existing and proposed 3-lane sections are urban x-section. Multilane sections as described below.
Low estimate utilizes 4-lane rural x-section, high estimate utilizes 5-lane urban x-section.
Total route length is equal to the construction length of 10.9 miles.

Eastern Spring Hill Bypass

ID	Location/ Description	Existing Roadway Classification	Proposed Roadway Classification	Length of Const. (Miles)	Estimated Low Cost	Estimated High Cost
Byp.	Eastern Bypass from Saturn Parkway (SR-396) to SR-6 at Miles Johnson Parkway	n/a	4-Travel Lane Urban Other Principal Arterial	1.90	$ 16,511,000	$ 19,836,000
1	SR-6 from Kedron Rd. to Williamson County Line (L.M. 32.47 to 33.31)	3-Lane Urban Other Principal Arterial	2-Travel Lane Urban Other Principal Arterial	0.00	$ -	$ -
2	SR-6 from Maury County Line to Thompson's Station City Limits (L.M. 0 to 2.49)	2-Lane Urban Other Principal Arterial	2/4 Travel-Lane Urban Other Principal Arterial	2.29	$ 17,999,400	$ 21,732,100
3	SR-6 from Thompson's Station City Limits to south of SR-840 (L.M. 2.5 to 4.75)	2-Lane Rural Minor Arterial	4 Travel-Lane Rural Minor Arterial	2.26	$ 15,413,200	$ 17,424,600
4	SR-6 from south of SR-840 to Tollgate Rd. (L.M. 4.76 to 5.55)	5-Lane Rural Minor Arterial	5-Lane Rural Minor Arterial	0.80	$ -	$ -
5	SR-6 from Tollgate Rd. to Nashville Urban Boundary (L.M. 5.56 to 8.67)	2-Lane Rural Minor Arterial	4 Travel-Lane Rural Minor Arterial	3.12	$ 25,989,600	$ 28,766,400
6	SR-6 from Nashville Urban Boundary to SR-397 (Mack Hatcher Pkwy.) (L.M. 8.68 to 10.03)	2-Lane Urban Other Principal Arterial	4 Travel-Lane Urban Other Principal Arterial	1.36	$ 15,572,000	$ 17,122,400
Total				11.73	$ 91,490,000	$104,880,000

Notes: Low estimate utilizes 4-lane rural x-section, high estimate utilizes 5-lane urban x-section.
Total route length is equal to 13.1 miles. 1.4 miles of existing Saturn Parkway is utilized.

Western Spring Hill Bypass

ID	Location/ Description	Existing Roadway Classification	Proposed Roadway Classification	Length of Const. (Miles)	Estimated Low Cost	Estimated High Cost
Byp.	Western Bypass from Stephen P. Yokich Parkway/Town Center Parkway to Cemetery Road	n/a	4-Travel Lane Urban Other Principal Arterial	2.53	$ 47,488,100	$ 51,915,600
1	SR-6 from Kedron Rd. to Williamson County Line (L.M. 32.47 to 33.31)	3-Lane Urban Other Principal Arterial	2-Travel Lane Urban Other Principal Arterial	0.00	$ -	$ -
2	SR-6 from Maury County Line to Thompson's Station City Limits (L.M. 0 to 2.49)	2-Lane Urban Other Principal Arterial	2/4 Travel-Lane Urban Other Principal Arterial	1.19	$ 9,353,400	$ 11,293,100
3	SR-6 from Thompson's Station City Limits to south of SR-840 (L.M. 2.5 to 4.75)	2-Lane Rural Minor Arterial	4 Travel-Lane Rural Minor Arterial	2.26	$ 15,413,200	$ 17,424,600
4	SR-6 from south of SR-840 to Tollgate Rd. (L.M. 4.76 to 5.55)	5-Lane Rural Minor Arterial	5-Lane Rural Minor Arterial	0.80	$ -	$ -
5	SR-6 from Tollgate Rd. to Nashville Urban Boundary (L.M. 5.56 to 8.67)	2-Lane Rural Minor Arterial	4 Travel-Lane Rural Minor Arterial	3.12	$ 25,989,600	$ 28,766,400
6	SR-6 from Nashville Urban Boundary to SR-397 (Mack Hatcher Pkwy.) (L.M. 8.68 to 10.03)	2-Lane Urban Other Principal Arterial	4 Travel-Lane Urban Other Principal Arterial	1.36	$ 15,572,000	$ 17,122,400
Total				11.26	$113,820,000	$126,520,000

Notes: Low estimate utilizes 4-lane rural x-section, high estimate utilizes 5-lane urban x-section.
Total route length is equal to 11.9 miles. 0.65 miles of existing Town Center Parkway is utilized.

Spot Improvements

ID	Location/ Description	Existing Roadway Classification	Proposed Roadway Classification	Length of Const. (Miles)	Estimated Cost
n/a	Signalization	n/a	n/a	0.00	$ 150,000
n/a	Signalization	n/a	n/a	0.00	$ 150,000
n/a	Turn Lane Improvements	n/a	n/a	0.00	$ 300,000
n/a	Turn Lane Improvements	n/a	n/a	0.00	$ 300,000
n/a	Turn Lane Improvements	n/a	n/a	0.00	$ 300,000
n/a	Bridge over Harpeth	n/a	n/a	0.00	$ 1,512,000
n/a	SR-6 at SR-247	n/a	n/a	0.00	$ 740,000
n/a	SR-6 at Critz Lane	n/a	n/a	0.19	$ 950,000
n/a	SR-6 at Goose Creek Bypass	n/a	n/a	0.57	$ 5,680,000
n/a	SR-6 at Coleman Road/Henpeck Lane	n/a	n/a	0.28	$ 1,950,000
n/a	SR-6 at Mack Hatcher Parkway	n/a	n/a	3.12	$ 200,000
Total				4.16	$ 12,232,000

Notes: Low estimate utilizes 4-lane rural x-section, high estimate utilizes 5-lane urban x-section.
Total route length is equal to 11.9 miles. 0.7 miles of existing Town Center Parkway is utilized.

Widen Along the Existing Alignment **Cost per mile Calculations**

ID	Low Roadway Construction & Engineering Cost	High Roadway Construction & Engineering Cost	Low ROW Cost	High ROW Cost	Structures Cost	Low Total Estimated Cost	High Total Estimated Cost
1	$ 5,594,000	$ 6,165,000	$ 9,881,000	$ 13,369,000	$ -	$ 15,480,000	$ 19,530,000
2	$ 5,594,000	$ 6,165,000	$ 1,511,000	$ 2,569,000	$ 756,000	$ 7,860,000	$ 9,490,000
3	$ 5,594,000	$ 6,165,000	$ 465,000	$ 791,000	$ 756,000	$ 6,820,000	$ 7,710,000
4	$ -	$ -	$ -	$ -	$ -	$ -	$ -
5	$ 5,594,000	$ 6,165,000	$ 465,000	$ 791,000	$ 2,268,000	$ 8,330,000	$ 9,220,000
6	$ 5,594,000	$ 6,165,000	$ 814,000	$ 1,383,000	$ 5,040,000	$ 11,450,000	$ 12,590,000

Three Lane Spring Hill Option **Cost per mile Calculations**

ID	Low Roadway Construction & Engineering Cost	High Roadway Construction & Engineering Cost	Low ROW Cost	High ROW Cost	Structures Cost	Low Total Estimated Cost	High Total Estimated Cost
1	$ 857,000	$ 857,000	$ -	$ -	$ -	$ 860,000	$ 860,000
2A	$ 4,797,000	$ 4,812,000	$ 465,000	$ 791,000	$ 756,000	$ 6,020,000	$ 6,360,000
2	$ 5,594,000	$ 6,165,000	$ 1,511,000	$ 2,569,000	$ -	$ 7,110,000	$ 8,730,000
3	$ 5,594,000	$ 6,165,000	$ 465,000	$ 791,000	$ 756,000	$ 6,820,000	$ 7,710,000
4	$ -	$ -	$ -	$ -	$ -	$ -	$ -
5	$ 5,594,000	$ 6,165,000	$ 465,000	$ 791,000	$ 2,268,000	$ 8,330,000	$ 9,220,000
6	$ 5,594,000	$ 6,165,000	$ 814,000	$ 1,383,000	$ 5,040,000	$ 11,450,000	$ 12,590,000

Three Lane Thompson's Station Option **Cost per mile Calculations**

ID	Low Roadway Construction & Engineering Cost	High Roadway Construction & Engineering Cost	Low ROW Cost	High ROW Cost	Structures Cost	Low Total Estimated Cost	High Total Estimated Cost
1	$ 5,594,000	$ 6,165,000	$ 9,881,000	$ 13,369,000	$ -	$ 15,480,000	$ 19,530,000
2	$ 5,594,000	$ 6,165,000	$ 1,511,000	$ 2,569,000	$ 756,000	$ 7,860,000	$ 9,490,000
3	$ 4,797,000	$ 4,812,000	$ 465,000	$ 791,000	$ 756,000	$ 6,020,000	$ 6,360,000
4	$ -	$ -	$ -	$ -	$ -	$ -	$ -
5	$ 5,594,000	$ 6,165,000	$ 465,000	$ 791,000	$ 2,268,000	$ 8,330,000	$ 9,220,000
6	$ 5,594,000	$ 6,165,000	$ 814,000	$ 1,383,000	$ 5,040,000	$ 11,450,000	$ 12,590,000

Three Lane Spring Hill & Thompson's Station Option **Cost per mile Calculations**

ID	Low Roadway Construction & Engineering Cost	High Roadway Construction & Engineering Cost	Low ROW Cost	High ROW Cost	Structures Cost	Low Total Estimated Cost	High Total Estimated Cost
1	$ 857,000	$ 857,000	$ -	$ -	$ -	$ 860,000	$ 860,000
2A	$ 4,797,000	$ 4,812,000	$ 465,000	$ 791,000	$ 756,000	$ 6,020,000	$ 6,360,000
2	$ 5,594,000	$ 6,165,000	$ 1,511,000	$ 2,569,000	$ -	$ 7,110,000	$ 8,730,000
3	$ 4,797,000	$ 4,812,000	$ 465,000	$ 791,000	$ 756,000	$ 6,020,000	$ 6,360,000
4	$ -	$ -	$ -	$ -	$ -	$ -	$ -
5	$ 5,594,000	$ 6,165,000	$ 465,000	$ 791,000	$ 2,268,000	$ 8,330,000	$ 9,220,000
6	$ 5,594,000	$ 6,165,000	$ 814,000	$ 1,383,000	$ 5,040,000	$ 11,450,000	$ 12,590,000

Eastern Spring Hill Bypass **Cost per mile Calculations**

ID	Low Roadway Construction & Engineering Cost	High Roadway Construction & Engineering Cost	Low ROW Cost	High ROW Cost	Structures Cost	Low Total Estimated Cost	High Total Estimated Cost
Byp.	$ 7,894,000	$ 9,368,000	$ 791,000	$ 1,070,000	$ -	$ 8,690,000	$ 10,440,000
1	$ 5,594,000	$ 6,165,000	$ 9,881,000	$ 13,369,000	$ -	$ 15,480,000	$ 19,530,000
2	$ 5,594,000	$ 6,165,000	$ 1,511,000	$ 2,569,000	$ 756,000	$ 7,860,000	$ 9,490,000
3	$ 5,594,000	$ 6,165,000	$ 465,000	$ 791,000	$ 756,000	$ 6,820,000	$ 7,710,000
4	$ -	$ -	$ -	$ -	$ -	$ -	$ -
5	$ 5,594,000	$ 6,165,000	$ 465,000	$ 791,000	$ 2,268,000	$ 8,330,000	$ 9,220,000
6	$ 5,594,000	$ 6,165,000	$ 814,000	$ 1,383,000	$ 5,040,000	$ 11,450,000	$ 12,590,000

Western Spring Hill Bypass **Cost per mile Calculations**

ID	Low Roadway Construction & Engineering Cost	High Roadway Construction & Engineering Cost	Low ROW Cost	High ROW Cost	Structures Cost	Low Total Estimated Cost	High Total Estimated Cost
Byp.	$ 7,894,000	$ 9,368,000	$ 791,000	$ 1,070,000	$ 10,080,000	$ 18,770,000	$ 20,520,000
1	$ 5,594,000	$ 6,165,000	$ 9,881,000	$ 13,369,000	$ -	$ 15,480,000	$ 19,530,000
2	$ 5,594,000	$ 6,165,000	$ 1,511,000	$ 2,569,000	$ 756,000	$ 7,860,000	$ 9,490,000
3	$ 5,594,000	$ 6,165,000	$ 465,000	$ 791,000	$ 756,000	$ 6,820,000	$ 7,710,000
4	$ -	$ -	$ -	$ -	$ -	$ -	$ -
5	$ 5,594,000	$ 6,165,000	$ 465,000	$ 791,000	$ 2,268,000	$ 8,330,000	$ 9,220,000
6	$ 5,594,000	$ 6,165,000	$ 814,000	$ 1,383,000	$ 5,040,000	$ 11,450,000	$ 12,590,000

Spot Improvements **Cost per mile Calculations**

ID	Location/ Description	Roadway Construction & Engineering Cost	ROW Cost	Structures Cost	Total Estimated Cost
n/a	Signalization	n/a	$ -	$ -	$ -
n/a	Signalization	n/a	$ -	$ -	$ -
n/a	Turn Lane	n/a	$ -	$ -	$ -
n/a	Turn Lane	n/a	$ -	$ -	$ -
n/a	Turn Lane	n/a	$ -	$ -	$ -
n/a	SR-6 at SR-	n/a	$ -	$ -	$ -
n/a	SR-6 at Critz Lane	$ 5,000,000	$0 - Dedicated	$ -	$ 5,000,000
n/a	SR-6 at Goose Creek Bypass	$ 10,000,000	$ 0 fits in exist	$ -	$ 10,000,000
n/a	SR-6 at Coleman Road/Henpeck Lane	$ 5,000,000	$ 1,872,000	$ -	$ 6,870,000
n/a	SR-6 at Mack Hatcher Parkway	n/a	$ -	$ -	$ -

Route Construction & Engineering Cost Data Sheet

Option: 2 lane existing to 3 lane rural cross section
Length: 1 Mile

Right-of-Way

TDOT cost per mile data utilzed & varies by adjacent land use. Please see ROW cost calculations

Utility Relocation

Reimbursable		$ -		
Non-reimbursable		$ 260,000		
Total Utility Cost				**$ 260,000**

Construction

Clear and Grubbing		$ 20,000		
Earthwork		$ 478,500		
Pavement Removal		$ 5,000		
Drainage		$ 60,000		
Structures		$ -	Structures estimated separately	
Railroad Crossing or Separation		$ -		
Paving		$ 957,000		
Retaining Walls		$ 71,000		
Maintenance of Traffic		$ 100,000		
Topsoil		$ 20,000		
Seeding		$ 7,000		
Sodding		$ -		
Signing		$ 5,000		
Lighting		$ 25,000		
Signalization		$ 150,000		
Fence		$ -		
Guardrail		$ 54,000		
Rip Rap or Slope Protection		$ 6,000		
Construction Item Subtotal	$ 1,958,500			
Other Construction Items (15%)		$ 294,000		
Erosion Control (3.5%)		$ 69,000		
Mobilization (5%)		$ 98,000		
Construction Cost			$ 2,419,500	
10% Engineering & Cont.			$ 242,000	
Total Construction Cost				**$ 2,661,500**
Preliminary Engineering (10%)				**$ 266,000**

Total Cost (Rounded) Present Year AUP (2007)	**$ 3,190,000**
Total Cost (Rounded) Construction Year (2014) at 6% Inflation for 7 Years	**$ 4,797,000**

Route Construction & Engineering Cost Data Sheet

Option: 2 lane existing to 3 lane urban cross section
Length: 1 Mile

Right-of-Way

TDOT cost per mile data utilzed & varies by adjacent land use. Please see ROW cost calculations

Utility Relocation

Reimbursable		$ -		
Non-reimbursable		$ 260,000		
Total Utility Cost				**$ 260,000**

Construction

Clear and Grubbing		$ 20,000		
Earthwork		$ 214,000		
Pavement Removal		$ 5,000		
Drainage		$ 435,000		
Structures		$ -	Structures estimated separately	
Railroad Crossing or Separation		$ -		
Paving		$ 856,000		
Retaining Walls		$ 71,000		
Maintenance of Traffic		$ 100,000		
Topsoil		$ 20,000		
Seeding		$ 7,000		
Sodding		$ -		
Signing		$ 5,000		
Lighting		$ 25,000		
Signalization		$ 150,000		
Fence		$ -		
Guardrail		$ 54,000		
Rip Rap or Slope Protection		$ 6,000		
Construction Item Subtotal	$ 1,968,000			
Other Construction Items (15%)		$ 295,000		
Erosion Control (3.5%)		$ 69,000		
Mobilization (5%)		$ 98,000		
Construction Cost			$ 2,430,000	
10% Engineering & Cont.			$ 243,000	
Total Construction Cost				**$ 2,673,000**
Preliminary Engineering (10%)				**$ 267,000**

Total Cost (Rounded) Present Year AUP (2007)	**$ 3,200,000**
Total Cost (Rounded) Construction Year (2014) at 6% Inflation for 7 Years	**$ 4,812,000**

Route Construction & Engineering Cost Data Sheet

Option: 2 lane existing to 4 lane rural cross section
Length: 1 Mile

Right-of-Way

TDOT cost per mile data utilzed & varies by adjacent land use. Please see ROW cost calculations

Utility Relocation

Reimbursable		$ -		
Non-reimbursable		$ 260,000		
Total Utility Cost				**$ 260,000**

Construction

Clear and Grubbing		$ 20,000		
Earthwork		$ 598,500		
Pavement Removal		$ 5,000		
Drainage		$ 60,000		
Structures		$ -	Structures estimated separately	
Railroad Crossing or Separation		$ -		
Paving		$ 1,197,000		
Retaining Walls		$ 71,000		
Maintenance of Traffic		$ 100,000		
Topsoil		$ 20,000		
Seeding		$ 7,000		
Sodding		$ -		
Signing		$ 5,000		
Lighting		$ 25,000		
Signalization		$ 150,000		
Fence		$ -		
Guardrail		$ 54,000		
Rip Rap or Slope Protection		$ 6,000		
Construction Item Subtotal	$ 2,318,500			
Other Construction Items (15%)		$ 348,000		
Erosion Control (3.5%)		$ 81,000		
Mobilization (5%)		$ 116,000		
Construction Cost			$ 2,863,500	
10% Engineering & Cont.			$ 286,000	
Total Construction Cost				**$ 3,149,500**
Preliminary Engineering (10%)				**$ 315,000**

Total Cost (Rounded) Present Year AUP (2007)	**$ 3,720,000**
Total Cost (Rounded) Construction Year (2014) at 6% Inflation for 7 Years	**$ 5,594,000**

Route Construction & Engineering Cost Data Sheet

Option: 2 lane existing to 5 lane urban cross section
Length: 1 Mile

Right-of-Way

TDOT cost per mile data utilzed & varies by adjacent land use. Please see ROW cost calculations

Utility Relocation

Reimbursable		$ -		
Non-reimbursable		$ 260,000		
Total Utility Cost				**$ 260,000**

Construction

Clear and Grubbing		$ 20,000		
Earthwork		$ 333,750		
Pavement Removal		$ 5,000		
Drainage		$ 435,000		
Structures		$ -	Structures estimated separately	
Railroad Crossing or Separation		$ -		
Paving		$ 1,335,000		
Retaining Walls		$ 71,000		
Maintenance of Traffic		$ 100,000		
Topsoil		$ 20,000		
Seeding		$ 7,000		
Sodding		$ -		
Signing		$ 5,000		
Lighting		$ 25,000		
Signalization		$ 150,000		
Fence		$ -		
Guardrail		$ 54,000		
Rip Rap or Slope Protection		$ 6,000		
Construction Item Subtotal	$ 2,566,750			
Other Construction Items (15%)		$ 385,000		
Erosion Control (3.5%)		$ 90,000		
Mobilization (5%)		$ 128,000		
Construction Cost			$ 3,169,750	
10% Engineering & Cont.			$ 317,000	
Total Construction Cost				**$ 3,486,750**
Preliminary Engineering (10%)				**$ 349,000**

Total Cost (Rounded) Present Year AUP (2007)	**$ 4,100,000**
Total Cost (Rounded) Construction Year (2014) at 6% Inflation for 7 Years	**$ 6,165,000**

Route Construction & Engineering Cost Data Sheet

Option: 3 lane existing to 4 lane rural cross section
Length: 1 Mile

Right-of-Way

TDOT cost per mile data utilzed & varies by adjacent land use. Please see ROW cost calculations

Utility Relocation

Reimbursable		$ -		
Non-reimbursable		$ 260,000		
Total Utility Cost				**$ 260,000**

Construction

Clear and Grubbing		$ 20,000		
Earthwork		$ 598,500		
Pavement Removal		$ 5,000		
Drainage		$ 60,000		
Structures		$ -	Structures estimated separately	
Railroad Crossing or Separation		$ -		
Paving		$ 1,197,000		
Retaining Walls		$ 71,000		
Maintenance of Traffic		$ 100,000		
Topsoil		$ 20,000		
Seeding		$ 7,000		
Sodding		$ -		
Signing		$ 5,000		
Lighting		$ 25,000		
Signalization		$ 150,000		
Fence		$ -		
Guardrail		$ 54,000		
Rip Rap or Slope Protection		$ 6,000		
Construction Item Subtotal	$ 2,318,500			
Other Construction Items (15%)		$ 348,000		
Erosion Control (3.5%)		$ 81,000		
Mobilization (5%)		$ 116,000		
Construction Cost			$ 2,863,500	
10% Engineering & Cont.			$ 286,000	
Total Construction Cost				**$ 3,149,500**
Preliminary Engineering (10%)				**$ 315,000**

Total Cost (Rounded) Present Year AUP (2007)	**$ 3,720,000**
Total Cost (Rounded) Construction Year (2014) at 6% Inflation for 7 Years	**$ 5,594,000**

Route Construction & Engineering Cost Data Sheet

Option: 3 lane existing to 5 lane urban cross section
Length: 1 Mile

Right-of-Way

TDOT cost per mile data utilzed & varies by adjacent land use. Please see ROW cost calculations

Utility Relocation

Reimbursable		$ -		
Non-reimbursable		$ 260,000		
Total Utility Cost				**$ 260,000**

Construction

Clear and Grubbing		$ 20,000		
Earthwork		$ 333,750		
Pavement Removal		$ 5,000		
Drainage		$ 435,000		
Structures		$ -	Structures estimated separately	
Railroad Crossing or Separation		$ -		
Paving		$ 1,335,000		
Retaining Walls		$ 71,000		
Maintenance of Traffic		$ 100,000		
Topsoil		$ 20,000		
Seeding		$ 7,000		
Sodding		$ -		
Signing		$ 5,000		
Lighting		$ 25,000		
Signalization		$ 150,000		
Fence		$ -		
Guardrail		$ 54,000		
Rip Rap or Slope Protection		$ 6,000		
Construction Item Subtotal	$ 2,566,750			
Other Construction Items (15%)		$ 385,000		
Erosion Control (3.5%)		$ 90,000		
Mobilization (5%)		$ 128,000		
Construction Cost			$ 3,169,750	
10% Engineering & Cont.			$ 317,000	
Total Construction Cost				**$ 3,486,750**
Preliminary Engineering (10%)				**$ 349,000**

Total Cost (Rounded) Present Year AUP (2007)	**$ 4,100,000**
Total Cost (Rounded) Construction Year (2014) at 6% Inflation for 7 Years	**$ 6,165,000**

Route Construction & Engineering Cost Data Sheet

Option: New 4 lane rural cross section
Length: 1 Mile

Right-of-Way

TDOT cost per mile data utilzed & varies by adjacent land use. Please see ROW cost calculations

Utility Relocation

Reimbursable		$ -		
Non-reimbursable		$ 260,000		
Total Utility Cost				**$ 260,000**

Construction

Clear and Grubbing		$ 20,000		
Earthwork		$ 1,408,000		
Pavement Removal		$ 5,000		
Drainage		$ 60,000		
Structures		$ -	Structures estimated separately	
Railroad Crossing or Separation		$ -		
Paving		$ 1,408,000		
Retaining Walls		$ 71,000		
Maintenance of Traffic		$ 100,000		
Topsoil		$ 20,000		
Seeding		$ 7,000		
Sodding		$ -		
Signing		$ 5,000		
Lighting		$ 25,000		
Signalization		$ 150,000		
Fence		$ -		
Guardrail		$ 54,000		
Rip Rap or Slope Protection		$ 6,000		
Construction Item Subtotal	$ 3,339,000			
Other Construction Items (15%)		$ 501,000		
Erosion Control (3.5%)		$ 117,000		
Mobilization (5%)		$ 167,000		
Construction Cost			$ 4,124,000	
10% Engineering & Cont.			$ 412,000	
Total Construction Cost				**$ 4,536,000**
Preliminary Engineering (10%)				**$ 454,000**

Total Cost (Rounded) Present Year AUP (2007)	**$ 5,250,000**
Total Cost (Rounded) Construction Year (2014) at 6% Inflation for 7 Years	**$ 7,894,000**

Route Construction & Engineering Cost Data Sheet

Option: New 5 lane urban cross Section
Length: 1 Mile

Right-of-Way

TDOT cost per mile data utilzed & varies by adjacent land use. Please see ROW cost calculations

Utility Relocation

Reimbursable		$ -		
Non-reimbursable		$ 260,000		
Total Utility Cost				**$ 260,000**

Construction

Clear and Grubbing		$ 20,000		
Earthwork		$ 1,547,000		
Pavement Removal		$ 5,000		
Drainage		$ 435,000		
Structures		$ -	Structures estimated separately	
Railroad Crossing or Separation		$ -		
Paving		$ 1,547,000		
Retaining Walls		$ 71,000		
Maintenance of Traffic		$ 100,000		
Topsoil		$ 20,000		
Seeding		$ 7,000		
Sodding		$ -		
Signing		$ 5,000		
Lighting		$ 25,000		
Signalization		$ 150,000		
Fence		$ -		
Guardrail		$ 54,000		
Rip Rap or Slope Protection		$ 6,000		
Construction Item Subtotal	$ 3,992,000			
Other Construction Items (15%)		$ 599,000		
Erosion Control (3.5%)		$ 140,000		
Mobilization (5%)		$ 200,000		
Construction Cost			$ 4,931,000	
10% Engineering & Cont.			$ 493,000	
Total Construction Cost				**$ 5,424,000**
Preliminary Engineering (10%)				**$ 542,000**

Total Cost (Rounded) Present Year AUP (2007)	**$ 6,230,000**
Total Cost (Rounded) Construction Year (2014) at 6% Inflation for 7 Years	**$ 9,368,000**

Route Construction & Engineering Cost Data Sheet

Option: Rehabilitate 3 lane urban cross Section
Length: 1 Mile

Right-of-Way

No R.O.W. Cost for Rehabilitated Section

Utility Relocation

Reimbursable		$ -		
Non-reimbursable				
Total Utility Cost				**$ -**

Construction

Clear and Grubbing		$ -		
Earthwork		$ -		
Pavement Removal		$ 82,000		
Drainage		$ -		
Structures		$ -	Structures estimated separately	
Railroad Crossing or Separation		$ -		
Paving		$ 169,000		
Retaining Walls		$ -		
Maintenance of Traffic		$ 100,000		
Topsoil		$ -		
Seeding		$ -		
Sodding		$ -		
Signing		$ 5,000		
Lighting		$ 25,000		
Signalization		$ -		
Fence		$ -		
Guardrail		$ -		
Rip Rap or Slope Protection		$ -		
Construction Item Subtotal	$ 381,000			
Other Construction Items (15%)		$ 57,000		
Erosion Control (3.5%)		$ 13,000		
Mobilization (5%)		$ 19,000		
Construction Cost			$ 470,000	
10% Engineering & Cont.			$ 47,000	
Total Construction Cost				**$ 517,000**
Preliminary Engineering (10%)				**$ 52,000**

Total Cost (Rounded) Present Year AUP (2007)	**$ 570,000**
Total Cost (Rounded) Construction Year (2014) at 6% Inflation for 7 Years	**$ 857,000**

Route:
County: Maury and Williamson
Section: n/a - cost per mile estimate
Length: 1 Miles
X-Section: 2 lane existing to 3 lane rural cross section

Stream Crossings: Estimate 2 per mile

Item	Quantity	Unit	2007 Unit Cost	Sub-Total	Total Cost	Rounded Cost	Description/Quantity Calculation
Clear and Grubbing	20	Acres	$ 1,000.00		$ 20,000	$ 20,000	area inside prop. R.O.W.
Earthwork							
Excavation (Cut)	118000	CY	$ 4.05	$ -			Item # 203-01
Borrow (Fill)	0	CY	$ 5.89	$ -			Item # 203-03
		Total			$ -	$ 478,500	Est. based upon 1/2 paving cost for rural widening, 1/4 paving cost for C&G, and 1.0 paving cost for new location.
Pavement Removal	500	SY	$ 3.88	$ 1,940	$ 1,940	$ 5,000	Item #202-03.01 removal of asphalt pavement.
Drainage	0	FT Pipe	$ 44.21	$ -			24" pipe assumed length of project (C&G) Item # 607-05.02
	0	Catchbasins	$ 2,691.27	$ -			611-12.02, Type 12 CB 4-8' depth, 1 every 300' on each side of the street affected
	400	FT Pipe	$ 136.19	$ 54,476			48" pipe assummed at each stream crossings Item #607-09.02
	0	Medianbasin	$ 2,691.27	$ -			1 every 800' when have a median, estimate same price as catchbasins
	0	Medianpipe	$ 37.74	$ -			18" pipe every 800', length = 80' Item #607-03.02
		10% Factor		$ 5,448			
		Total			$ 59,924	$ 60,000	
Structures	0	SF	$ 150.00	$ -	$ -	$ -	Estimate for simple bridges
Railroad Crossing	0	Each	$ 50,000.00	$ -			common equipment
	0	FT	$ 200.00	$ -			per foot runaround
	0	SF	$ 70.00	$ -			vehicular bridge
	0	SF	$ 250.00	$ -			RR bridge
	0	LF	$ 200.00	$ -			at grade pad
	0	Each	$ 50,000.00	$ -			gates and signals
		Total			$ -	$ -	
Paving	190080	SF	$ 4.45	$ 845,856		$ -	arterial street asphalt paving - see separate calcs
	105600	SF	$ 2.65	$ 279,840		$ -	asphalt shoulder - see separate calcs
		15% Reduct.		$ (168,854)		$ -	if widening, cost = 85% of total paving
Curb and Gutter	0	FT	$ 202.57	$ -		$ -	concrete cost Item # 702-03, 0.06409 CY/LF (DWG RP-NMC-10) Unit price in CY
		Total			$ 956,842	$ 957,000	
Concrete	0	SF	$ 3.37		$ -	$ -	Sidewalks, Item # 701-01.01
Retaining Walls	660	FT	$ 107.89		$ 71,206	$ 71,000	Item #604-10.01 concrete and Std. Dwg. EL-W-2 for a 4' tall gravity
Maintenance of Traffic	4	Each	$ 25,000.00		$ 100,000	$ 100,000	estimate $25,000 per existing road crossed
Topsoil	8000	CY	$ 2.51		$ 20,080	$ 20,000	Item # 203-04
Seeding	211200	s.f.	$ 26.92		$ 7,107	$ 7,000	Item # 801-01 sq. ft to be seeded/1000 x 1.25 = units. Unit price in units
Sodding	0	SY	$ 2.41		$ -	$ -	Item # 803-01
Signing	1	Mile	$ 1,000.00		$ 1,000	$ 5,000	$1000/mile rural or $2000/mile urban (or $250/sign for standard signs)
Lighting	10	Each	$ 2,450.00		$ 24,500	$ 25,000	Item # 714-08
Signalization	1	Each	$150,000.00		$ 150,000	$ 150,000	per signalized intersesction
Fence	0	LF	$ 8.64		$ -	$ -	Chain Link 6', Item # 707-01.11
Guardrail	2640	LF	$ 20.30	$ 53,592			Item 705-02.03
Median Barrier	0	LF	$ 155.10	$ -			Item #711-04 Conc glare screen median barrier
		Total			$ 53,592	$ 54,000	
Rip Rap Slope Prot.	200	Ton	$ 27.67		$ 5,534	$ 6,000	Item # 709-05.06 1.5 ft deep, 1.75 Tons/CY

Total: **$ 1,959,000**

Route:
County: Maury and Williamson
Section: n/a - cost per mile estimate
Length: 1 Miles
X-Section: 2 lane existing to 3 lane urban cross section

Stream Crossings: Estimate 2 per mile

Item	Quantity	Unit	2007 Unit Cost	Sub-Total	Total Cost	Rounded Cost	Description/Quantity Calculation
Clear and Grubbing	20	Acres	$ 1,000.00		$ 20,000	$ 20,000	area inside prop. R.O.W.
Earthwork							
Excavation (Cut)	53000	CY	$ 4.05	$ -			Item # 203-01
Borrow (Fill)	0	CY	$ 5.89	$ -			Item # 203-03
		Total			$ -	$ 214,000	Est. based upon 1/2 paving cost for rural widening, 1/4 paving cost for C&G, and 1.0 paving cost for new location.
Pavement Removal	500	SY	$ 3.88	$ 1,940	$ 1,940	$ 5,000	Item #202-03.01 removal of asphalt pavement.
Drainage	5280	FT Pipe	$ 44.21	$ 233,429			24" pipe assumed length of project (C&G) Item # 607-05.02
	40	Catchbasins	$ 2,691.27	$ 107,651			611-12.02, Type 12 CB 4-8' depth, 1 every 300' on each side of the street affected
	400	FT Pipe	$ 136.19	$ 54,476			48" pipe assummed at each stream crossings Item #607-09.02
	0	Medianbasin	$ 2,691.27	$ -			1 every 800' when have a median, estimate same price as catchbasins
	0	Medianpipe	$ 37.74	$ -			18" pipe every 800', length = 80' Item #607-03.02
		10% Factor		$ 39,556			
		Total			$ 435,111	$ 435,000	
Structures	0	SF	$ 150.00	$ -	$ -	$ -	Estimate for simple bridges
Railroad Crossing	0	Each	$ 50,000.00	$ -			common equipment
	0	FT	$ 200.00	$ -			per foot runaround
	0	SF	$ 70.00	$ -			vehicular bridge
	0	SF	$ 250.00	$ -			RR bridge
	0	LF	$ 200.00	$ -			at grade pad
	0	Each	$ 50,000.00	$ -			gates and signals
		Total			$ -	$ -	
Paving	190080	SF	$ 4.45	$ 845,856		$ -	arterial street asphalt paving - see separate calcs
	0	SF	$ 2.65	$ -		$ -	asphalt shoulder - see separate calcs
		15% Reduct.		$ (126,878)	$ -	$ -	if widening, cost = 85% of total paving
Curb and Gutter	10560	FT	$ 202.57	$ 137,097		$ -	concrete cost Item # 702-03, 0.06409 CY/LF (DWG RP-NMC-10) Unit price in CY
		Total			$ 856,075	$ 856,000	
Concrete	42240	SF	$ 3.37		$ 142,349	$ 142,000	Sidewalks, Item # 701-01.01
Retaining Walls	660	FT	$ 107.89		$ 71,206	$ 71,000	Item #604-10.01 concrete and Std. Dwg. EL-W-2 for a 4' tall gravity
Maintenance of Traffic	4	Each	$ 25,000.00		$ 100,000	$ 100,000	estimate $25,000 per existing road crossed
Topsoil	8000	CY	$ 2.51		$ 20,080	$ 20,000	Item # 203-04
Seeding	211200	s.f.	$ 26.92		$ 7,107	$ 7,000	Item # 801-01 sq. ft to be seeded/1000 x 1.25 = units. Unit price in units
Sodding	0	SY	$ 2.41		$ -	$ -	Item # 803-01
Signing	1	Mile	$ 1,000.00		$ 1,000	$ 5,000	$1000/mile rural or $2000/mile urban (or $250/sign for standard signs)
Lighting	10	Each	$ 2,450.00		$ 24,500	$ 25,000	Item # 714-08
Signalization	1	Each	$150,000.00		$ 150,000	$ 150,000	per signalized intersesction
Fence	0	LF	$ 8.64		$ -	$ -	Chain Link 6', Item # 707-01.11
Guardrail	2640	LF	$ 20.30	$ 53,592			Item 705-02.03
Median Barrier	0	LF	$ 155.10	$ -			Item #711-04 Conc glare screen median barrier
		Total			$ 53,592	$ 54,000	
Rip Rap Slope Prot.	200	Ton	$ 27.67		$ 5,534	$ 6,000	Item # 709-05.06 1.5 ft deep, 1.75 Tons/CY

Total: **$ 2,110,000**

Route:
County: Maury and Williamson
Section: n/a - cost per mile estimate
Length: 1 Miles
X-Section: 2 lane existing to 4 lane rural cross section

Stream Crossings: Estimate 2 per mile

Item	Quantity	Unit	2007 Unit Cost	Sub-Total	Total Cost	Rounded Cost	Description/Quantity Calculation
Clear and Grubbing	20	Acres	$ 1,000.00		$ 20,000	$ 20,000	area inside prop. R.O.W.
Earthwork							
Excavation (Cut)	148000	CY	$ 4.05	$ -			Item # 203-01
Borrow (Fill)	0	CY	$ 5.89	$ -			Item # 203-03
		Total			$ -	$ 598,500	Est. based upon 1/2 paving cost for rural widening, 1/4 paving cost for C&G, and 1.0 paving cost for new location.
Pavement Removal	500	SY	$ 3.88	$ 1,940	$ 1,940	$ 5,000	Item #202-03.01 removal of asphalt pavement.
Drainage	0	FT Pipe	$ 44.21	$ -			24" pipe assumed length of project (C&G) Item # 607-05.02
	0	Catchbasins	$ 2,691.27	$ -			611-12.02, Type 12 CB 4-8' depth, 1 every 300' on each side of the street affected
	400	FT Pipe	$ 136.19	$ 54,476			48" pipe assummed at each stream crossings Item #607-09.02
	0	Medianbasin	$ 2,691.27	$ -			1 every 800' when have a median, estimate same price as catchbasins
	0	Medianpipe	$ 37.74	$ -			18" pipe every 800', length = 80' Item #607-03.02
		10% Factor		$ 5,448			
		Total			$ 59,924	$ 60,000	
Structures	0	SF	$ 150.00	$ -	$ -	$ -	Estimate for simple bridges
Railroad Crossing	0	Each	$ 50,000.00	$ -			common equipment
	0	FT	$ 200.00	$ -			per foot runaround
	0	SF	$ 70.00	$ -			vehicular bridge
	0	SF	$ 250.00	$ -			RR bridge
	0	LF	$ 200.00	$ -			at grade pad
	0	Each	$ 50,000.00	$ -			gates and signals
		Total			$ -	$ -	
Paving	253440	SF	$ 4.45	$ 1,127,808		$ -	arterial street asphalt paving - see separate calcs
	105600	SF	$ 2.65	$ 279,840		$ -	asphalt shoulder - see separate calcs
		15% Reduct.		$ (211,147)		$ -	if widening, cost = 85% of total paving
Curb and Gutter	0	FT	$ 202.57	$ -		$ -	concrete cost Item # 702-03, 0.06409 CY/LF (DWG RP-NMC-10) Unit price in CY
		Total			$ 1,196,501	$ 1,197,000	
Concrete	0	SF	$ 3.37		$ -	$ -	Sidewalks, Item # 701-01.01
Retaining Walls	660	FT	$ 107.89		$ 71,206	$ 71,000	Item #604-10.01 concrete and Std. Dwg. EL-W-2 for a 4' tall gravity
Maintenance of Traffic	4	Each	$ 25,000.00		$ 100,000	$ 100,000	estimate $25,000 per existing road crossed
Topsoil	8000	CY	$ 2.51		$ 20,080	$ 20,000	Item # 203-04
Seeding	211200	s.f.	$ 26.92		$ 7,107	$ 7,000	Item # 801-01 sq. ft to be seeded/1000 x 1.25 = units. Unit price in units
Sodding	0	SY	$ 2.41		$ -	$ -	Item # 803-01
Signing	1	Mile	$ 1,000.00		$ 1,000	$ 5,000	$1000/mile rural or $2000/mile urban (or $250/sign for standard signs)
Lighting	10	Each	$ 2,450.00		$ 24,500	$ 25,000	Item # 714-08
Signalization	1	Each	$150,000.00		$ 150,000	$ 150,000	per signalized intersesction
Fence	0	LF	$ 8.64		$ -	$ -	Chain Link 6', Item # 707-01.11
Guardrail	2640	LF	$ 20.30	$ 53,592			Item 705-02.03
Median Barrier	0	LF	$ 155.10	$ -			Item #711-04 Conc glare screen median barrier
		Total			$ 53,592	$ 54,000	
Rip Rap Slope Prot.	200	Ton	$ 27.67		$ 5,534	$ 6,000	Item # 709-05.06 1.5 ft deep, 1.75 Tons/CY

Total: **$ 2,319,000**

Route:
County: Maury and Williamson
Section: n/a - cost per mile estimate
Length: 1 Miles
X-Section: 2 lane existing to 5 lane urban cross section

Stream Crossings: Estimate 2 per mile

Item	Quantity	Unit	2007 Unit Cost	Sub-Total	Total Cost	Rounded Cost	Description/Quantity Calculation
Clear and Grubbing	20	Acres	$ 1,000.00		$ 20,000	$ 20,000	area inside prop. R.O.W.
Earthwork							
Excavation (Cut)	82000	CY	$ 4.05	$ -			Item # 203-01
Borrow (Fill)	0	CY	$ 5.89	$ -			Item # 203-03
		Total			$ -	$ 333,750	Est. based upon 1/2 paving cost for rural widening, 1/4 paving cost for C&G, and 1.0 paving cost for new location.
Pavement Removal	500	SY	$ 3.88	$ 1,940	$ 1,940	$ 5,000	Item #202-03.01 removal of asphalt pavement.
Drainage	5280	FT Pipe	$ 44.21	$ 233,429			24" pipe assumed length of project (C&G) Item # 607-05.02
	40	Catchbasins	$ 2,691.27	$ 107,651			611-12.02, Type 12 CB 4-8' depth, 1 every 300' on each side of the street affected
	400	FT Pipe	$ 136.19	$ 54,476			48" pipe assummed at each stream crossings Item #607-09.02
	0	Medianbasin	$ 2,691.27	$ -			1 every 800' when have a median, estimate same price as catchbasins
	0	Medianpipe	$ 37.74	$ -			18" pipe every 800', length = 80' Item #607-03.02
		10% Factor		$ 39,556			
		Total			$ 435,111	$ 435,000	
Structures	0	SF	$ 150.00	$ -	$ -	$ -	Estimate for simple bridges
Railroad Crossing	0	Each	$ 50,000.00	$ -			common equipment
	0	FT	$ 200.00	$ -			per foot runaround
	0	SF	$ 70.00	$ -			vehicular bridge
	0	SF	$ 250.00	$ -			RR bridge
	0	LF	$ 200.00	$ -			at grade pad
	0	Each	$ 50,000.00	$ -			gates and signals
		Total			$ -	$ -	
Paving	316800	SF	$ 4.45	$ 1,409,760		$ -	arterial street asphalt paving - see separate calcs
	0	SF	$ 2.65	$ -		$ -	asphalt shoulder - see separate calcs
		15% Reduct.		$ (211,464)		$ -	if widening, cost = 85% of total paving
Curb and Gutter	10560	FT	$ 202.57	$ 137,097		$ -	concrete cost Item # 702-03, 0.06409 CY/LF (DWG RP-NMC-10) Unit price in CY
		Total			$ 1,335,393	$ 1,335,000	
Concrete	42240	SF	$ 3.37		$ 142,349	$ 142,000	Sidewalks, Item # 701-01.01
Retaining Walls	660	FT	$ 107.89		$ 71,206	$ 71,000	Item #604-10.01 concrete and Std. Dwg. EL-W-2 for a 4' tall gravity
Maintenance of Traffic	4	Each	$ 25,000.00		$ 100,000	$ 100,000	estimate $25,000 per existing road crossed
Topsoil	8000	CY	$ 2.51		$ 20,080	$ 20,000	Item # 203-04
Seeding	211200	s.f.	$ 26.92		$ 7,107	$ 7,000	Item # 801-01 sq. ft to be seeded/1000 x 1.25 = units. Unit price in units
Sodding	0	SY	$ 2.41		$ -	$ -	Item # 803-01
Signing	1	Mile	$ 1,000.00		$ 1,000	$ 5,000	$1000/mile rural or $2000/mile urban (or $250/sign for standard signs)
Lighting	10	Each	$ 2,450.00		$ 24,500	$ 25,000	Item # 714-08
Signalization	1	Each	$150,000.00		$ 150,000	$ 150,000	per signalized intersesction
Fence	0	LF	$ 8.64		$ -	$ -	Chain Link 6', Item # 707-01.11
Guardrail	2640	LF	$ 20.30	$ 53,592			Item 705-02.03
Median Barrier	0	LF	$ 155.10	$ -			Item #711-04 Conc glare screen median barrier
		Total			$ 53,592	$ 54,000	
Rip Rap Slope Prot.	200	Ton	$ 27.67		$ 5,534	$ 6,000	Item # 709-05.06 1.5 ft deep, 1.75 Tons/CY

Total: **$ 2,709,000**

Route:
County: Maury and Williamson
Section: n/a - cost per mile estimate
Length: 1 Miles
X-Section: 3 lane existing to 4 lane rural cross section

Stream Crossings: Estimate 2 per mile

Item	Quantity	Unit	2007 Unit Cost	Sub-Total	Total Cost	Rounded Cost	Description/Quantity Calculation
Clear and Grubbing	20	Acres	$ 1,000.00		$ 20,000	$ 20,000	area inside prop. R.O.W.
Earthwork							
Excavation (Cut)	148000	CY	$ 4.05	$ -			Item # 203-01
Borrow (Fill)	0	CY	$ 5.89	$ -			Item # 203-03
		Total			$ -	$ 598,500	Est. based upon 1/2 paving cost for rural widening, 1/4 paving cost for C&G, and 1.0 paving cost for new location.
Pavement Removal	500	SY	$ 3.88	$ 1,940	$ 1,940	$ 5,000	Item #202-03.01 removal of asphalt pavement.
Drainage	0	FT Pipe	$ 44.21	$ -			24" pipe assumed length of project (C&G) Item # 607-05.02
	0	Catchbasins	$ 2,691.27	$ -			611-12.02, Type 12 CB 4-8' depth, 1 every 300' on each side of the street affected
	400	FT Pipe	$ 136.19	$ 54,476			48" pipe assummed at each stream crossings Item #607-09.02
	0	Medianbasin	$ 2,691.27	$ -			1 every 800' when have a median, estimate same price as catchbasins
	0	Medianpipe	$ 37.74	$ -			18" pipe every 800', length = 80' Item #607-03.02
		10% Factor		$ 5,448			
		Total			$ 59,924	$ 60,000	
Structures	0	SF	$ 150.00	$ -	$ -	$ -	Estimate for simple bridges
Railroad Crossing	0	Each	$ 50,000.00	$ -			common equipment
	0	FT	$ 200.00	$ -			per foot runaround
	0	SF	$ 70.00	$ -			vehicular bridge
	0	SF	$ 250.00	$ -			RR bridge
	0	LF	$ 200.00	$ -			at grade pad
	0	Each	$ 50,000.00	$ -			gates and signals
		Total			$ -	$ -	
Paving	253440	SF	$ 4.45	$ 1,127,808		$ -	arterial street asphalt paving - see separate calcs
	105600	SF	$ 2.65	$ 279,840		$ -	asphalt shoulder - see separate calcs
		15% Reduct.		$ (211,147)		$ -	if widening, cost = 85% of total paving
Curb and Gutter	0	FT	$ 202.57	$ -		$ -	concrete cost Item # 702-03, 0.06409 CY/LF (DWG RP-NMC-10) Unit price in CY
		Total			$ 1,196,501	$ 1,197,000	
Concrete	0	SF	$ 3.37		$ -	$ -	Sidewalks, Item # 701-01.01
Retaining Walls	660	FT	$ 107.89		$ 71,206	$ 71,000	Item #604-10.01 concrete and Std. Dwg. EL-W-2 for a 4' tall gravity
Maintenance of Traffic	4	Each	$ 25,000.00		$ 100,000	$ 100,000	estimate $25,000 per existing road crossed
Topsoil	8000	CY	$ 2.51		$ 20,080	$ 20,000	Item # 203-04
Seeding	211200	s.f.	$ 26.92		$ 7,107	$ 7,000	Item # 801-01 sq. ft to be seeded/1000 x 1.25 = units. Unit price in units
Sodding	0	SY	$ 2.41		$ -	$ -	Item # 803-01
Signing	1	Mile	$ 1,000.00		$ 1,000	$ 5,000	$1000/mile rural or $2000/mile urban (or $250/sign for standard signs)
Lighting	10	Each	$ 2,450.00		$ 24,500	$ 25,000	Item # 714-08
Signalization	1	Each	$150,000.00		$ 150,000	$ 150,000	per signalized intersesction
Fence	0	LF	$ 8.64		$ -	$ -	Chain Link 6', Item # 707-01.11
Guardrail	2640	LF	$ 20.30	$ 53,592			Item 705-02.03
Median Barrier	0	LF	$ 155.10	$ -			Item #711-04 Conc glare screen median barrier
		Total			$ 53,592	$ 54,000	
Rip Rap Slope Prot.	200	Ton	$ 27.67		$ 5,534	$ 6,000	Item # 709-05.06 1.5 ft deep, 1.75 Tons/CY

Total: **$ 2,319,000**

Route:
County: Maury and Williamson
Section: n/a - cost per mile estimate
Length: 1 Miles
X-Section: 3 lane existing to 5 lane urban cross section

Stream Crossings: Estimate 2 per mile

Item	Quantity	Unit	2007 Unit Cost	Sub-Total	Total Cost	Rounded Cost	Description/Quantity Calculation
Clear and Grubbing	20	Acres	$ 1,000.00		$ 20,000	$ 20,000	area inside prop. R.O.W.
Earthwork							
Excavation (Cut)	82000	CY	$ 4.05	$ -			Item # 203-01
Borrow (Fill)	0	CY	$ 5.89	$ -			Item # 203-03
		Total			$ -	$ 333,750	Est. based upon 1/2 paving cost for rural widening, 1/4 paving cost for C&G, and 1.0 paving cost for new location.
Pavement Removal	500	SY	$ 3.88	$ 1,940	$ 1,940	$ 5,000	Item #202-03.01 removal of asphalt pavement.
Drainage	5280	FT Pipe	$ 44.21	$ 233,429			24" pipe assumed length of project (C&G) Item # 607-05.02
	40	Catchbasins	$ 2,691.27	$ 107,651			611-12.02, Type 12 CB 4-8' depth, 1 every 300' on each side of the street affected
	400	FT Pipe	$ 136.19	$ 54,476			48" pipe assummed at each stream crossings Item #607-09.02
	0	Medianbasin	$ 2,691.27	$ -			1 every 800' when have a median, estimate same price as catchbasins
	0	Medianpipe	$ 37.74	$ -			18" pipe every 800', length = 80' Item #607-03.02
		10% Factor		$ 39,556			
		Total			$ 435,111	$ 435,000	
Structures	0	SF	$ 150.00	$ -	$ -	$ -	Estimate for simple bridges
Railroad Crossing	0	Each	$ 50,000.00	$ -			common equipment
	0	FT	$ 200.00	$ -			per foot runaround
	0	SF	$ 70.00	$ -			vehicular bridge
	0	SF	$ 250.00	$ -			RR bridge
	0	LF	$ 200.00	$ -			at grade pad
	0	Each	$ 50,000.00	$ -			gates and signals
		Total			$ -	$ -	
Paving	316800	SF	$ 4.45	$ 1,409,760		$ -	arterial street asphalt paving - see separate calcs
	0	SF	$ 2.65	$ -		$ -	asphalt shoulder - see separate calcs
		15% Reduct.		$ (211,464)		$ -	if widening, cost = 85% of total paving
Curb and Gutter	10560	FT	$ 202.57	$ 137,097		$ -	concrete cost Item # 702-03, 0.06409 CY/LF (DWG RP-NMC-10) Unit price in CY
		Total			$ 1,335,393	$ 1,335,000	
Concrete	42240	SF	$ 3.37		$ 142,349	$ 142,000	Sidewalks, Item # 701-01.01
Retaining Walls	660	FT	$ 107.89		$ 71,206	$ 71,000	Item #604-10.01 concrete and Std. Dwg. EL-W-2 for a 4' tall gravity
Maintenance of Traffic	4	Each	$ 25,000.00		$ 100,000	$ 100,000	estimate $25,000 per existing road crossed
Topsoil	8000	CY	$ 2.51		$ 20,080	$ 20,000	Item # 203-04
Seeding	211200	s.f.	$ 26.92		$ 7,107	$ 7,000	Item # 801-01 sq. ft to be seeded/1000 x 1.25 = units. Unit price in units
Sodding	0	SY	$ 2.41		$ -	$ -	Item # 803-01
Signing	1	Mile	$ 1,000.00		$ 1,000	$ 5,000	$1000/mile rural or $2000/mile urban (or $250/sign for standard signs)
Lighting	10	Each	$ 2,450.00		$ 24,500	$ 25,000	Item # 714-08
Signalization	1	Each	$150,000.00		$ 150,000	$ 150,000	per signalized intersesction
Fence	0	LF	$ 8.64		$ -	$ -	Chain Link 6', Item # 707-01.11
Guardrail	2640	LF	$ 20.30	$ 53,592			Item 705-02.03
Median Barrier	0	LF	$ 155.10	$ -			Item #711-04 Conc glare screen median barrier
		Total			$ 53,592	$ 54,000	
Rip Rap Slope Prot.	200	Ton	$ 27.67		$ 5,534	$ 6,000	Item # 709-05.06 1.5 ft deep, 1.75 Tons/CY

Total: **$ 2,709,000**

Route:
County: Maury and Williamson
Section: n/a - cost per mile estimate
Length: 1 Miles
X-Section: New 4 lane rural cross section

Stream Crossings: Estimate 2 per mile

Item	Quantity	Unit	2007 Unit Cost	Sub-Total	Total Cost	Rounded Cost	Description/Quantity Calculation
Clear and Grubbing	20	Acres	$ 1,000.00		$ 20,000	$ 20,000	area inside prop. R.O.W.
Earthwork							
Excavation (Cut)	348000	CY	$ 4.05	$ -			Item # 203-01
Borrow (Fill)	0	CY	$ 5.89	$ -			Item # 203-03
		Total			$ -	$ 1,408,000	Est. based upon 1/2 paving cost for rural widening, 1/4 paving cost for C&G, and 1.0 paving cost for new location.
Pavement Removal	500	SY	$ 3.88	$ 1,940	$ 1,940	$ 5,000	Item #202-03.01 removal of asphalt pavement.
Drainage	0	FT Pipe	$ 44.21	$ -			24" pipe assumed length of project (C&G) Item # 607-05.02
	0	Catchbasins	$ 2,691.27	$ -			611-12.02, Type 12 CB 4-8' depth, 1 every 300' on each side of the street affected
	400	FT Pipe	$ 136.19	$ 54,476			48" pipe assummed at each stream crossings Item #607-09.02
	0	Medianbasin	$ 2,691.27	$ -			1 every 800' when have a median, estimate same price as catchbasins
	0	Medianpipe	$ 37.74	$ -			18" pipe every 800', length = 80' Item #607-03.02
		10% Factor		$ 5,448			
		Total			$ 59,924	$ 60,000	
Structures	0	SF	$ 150.00	$ -	$ -	$ -	Estimate for simple bridges
Railroad Crossing	0	Each	$ 50,000.00	$ -			common equipment
	0	FT	$ 200.00	$ -			per foot runaround
	0	SF	$ 70.00	$ -			vehicular bridge
	0	SF	$ 250.00	$ -			RR bridge
	0	LF	$ 200.00	$ -			at grade pad
	0	Each	$ 50,000.00	$ -			gates and signals
		Total			$ -	$ -	
Paving	253440	SF	$ 4.45	$ 1,127,808		$ -	arterial street asphalt paving - see separate calcs
	105600	SF	$ 2.65	$ 279,840		$ -	asphalt shoulder - see separate calcs
		15% Reduct.		$ -		$ -	if widening, cost = 85% of total paving
Curb and Gutter	0	FT	$ 202.57	$ -		$ -	concrete cost Item # 702-03, 0.06409 CY/LF (DWG RP-NMC-10) Unit price in CY
		Total			$ 1,407,648	$ 1,408,000	
Concrete	0	SF	$ 3.37		$ -	$ -	Sidewalks, Item # 701-01.01
Retaining Walls	660	FT	$ 107.89		$ 71,206	$ 71,000	Item #604-10.01 concrete and Std. Dwg. EL-W-2 for a 4' tall gravity
Maintenance of Traffic	4	Each	$ 25,000.00		$ 100,000	$ 100,000	estimate $25,000 per existing road crossed
Topsoil	8000	CY	$ 2.51		$ 20,080	$ 20,000	Item # 203-04
Seeding	211200	s.f.	$ 26.92		$ 7,107	$ 7,000	Item # 801-01 sq. ft to be seeded/1000 x 1.25 = units. Unit price in units
Sodding	0	SY	$ 2.41		$ -	$ -	Item # 803-01
Signing	1	Mile	$ 1,000.00		$ 1,000	$ 5,000	$1000/mile rural or $2000/mile urban (or $250/sign for standard signs)
Lighting	10	Each	$ 2,450.00		$ 24,500	$ 25,000	Item # 714-08
Signalization	1	Each	$150,000.00		$ 150,000	$ 150,000	per signalized intersesction
Fence	0	LF	$ 8.64		$ -	$ -	Chain Link 6', Item # 707-01.11
Guardrail	2640	LF	$ 20.30	$ 53,592			Item 705-02.03
Median Barrier	0	LF	$ 155.10	$ -			Item #711-04 Conc glare screen median barrier
		Total			$ 53,592	$ 54,000	
Rip Rap Slope Prot.	200	Ton	$ 27.67		$ 5,534	$ 6,000	Item # 709-05.06 1.5 ft deep, 1.75 Tons/CY

Total: **$ 3,339,000**

Route:
County: Maury and Williamson
Section: n/a - cost per mile estimate
Length: 1 Miles
X-Section: New 5 lane urban cross Section

Stream Crossings: Estimate 2 per mile

Item	Quantity	Unit	2007 Unit Cost	Sub-Total	Total Cost	Rounded Cost	Description/Quantity Calculation
Clear and Grubbing	20	Acres	$ 1,000.00		$ 20,000	$ 20,000	area inside prop. R.O.W.
Earthwork							
Excavation (Cut)	382000	CY	$ 4.05	$ -			Item # 203-01
Borrow (Fill)	0	CY	$ 5.89	$ -			Item # 203-03
		Total			$ -	$ 1,547,000	Est. based upon 1/2 paving cost for rural widening, 1/4 paving cost for C&G, and 1.0 paving cost for new location.
Pavement Removal	500	SY	$ 3.88	$ 1,940	$ 1,940	$ 5,000	Item #202-03.01 removal of asphalt pavement.
Drainage	5280	FT Pipe	$ 44.21	$ 233,429			24" pipe assumed length of project (C&G) Item # 607-05.02
	40	Catchbasins	$ 2,691.27	$ 107,651			611-12.02, Type 12 CB 4-8' depth, 1 every 300' on each side of the street affected
	400	FT Pipe	$ 136.19	$ 54,476			48" pipe assummed at each stream crossings Item #607-09.02
	0	Medianbasin	$ 2,691.27	$ -			1 every 800' when have a median, estimate same price as catchbasins
	0	Medianpipe	$ 37.74	$ -			18" pipe every 800', length = 80' Item #607-03.02
		10% Factor		$ 39,556			
		Total			$ 435,111	$ 435,000	
Structures	0	SF	$ 150.00	$ -	$ -	$ -	Estimate for simple bridges
Railroad Crossing	0	Each	$ 50,000.00	$ -			common equipment
	0	FT	$ 200.00	$ -			per foot runaround
	0	SF	$ 70.00	$ -			vehicular bridge
	0	SF	$ 250.00	$ -			RR bridge
	0	LF	$ 200.00	$ -			at grade pad
	0	Each	$ 50,000.00	$ -			gates and signals
		Total			$ -	$ -	
Paving	316800	SF	$ 4.45	$ 1,409,760		$ -	arterial street asphalt paving - see separate calcs
	0	SF	$ 2.65	$ -		$ -	asphalt shoulder - see separate calcs
		15% Reduct.		$ -		$ -	if widening, cost = 85% of total paving
Curb and Gutter	10560	FT	$ 202.57	$ 137,097		$ -	concrete cost Item # 702-03, 0.06409 CY/LF (DWG RP-NMC-10) Unit price in CY
		Total			$ 1,546,857	$ 1,547,000	
Concrete	42240	SF	$ 3.37		$ 142,349	$ 142,000	Sidewalks, Item # 701-01.01
Retaining Walls	660	FT	$ 107.89		$ 71,206	$ 71,000	Item #604-10.01 concrete and Std. Dwg. EL-W-2 for a 4' tall gravity
Maintenance of Traffic	4	Each	$ 25,000.00		$ 100,000	$ 100,000	estimate $25,000 per existing road crossed
Topsoil	8000	CY	$ 2.51		$ 20,080	$ 20,000	Item # 203-04
Seeding	211200	s.f.	$ 26.92		$ 7,107	$ 7,000	Item # 801-01 sq. ft to be seeded/1000 x 1.25 = units. Unit price in units
Sodding	0	SY	$ 2.41		$ -	$ -	Item # 803-01
Signing	1	Mile	$ 1,000.00		$ 1,000	$ 5,000	$1000/mile rural or $2000/mile urban (or $250/sign for standard signs)
Lighting	10	Each	$ 2,450.00		$ 24,500	$ 25,000	Item # 714-08
Signalization	1	Each	$150,000.00		$ 150,000	$ 150,000	per signalized intersesction
Fence	0	LF	$ 8.64		$ -	$ -	Chain Link 6', Item # 707-01.11
Guardrail	2640	LF	$ 20.30	$ 53,592			Item 705-02.03
Median Barrier	0	LF	$ 155.10	$ -			Item #711-04 Conc glare screen median barrier
		Total			$ 53,592	$ 54,000	
Rip Rap Slope Prot.	200	Ton	$ 27.67		$ 5,534	$ 6,000	Item # 709-05.06 1.5 ft deep, 1.75 Tons/CY

Total: **$ 4,134,000**

Route:
County: Maury and Williamson
Section: n/a - cost per mile estimate
Length: 1 Miles
X-Section: Rehabilitate 3 lane urban cross Section

Stream Crossings: Estimate 2 per mile

Item	Quantity	Unit	2007 Unit Cost	Sub-Total	Total Cost	Rounded Cost	Description/Quantity Calculation
Clear and Grubbing	0	Acres	$ 1,000.00		$ -	$ -	area inside prop. R.O.W.
Earthwork							
Excavation (Cut)	0	CY	$ 4.05	$ -			Item # 203-01
Borrow (Fill)	0	CY	$ 5.89	$ -			Item # 203-03
		Total			$ -	$ -	Est. based upon 1/2 paving cost for rural widening, 1/4 paving cost for C&G, and 1.0 paving cost for new location.
Pavement Removal	21120	SY	$ 3.88	$ 81,946	$ 81,946	$ 82,000	Item #202-03.01 removal of asphalt pavement.
Drainage	0	FT Pipe	$ 44.21	$ -			24" pipe assumed length of project (C&G) Item # 607-05.02
	0	Catchbasins	$ 2,691.27	$ -			611-12.02, Type 12 CB 4-8' depth, 1 every 300' on each side of the street affected
	0	FT Pipe	$ 136.19	$ -			48" pipe assummed at each stream crossings Item #607-09.02
	0	Medianbasin	$ 2,691.27	$ -			1 every 800' when have a median, estimate same price as catchbasins
	0	Medianpipe	$ 37.74	$ -			18" pipe every 800', length = 80' Item #607-03.02
		10% Factor		$ -			
		Total			$ -	$ -	
Structures	0	SF	$ 150.00	$ -	$ -	$ -	Estimate for simple bridges
Railroad Crossing	0	Each	$ 50,000.00	$ -			common equipment
	0	FT	$ 200.00	$ -			per foot runaround
	0	SF	$ 70.00	$ -			vehicular bridge
	0	SF	$ 250.00	$ -			RR bridge
	0	LF	$ 200.00	$ -			at grade pad
	0	Each	$ 50,000.00	$ -			gates and signals
		Total			$ -	$ -	
Paving	190080	SF	$ 0.89	$ 169,171		$ -	arterial street asphalt paving - see separate calcs
	0	SF	$ 2.65	$ -		$ -	asphalt shoulder - see separate calcs
		15% Reduct.		$ -		$ -	if widening, cost = 85% of total paving
Curb and Gutter	0	FT	$ 202.57	$ -		$ -	concrete cost Item # 702-03, 0.06409 CY/LF (DWG RP-NMC-10) Unit price in CY
		Total			$ 169,171	$ 169,000	
Concrete	42240	SF	$ 3.37		$ 142,349	$ 142,000	Sidewalks, Item # 701-01.01
Retaining Walls	0	FT	$ 107.89		$ -	$ -	Item #604-10.01 concrete and Std. Dwg. EL-W-2 for a 4' tall gravity
Maintenance of Traffic	4	Each	$ 25,000.00		$ 100,000	$ 100,000	estimate $25,000 per existing road crossed
Topsoil	0	CY	$ 2.51		$ -	$ -	Item # 203-04
Seeding	0	s.f.	$ 26.92		$ -	$ -	Item # 801-01 sq. ft to be seeded/1000 x 1.25 = units. Unit price in units
Sodding	0	SY	$ 2.41		$ -	$ -	Item # 803-01
Signing	1	Mile	$ 1,000.00		$ 1,000	$ 5,000	$1000/mile rural or $2000/mile urban (or $250/sign for standard signs)
Lighting	10	Each	$ 2,450.00		$ 24,500	$ 25,000	Item # 714-08
Signalization	0	Each	$150,000.00		$ -	$ -	per signalized intersesction
Fence	0	LF	$ 8.64		$ -	$ -	Chain Link 6', Item # 707-01.11
Guardrail	0	LF	$ 20.30	$ -			Item 705-02.03
Median Barrier	0	LF	$ 155.10	$ -			Item #711-04 Conc glare screen median barrier
		Total			$ -	$ -	
Rip Rap Slope Prot.	0	Ton	$ 27.67		$ -	$ -	Item # 709-05.06 1.5 ft deep, 1.75 Tons/CY

Total: **$ 523,000**

SR-6 TPR Structures Cost Data Sheet

Route	Log Mile	Section ID	Description	Estimated Length (ft.)	Estimated Width (ft.)	Cost per S.F.	Estimated Structure Cost
SR-6	0.17	2	Crossing McCutcheon Creek	60	84	$ 150	$ 756,000
SR-6	4.66	3	Crossing Branch	60	84	$ 150	$ 756,000
SR-6	5.72	5	Crossing West Harpeth River	120	84	$ 150	$ 1,512,000
SR-6	8.11	5	Crossing Branch	60	84	$ 150	$ 756,000
SR-6	8.89	6	Exist. Crossing CSX	200	84	$ 300	$ 5,040,000
W. Bypass	n/a	n/a	Prop. Crossing CSX	200	84	$ 300	$ 5,040,000
W. Bypass	n/a	n/a	Prop. Crossing CSX	200	84	$ 300	$ 5,040,000

Route Utility Cost Estimate Calculations

Option: All
Route: SR-6 and Bypasses
County: Maury and Williamson
Length: 1 Mile Estimate for Cost per Mile

Item	Quantity	Unit	Unit Cost	Total Cost	Description/Quantity Calculation
Water Line	2640	FT	$ 36	$ 95,000	1/2 project length
Sewer Line	2640	FT	$ 22	$ 58,000	1/2 project length
Gas Line	2640	FT	$ 12	$ 32,000	1/2 project length
Electric & Phone Line	20	Pole -Each	$ 3,600	$ 72,000	Entire project length, estimated 1 pole every 100 yards

Total: **$ 260,000**

2008 COST DATA SHEET

Base Per Mile ROW Cost $930,000

Right Of Way (ROW) Factor

Area	Factor	TDOT Estimated Cost per Mile	For Widening		For New Const.	
			Low Estimate (50%)	High Estimate (85%)	Low Estimate (85%)	High Estimate (1.15%)
CBD	3.25	$3,022,500	$1,511,000	$2,569,000	$2,569,000	$3,476,000
CBD Urbanized	12.50	$11,625,000	$5,813,000	$9,881,000	$9,881,000	$13,369,000
Heavy Commercial (High Rise, Large Building)	3.25	$3,022,500	$1,511,000	$2,569,000	$2,569,000	$3,476,000
Strip Commercial	3.25	$3,022,500	$1,511,000	$2,569,000	$2,569,000	$3,476,000
Fringe (Mixed, Residential/Commercial)	1.75	$1,627,500	$814,000	$1,383,000	$1,383,000	$1,872,000
Industries (Factories, Warehouse)	1.75	$1,627,500	$814,000	$1,383,000	$1,383,000	$1,872,000
Light Residential (1/4- Acres)	1.75	$1,627,500	$814,000	$1,383,000	$1,383,000	$1,872,000
Medium Residential (Acres+)	1.75	$1,627,500	$814,000	$1,383,000	$1,383,000	$1,872,000
Heavy Residential (Apartments)	1.75	$1,627,500	$814,000	$1,383,000	$1,383,000	$1,872,000
Public Use (Parks, School)	1.75	$1,627,500	$814,000	$1,383,000	$1,383,000	$1,872,000
Rural	1.00	$930,000	$465,000	$791,000	$791,000	$1,070,000

Note: TDOT provided estimated cost per mile for new construction. Percentages of the cost per mile taken into account for New Construction (Bypass) and widening (SR-6) Sections.

For SR-6 widening, Section 1 utilizes "CBD Urbanized" (for new construction due to compact adjacent development), Section 2 utilizes "Strip Commercial", Section 3-5 utilizes "Rural".

For the Bypass Options, "Rural" for new construction is utilized.

Paving Cost by Cross Section
JHS

City Street Mainline:

Item No.	Description	Units	2007 Unit Cost	Thickness (Inches)	Cost per S.F.	Based On
411-01.10	Surface AC (PG64-22) GR "D"	Ton	$ 60.66	1.25	$ 0.45	Design Guidelines 4-411.00
307-01.08	Binder AC (PG64-22) GR "B-M2"	Ton	$ 56.40	2	$ 0.71	Design Guidelines 4-307.00
307-01.01	Black Base AC (PG64-22) GR "A"	Ton	$ 57.18	3	$ 1.10	Design Guidelines 4-307.00
303-01	Mineral Agg Base GRA "D"	Ton	$ 14.18	8	$ 0.71	Design Guidelines 4-303.00
Total:				**14.25**	**$ 2.96**	

Arterial (Asphalt) Mainline:

Item No.	Description	Units	2007 Unit Cost	Thickness (Inches)	Cost per S.F.	Based On
411-02.10	Bituminous Surface	Tons	$ 62.68	1.25	$ 0.46	Design Guidelines 4-411.00
403-01	Tack Coat	Tons	$ 339.50	0.00	$ 0.00	Design Guidelines 4-403.00
307-02.08	Bituminous Binder	Tons	$ 57.47	2.00	$ 0.72	Design Guidelines 4-307.00
307-02.01	Bituminious Base	Tons	$ 55.79	6.50	$ 2.32	Design Guidelines 4-307.00
402-01	Prime Coat	Tons	$ 382.39	0.00	$ 0.06	Design Guidelines 4-402.00
402-02		Tons	$ 18.19		$ 0.01	Design Guidelines 4-402.00
303-01	Mineral Aggregate Base	Tons	$ 14.18	10.00	$ 0.89	Design Guidleines 4-303.00
Total:				**19.75**	**$ 4.45**	

City Street Overlay (Assume Double Layer of Surface AC)

Item No.	Description	Units	2007 Unit Cost	Thickness (Inches)	Cost per S.F.	Based On
411-01.10	Surface AC (PG64-22) GR "D"	Ton	$ 60.66	2.5	$ 0.89	Design Guidelines 4-411.00
Total:				**2.5**	**$ 0.89**	

Ramp (Concrete) Mainline:

Item No.	Description	Units	2007 Unit Cost	Thickness (Inches)	Cost per S.F.	Based On
501-01.03	Portland Cement Concrete PVMT (Plain	S.Y.	$ 41.91	10.00	$ 4.66	
313-03	Treated Permeable Base	S.Y.	$ 9.63	4.00	$ 1.07	
303-01	Mineral Aggregate Base	Tons	$ 14.18	4.00	$ 0.36	Design Guidleines 4-303.00
Total:				**18**	**$ 6.08**	

City Street Shoulder:

Item No.	Description	Units	2007 Unit Cost	Thickness (Inches)	Cost per S.F.	Based On
411-01.07	Surface AC (PG64-22) GR "E"	Ton	$ 56.92	1.5	$ 0.49	Design Guidelines 4-411.00
303-01	Mineral Agg Base GRA "D"	Ton	$ 14.18	12.75	$ 1.13	Design Guidelines 4-303.00
Total:				**14.25**	**$ 1.62**	

Arterial and Ramp (Asphalt) Shoulder:

Item No.	Description	Units	2007 Unit Cost	Thickness (Inches)	Cost per S.F.	Based On
411-01.07	Bituminous Surface	Tons	$ 56.92	1.25	$ 0.41	Design Guidelines 4-411.00
403-01	Tack Coat	Tons	$ 339.50	0.00	$ 0.00	Design Guidelines 4-403.00
307-01.08	Bituminous Binder	Tons	$ 56.40	2.00	$ 0.71	Design Guidelines 4-307.00
402-01	Prime Coat	Tons	$ 382.39	0.00	$ 0.06	Design Guidelines 4-402.00
402-02		Tons	$ 18.19		$ 0.01	Design Guidelines 4-402.00
303-01	Mineral Aggregate Base	Tons	$ 14.18	16.50	$ 1.47	Design Guidleines 4-303.00
Total:				**19.75**	**$ 2.65**	

= referenced from previous input price

TRAFFIC CALCULATIONS

Appendix

SR-6 (US-31) TRAFFIC STUDY

MAURY AND WILLIAMSON COUNTIES, TENNESSEE

L.M. 32.47(MAURY COUNTY) TO 10.03 (WILLIAMSON COUNTY)

PIN # 111040.00

PREPARED BY:

Florence & Hutcheson, Inc.
CONSULTING ENGINEERS

FOR:

TDOT Go.

TENNESSEE DEPARTMENT OF TRANSPORTATION
PROJECT PLANNING DIVISION

Updated 8/08

TRAFFIC PROJECTIONS

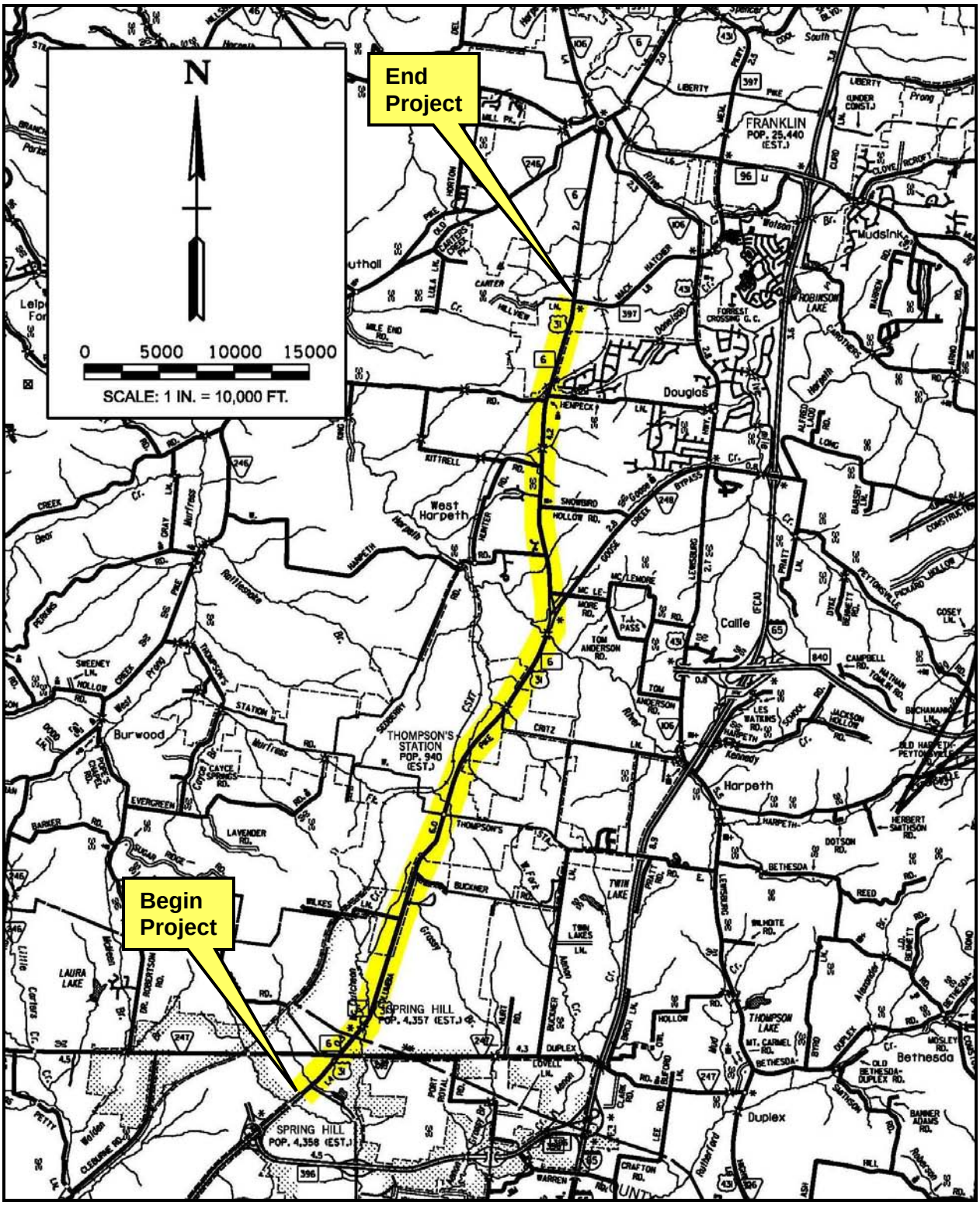
County: Maury and Williamson
Location: SR-6 (US-31) from Log Mile (L.M.) 32.47 (Kedron Road) to L.M. 10.03 (Mack Hatcher Parkway)
Date of Counts: June, 2008

1.0 DESCRIPTION OF PROJECT AND BACKGROUND

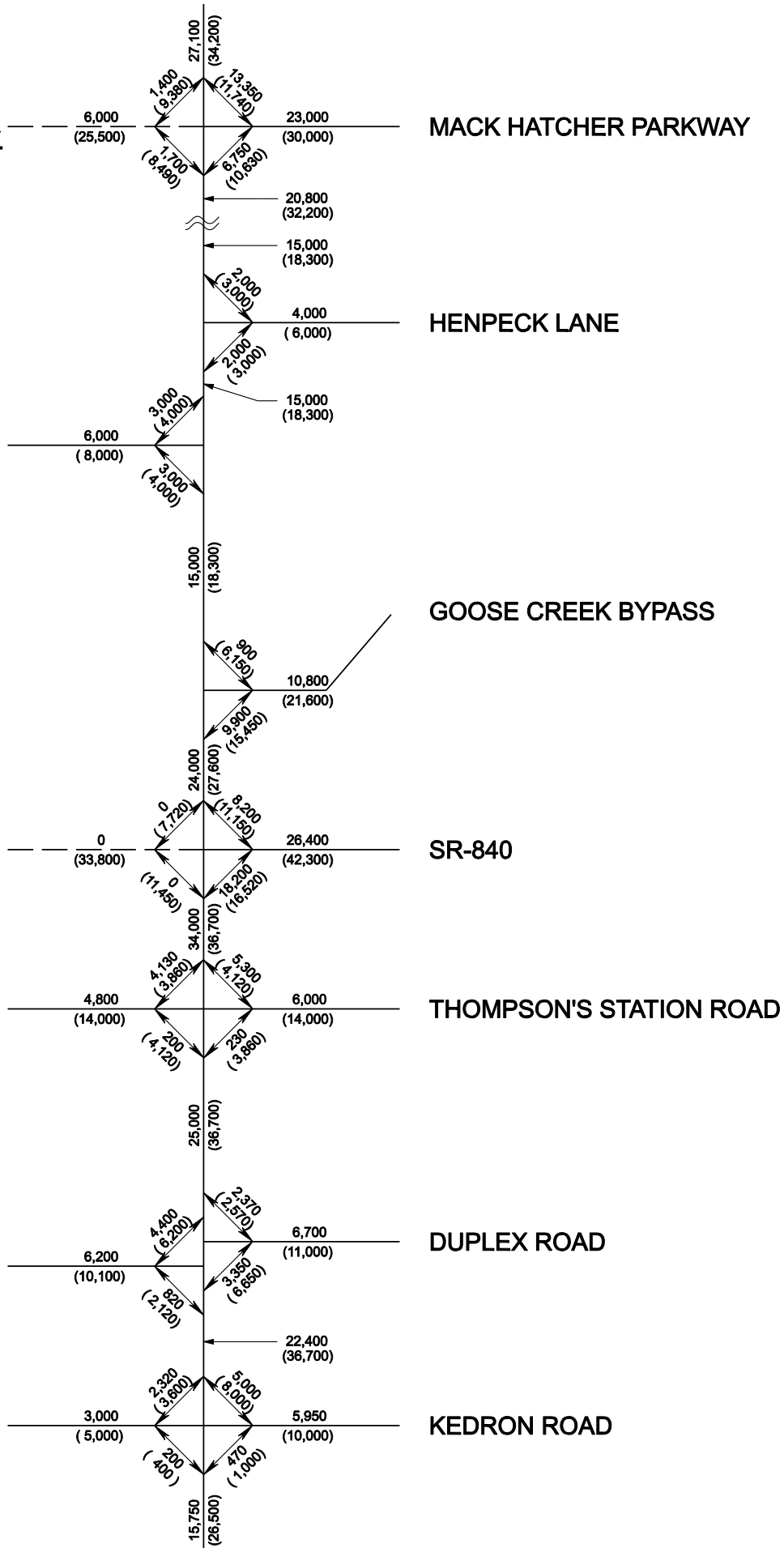
The traffic projections provided in this Appendix are utilized in the SR-6 (US-31) Transportation Planning Report (TPR) in Maury and Williamson Counties, Tennessee. The Annual Average Daily Traffic (AADT) are projected for the years 2014 and 2034. The AADT turning volumes are included in these projections.

A map of the study area is provided in **Exhibit 1.1. Vicinity Map**. The results of the traffic projections are provided in the form of a line sketch following the Vicinity Map. A discussion of the traffic projection calculations is provided.

EXHIBIT 1.1 VICINITY MAP



SR-6 TPR AADT TRAFFIC PROJECTIONS
MAURY & WILLIAMSON COUNTIES



SR-6 TRAFFIC DATA

AADT (2014):	23,300
AADT (2034):	30,700
"K":	8%
D:	70:30
PHF:	0.95
TRUCK %:	3%

SIDE ROAD DATA

AADT (2014):	SEE DIAGRAM
AADT (2034):	SEE DIAGRAM
"K":	8%
D:	60:40
PHF:	0.95
TRUCK %:	3%

LEGEND

— — —	YEAR 2016 IMPROVEMENT
X,XXX	2014 AADT
(X,XXX)	2034 AADT

2.0 INFORMATION USED IN THE PROJECTIONS

8-HOUR TURNING MOVEMENT TRAFFIC COUNTS

The counts were collected in June of 2008 between the hours of: 6-9 am, 11 am – 1 pm, 3 pm to 6 pm at the following locations along SR-6:

1. L.M. 32.47 Kedron Road
2. L.M. 32.99 Beechcroft/Duplex (collected 11/28/2006)
3. L.M. 3.07 Thompson's Station Road
4. L.M. 6.00 Goose Creek Bypass
5. L.M. 8.71 Coleman Road
6. L.M. 8.78 Henpeck Lane
7. L.M. 10.03 Hillview Lane/Mack Hatcher Parkway

The count data collected is provided in the **Calculations and Data Collection** portion of this **Appendix**.

TDOT 24-HOUR AADT HISTORICAL DATA

Count data was attained from TDOT's Tennessee Roadway Information Management System (TRIMS) database. Historical growth rate data was also attained from TDOT's Traffic History GIS system available online at the following address:

http://ww3.tdot.state.tn.us/traffichistory/

The following count locations within the study area were utilized:

1. SR-6 Maury County Station 007
2. SR-6 Maury County Station 009
3. SR-6 Williamson County Station 67
4. SR-6 Williamson County Station 94
5. SR-6 Williamson County Station 197
6. SR-6 Williamson County Station 35
7. Kedron Road Maury County Station 170
8. Beechcroft Road Maury County Station 169
9. Duplex Road Maury County Station 010
10. Thompson Station Williamson County Stations 068 and 066
11. SR-840 Williamson County Station 201
12. Goose Creek Bypass Williamson County Station 095
13. Henpeck Lane Williamson County Station 036
14. Mack Hatcher Parkway Williamson County Station 142

The TDOT count data is provided in the **Calculations and Data Collection** portion of this **Appendix**.

STAKEHOLDER INTERVIEWS

Interviews were conducted to determine known proposed traffic generators of significant size, zoning information, and to attain traffic data from the Metropolitan Planning Organization (MPO) Traffic Model. The following people were contacted:

Nashville Area MPO
Michael Skipper, Director (615) 862-7204
Matt Meservy (615) 862-6887

Williamson County
Mike Matteson, Director of Planning (615) 790-5725
Joe Horne, Community Development Director (615) 790-5725

City of Spring Hill
Ferrell White, Director of Planning (931) 486-2242x212

City of Franklin
Eric Gardner, Engineering Director (615) 791-3218

Town of Thompson's Station
Greg Langeliers, Town Administrator (615) 794-4333

MPO TRAFFIC MODEL

The output from the MPO's Traffic Model was provided for the years 2006, 2016, and 2030. The MPO noted that the travel demand model information is regional in nature and not necessarily intended for corridors. It was recommended to utilize the model as a tool, but not to take the numbers directly as traffic projections. The model should primarily be utilized to observe trends related to roadway improvements and create factors or orders of magnitude to adjust field counts. It was also noted that the model includes future improvements as programmed in the Long Range Transportation Plan (LRTP). The MPO Traffic Model output is provided in the **Calculations and Data Collection** portion of this **Appendix**.

3.0 METHODOLOGY AND PROJECTIONS

DATA COLLECTION

The following data was collected to create the traffic projections along the route. The traffic projections were created for the years 2014 and 2034. The year 2014 was determined as the "existing" year due to it being 5 years from the year the TPR is scheduled to be approved. The year 2034 was determined as the "design" year due to it being 20 years from the "existing" date.

Base AADT	The 2006 base Annual Average Daily Traffic (AADT) was determined from TRIMS, TDOT AADT Traffic Maps, and the MPO Traffic Model. Year 2006 traffic was utilized due to that being a year in the MPO model (there is no 2008 MPO traffic model).
Base Turning Movement Volumes	The base turning movement volumes were determined from field-collected data along the route.
Growth Rate	Growth rates were attained from TDOT's website and the MPO Traffic Model.
Directional Split	The directional split, or "D", was attained from field collected turning movement counts taken along the route and from TRIMS traffic reports. A "D" of 70:30 was observed.
Truck Percentages	The truck percentages were determined from field collected turning movement counts and from TDOT's TRIMS traffic report. A truck percentage of 3% was observed.
"K" Factor	The percentage of traffic in the peak hour compared to the AADT was determined from TRIMS traffic reports and by comparing the observed peak hours collected in the turning movement counts with the 2006 AADT data in TDOT's TRIMS database. A "K" factor of 0.08 was observed.
PHF	The Peak Hour Factor (PHF) was determined from field collected turning movement counts. The PHF observed was 0.95.
Future Traffic Generators	Interviews determined that although considerable development is occurring in the vicinity of the corridor, no planned generators are known that would warrant separate consideration for traffic projections. In other words, historical and MPO Traffic Model growth rates are estimated to account for the future growth in traffic along the corridor. Williamson County noted that the area along the corridor in the county's jurisdiction is zoned 1 dwelling unit per acre (max density), with no commercial development. It was also noted that the primary development was occurring within the cities and towns along the route. These developments are primarily residential.

METHODOLOGY

AADT Calculations

The AADT calculations were performed in two iterations. In the first iteration, the 2006 TDOT AADT traffic data was compared to the 2006 MPO Traffic Model AADT data. A factor comparing the TDOT to the MPO data was attained. This factor was applied to the 2016 and 2030 MPO AADT model information. The 1st iteration 2014 and 2034 AADT was interpolated/extrapolated directly from this data, with no engineering judgment being applied.

The 1st iteration AADT volumes were examined and compared to the MPO models, and to expected volumes utilizing historic growth rates. Engineering judgment was utilized to smooth the AADT volumes along the route and to eliminate unrealistic projections. The 2nd iteration AADT volumes are what appear on the provided Traffic Volume Line Sketch. The procedures described here were utilized for both SR-6 and the side roads. A chart summarizing the various AADT data points utilized in the calculations is provided in **Exhibit 3.1 AADT Traffic Volumes**. The traffic calculations are provided in the **Calculations and Data Collection** portion of this **Appendix**.

EXHIBIT 3.1 AADT TRAFFIC VOLUMES

SR-6 AADT Projections		MPO 2006 AADT	TDOT 2006 AADT	Factor	MPO 2016 AADT	MPO 2030 AADT	2nd Iter. AADT	
From	To						2014	2034
Beginning	Kedron	7,482	14,621	1.95	8,179	12,305	**15,750**	**26,500**
Kedron	Duplex/Beechcroft	13,252	18,007	1.36	17,289	28,315	**22,400**	**36,700**
Duplex/Beechcroft	Thompson's Sta.	18,195	18,007	0.99	27,114	34,843	**25,000**	**36,700**
Thompson's Sta.	SR-840	17,602	21,645	1.23	30,173	35,346	**34,000**	**36,700**
SR-840	Goose Creek	13,341	21,645	1.62	14,912	21,558	**24,000**	**27,600**
Goose Creek	Coleman/Henpeck	13,622	12,646	0.93	14,816	18,643	**15,000**	**18,300**
Coleman/Henpeck	Mack Hatcher	12,027	16,682	1.39	15,715	21,532	**20,800**	**32,200**
MackHatcher	End	8,620	21,835	2.53	14,620	18,435	**27,100**	**34,200**

Side Road	Side of SR-6		MPO 2006 AADT	TDOT 2006 AADT	Factor	MPO 2016 AADT	MPO 2030 AADT	2nd Iter. AADT	
	West	East						2014	2034
Kedron Parkway	x							**3,000**	**5,000**
Kedron Road		x	2254	5,239	2.32	4,613	8,611	**5,950**	**10,000**
Beechcroft Road	x		3922	4,353	1.11	5,979	8,361	**6,200**	**10,100**
Duplex Road		x	3992	6,126	1.53	4,485	6,552	**6,700**	**11,000**
Thompson's Sta. Rd.	x		6543	2,858	0.44	4,806	13,637	**4,800**	**14,000**
Thompson's Sta. Rd.		x	3719	2,571	0.69	4,910	5,083	**6,000**	**14,000**
SR-840	x		n/a	n/a	n/a	14,055	20,639	**0**	**33,800**
SR-840		x	6222	10,060	1.62	18,836	24,583	**26,400**	**42,300**
Goose Creek Byp.		x	1096	8,447	7.71	1,570	4,709	**10,800**	**21,600**
Coleman Road	x		6626			1,254	3,318	**6,000**	**8,000**
Henpeck Lane		x	1770	3,335	1.88	1,541	1,788	**4,000**	**6,000**
Mack Hatcher Pkwy.	x		n/a	n/a	n/a	12,355	16,196	**6,000**	**25,500**
Mack Hatcher Pkwy.		x	5994	19,207	3.20	13,791	18,485	**23,000**	**30,000**

AADT Turning Movements

After the AADT mainline volumes were projected, the AADT turning movements were calculated. The turning volumes were estimated by using software that performed the calculations outlined in Chapter 8, *Turning Movement Procedures,* of NCHRP 255 *Highway Traffic Data for Urbanized Area Project Planning and Design*. These calculations utilize the field-collected counts as the basis of the turning volumes. The results of the AADT turning movement calculations are provided in the Traffic Schematics. The traffic calculations are provided in the **Calculations and Data Collection** portion of this **Appendix**.

CALCULATIONS AND DATA COLLECTIONS

AADT Calculations	A-1
AADT Turning Movement Calculations	A-7
“D” & “K” Calculations	A-26
Field Collected Traffic Counts	A-31
MPO Traffic Model Data	A-66
TRIMS Traffic Data	A-70

TDOT EES MAPS

Tennessee Department of Transportation

EARLY ENVIRONMENTAL SCREENING PROCESS (EES) PROJECT SCORING

Project Score Factors

	Total Impacts Evaluated	Total Impacts to Evaluate	EES Evaluation
Project Impact Areas:	15	15	**Complete**
Date of Evaluation:	December 30, 2008		
Evaluation done by:	Chris Armstrong		
	Transportation Planner 4		
County:	Maury-Williamson		
Route:	State Route 6 (US-31)		
PIN:	111040.00		
Termini:	From Old Kedron Road in Maury Co. to Mack Hatcher Pkwy. in Williamson Co.		

Impact Ranking of Features Evaluated:	**Total by Rank**
Features with No Impact	**9**
Bat	
Terrestrial Species	
TDEC Conservation Sites & TDEC Scenic Waterways	
Superfund Sites	
Caves	
Pyritic Rock	
Tennessee Natural Areas Program	
Wildlife Management Areas	
TWRA Lakes & Other Public Lands	
Features with Low Impact	**0**
Features with Moderate Impact	**3**
Cemetery Sites & Cemetery Properties	
Aquatic Species	

Railroads

Features with Substantial Impact **2**

National Register Sites

Large Wetland Impacts

Community Impacts Present:

Institutions:

School

Church

Populations:

No population present

Linguistically isolated populations

EES Project Impact: **Complete**

Community Impact Group

INSTITUTIONS & SENSITIVE COMMUNITY POPULATIONS

Sensitive Populations Project Impact:	Present	Not Present
Institutions:		
Hospital	☐	☑
School	☑	☐
Church	☑	☐
Public Building	☐	☑
Populations:		
No population present	☑	☐
65 and older populations	☐	☑
Disability populations	☐	☑
Households without a vehicle	☐	☑
Minority populations 24%	☐	☑
Linguistically isolated populations	☑	☐
Populations below poverty - State average - 13%	☐	☑
Populations below poverty - State average - 27%	☐	☑

Historic Architecture/Archaeology Group

NATIONAL REGISTER SITES

Impact	

Project Impact (Environmental, Time, Cost, Design, and Maintenance)	☑ **Substantial -** A substantial impact on the project is anticipated as there is a National Register historic property within the project study area or corridor. It is not possible to avoid a taking or impact of the surveyed site and/or the historic property. Other concerns are the visual or audible effects upon the survey site and/or historic property that need to be considered and minimized. An environmental impact will likely result and necessitate coordination with State Historic Preservation Office as part of NEPA. Additional project alternatives may be needed to minimize the amount of takings. Indirect effects (visual and audible) may occur, and may require one of more of the following: vegetative plantings, a noise wall and/or beautification of the roadway/bridges. Design efforts that may be required to include coordination, negotiation and planning mitigation measures for any taking.

CEMETERY SITES & CEMETERY PROPERTIES

Impact

Project Impact (Environmental, Time, Cost, Design, and Maintenance)	☑ **Moderate** – Medium impact on environment is anticipated as there is a cemetery within the project study area or corridor. It is possible to avoid impacts to the cemetery. Although the cemetery site is present in the study area or corridor, it is possible to avoid impacts to the cemetery. An environmental impact may still result and necessitate an archaeological review as part of NEPA. A moderate level of environmental documentation and time will be required to proceed with development of the project, including steps reach 'no adverse effect' and/or *de minimus* impact determination on the impacts to the cemetery.

Ecology Group

RARE AND PROTECTED SPECIES

BAT

Impact

Project Impact (Environment, Time, Cost, Design, and Maintenance)	☑ **None** – No project impact is anticipated. There is no occurrence of Indiana or gray bats within 4 miles of the proposed project study area or corridor.

TERRESTRIAL SPECIES

Impact

Project Impact (Environment, Time, Cost, Design, and Maintenance)	☑ **None -** No impact to the project is anticipated. There is no known occurrence of a rare, state, or federally-protected terrestrial species within the proposed transportation study area or corridor.

AQUATIC SPECIES

Impact

Project Impact (Environment, Time, Cost, Design, and Maintenance)	☑ **Moderate** – Medium impact on the project is expected as there is a known occurrence of federally-protected aquatic species or a state protected species with a status of threatened or endangered located within the project study area or corridor. Additional alternatives could likely reduce species impacts. Consultation with the US Fish and Wildlife Service and/or the Tennessee Wildlife Resources Agency will be required possibly resulting in a survey for the species. Special construction considerations may be required.

TDEC CONSERVATION SITES & TDEC SCENIC WATERWAYS

Impact

Project Impact (Environment, Time, Cost, Design, Maintenance)	☑ **None** – No project impact is expected as there are no scenic waterways or TDEC Conservation Sites within project study area or corridor.

LARGE WETLAND IMPACTS

Impact

Project Impact (Environment, Time, Cost, Design, Maintenance)	☑ **Substantial** – Regions 1, 2, and 3: A substantial impact to the project is probable as there is greater than 2 acres of wetlands within the project study area or corridor. Compensatory mitigation will be required. Design effort will be needed to avoid and minimize impacts to wetlands to the maximum extent practicable. If a floodplain is crossed by the project, floodplain culverts may be necessary.

Hazardous Substances/Geology Group

SUPERFUND SITES

Impact

Project Impact (Environment, Time, Cost, Design, and Maintenance)	☑ **None** – No project impact is anticipated as there are no known contaminated land tracts abutting or within the project study area or corridor.

CAVES

Impact

Project Impact (Environment, Time, Cost, Design, and Maintenance)	☑ **None** – No project impact is anticipated as there are no caves in the project study area or corridor.

PYRITIC ROCK

Impact

Project Impact (Environment, Time, Cost, Design, and Maintenance)	☑ **None** – No project impact is anticipated. Pyritic rock is not known to occur in the study area/corridor or project does not involve excavation. Limestone (symbolized as dark green) and dolomite (symbolized as light green) are present.

Railroad & Public Lands Group

RAILROADS

Impact

Project Impact (Environment, Time, Cost, Design, and Maintenance)	☑ **Moderate** – Medium impact on the project is anticipated as a railroad lies within the project study area or corridor. An impact on the railroad cannot be avoided through more detailed planning or the railroad will be within 200 feet of the proposed transportation project. The initial idea is that there will be an existing at-grade crossing, and coordination with the Tennessee DOT Safety Planning and Travel Data Office and the Tennessee DOT Right-Of-Way Division - Utilities Section should be initiated. An impact on the project is likely due to the need to resolve major drainage issues, grade crossing mitigation, grade separations, railroad property acquisition, and railroad relocations. Coordination with the railroad on right of way issues is anticipated which may require much time, including a maintenance agreement. Additional design effort to avoid/minimize impacts may be needed and to create additional alternatives. Maintenance agreements with the railroad may need to be resolved, and any maintenance will be dependent upon these agreements. Typical maintenance includes mowing and clearing of the right of way and/or repairs of signalized at-grade intersection.

TENNESSEE NATURAL AREAS PROGRAM

Impact

Project Impact (Environment, Time, Cost, Design, and Maintenance)	☑ **None** – No impact on the project is anticipated as the project study area or corridor does not include a Natural Area.

WILDLIFE MANAGEMENT AREAS

Impact

Project Impact (Environment, Time, Cost, Design, and Maintenance)	☑ **None** – No project impact is anticipated as a WMA does not abut nor is located within the project study area or corridor.

TWRA LAKES & OTHER PUBLIC LANDS

Impact

Project Impact (Environment, Time, Cost, Design, and Maintenance)	☑ **None** – No impact on the project is anticipated as there area no parks located within or abutting the project study area or corridor.

EES Report

PIN 111040.00

10,000 Foot Corridor
December 30, 2008

Ecology

Rare & Protected Species

Aquatic Species	Total= 5	USESA	SPROT
Etheostoma luteovinctum			D
Etheostoma luteovinctum			D
Etheostoma luteovinctum			D
Etheostoma luteovinctum			D
Etheostoma luteovinctum			D

Hazardous Substances & Geology

Geology

Caves There are none.

EES Report

PIN 111040.00
4,000 Foot Corridor
December 30, 2008

Ecology

Rare & Protected Species

Terrestrial Species — There are none.

TDEC Conservation Sites — There are none.

TDEC Scenic Waterways — There are none.

Large Wetland Impacts — Total= 134

POWHh
POWHx
PFO1A
POWHx
POWHx
POWHx
POWHh
POWHx
POWHh
POWHx
POWHh
POWHh
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POWHx
PEM1Cx
POWHh
POWHh
POWHx
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POWHx
POWHh

PIN 111040.00
4,000 Foot Corridor
December 30, 2008

POWHx
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POWHh
PEM1Ax
POWHx
POWHh
POWHh
POWHh
POWHh
POWHh
POWHh
POWHx
POWHh
PEM1F
POWHx
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PIN 111040.00
4,000 Foot Corridor
December 30, 2008

PEM1C
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POWHh
POWHh
POWHh
POWHh
POWFx
POWHx
POWHh
POWHx

Railroads & Public Lands

Public Lands

Tennessee Natural Areas Program	There are none.
Wildlife Management Areas	There are none.

EES Report

PIN 111040.00
2,000 Foot Corridor
December 30, 2008

Historic Architecture & Archaeology

Historic Architecture

National Register Sites — Total= 12

- Pointer, Henry, House
- Homestead Manor
- Cheairs, Martin, House
- Spring Hill Presbyterian Church
- Ritter-Morton House
- Harrison House
- Winstead Hill
- Grace Episcopal Church
- White Hall
- St. Mark United Primitive Baptist Church
- Johnson, James P., House
- Buford, Spencer, House

Hazardous Substances & Geology

Superfund Sites

There are none.

Geology

Pyritic Rock	Total= 16	Classification
Carters Limestone	Limestone	
Sequatchie Formation, Liepers Formation, Inman Formation, Catheys Formation	Limestone	
Fort Payne Formation, Chattanooga Shale	Limestone	
Carters Limestone	Limestone	
Sequatchie Formation, Liepers Formation, Inman Formation, Catheys Formation	Limestone	
Sequatchie Formation, Liepers Formation, Inman Formation, Catheys Formation	Limestone	
Sequatchie Formation, Liepers Formation, Inman Formation, Catheys Formation	Limestone	
Sequatchie Formation, Liepers Formation, Inman Formation, Catheys Formation	Limestone	
Sequatchie Formation, Liepers Formation, Inman Formation, Catheys Formation	Limestone	
Fort Payne Formation, Chattanooga Shale	Limestone	
Sequatchie Formation, Liepers Formation, Inman Formation, Catheys Formation	Limestone	
Carters Limestone	Limestone	
Bigby-Cannon Limestone, Hermitage Formation	Limestone	

Sequatchie Formation, Liepers Formation, Inman Formation, Catheys Formation	Limestone
Sequatchie Formation, Liepers Formation, Inman Formation, Catheys Formation	Limestone
Sequatchie Formation, Liepers Formation, Inman Formation, Catheys Formation	Limestone

Railroads & Public Lands

Public Lands

TWRA Lakes	There are none.
Other Public Lands	There are none.

EES Report

PIN 111040.00

1,000 Foot Corridor

December 29, 2008

Community Impact

Cemetery Sites

Cemetery	Total= 3
Williamson Memorial Gardens	
Lavender Cemetery	
Harrison Cemetery	
Cemetery Property	Total= 1
Williamson Memorial Gardens	
Institutions	Total= 4
Heritage Elem	School
Spring Hill Elementary School	School
West Harpeth Church	Church
Heritage Middle School	School

Sensitive Community Populations

No Population Present	Present
Population 65 & Over	Not Present
Disability	Not Present
Households without Vehicle	Not Present
Minority Populuation-24%	Not Present
Linguistically Isolated	Present
Below Poverty-13.5%	Not Present
Below Poverty-27%	Not Present

Ecology

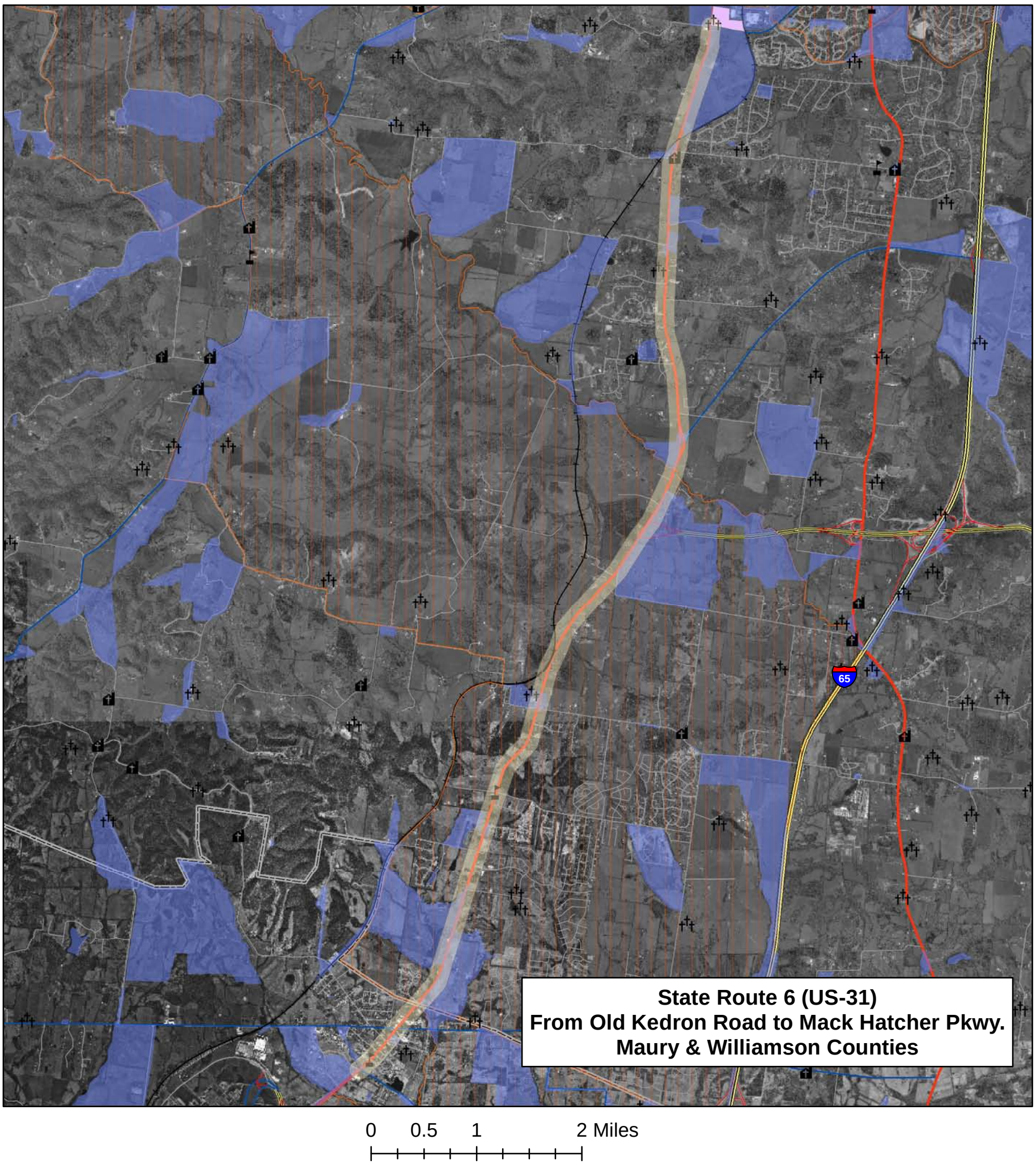
Rare & Protected Species

Bats	There are none.

Railroads & Public Lands

Railroads	Present

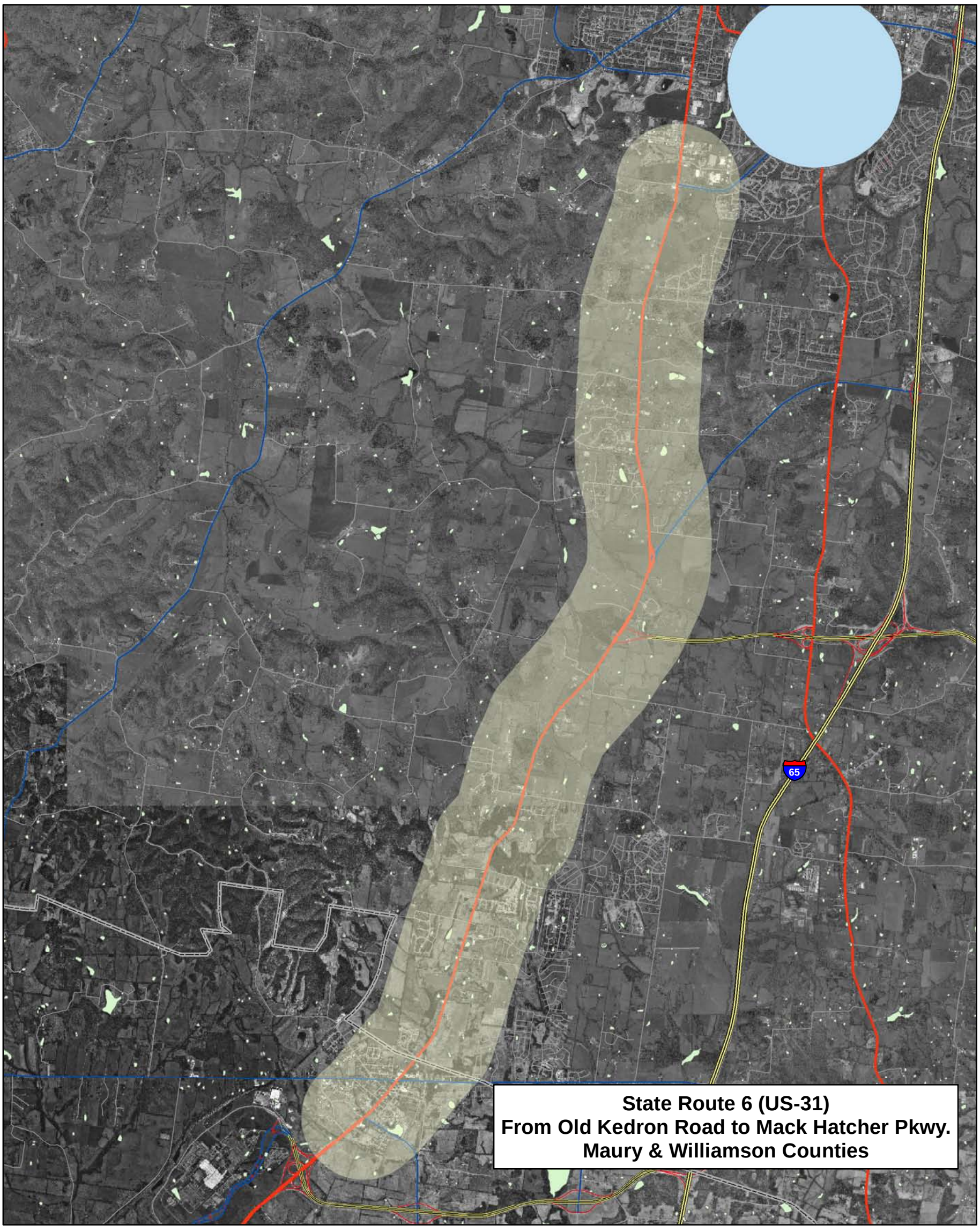
EES Map with 1,000 ft Corridor



Legend

- Cemetery
- Cemetery Property
- Hospital
- School
- Church
- Public Building
- No Population Present
- Population 65 and Over
- Disability
- Households without a vehicle
- Minority Population - 24%
- Linguistically Isolated
- Below Poverty - 13.5%
- Below Poverty - 27%
- Bat
- Railroads

EES Map with 4,000 ft Corridor



Legend

0 0.5 1 2 Miles

- Terrestrial Species
- TDEC Conservation Sites
- TDEC Scenic Waterways
- Large Wetland Impacts
- Tennessee Natural Areas Program
- Wildlife Management Areas
- Rivers and Waterways

EES Map with 2,000 ft Corridor

0 0.5 1 2 Miles

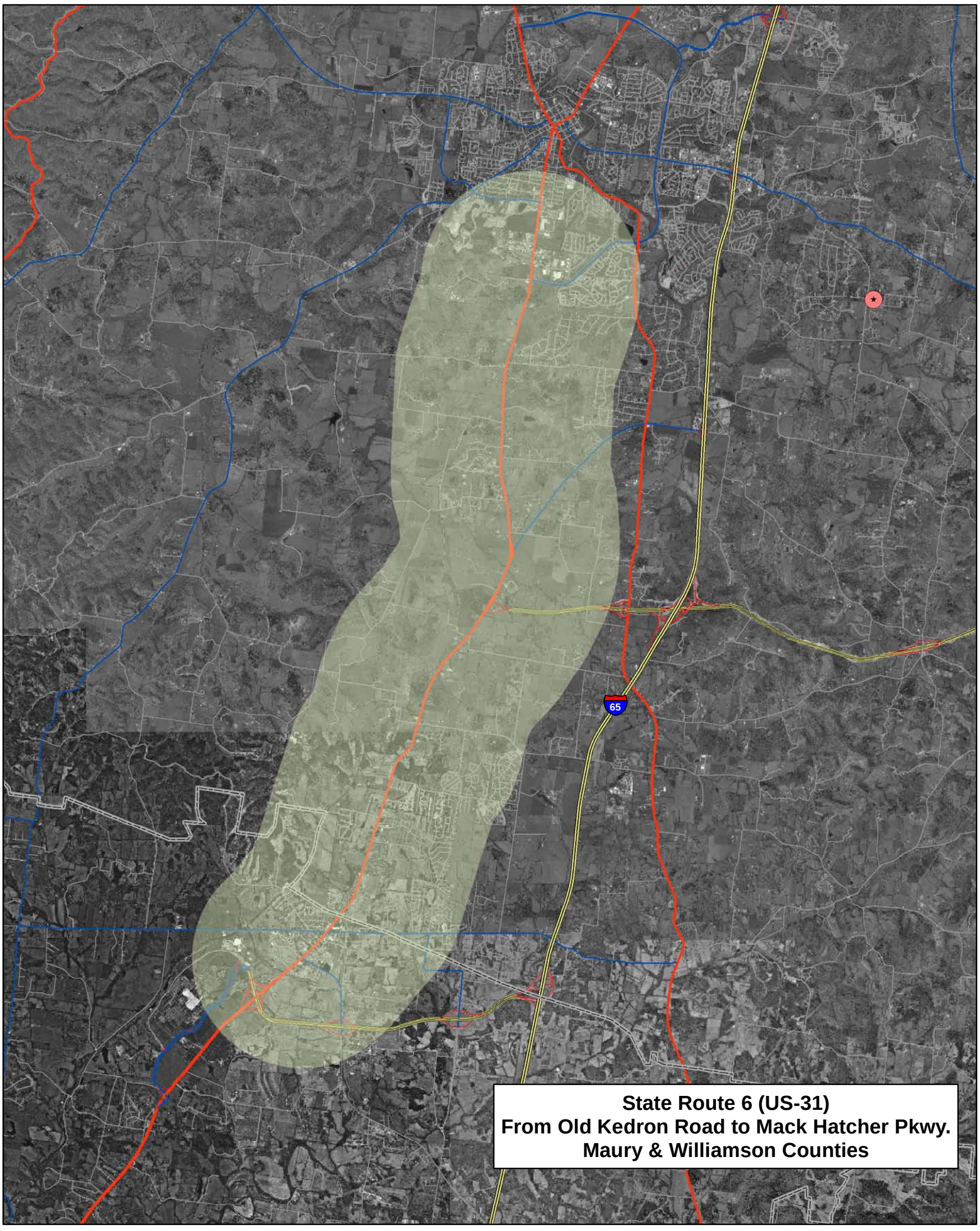
Legend

- National Register Sites
- Superfund Sites
- Formation that contains acid producing rock
- Includes formations that contain acid producing rock

Formation that contains acid

- Formation that may contain potentially acid producing rock
- Includes formations that may contain acid producing rock
- Limestone
- Dolomite
- TWRA Lakes
- Recreation
- Nature
- Federal
- State
- Rivers and Waterways

EES Map with 10,000 ft Corridor



0 0.5 1 2 Miles

Legend

- Aquatic Species
- Caves
- Rivers and Waterways

HCS+ CALCULATIONS

No Build Option
Widen Along the Existing Alignment Option
Three Lane Thompson's Station Option

NO BUILD OPTION

HCS+ ANALYSIS

Segment 1 L.M. 32.47 to 33.31 Year 2014
Segment 1 L.M. 32.47 to 33.31 Year 2034
Segment 2A L.M. 0.00 to 1.20 Year 2014
Segment 2A L.M. 0.00 to 1.20 Year 2034
Segment 2B L.M. 1.30 to 2.17 Year 2014
Segment 2B L.M. 1.30 to 2.17 Year 2034
Segment 2C L.M. 2.17 to 2.49 Year 2014
Segment 2C L.M. 2.17 to 2.49 Year 2034
Segment 3 L.M. 2.49 to 4.75 Year 2014
Segment 3 L.M. 2.49 to 4.75 Year 2034
Segment 4 L.M. 4.15 to 5.55 Year 2014
Segment 4 L.M. 4.15 to 5.55 Year 2034
Segment 5A L.M. 5.55 to 6.60 Year 2014
Segment 5A L.M. 5.55 to 6.60 Year 2034
Segment 5B L.M. 6.60 to 8.67 Year 2014
Segment 5B L.M. 6.60 to 8.67 Year 2034
Segment 6 L.M. 8.67 to 10.03 Year 2014
Segment 6 L.M. 8.67 to 10.03 Year 2034

HCS+: Urban Streets Release 5.3

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PLANNING ANALYSIS

Analyst:	
Agency/Co.:	
Date Performed:	11/6/2008
Analysis Time Period:	2014
Urban Street:	SR-6
Direction of Travel:	
Jurisdiction:	Segment 1
Analysis Year:	2014
Project ID:	SR-6 TPR

Traffic Characteristics

Annual average daily traffic, AADT	22400	vpd
Planning analysis hour factor, K	0.080	
Directional distribution factor, D	0.700	
Peak-hour factor, PHF	0.950	
Adjusted saturation flow rate	1800	pcphgpl
Percent turns from exclusive lanes	50	%

Roadway Characteristics

Number of through lanes one direction, N	1	
Free flow speed, FFS	35	mph
Urban class	3	
Section length	0.84	miles
Median	Yes	
Left-turn bays	Yes	

Signal Characteristics

Signalized intersections	3	
Arrival type, AT	4	
Signal type (k = 0.5 for planning)	Actuated	
Cycle length, C	120.0	sec
Effective green ratio, g/C	0.400	

Results

Annual average daily traffic, AADT	22400	vpd
Two-way hourly volume	1791	vph
Hourly directional volume	1253	vph
Through-volume 15-min. flow rate	659	v
Running time	96.8	sec
v/c ratio	0.92	
Through capacity	720	vph
Progression factor, PF	0.895	
Uniform delay	34.1	sec
Filtering/metering factor, I	0.282	
Incremental delay	6.5	sec
Control delay	37.0	sec/v
Total travel speed, Sa	14.6	mph
Total urban street LOS	D	

HCS+: Urban Streets Release 5.3

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PLANNING ANALYSIS

Analyst:	
Agency/Co.:	
Date Performed:	11/6/2008
Analysis Time Period:	2014
Urban Street:	SR-6
Direction of Travel:	
Jurisdiction:	Segment 1
Analysis Year:	2014
Project ID:	SR-6 TPR

Traffic Characteristics

Annual average daily traffic, AADT	36700	vpd
Planning analysis hour factor, K	0.080	
Directional distribution factor, D	0.700	
Peak-hour factor, PHF	0.950	
Adjusted saturation flow rate	1800	pcphgpl
Percent turns from exclusive lanes	50	%

Roadway Characteristics

Number of through lanes one direction, N	1	
Free flow speed, FFS	35	mph
Urban class	3	
Section length	0.84	miles
Median	Yes	
Left-turn bays	Yes	

Signal Characteristics

Signalized intersections	3	
Arrival type, AT	4	
Signal type (k = 0.5 for planning)	Actuated	
Cycle length, C	120.0	sec
Effective green ratio, g/C	0.400	

Results

Annual average daily traffic, AADT	36700	vpd
Two-way hourly volume	2935	vph
Hourly directional volume	2054	vph
Through-volume 15-min. flow rate	1081	v
Running time	96.8	sec
v/c ratio	1.50	
Through capacity	720	vph
Progression factor, PF	0.895	
Uniform delay	36.0	sec
Filtering/metering factor, I	0.090	
Incremental delay	226.3	sec
Control delay	258.5	sec/v
Total travel speed, Sa	3.5	mph
Total urban street LOS	F	

HCS+: Urban Streets Release 5.3

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PLANNING ANALYSIS

Analyst:	
Agency/Co.:	
Date Performed:	11/6/2008
Analysis Time Period:	2014
Urban Street:	SR-6
Direction of Travel:	
Jurisdiction:	Segment 2A
Analysis Year:	2014
Project ID:	SR-6 TPR LM 0.00 to 1.30

Traffic Characteristics

Annual average daily traffic, AADT	25000	vpd
Planning analysis hour factor, K	0.080	
Directional distribution factor, D	0.700	
Peak-hour factor, PHF	0.950	
Adjusted saturation flow rate	1800	pcphgpl
Percent turns from exclusive lanes	50	%

Roadway Characteristics

Number of through lanes one direction, N	1	
Free flow speed, FFS	45	mph
Urban class	2	
Section length	2.49	miles
Median	No	
Left-turn bays	Yes	

Signal Characteristics

Signalized intersections	2	
Arrival type, AT	4	
Signal type (k = 0.5 for planning)	Actuated	
Cycle length, C	120.0	sec
Effective green ratio, g/C	0.400	

Results

Annual average daily traffic, AADT	25000	vpd
Two-way hourly volume	1999	vph
Hourly directional volume	1399	vph
Through-volume 15-min. flow rate	736	v
Running time	199.2	sec
v/c ratio	1.08	
Through capacity	683	vph
Progression factor, PF	0.895	
Uniform delay	36.0	sec
Filtering/metering factor, I	0.090	
Incremental delay	38.0	sec
Control delay	70.2	sec/v
Total travel speed, Sa	26.4	mph
Total urban street LOS	C	

HCS+: Urban Streets Release 5.3

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PLANNING ANALYSIS

Analyst:	
Agency/Co.:	
Date Performed:	11/6/2008
Analysis Time Period:	2014
Urban Street:	SR-6
Direction of Travel:	
Jurisdiction:	Segment 2A
Analysis Year:	2034
Project ID:	SR-6 TPR LM 0.00 to 1.30

Traffic Characteristics

Annual average daily traffic, AADT	36700	vpd
Planning analysis hour factor, K	0.080	
Directional distribution factor, D	0.700	
Peak-hour factor, PHF	0.950	
Adjusted saturation flow rate	1800	pcphgpl
Percent turns from exclusive lanes	50	%

Roadway Characteristics

Number of through lanes one direction, N	1	
Free flow speed, FFS	45	mph
Urban class	2	
Section length	2.49	miles
Median	No	
Left-turn bays	Yes	

Signal Characteristics

Signalized intersections	2	
Arrival type, AT	4	
Signal type (k = 0.5 for planning)	Actuated	
Cycle length, C	120.0	sec
Effective green ratio, g/C	0.400	

Results

Annual average daily traffic, AADT	36700	vpd
Two-way hourly volume	2935	vph
Hourly directional volume	2054	vph
Through-volume 15-min. flow rate	1081	v
Running time	199.2	sec
v/c ratio	1.58	
Through capacity	683	vph
Progression factor, PF	0.895	
Uniform delay	36.0	sec
Filtering/metering factor, I	0.090	
Incremental delay	262.9	sec
Control delay	295.1	sec/v
Total travel speed, Sa	11.4	mph
Total urban street LOS	F	

HCS+: Urban Streets Release 5.3

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PLANNING ANALYSIS

Analyst:	
Agency/Co.:	
Date Performed:	11/6/2008
Analysis Time Period:	2014
Urban Street:	SR-6
Direction of Travel:	
Jurisdiction:	Segment 2B
Analysis Year:	2014
Project ID:	SR-6 TPR LM 1.30 to 2.17

Traffic Characteristics

Annual average daily traffic, AADT	25000	vpd
Planning analysis hour factor, K	0.080	
Directional distribution factor, D	0.700	
Peak-hour factor, PHF	0.950	
Adjusted saturation flow rate	1800	pcphgpl
Percent turns from exclusive lanes	75	%

Roadway Characteristics

Number of through lanes one direction, N	1	
Free flow speed, FFS	45	mph
Urban class	2	
Section length	2.49	miles
Median	Yes	
Left-turn bays	Yes	

Signal Characteristics

Signalized intersections	2	
Arrival type, AT	4	
Signal type (k = 0.5 for planning)	Actuated	
Cycle length, C	120.0	sec
Effective green ratio, g/C	0.400	

Results

Annual average daily traffic, AADT	25000	vpd
Two-way hourly volume	1999	vph
Hourly directional volume	1399	vph
Through-volume 15-min. flow rate	368	v
Running time	199.2	sec
v/c ratio	0.51	
Through capacity	720	vph
Progression factor, PF	0.895	
Uniform delay	27.2	sec
Filtering/metering factor, I	0.849	
Incremental delay	2.2	sec
Control delay	26.5	sec/v
Total travel speed, Sa	35.5	mph
Total urban street LOS	A	

HCS+: Urban Streets Release 5.3

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PLANNING ANALYSIS

Analyst:	
Agency/Co.:	
Date Performed:	11/6/2008
Analysis Time Period:	2034
Urban Street:	SR-6
Direction of Travel:	
Jurisdiction:	Segment 2B
Analysis Year:	2034
Project ID:	SR-6 TPR LM 1.30 to 2.17

Traffic Characteristics

Annual average daily traffic, AADT	36700	vpd
Planning analysis hour factor, K	0.080	
Directional distribution factor, D	0.700	
Peak-hour factor, PHF	0.950	
Adjusted saturation flow rate	1800	pcphgpl
Percent turns from exclusive lanes	75	%

Roadway Characteristics

Number of through lanes one direction, N	1	
Free flow speed, FFS	45	mph
Urban class	2	
Section length	2.49	miles
Median	Yes	
Left-turn bays	Yes	

Signal Characteristics

Signalized intersections	2	
Arrival type, AT	4	
Signal type (k = 0.5 for planning)	Actuated	
Cycle length, C	120.0	sec
Effective green ratio, g/C	0.400	

Results

Annual average daily traffic, AADT	36700	vpd
Two-way hourly volume	2935	vph
Hourly directional volume	2054	vph
Through-volume 15-min. flow rate	540	v
Running time	199.2	sec
v/c ratio	0.75	
Through capacity	720	vph
Progression factor, PF	0.895	
Uniform delay	30.9	sec
Filtering/metering factor, I	0.579	
Incremental delay	4.2	sec
Control delay	31.8	sec/v
Total travel speed, Sa	34.1	mph
Total urban street LOS	B	

HCS+: Urban Streets Release 5.3

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PLANNING ANALYSIS

Analyst:	
Agency/Co.:	
Date Performed:	11/6/2008
Analysis Time Period:	2014
Urban Street:	SR-6
Direction of Travel:	
Jurisdiction:	Segment 2C
Analysis Year:	2014
Project ID:	SR-6 TPR LM 2.17 to 2.49

Traffic Characteristics

Annual average daily traffic, AADT	25000	vpd
Planning analysis hour factor, K	0.080	
Directional distribution factor, D	0.700	
Peak-hour factor, PHF	0.950	
Adjusted saturation flow rate	1800	pcphgpl
Percent turns from exclusive lanes	75	%

Roadway Characteristics

Number of through lanes one direction, N	1	
Free flow speed, FFS	45	mph
Urban class	2	
Section length	2.49	miles
Median	No	
Left-turn bays	Yes	

Signal Characteristics

Signalized intersections	2	
Arrival type, AT	4	
Signal type (k = 0.5 for planning)	Actuated	
Cycle length, C	120.0	sec
Effective green ratio, g/C	0.400	

Results

Annual average daily traffic, AADT	25000	vpd
Two-way hourly volume	1999	vph
Hourly directional volume	1399	vph
Through-volume 15-min. flow rate	368	v
Running time	199.2	sec
v/c ratio	0.54	
Through capacity	683	vph
Progression factor, PF	0.895	
Uniform delay	27.5	sec
Filtering/metering factor, I	0.827	
Incremental delay	2.5	sec
Control delay	27.1	sec/v
Total travel speed, Sa	35.4	mph
Total urban street LOS	A	

HCS+: Urban Streets Release 5.3

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PLANNING ANALYSIS

Analyst:	
Agency/Co.:	
Date Performed:	11/6/2008
Analysis Time Period:	2034
Urban Street:	SR-6
Direction of Travel:	
Jurisdiction:	Segment 2C
Analysis Year:	2034
Project ID:	SR-6 TPR LM 2.17 to 2.49

Traffic Characteristics

Annual average daily traffic, AADT	36700	vpd
Planning analysis hour factor, K	0.080	
Directional distribution factor, D	0.700	
Peak-hour factor, PHF	0.950	
Adjusted saturation flow rate	1800	pcphgpl
Percent turns from exclusive lanes	75	%

Roadway Characteristics

Number of through lanes one direction, N	1	
Free flow speed, FFS	45	mph
Urban class	2	
Section length	2.49	miles
Median	No	
Left-turn bays	Yes	

Signal Characteristics

Signalized intersections	2	
Arrival type, AT	4	
Signal type (k = 0.5 for planning)	Actuated	
Cycle length, C	120.0	sec
Effective green ratio, g/C	0.400	

Results

Annual average daily traffic, AADT	36700	vpd
Two-way hourly volume	2935	vph
Hourly directional volume	2054	vph
Through-volume 15-min. flow rate	540	v
Running time	199.2	sec
v/c ratio	0.79	
Through capacity	683	vph
Progression factor, PF	0.895	
Uniform delay	31.6	sec
Filtering/metering factor, I	0.515	
Incremental delay	4.9	sec
Control delay	33.1	sec/v
Total travel speed, Sa	33.8	mph
Total urban street LOS	B	

HCS+: Two-Lane Highways Release 5.3

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Two-Way Two-Lane Highway Segment Analysis

Analyst	
Agency/Co.	
Date Performed	11/6/2008
Analysis Time Period	2014
Highway	SR-6
From/To	LM 2.49 to LM 4.75
Jurisdiction	TDOT
Analysis Year	2014
Description	SR-6 TPR

Input Data

Highway class	Class 1				
Shoulder width	5.0	ft	Peak-hour factor, PHF	0.95	
Lane width	12.0	ft	% Trucks and buses	3	%
Segment length	2.3	mi	% Recreational vehicles	0	%
Terrain type	Rolling		% No-passing zones	100	%
Grade: Length		mi	Access points/mi	16	/mi
Up/down		%			

Two-way hourly volume, V	2720	veh/h	
Directional split	70 / 30	%	

Average Travel Speed

Grade adjustment factor, fG	0.99	
PCE for trucks, ET	1.5	
PCE for RVs, ER	1.1	
Heavy-vehicle adjustment factor,	0.985	
Two-way flow rate,(note-1) vp	2935	pc/h
Highest directional split proportion (note-2)	2055	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	50.0	mi/h
Adj. for lane and shoulder width, fLS	1.3	mi/h
Adj. for access points, fA	4.0	mi/h
Free-flow speed, FFS	44.7	mi/h
Adjustment for no-passing zones, fnp	0.8	mi/h
Average travel speed, ATS	21.1	mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	2863	pc/h
Highest directional split proportion (note-2)	2004	
Base percent time-spent-following, BPTSF	91.9	%
Adj.for directional distribution and no-passing zones, fd/np	4.2	
Percent time-spent-following, PTSF	96.1	%

Level of Service and Other Performance Measures

Level of service, LOS	F	
Volume to capacity ratio, v/c	0.92	
Peak 15-min vehicle-miles of travel, VMT15	1618	veh-mi
Peak-hour vehicle-miles of travel, VMT60	6147	veh-mi
Peak 15-min total travel time, TT15	76.7	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.3

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Two-Way Two-Lane Highway Segment Analysis

Analyst	
Agency/Co.	
Date Performed	11/6/2008
Analysis Time Period	2034
Highway	SR-6
From/To	LM 2.49 to LM 4.75
Jurisdiction	TDOT
Analysis Year	2034
Description	SR-6 TPR

Input Data

Highway class	Class 1				
Shoulder width	5.0	ft	Peak-hour factor, PHF	0.95	
Lane width	12.0	ft	% Trucks and buses	3	%
Segment length	2.3	mi	% Recreational vehicles	0	%
Terrain type	Rolling		% No-passing zones	100	%
Grade: Length		mi	Access points/mi	16	/mi
Up/down		%			

Two-way hourly volume, V	2936	veh/h	
Directional split	70 / 30	%	

Average Travel Speed

Grade adjustment factor, fG	0.99	
PCE for trucks, ET	1.5	
PCE for RVs, ER	1.1	
Heavy-vehicle adjustment factor,	0.985	
Two-way flow rate,(note-1) vp	3169	pc/h
Highest directional split proportion (note-2)	2218	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	50.0	mi/h
Adj. for lane and shoulder width, fLS	1.3	mi/h
Adj. for access points, fA	4.0	mi/h
Free-flow speed, FFS	44.7	mi/h
Adjustment for no-passing zones, fnp	0.7	mi/h
Average travel speed, ATS	19.4	mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	3091	pc/h
Highest directional split proportion (note-2)	2164	
Base percent time-spent-following, BPTSF	93.4	%
Adj.for directional distribution and no-passing zones, fd/np	4.2	
Percent time-spent-following, PTSF	97.6	%

Level of Service and Other Performance Measures

Level of service, LOS	F	
Volume to capacity ratio, v/c	0.99	
Peak 15-min vehicle-miles of travel, VMT15	1746	veh-mi
Peak-hour vehicle-miles of travel, VMT60	6635	veh-mi
Peak 15-min total travel time, TT15	90.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Multilane Highways Release 5.3

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OPERATIONAL ANALYSIS

Analyst:
Agency/Co:
Date: 11/6/2008
Analysis Period: 2014
Highway: SR-6
From/To: Seg. 4 LM 4.75 to LM 5.55
Jurisdiction: TDOT
Analysis Year: 2014
Project ID: SR-6 TPR

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	16		0	
Median type	Divided			
Free-flow speed:	Base		Measured	
FFS or BFFS	50.0	mph	60.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	0.0	mph	0.0	mph
Access points adjustment, FA	4.0	mph	0.0	mph
Free-flow speed	46.0	mph	60.0	mph

VOLUME

Direction	1		2	
Volume, V	1904	vph	816	vph
Peak-hour factor, PHF	0.95		0.95	
Peak 15-minute volume, v15	501		215	
Trucks and buses	3	%	3	%
Recreational vehicles	0	%	0	%
Terrain type	Rolling		Rolling	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	2.5		2.5	
Recreational vehicles PCE, ER	2.0		2.0	
Heavy vehicle adjustment, fHV	0.957		0.957	
Flow rate, vp	1047	pcphpl	448	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	1047	pcphpl	448	pcphpl
Free-flow speed, FFS	46.0	mph	60.0	mph
Avg. passenger-car travel speed, S	46.0	mph	60.0	mph
Level of service, LOS	C		A	
Density, D	22.8	pc/mi/ln	7.5	pc/mi/ln

Overall results are not computed when free-flow speed is less than 45 mph.

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OPERATIONAL ANALYSIS

Analyst:
Agency/Co:
Date: 11/6/2008
Analysis Period: 2034
Highway: SR-6
From/To: Seg. 4 LM 4.75 to LM 5.55
Jurisdiction: TDOT
Analysis Year: 2034
Project ID: SR-6 TPR

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	16		0	
Median type	Divided			
Free-flow speed:	Base		Measured	
FFS or BFFS	50.0	mph	60.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	0.0	mph	0.0	mph
Access points adjustment, FA	4.0	mph	0.0	mph
Free-flow speed	46.0	mph	60.0	mph

VOLUME

Direction	1		2	
Volume, V	2055	vph	881	vph
Peak-hour factor, PHF	0.95		0.95	
Peak 15-minute volume, v15	541		232	
Trucks and buses	3	%	3	%
Recreational vehicles	0	%	0	%
Terrain type	Rolling		Rolling	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	2.5		2.5	
Recreational vehicles PCE, ER	2.0		2.0	
Heavy vehicle adjustment, fHV	0.957		0.957	
Flow rate, vp	1130	pcphpl	484	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	1130	pcphpl	484	pcphpl
Free-flow speed, FFS	46.0	mph	60.0	mph
Avg. passenger-car travel speed, S	46.0	mph	60.0	mph
Level of service, LOS	C		A	
Density, D	24.6	pc/mi/ln	8.1	pc/mi/ln

Overall results are not computed when free-flow speed is less than 45 mph.

HCS+: Two-Lane Highways Release 5.3

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Two-Way Two-Lane Highway Segment Analysis

Analyst	
Agency/Co.	
Date Performed	11/6/2008
Analysis Time Period	2014
Highway	SR-6
From/To	LM 5.55 to LM 6.60
Jurisdiction	TDOT
Analysis Year	2014
Description	SR-6 TPR

Input Data

Highway class	Class 1				
Shoulder width	5.0	ft	Peak-hour factor, PHF	0.95	
Lane width	12.0	ft	% Trucks and buses	3	%
Segment length	1.0	mi	% Recreational vehicles	0	%
Terrain type	Rolling		% No-passing zones	100	%
Grade: Length		mi	Access points/mi	8	/mi
Up/down		%			

Two-way hourly volume, V	1920	veh/h	
Directional split	70 / 30	%	

Average Travel Speed

Grade adjustment factor, fG	0.99	
PCE for trucks, ET	1.5	
PCE for RVs, ER	1.1	
Heavy-vehicle adjustment factor,	0.985	
Two-way flow rate,(note-1) vp	2072	pc/h
Highest directional split proportion (note-2)	1450	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	50.0	mi/h
Adj. for lane and shoulder width, fLS	1.3	mi/h
Adj. for access points, fA	2.0	mi/h
Free-flow speed, FFS	46.7	mi/h
Adjustment for no-passing zones, fnp	1.1	mi/h
Average travel speed, ATS	29.5	mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	2021	pc/h
Highest directional split proportion (note-2)	1415	
Base percent time-spent-following, BPTSF	83.1	%
Adj.for directional distribution and no-passing zones, fd/np	4.2	
Percent time-spent-following, PTSF	87.3	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.65	
Peak 15-min vehicle-miles of travel, VMT15	531	veh-mi
Peak-hour vehicle-miles of travel, VMT60	2016	veh-mi
Peak 15-min total travel time, TT15	18.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

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Two-Way Two-Lane Highway Segment Analysis

Analyst	
Agency/Co.	
Date Performed	11/6/2008
Analysis Time Period	2034
Highway	SR-6
From/To	LM 5.55 to LM 6.60
Jurisdiction	TDOT
Analysis Year	2034
Description	SR-6 TPR

Input Data

Highway class	Class 1				
Shoulder width	5.0	ft	Peak-hour factor, PHF	0.95	
Lane width	12.0	ft	% Trucks and buses	3	%
Segment length	1.0	mi	% Recreational vehicles	0	%
Terrain type	Rolling		% No-passing zones	100	%
Grade: Length		mi	Access points/mi	8	/mi
Up/down		%			

Two-way hourly volume, V	2208	veh/h	
Directional split	70 / 30	%	

Average Travel Speed

Grade adjustment factor, fG	0.99	
PCE for trucks, ET	1.5	
PCE for RVs, ER	1.1	
Heavy-vehicle adjustment factor,	0.985	
Two-way flow rate,(note-1) vp	2383	pc/h
Highest directional split proportion (note-2)	1668	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	50.0	mi/h
Adj. for lane and shoulder width, fLS	1.3	mi/h
Adj. for access points, fA	2.0	mi/h
Free-flow speed, FFS	46.7	mi/h
Adjustment for no-passing zones, fnp	1.1	mi/h
Average travel speed, ATS	27.1	mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	2324	pc/h
Highest directional split proportion (note-2)	1627	
Base percent time-spent-following, BPTSF	87.0	%
Adj.for directional distribution and no-passing zones, fd/np	4.2	
Percent time-spent-following, PTSF	91.2	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.74	
Peak 15-min vehicle-miles of travel, VMT15	610	veh-mi
Peak-hour vehicle-miles of travel, VMT60	2318	veh-mi
Peak 15-min total travel time, TT15	22.5	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

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Two-Way Two-Lane Highway Segment Analysis

Analyst	
Agency/Co.	
Date Performed	11/6/2008
Analysis Time Period	2014
Highway	SR-6
From/To	LM 6.60 to 8.67
Jurisdiction	TDOT
Analysis Year	2014
Description	SR-6 TPR

Input Data

Highway class	Class 1				
Shoulder width	5.0	ft	Peak-hour factor, PHF	0.95	
Lane width	12.0	ft	% Trucks and buses	3	%
Segment length	1.0	mi	% Recreational vehicles	0	%
Terrain type	Rolling		% No-passing zones	100	%
Grade: Length		mi	Access points/mi	8	/mi
Up/down		%			

Two-way hourly volume, V	1200	veh/h	
Directional split	70 / 30	%	

Average Travel Speed

Grade adjustment factor, fG	0.99	
PCE for trucks, ET	1.5	
PCE for RVs, ER	1.1	
Heavy-vehicle adjustment factor,	0.985	
Two-way flow rate,(note-1) vp	1295	pc/h
Highest directional split proportion (note-2)	907	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	60.0	mi/h
Adj. for lane and shoulder width, fLS	1.3	mi/h
Adj. for access points, fA	2.0	mi/h
Free-flow speed, FFS	56.7	mi/h
Adjustment for no-passing zones, fnp	1.9	mi/h
Average travel speed, ATS	44.7	mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1263	pc/h
Highest directional split proportion (note-2)	884	
Base percent time-spent-following, BPTSF	67.0	%
Adj.for directional distribution and no-passing zones, fd/np	9.7	
Percent time-spent-following, PTSF	76.8	%

Level of Service and Other Performance Measures

Level of service, LOS	D	
Volume to capacity ratio, v/c	0.40	
Peak 15-min vehicle-miles of travel, VMT15	332	veh-mi
Peak-hour vehicle-miles of travel, VMT60	1260	veh-mi
Peak 15-min total travel time, TT15	7.4	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.3

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Two-Way Two-Lane Highway Segment Analysis

Analyst	
Agency/Co.	
Date Performed	11/6/2008
Analysis Time Period	2034
Highway	SR-6
From/To	LM 6.60 to 8.67
Jurisdiction	TDOT
Analysis Year	2034
Description	SR-6 TPR

Input Data

Highway class	Class 1				
Shoulder width	5.0	ft	Peak-hour factor, PHF	0.95	
Lane width	12.0	ft	% Trucks and buses	3	%
Segment length	1.0	mi	% Recreational vehicles	0	%
Terrain type	Rolling		% No-passing zones	100	%
Grade: Length		mi	Access points/mi	8	/mi
Up/down		%			

Two-way hourly volume, V	1464	veh/h	
Directional split	70 / 30	%	

Average Travel Speed

Grade adjustment factor, fG	0.99	
PCE for trucks, ET	1.5	
PCE for RVs, ER	1.1	
Heavy-vehicle adjustment factor,	0.985	
Two-way flow rate,(note-1) vp	1580	pc/h
Highest directional split proportion (note-2)	1106	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	60.0	mi/h
Adj. for lane and shoulder width, fLS	1.3	mi/h
Adj. for access points, fA	2.0	mi/h
Free-flow speed, FFS	56.7	mi/h
Adjustment for no-passing zones, fnp	1.5	mi/h
Average travel speed, ATS	42.9	mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1541	pc/h
Highest directional split proportion (note-2)	1079	
Base percent time-spent-following, BPTSF	74.2	%
Adj.for directional distribution and no-passing zones, fd/np	7.3	
Percent time-spent-following, PTSF	81.5	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.49	
Peak 15-min vehicle-miles of travel, VMT15	405	veh-mi
Peak-hour vehicle-miles of travel, VMT60	1537	veh-mi
Peak 15-min total travel time, TT15	9.4	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.3

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Two-Way Two-Lane Highway Segment Analysis

Analyst	
Agency/Co.	
Date Performed	11/6/2008
Analysis Time Period	2014
Highway	SR-6
From/To	LM 6.60 to 8.67
Jurisdiction	TDOT
Analysis Year	2014
Description	SR-6 TPR

Input Data

Highway class	Class 1				
Shoulder width	5.0	ft	Peak-hour factor, PHF	0.95	
Lane width	12.0	ft	% Trucks and buses	3	%
Segment length	1.0	mi	% Recreational vehicles	0	%
Terrain type	Rolling		% No-passing zones	100	%
Grade: Length		mi	Access points/mi	16	/mi
Up/down		%			

Two-way hourly volume, V	1664	veh/h	
Directional split	70 / 30	%	

Average Travel Speed

Grade adjustment factor, fG	0.99	
PCE for trucks, ET	1.5	
PCE for RVs, ER	1.1	
Heavy-vehicle adjustment factor,	0.985	
Two-way flow rate,(note-1) vp	1796	pc/h
Highest directional split proportion (note-2)	1257	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	1.3	mi/h
Adj. for access points, fA	4.0	mi/h
Free-flow speed, FFS	39.7	mi/h
Adjustment for no-passing zones, fnp	1.3	mi/h
Average travel speed, ATS	24.5	mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1752	pc/h
Highest directional split proportion (note-2)	1226	
Base percent time-spent-following, BPTSF	78.6	%
Adj.for directional distribution and no-passing zones, fd/np	5.9	
Percent time-spent-following, PTSF	84.5	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.56	
Peak 15-min vehicle-miles of travel, VMT15	460	veh-mi
Peak-hour vehicle-miles of travel, VMT60	1747	veh-mi
Peak 15-min total travel time, TT15	18.8	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.3

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Two-Way Two-Lane Highway Segment Analysis

Analyst	
Agency/Co.	
Date Performed	11/6/2008
Analysis Time Period	2034
Highway	SR-6
From/To	LM 6.60 to 8.67
Jurisdiction	TDOT
Analysis Year	2034
Description	SR-6 TPR

Input Data

Highway class	Class 1				
Shoulder width	5.0	ft	Peak-hour factor, PHF	0.95	
Lane width	12.0	ft	% Trucks and buses	3	%
Segment length	1.0	mi	% Recreational vehicles	0	%
Terrain type	Rolling		% No-passing zones	100	%
Grade: Length		mi	Access points/mi	16	/mi
Up/down		%			

Two-way hourly volume, V	2576	veh/h	
Directional split	70 / 30	%	

Average Travel Speed

Grade adjustment factor, fG	0.99	
PCE for trucks, ET	1.5	
PCE for RVs, ER	1.1	
Heavy-vehicle adjustment factor,	0.985	
Two-way flow rate,(note-1) vp	2780	pc/h
Highest directional split proportion (note-2)	1946	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	1.3	mi/h
Adj. for access points, fA	4.0	mi/h
Free-flow speed, FFS	39.7	mi/h
Adjustment for no-passing zones, fnp	0.9	mi/h
Average travel speed, ATS	17.2	mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	2712	pc/h
Highest directional split proportion (note-2)	1898	
Base percent time-spent-following, BPTSF	90.8	%
Adj.for directional distribution and no-passing zones, fd/np	4.2	
Percent time-spent-following, PTSF	95.0	%

Level of Service and Other Performance Measures

Level of service, LOS	F	
Volume to capacity ratio, v/c	0.87	
Peak 15-min vehicle-miles of travel, VMT15	712	veh-mi
Peak-hour vehicle-miles of travel, VMT60	2705	veh-mi
Peak 15-min total travel time, TT15	41.4	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

WIDEN ALONG THE EXISTING ALIGNMENT OPTION

HCS+ ANALYSIS

Segment 1 L.M. 32.47 to 33.31 Year 2014
Segment 1 L.M. 32.47 to 33.31 Year 2034
Segment 2A L.M. 0.00 to 1.20 Year 2014
Segment 2A L.M. 0.00 to 1.20 Year 2034
Segment 2B L.M. 1.30 to 2.17 Year 2014
Segment 2B L.M. 1.30 to 2.17 Year 2034
Segment 2C L.M. 2.17 to 2.49 Year 2014
Segment 2C L.M. 2.17 to 2.49 Year 2034
Segment 3 L.M. 2.49 to 4.75 Year 2014
Segment 3 L.M. 2.49 to 4.75 Year 2034
Segment 4 L.M. 4.15 to 5.55 Year 2014
Segment 4 L.M. 4.15 to 5.55 Year 2034
Segment 5A L.M. 5.55 to 6.60 Year 2014
Segment 5A L.M. 5.55 to 6.60 Year 2034
Segment 5B L.M. 6.60 to 8.67 Year 2014
Segment 5B L.M. 6.60 to 8.67 Year 2034
Segment 6 L.M. 8.67 to 10.03 Year 2014
Segment 6 L.M. 8.67 to 10.03 Year 2034

HCS+: Urban Streets Release 5.3

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PLANNING ANALYSIS

Analyst:	
Agency/Co.:	
Date Performed:	11/6/2008
Analysis Time Period:	2014
Urban Street:	SR-6
Direction of Travel:	
Jurisdiction:	Segment 1
Analysis Year:	2014
Project ID:	SR-6 TPR

Traffic Characteristics

Annual average daily traffic, AADT	22400	vpd
Planning analysis hour factor, K	0.080	
Directional distribution factor, D	0.700	
Peak-hour factor, PHF	0.950	
Adjusted saturation flow rate	1800	pcphgpl
Percent turns from exclusive lanes	50	%

Roadway Characteristics

Number of through lanes one direction, N	2	
Free flow speed, FFS	35	mph
Urban class	3	
Section length	0.84	miles
Median	Yes	
Left-turn bays	Yes	

Signal Characteristics

Signalized intersections	3	
Arrival type, AT	4	
Signal type (k = 0.5 for planning)	Actuated	
Cycle length, C	120.0	sec
Effective green ratio, g/C	0.400	

Results

Annual average daily traffic, AADT	22400	vpd
Two-way hourly volume	1791	vph
Hourly directional volume	1253	vph
Through-volume 15-min. flow rate	659	v
Running time	96.8	sec
v/c ratio	0.46	
Through capacity	1440	vph
Progression factor, PF	0.895	
Uniform delay	26.4	sec
Filtering/metering factor, I	0.888	
Incremental delay	0.9	sec
Control delay	24.6	sec/v
Total travel speed, Sa	17.7	mph
Total urban street LOS	D	

HCS+: Urban Streets Release 5.3

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PLANNING ANALYSIS

Analyst:	
Agency/Co.:	
Date Performed:	11/6/2008
Analysis Time Period:	2034
Urban Street:	SR-6
Direction of Travel:	
Jurisdiction:	Segment 1
Analysis Year:	2034
Project ID:	SR-6 TPR

Traffic Characteristics

Annual average daily traffic, AADT	36700	vpd
Planning analysis hour factor, K	0.080	
Directional distribution factor, D	0.700	
Peak-hour factor, PHF	0.950	
Adjusted saturation flow rate	1800	pcphgpl
Percent turns from exclusive lanes	50	%

Roadway Characteristics

Number of through lanes one direction, N	2	
Free flow speed, FFS	35	mph
Urban class	3	
Section length	0.84	miles
Median	Yes	
Left-turn bays	Yes	

Signal Characteristics

Signalized intersections	3	
Arrival type, AT	4	
Signal type (k = 0.5 for planning)	Actuated	
Cycle length, C	120.0	sec
Effective green ratio, g/C	0.400	

Results

Annual average daily traffic, AADT	36700	vpd
Two-way hourly volume	2935	vph
Hourly directional volume	2054	vph
Through-volume 15-min. flow rate	1081	v
Running time	96.8	sec
v/c ratio	0.75	
Through capacity	1440	vph
Progression factor, PF	0.895	
Uniform delay	30.9	sec
Filtering/metering factor, I	0.578	
Incremental delay	2.1	sec
Control delay	29.8	sec/v
Total travel speed, Sa	16.3	mph
Total urban street LOS	D	

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PLANNING ANALYSIS

Analyst:	
Agency/Co.:	
Date Performed:	11/6/2008
Analysis Time Period:	2014
Urban Street:	SR-6
Direction of Travel:	
Jurisdiction:	Segment 2A
Analysis Year:	2014
Project ID:	SR-6 TPR LM 0.00 to 1.30

Traffic Characteristics

Annual average daily traffic, AADT	25000	vpd
Planning analysis hour factor, K	0.080	
Directional distribution factor, D	0.700	
Peak-hour factor, PHF	0.950	
Adjusted saturation flow rate	1800	pcphgpl
Percent turns from exclusive lanes	50	%

Roadway Characteristics

Number of through lanes one direction, N	2	
Free flow speed, FFS	45	mph
Urban class	2	
Section length	2.49	miles
Median	No	
Left-turn bays	Yes	

Signal Characteristics

Signalized intersections	2	
Arrival type, AT	4	
Signal type (k = 0.5 for planning)	Actuated	
Cycle length, C	120.0	sec
Effective green ratio, g/C	0.400	

Results

Annual average daily traffic, AADT	25000	vpd
Two-way hourly volume	1999	vph
Hourly directional volume	1399	vph
Through-volume 15-min. flow rate	736	v
Running time	199.2	sec
v/c ratio	0.54	
Through capacity	1367	vph
Progression factor, PF	0.895	
Uniform delay	27.5	sec
Filtering/metering factor, I	0.827	
Incremental delay	1.3	sec
Control delay	25.9	sec/v
Total travel speed, Sa	35.7	mph
Total urban street LOS	A	

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PLANNING ANALYSIS

Analyst:	
Agency/Co.:	
Date Performed:	11/6/2008
Analysis Time Period:	2014
Urban Street:	SR-6
Direction of Travel:	
Jurisdiction:	Segment 2A
Analysis Year:	2034
Project ID:	SR-6 TPR LM 0.00 to 1.30

Traffic Characteristics

Annual average daily traffic, AADT	36700	vpd
Planning analysis hour factor, K	0.080	
Directional distribution factor, D	0.700	
Peak-hour factor, PHF	0.950	
Adjusted saturation flow rate	1800	pcphgpl
Percent turns from exclusive lanes	50	%

Roadway Characteristics

Number of through lanes one direction, N	2	
Free flow speed, FFS	45	mph
Urban class	2	
Section length	2.49	miles
Median	No	
Left-turn bays	Yes	

Signal Characteristics

Signalized intersections	2	
Arrival type, AT	4	
Signal type (k = 0.5 for planning)	Actuated	
Cycle length, C	120.0	sec
Effective green ratio, g/C	0.400	

Results

Annual average daily traffic, AADT	36700	vpd
Two-way hourly volume	2935	vph
Hourly directional volume	2054	vph
Through-volume 15-min. flow rate	1081	v
Running time	199.2	sec
v/c ratio	0.79	
Through capacity	1367	vph
Progression factor, PF	0.895	
Uniform delay	31.6	sec
Filtering/metering factor, I	0.515	
Incremental delay	2.5	sec
Control delay	30.8	sec/v
Total travel speed, Sa	34.4	mph
Total urban street LOS	B	

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PLANNING ANALYSIS

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Agency/Co.:	
Date Performed:	11/6/2008
Analysis Time Period:	2014
Urban Street:	SR-6
Direction of Travel:	
Jurisdiction:	Segment 2B
Analysis Year:	2014
Project ID:	SR-6 TPR LM 1.30 to 2.17

Traffic Characteristics

Annual average daily traffic, AADT	25000	vpd
Planning analysis hour factor, K	0.080	
Directional distribution factor, D	0.700	
Peak-hour factor, PHF	0.950	
Adjusted saturation flow rate	1800	pcphgpl
Percent turns from exclusive lanes	75	%

Roadway Characteristics

Number of through lanes one direction, N	2	
Free flow speed, FFS	45	mph
Urban class	2	
Section length	2.49	miles
Median	Yes	
Left-turn bays	Yes	

Signal Characteristics

Signalized intersections	2	
Arrival type, AT	4	
Signal type (k = 0.5 for planning)	Actuated	
Cycle length, C	120.0	sec
Effective green ratio, g/C	0.400	

Results

Annual average daily traffic, AADT	25000	vpd
Two-way hourly volume	1999	vph
Hourly directional volume	1399	vph
Through-volume 15-min. flow rate	368	v
Running time	199.2	sec
v/c ratio	0.26	
Through capacity	1440	vph
Progression factor, PF	0.895	
Uniform delay	24.1	sec
Filtering/metering factor, I	0.976	
Incremental delay	0.4	sec
Control delay	21.9	sec/v
Total travel speed, Sa	36.9	mph
Total urban street LOS	A	

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PLANNING ANALYSIS

Analyst:	
Agency/Co.:	
Date Performed:	11/6/2008
Analysis Time Period:	2034
Urban Street:	SR-6
Direction of Travel:	
Jurisdiction:	Segment 2B
Analysis Year:	2034
Project ID:	SR-6 TPR LM 1.30 to 2.17

Traffic Characteristics

Annual average daily traffic, AADT	36700	vpd
Planning analysis hour factor, K	0.080	
Directional distribution factor, D	0.700	
Peak-hour factor, PHF	0.950	
Adjusted saturation flow rate	1800	pcphgpl
Percent turns from exclusive lanes	75	%

Roadway Characteristics

Number of through lanes one direction, N	2	
Free flow speed, FFS	45	mph
Urban class	2	
Section length	2.49	miles
Median	Yes	
Left-turn bays	Yes	

Signal Characteristics

Signalized intersections	2	
Arrival type, AT	4	
Signal type (k = 0.5 for planning)	Actuated	
Cycle length, C	120.0	sec
Effective green ratio, g/C	0.400	

Results

Annual average daily traffic, AADT	36700	vpd
Two-way hourly volume	2935	vph
Hourly directional volume	2054	vph
Through-volume 15-min. flow rate	540	v
Running time	199.2	sec
v/c ratio	0.38	
Through capacity	1440	vph
Progression factor, PF	0.895	
Uniform delay	25.4	sec
Filtering/metering factor, I	0.934	
Incremental delay	0.7	sec
Control delay	23.4	sec/v
Total travel speed, Sa	36.4	mph
Total urban street LOS	A	

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PLANNING ANALYSIS

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Agency/Co.:	
Date Performed:	11/6/2008
Analysis Time Period:	2014
Urban Street:	SR-6
Direction of Travel:	
Jurisdiction:	Segment 2C
Analysis Year:	2014
Project ID:	SR-6 TPR LM 2.17 to 2.49

Traffic Characteristics

Annual average daily traffic, AADT	25000	vpd
Planning analysis hour factor, K	0.080	
Directional distribution factor, D	0.700	
Peak-hour factor, PHF	0.950	
Adjusted saturation flow rate	1800	pcphgpl
Percent turns from exclusive lanes	75	%

Roadway Characteristics

Number of through lanes one direction, N	2	
Free flow speed, FFS	45	mph
Urban class	2	
Section length	2.49	miles
Median	No	
Left-turn bays	Yes	

Signal Characteristics

Signalized intersections	2	
Arrival type, AT	4	
Signal type (k = 0.5 for planning)	Actuated	
Cycle length, C	120.0	sec
Effective green ratio, g/C	0.400	

Results

Annual average daily traffic, AADT	25000	vpd
Two-way hourly volume	1999	vph
Hourly directional volume	1399	vph
Through-volume 15-min. flow rate	368	v
Running time	199.2	sec
v/c ratio	0.27	
Through capacity	1367	vph
Progression factor, PF	0.895	
Uniform delay	24.2	sec
Filtering/metering factor, I	0.973	
Incremental delay	0.5	sec
Control delay	22.1	sec/v
Total travel speed, Sa	36.8	mph
Total urban street LOS	A	

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PLANNING ANALYSIS

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Agency/Co.:	
Date Performed:	11/6/2008
Analysis Time Period:	2034
Urban Street:	SR-6
Direction of Travel:	
Jurisdiction:	Segment 2C
Analysis Year:	2034
Project ID:	SR-6 TPR LM 2.17 to 2.49

Traffic Characteristics

Annual average daily traffic, AADT	36700	vpd
Planning analysis hour factor, K	0.080	
Directional distribution factor, D	0.700	
Peak-hour factor, PHF	0.950	
Adjusted saturation flow rate	1800	pcphgpl
Percent turns from exclusive lanes	75	%

Roadway Characteristics

Number of through lanes one direction, N	2	
Free flow speed, FFS	45	mph
Urban class	2	
Section length	2.49	miles
Median	No	
Left-turn bays	Yes	

Signal Characteristics

Signalized intersections	2	
Arrival type, AT	4	
Signal type (k = 0.5 for planning)	Actuated	
Cycle length, C	120.0	sec
Effective green ratio, g/C	0.400	

Results

Annual average daily traffic, AADT	36700	vpd
Two-way hourly volume	2935	vph
Hourly directional volume	2054	vph
Through-volume 15-min. flow rate	540	v
Running time	199.2	sec
v/c ratio	0.40	
Through capacity	1367	vph
Progression factor, PF	0.895	
Uniform delay	25.7	sec
Filtering/metering factor, I	0.924	
Incremental delay	0.8	sec
Control delay	23.7	sec/v
Total travel speed, Sa	36.3	mph
Total urban street LOS	A	

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OPERATIONAL ANALYSIS

Analyst:
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Date: 11/6/2008
Analysis Period: 2014
Highway: SR-6
From/To: Seg. 3 LM 2.49 to LM 4.75
Jurisdiction: TDOT
Analysis Year: 2014
Project ID: SR-6 TPR

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	16		0	
Median type	Undivided			
Free-flow speed:	Base		Measured	
FFS or BFFS	50.6	mph	50.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	1.6	mph	0.0	mph
Access points adjustment, FA	4.0	mph	0.0	mph
Free-flow speed	45.0	mph	50.0	mph

VOLUME

Direction	1		2	
Volume, V	1904	vph	816	vph
Peak-hour factor, PHF	0.95		0.95	
Peak 15-minute volume, v15	501		215	
Trucks and buses	3	%	3	%
Recreational vehicles	0	%	0	%
Terrain type	Rolling		Rolling	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	2.5		2.5	
Recreational vehicles PCE, ER	2.0		2.0	
Heavy vehicle adjustment, fHV	0.957		0.957	
Flow rate, vp	1047	pcphpl	448	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	1047	pcphpl	448	pcphpl
Free-flow speed, FFS	45.0	mph	50.0	mph
Avg. passenger-car travel speed, S	45.0	mph	50.0	mph
Level of service, LOS	C		A	
Density, D	23.3	pc/mi/ln	9.0	pc/mi/ln

Overall results are not computed when free-flow speed is less than 45 mph.

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OPERATIONAL ANALYSIS

Analyst:
Agency/Co:
Date: 11/6/2008
Analysis Period: 2034
Highway: SR-6
From/To: Seg. 3 LM 2.49 to LM 4.75
Jurisdiction: TDOT
Analysis Year: 2034
Project ID: SR-6 TPR

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	16		0	
Median type	Undivided			
Free-flow speed:	Base		Measured	
FFS or BFFS	50.6	mph	50.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	1.6	mph	0.0	mph
Access points adjustment, FA	4.0	mph	0.0	mph
Free-flow speed	45.0	mph	50.0	mph

VOLUME

Direction	1		2	
Volume, V	2055	vph	881	vph
Peak-hour factor, PHF	0.95		0.95	
Peak 15-minute volume, v15	541		232	
Trucks and buses	3	%	3	%
Recreational vehicles	0	%	0	%
Terrain type	Rolling		Rolling	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	2.5		2.5	
Recreational vehicles PCE, ER	2.0		2.0	
Heavy vehicle adjustment, fHV	0.957		0.957	
Flow rate, vp	1130	pcphpl	484	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	1130	pcphpl	484	pcphpl
Free-flow speed, FFS	45.0	mph	50.0	mph
Avg. passenger-car travel speed, S	45.0	mph	50.0	mph
Level of service, LOS	C		A	
Density, D	25.1	pc/mi/ln	9.7	pc/mi/ln

Overall results are not computed when free-flow speed is less than 45 mph.

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OPERATIONAL ANALYSIS

Analyst:
Agency/Co:
Date: 11/6/2008
Analysis Period: 2014
Highway: SR-6
From/To: Seg. 4 LM 4.75 to LM 5.55
Jurisdiction: TDOT
Analysis Year: 2014
Project ID: SR-6 TPR

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	16		0	
Median type	Divided			
Free-flow speed:	Base		Measured	
FFS or BFFS	50.0	mph	60.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	0.0	mph	0.0	mph
Access points adjustment, FA	4.0	mph	0.0	mph
Free-flow speed	46.0	mph	60.0	mph

VOLUME

Direction	1		2	
Volume, V	1904	vph	816	vph
Peak-hour factor, PHF	0.95		0.95	
Peak 15-minute volume, v15	501		215	
Trucks and buses	3	%	3	%
Recreational vehicles	0	%	0	%
Terrain type	Rolling		Rolling	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	2.5		2.5	
Recreational vehicles PCE, ER	2.0		2.0	
Heavy vehicle adjustment, fHV	0.957		0.957	
Flow rate, vp	1047	pcphpl	448	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	1047	pcphpl	448	pcphpl
Free-flow speed, FFS	46.0	mph	60.0	mph
Avg. passenger-car travel speed, S	46.0	mph	60.0	mph
Level of service, LOS	C		A	
Density, D	22.8	pc/mi/ln	7.5	pc/mi/ln

Overall results are not computed when free-flow speed is less than 45 mph.

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OPERATIONAL ANALYSIS

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Agency/Co:
Date: 11/6/2008
Analysis Period: 2034
Highway: SR-6
From/To: Seg. 4 LM 4.75 to LM 5.55
Jurisdiction: TDOT
Analysis Year: 2034
Project ID: SR-6 TPR

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	16		0	
Median type	Divided			
Free-flow speed:	Base		Measured	
FFS or BFFS	50.0	mph	60.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	0.0	mph	0.0	mph
Access points adjustment, FA	4.0	mph	0.0	mph
Free-flow speed	46.0	mph	60.0	mph

VOLUME

Direction	1		2	
Volume, V	2055	vph	881	vph
Peak-hour factor, PHF	0.95		0.95	
Peak 15-minute volume, v15	541		232	
Trucks and buses	3	%	3	%
Recreational vehicles	0	%	0	%
Terrain type	Rolling		Rolling	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	2.5		2.5	
Recreational vehicles PCE, ER	2.0		2.0	
Heavy vehicle adjustment, fHV	0.957		0.957	
Flow rate, vp	1130	pcphpl	484	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	1130	pcphpl	484	pcphpl
Free-flow speed, FFS	46.0	mph	60.0	mph
Avg. passenger-car travel speed, S	46.0	mph	60.0	mph
Level of service, LOS	C		A	
Density, D	24.6	pc/mi/ln	8.1	pc/mi/ln

Overall results are not computed when free-flow speed is less than 45 mph.

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OPERATIONAL ANALYSIS

Analyst:
Agency/Co:
Date: 11/6/2008
Analysis Period: 2014
Highway: SR-6
From/To: Seg. 5A LM 5.55 to LM 6.60
Jurisdiction: TDOT
Analysis Year: 2014
Project ID: SR-6 TPR

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	16		0	
Median type	Undivided			
Free-flow speed:	Base		Measured	
FFS or BFFS	50.0	mph	50.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	1.6	mph	0.0	mph
Access points adjustment, FA	4.0	mph	0.0	mph
Free-flow speed	44.4	mph	50.0	mph

VOLUME

Direction	1		2	
Volume, V	1344	vph	576	vph
Peak-hour factor, PHF	0.95		0.95	
Peak 15-minute volume, v15	354		152	
Trucks and buses	3	%	3	%
Recreational vehicles	0	%	0	%
Terrain type	Rolling		Rolling	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	2.5		2.5	
Recreational vehicles PCE, ER	2.0		2.0	
Heavy vehicle adjustment, fHV	0.957		0.957	
Flow rate, vp	739	pcphpl	316	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	739	pcphpl	316	pcphpl
Free-flow speed, FFS	44.4	mph	50.0	mph
Avg. passenger-car travel speed, S		mph	50.0	mph
Level of service, LOS			A	
Density, D		pc/mi/ln	6.3	pc/mi/ln

Overall results are not computed when free-flow speed is less than 45 mph.

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OPERATIONAL ANALYSIS

Analyst:
Agency/Co:
Date: 11/6/2008
Analysis Period: 2034
Highway: SR-6
From/To: Seg. 5A LM 5.55 to LM 6.60
Jurisdiction: TDOT
Analysis Year: 2034
Project ID: SR-6 TPR

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	16		0	
Median type	Undivided			
Free-flow speed:	Base		Measured	
FFS or BFFS	50.0	mph	50.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	1.6	mph	0.0	mph
Access points adjustment, FA	4.0	mph	0.0	mph
Free-flow speed	44.4	mph	50.0	mph

VOLUME

Direction	1		2	
Volume, V	1546	vph	662	vph
Peak-hour factor, PHF	0.95		0.95	
Peak 15-minute volume, v15	407		174	
Trucks and buses	3	%	3	%
Recreational vehicles	0	%	0	%
Terrain type	Rolling		Rolling	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	2.5		2.5	
Recreational vehicles PCE, ER	2.0		2.0	
Heavy vehicle adjustment, fHV	0.957		0.957	
Flow rate, vp	850	pcphpl	364	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	850	pcphpl	364	pcphpl
Free-flow speed, FFS	44.4	mph	50.0	mph
Avg. passenger-car travel speed, S		mph	50.0	mph
Level of service, LOS			A	
Density, D		pc/mi/ln	7.3	pc/mi/ln

Overall results are not computed when free-flow speed is less than 45 mph.

HCS+: Multilane Highways Release 5.3

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OPERATIONAL ANALYSIS

Analyst:
Agency/Co:
Date: 11/6/2008
Analysis Period: 2014
Highway: SR-6
From/To: Seg. 5B LM 6.60 to LM 8.67
Jurisdiction: TDOT
Analysis Year: 2014
Project ID: SR-6 TPR

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	16		0	
Median type	Undivided			
Free-flow speed:	Base		Measured	
FFS or BFFS	60.0	mph	50.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	1.6	mph	0.0	mph
Access points adjustment, FA	4.0	mph	0.0	mph
Free-flow speed	54.4	mph	50.0	mph

VOLUME

Direction	1		2	
Volume, V	840	vph	360	vph
Peak-hour factor, PHF	0.95		0.95	
Peak 15-minute volume, v15	221		95	
Trucks and buses	3	%	3	%
Recreational vehicles	0	%	0	%
Terrain type	Rolling		Rolling	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	2.5		2.5	
Recreational vehicles PCE, ER	2.0		2.0	
Heavy vehicle adjustment, fHV	0.957		0.957	
Flow rate, vp	462	pcphpl	198	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	462	pcphpl	198	pcphpl
Free-flow speed, FFS	54.4	mph	50.0	mph
Avg. passenger-car travel speed, S	54.4	mph	50.0	mph
Level of service, LOS	A		A	
Density, D	8.5	pc/mi/ln	4.0	pc/mi/ln

Overall results are not computed when free-flow speed is less than 45 mph.

HCS+: Multilane Highways Release 5.3

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OPERATIONAL ANALYSIS

Analyst:
Agency/Co:
Date: 11/6/2008
Analysis Period: 2034
Highway: SR-6
From/To: Seg. 5B LM 6.60 to LM 8.67
Jurisdiction: TDOT
Analysis Year: 2034
Project ID: SR-6 TPR

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	16		0	
Median type	Undivided			
Free-flow speed:	Base		Measured	
FFS or BFFS	60.0	mph	50.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	1.6	mph	0.0	mph
Access points adjustment, FA	4.0	mph	0.0	mph
Free-flow speed	54.4	mph	50.0	mph

VOLUME

Direction	1		2	
Volume, V	1025	vph	439	vph
Peak-hour factor, PHF	0.95		0.95	
Peak 15-minute volume, v15	270		116	
Trucks and buses	3	%	3	%
Recreational vehicles	0	%	0	%
Terrain type	Rolling		Rolling	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	2.5		2.5	
Recreational vehicles PCE, ER	2.0		2.0	
Heavy vehicle adjustment, fHV	0.957		0.957	
Flow rate, vp	563	pcphpl	241	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	563	pcphpl	241	pcphpl
Free-flow speed, FFS	54.4	mph	50.0	mph
Avg. passenger-car travel speed, S	54.4	mph	50.0	mph
Level of service, LOS	A		A	
Density, D	10.3	pc/mi/ln	4.8	pc/mi/ln

Overall results are not computed when free-flow speed is less than 45 mph.

HCS+: Multilane Highways Release 5.3

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OPERATIONAL ANALYSIS

Analyst:
Agency/Co:
Date: 11/6/2008
Analysis Period: 2014
Highway: SR-6
From/To: Seg. 6 LM 8.67 to 10.03
Jurisdiction: TDOT
Analysis Year: 2014
Project ID: SR-6 TPR

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	16		0	
Median type	Undivided			
Free-flow speed:	Base		Measured	
FFS or BFFS	45.0	mph	45.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	1.6	mph	0.0	mph
Access points adjustment, FA	4.0	mph	0.0	mph
Free-flow speed	39.4	mph	45.0	mph

VOLUME

Direction	1		2	
Volume, V	1165	vph	499	vph
Peak-hour factor, PHF	0.95		0.95	
Peak 15-minute volume, v15	307		131	
Trucks and buses	3	%	3	%
Recreational vehicles	0	%	0	%
Terrain type	Rolling		Rolling	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	2.5		2.5	
Recreational vehicles PCE, ER	2.0		2.0	
Heavy vehicle adjustment, fHV	0.957		0.957	
Flow rate, vp	640	pcphpl	274	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	640	pcphpl	274	pcphpl
Free-flow speed, FFS	39.4	mph	45.0	mph
Avg. passenger-car travel speed, S		mph	45.0	mph
Level of service, LOS			A	
Density, D		pc/mi/ln	6.1	pc/mi/ln

Overall results are not computed when free-flow speed is less than 45 mph.

HCS+: Multilane Highways Release 5.3

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OPERATIONAL ANALYSIS

Analyst:
Agency/Co:
Date: 11/6/2008
Analysis Period: 2034
Highway: SR-6
From/To: Seg. 6 LM 8.67 to 10.03
Jurisdiction: TDOT
Analysis Year: 2034
Project ID: SR-6 TPR

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	16		0	
Median type	Undivided			
Free-flow speed:	Base		Measured	
FFS or BFFS	45.0	mph	45.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	1.6	mph	0.0	mph
Access points adjustment, FA	4.0	mph	0.0	mph
Free-flow speed	39.4	mph	45.0	mph

VOLUME

Direction	1		2	
Volume, V	1803	vph	773	vph
Peak-hour factor, PHF	0.95		0.95	
Peak 15-minute volume, v15	474		203	
Trucks and buses	3	%	3	%
Recreational vehicles	0	%	0	%
Terrain type	Rolling		Rolling	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	2.5		2.5	
Recreational vehicles PCE, ER	2.0		2.0	
Heavy vehicle adjustment, fHV	0.957		0.957	
Flow rate, vp	991	pcphpl	425	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	991	pcphpl	425	pcphpl
Free-flow speed, FFS	39.4	mph	45.0	mph
Avg. passenger-car travel speed, S		mph	45.0	mph
Level of service, LOS			A	
Density, D		pc/mi/ln	9.4	pc/mi/ln

Overall results are not computed when free-flow speed is less than 45 mph.

THREE LANE SPRING HILL OPTION

HCS+ ANALYSIS

Segment 2A L.M. 0.00 to 0.20 Year 2014
Segment 2A L.M. 0.00 to 0.20 Year 2034

HCS+: Urban Streets Release 5.3

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PLANNING ANALYSIS

Analyst:	
Agency/Co.:	
Date Performed:	11/6/2008
Analysis Time Period:	2014
Urban Street:	SR-6
Direction of Travel:	
Jurisdiction:	Segment 2A
Analysis Year:	2014

Project ID: SR-6 TPR LM 0.00 to 0.20 (SH 3 Lane Option)

Traffic Characteristics

Annual average daily traffic, AADT	25000	vpd
Planning analysis hour factor, K	0.080	
Directional distribution factor, D	0.700	
Peak-hour factor, PHF	0.950	
Adjusted saturation flow rate	1800	pcphgpl
Percent turns from exclusive lanes	50	%

Roadway Characteristics

Number of through lanes one direction, N	1	
Free flow speed, FFS	45	mph
Urban class	2	
Section length	2.49	miles
Median	Yes	
Left-turn bays	Yes	

Signal Characteristics

Signalized intersections	2	
Arrival type, AT	4	
Signal type (k = 0.5 for planning)	Actuated	
Cycle length, C	120.0	sec
Effective green ratio, g/C	0.400	

Results

Annual average daily traffic, AADT	25000	vpd
Two-way hourly volume	1999	vph
Hourly directional volume	1399	vph
Through-volume 15-min. flow rate	736	v
Running time	199.2	sec
v/c ratio	1.02	
Through capacity	720	vph
Progression factor, PF	0.895	
Uniform delay	36.0	sec
Filtering/metering factor, I	0.090	
Incremental delay	16.3	sec
Control delay	48.5	sec/v
Total travel speed, Sa	30.3	mph
Total urban street LOS	B	

HCS+: Urban Streets Release 5.3

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PLANNING ANALYSIS

Analyst:	
Agency/Co.:	
Date Performed:	11/6/2008
Analysis Time Period:	2014
Urban Street:	SR-6
Direction of Travel:	
Jurisdiction:	Segment 2A
Analysis Year:	2034
Project ID:	SR-6 TPR LM 0.00 to 0.20

Traffic Characteristics

Annual average daily traffic, AADT	36700	vpd
Planning analysis hour factor, K	0.080	
Directional distribution factor, D	0.700	
Peak-hour factor, PHF	0.950	
Adjusted saturation flow rate	1800	pcphgpl
Percent turns from exclusive lanes	50	%

Roadway Characteristics

Number of through lanes one direction, N	1	
Free flow speed, FFS	45	mph
Urban class	2	
Section length	2.49	miles
Median	Yes	
Left-turn bays	Yes	

Signal Characteristics

Signalized intersections	2	
Arrival type, AT	4	
Signal type (k = 0.5 for planning)	Actuated	
Cycle length, C	120.0	sec
Effective green ratio, g/C	0.400	

Results

Annual average daily traffic, AADT	36700	vpd
Two-way hourly volume	2935	vph
Hourly directional volume	2054	vph
Through-volume 15-min. flow rate	1081	v
Running time	199.2	sec
v/c ratio	1.50	
Through capacity	720	vph
Progression factor, PF	0.895	
Uniform delay	36.0	sec
Filtering/metering factor, I	0.090	
Incremental delay	226.3	sec
Control delay	258.5	sec/v
Total travel speed, Sa	12.5	mph
Total urban street LOS	F	

THREE LANE THOMPSON'S STATION OPTION

HCS+ ANALYSIS

Segment 2C L.M. 2.17 to 2.49 Year 2014
Segment 2C L.M. 2.17 to 2.49 Year 2034

HCS+: Urban Streets Release 5.3

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PLANNING ANALYSIS

Analyst:	
Agency/Co.:	
Date Performed:	11/6/2008
Analysis Time Period:	2014
Urban Street:	SR-6
Direction of Travel:	
Jurisdiction:	Segment 2C
Analysis Year:	2014
Project ID:	SR-6 TPR LM 2.17 to 2.49

Traffic Characteristics

Annual average daily traffic, AADT	25000	vpd
Planning analysis hour factor, K	0.080	
Directional distribution factor, D	0.700	
Peak-hour factor, PHF	0.950	
Adjusted saturation flow rate	1800	pcphgpl
Percent turns from exclusive lanes	75	%

Roadway Characteristics

Number of through lanes one direction, N	1	
Free flow speed, FFS	45	mph
Urban class	2	
Section length	2.49	miles
Median	Yes	
Left-turn bays	Yes	

Signal Characteristics

Signalized intersections	2	
Arrival type, AT	4	
Signal type (k = 0.5 for planning)	Actuated	
Cycle length, C	120.0	sec
Effective green ratio, g/C	0.400	

Results

Annual average daily traffic, AADT	25000	vpd
Two-way hourly volume	1999	vph
Hourly directional volume	1399	vph
Through-volume 15-min. flow rate	368	v
Running time	199.2	sec
v/c ratio	0.51	
Through capacity	720	vph
Progression factor, PF	0.895	
Uniform delay	27.2	sec
Filtering/metering factor, I	0.849	
Incremental delay	2.2	sec
Control delay	26.5	sec/v
Total travel speed, Sa	35.5	mph
Total urban street LOS	A	

HCS+: Urban Streets Release 5.3

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PLANNING ANALYSIS

Analyst:	
Agency/Co.:	
Date Performed:	11/6/2008
Analysis Time Period:	2034
Urban Street:	SR-6
Direction of Travel:	
Jurisdiction:	Segment 2C
Analysis Year:	2034
Project ID:	SR-6 TPR LM 2.17 to 2.49

Traffic Characteristics

Annual average daily traffic, AADT	36700	vpd
Planning analysis hour factor, K	0.080	
Directional distribution factor, D	0.700	
Peak-hour factor, PHF	0.950	
Adjusted saturation flow rate	1800	pcphgpl
Percent turns from exclusive lanes	75	%

Roadway Characteristics

Number of through lanes one direction, N	1	
Free flow speed, FFS	45	mph
Urban class	2	
Section length	2.49	miles
Median	Yes	
Left-turn bays	Yes	

Signal Characteristics

Signalized intersections	2	
Arrival type, AT	4	
Signal type (k = 0.5 for planning)	Actuated	
Cycle length, C	120.0	sec
Effective green ratio, g/C	0.400	

Results

Annual average daily traffic, AADT	36700	vpd
Two-way hourly volume	2935	vph
Hourly directional volume	2054	vph
Through-volume 15-min. flow rate	540	v
Running time	199.2	sec
v/c ratio	0.75	
Through capacity	720	vph
Progression factor, PF	0.895	
Uniform delay	30.9	sec
Filtering/metering factor, I	0.579	
Incremental delay	4.2	sec
Control delay	31.8	sec/v
Total travel speed, Sa	34.1	mph
Total urban street LOS	B	

A JOINT RESOLUTION
City of Spring Hill Resolution 10-19
Town of Thompson's Station Resolution 10-001

A JOINT RESOLUTION OF THE CITY OF SPRING HILL AND THE TOWN OF THOMPSON'S STATION RELATING TO COORDINATION OF THEIR RESPECTIVE COMPREHENSIVE PLANS AND TO REQUEST THE NASHVILLE AREA METROPOLITAN PLANNING ORGANIZATION CONSIDER AN INTERCHANGE AT INTERSTATE 65 AS THE HIGHEST OF PRIORITIES

WHEREAS, the City of Spring Hill (Spring Hill) is a municipality, a portion of which is located in southern Williamson County, Tennessee, and a portion of which is located in northern Maury County, Tennessee, whose legislative body is the Board of Mayor and Aldermen; and

WHEREAS, the Town of Thompson's Station (Thompson's Station) is a municipality located in southern Williamson County, Tennessee, whose legislative body is the Board of Mayor and Aldermen; and

WHEREAS, the Nashville Area Metropolitan Planning Organization (MPO) is the federally mandated transportation planning agency for the Nashville region that includes Davidson, Rutherford, Sumner, Wilson and Williamson Counties, including the cities of Spring Hill and Thompson's Station, and is charged with establishing the priorities for regionally significant transportation related projects through its Long Range Transportation Plan (LRTP); and

WHEREAS, Spring Hill and Thompson's Station recognize each city as a distinctive community and are desirous of engaging in joint efforts to protect the unique character of each community's values and resources; and

WHEREAS, it is the collective desire of Spring Hill and Thompson's Station to practice and promote comprehensive municipal planning as it relates to sound growth management within their respective municipal corporate boundaries; and

WHEREAS, Spring Hill and Thompson's Station are currently updating or developing Comprehensive Plans for their respective municipal corporate boundaries and recognize that intergovernmental coordination is essential to ensure that future development occurs in a harmonious fashion and that such coordination will benefit both municipalities as well as citizens and property owners of the entire region; and

WHEREAS, Spring Hill and Thompson's Station acknowledge the future economic development potential of properties adjacent to their common boundary in the vicinity of Interstate 65 and consequently the need to coordinate compatible land use, transportation, and delivery of services in this general vicinity; and

WHEREAS, Spring Hill and Thompson's Station recognize the critical need for an interchange on Interstate 65 to service South Williamson County, Spring Hill and Thompson's Station; and

WHEREAS, a properly located interchange at Interstate 65 is likely to reduce the Average Daily Trips (ADT) on existing roadways in the region, improve the Level of Service (LOS) on these roadways,

reduce ongoing maintenance costs, and reduce emissions providing better air quality for the region, all consistent with the Transportation Equity Act for the 21st Century (TEA-21) passed in 1998 and the Clean Air Act Amendments (CAAA) of 1990 and 1997; and

WHEREAS, it is anticipated that further study through the completion of an Interchange Justification Study (IJS) will identify the need and viable alternatives for the appropriate location for an interchange at Interstate 65 which will provide the greatest mutual benefit to the citizens of this region; and

WHEREAS, Spring Hill adopted a Major Thoroughfare Plan in October 2007 which includes projects P8, "Buckner Road Extension" and P31, "Buckner Road Extension 2" which include an extension of Buckner Road from Buckner Lane to U.S. 431/Lewisburg Pike with a constructed interchange at Interstate 65 as a highest of priorities; and

WHEREAS, the current 2030 Long Range Transportation Plan adopted by the Nashville Area MPO includes project LRTP-3046 to "Construct Interchange at Interstate 65 and Thompson's Station Rd East" with a 2030 planning horizon year and an estimated cost of $6,500,000; and

WHEREAS, the Nashville Area MPO is in the process of developing and adopting a new Long Range Transportation Plan with the working title 2035 Regional Transportation Plan; and

WHEREAS, Spring Hill and Thompson's Station believe the need for an interchange on Interstate 65 to be the highest of priorities because an interchange will provide access to Interstate 65 for a substantial population center, will relieve congestion on U.S. 31 (S.R. 6) and for these reasons should be considered for the earliest planning horizon year in the 2035 Regional Transportation Plan; and

WHEREAS, this joint resolution is a statement of will by both Spring Hill and Thompson's Station that both parties are in agreement that the Nashville Area MPO should include in the 2035 Regional Transportation Plan a project in the earliest panning horizon year to construct an interchange at Interstate 65 to be located at or south of Thompson's Station Road East and no further south than Duplex Road, to provide for greater regional mobility throughout the southern portions of Williamson County and relieve congestion on U.S. 31 (S.R. 6); and

WHEREAS, there is no intent for this Joint Resolution to restrict either Spring Hill or Thompson's Station authority to amend their Comprehensive Plan, Official Zoning Map, or apply land development regulations consistent with this Joint Resolution, or otherwise to make land use decisions for lands within their municipal corporate boundaries as either Spring Hill or Thompson's Station determines.

NOW, THEREFORE BE IT RESOLVED, by the Board of Mayor and Aldermen of the City of Spring Hill, Tennessee, and the Board of Mayor and Aldermen of the Town of Thompson's Station Tennessee that both parties affirm a shared commitment to coordinate compatible land use, transportation, and delivery of service issues for properties adjacent to their common boundary through the development of their respective Comprehensive Plans;

NOW, THEREFORE BE IT FURTHER RESOLVED, that Spring Hill and Thompson's Station are in willful agreement that the Nashville Area MPO should include in the 2035 Regional Transportation Plan a project in the earliest panning horizon year to construct an interchange at Interstate 65 to be located at or no further North than Thompson's Station Road East and no further South than

Duplex Road. to provide for greater regional mobility throughout the southern portions of Williamson County and relieve congestion on U.S. 31 (S.R. 6).

Passed and adopted by the Board of Mayor and Aldermen of the City of Spring Hill, Tennessee on the 16th day of February, 2010.

ATTEST:

Michael Dinwiddie, Mayor

April Goad, City Recorder

Passed and adopted by the Board of Mayor and Aldermen of the Town of Thompson's Station, Tennessee on the 9th day of March, 2010.

ATTEST:

Corey Napier, Vice-Mayor

Doug Goetsch, Town Recorder

TRAFFIC SIGNAL SYNCHRONIZATION STUDY

PREPARED FOR:
CITY OF SPRING HILL, TN

PREPARED BY:

RGPHILLIPS CONSULTING
TRAFFIC ENGINEERING & TRANSPORTATION PLANNING

IN ASSOCIATION WITH:

NEEL-SCHAFFER
Solutions you can build upon

OCTOBER 2008

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1. Introduction

Traffic on US Highway 31 (Main Street) in Spring Hill has grown tremendously in recent years and the volumes now push the limits of the capacity of the roadway during peak hours. This combined with the recent escalation in fuel prices has placed great importance on efficient operation of traffic signals.

Signal timing optimization is typically a very cost effective strategy toward relieving traffic congestion. Optimized timings can include free standing traffic signals, but more commonly involve the synchronization of several adjacent signals along an arterial highway. Benefits of signal coordination often include improved travel times, reduced fuel consumption, and improved emergency response.

As a part of this study, nine intersections along US Highway 31 were evaluated to determine their current level of operation and to identify potential changes that could improve the efficiency of the traffic signal operation. The nine intersections are located in a 4.1 mile stretch of US Highway 31. A total of eight of the signals are located within the City of Spring Hill, with the remaining signal being under the jurisdiction of the Town of Thompson's Station.

The signalized intersections contained in the scope of the project, listed from south to north, are as follows:

- Crossings Boulevard
- Stephen P. Yokich Parkway
- Kedron Road / Kedron Parkway
- McLemore Avenue / Depot Street
- Beechcroft Road (SR 247)
- Duplex Road (SR 247)
- Campbell Station Parkway
- Buckner Road
- Thompson Station Road

2. Existing Traffic Data

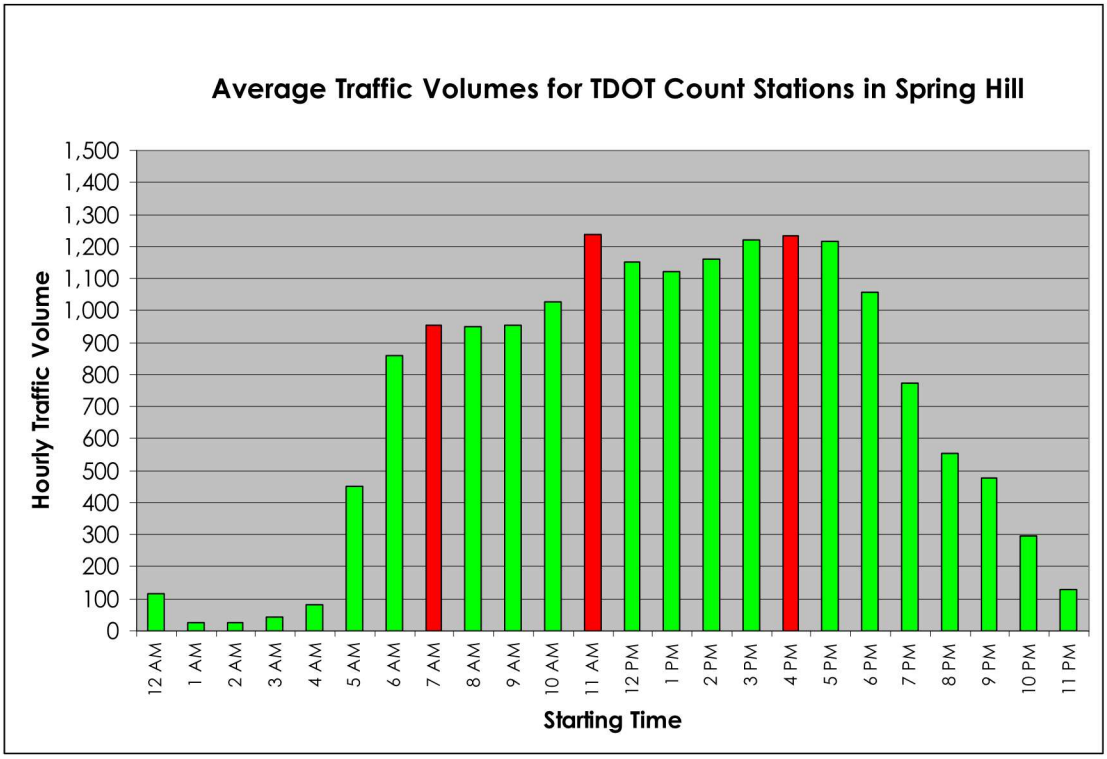
2.1 Average Daily Traffic Volumes

The Tennessee Department of Transportation has three count stations on US Highway 31 within the study area. Station #7 is located just north of Saturn Parkway and station #9 is located just north of Duplex Road. Farther north, in Thompson's Station, count station #67 is located north of Thompson Station Road. The adjusted 2007 average daily traffic volumes at these stations are as follows:

- Station #7 15,405
- Station #9 18,831
- Station #67 20,488

Hourly data from count station #7 was analyzed to determine the directional split of traffic throughout the day. During the AM peak, traffic is split roughly 60% northbound and 40% southbound. The mid-day peak indicated an even split in traffic, while the PM peak showed a 43% split northbound and a 57% split for southbound traffic. Summary printouts of the ADT data are included in Appendix A.

As shown in the graph below, traffic is heavy from 6 AM to 7 PM, with the peak hours of flow occurring from 7-8 AM, 11 AM-12 PM, and 4-5 PM.



2.2 Historical Traffic Growth

Historical data from the same TDOT count stations indicate rapid traffic growth in the central and northern areas studied. Station #9, located just north of Duplex Road, showed an average growth rate of 11% per year over the last five years. While count station #67, located north of Thompson Station Road, indicated an average five year growth rate of over 9% per year. The historical data from these TDOT count stations is included in Appendix A.

2.3 Turning Movement Counts

To provide data for the analysis, manual traffic counts were conducted at the each of the nine intersections contained in the project scope.

The traffic counts were collected on typical weekdays in April, 2008 with special care being given to ensure that both Williamson County and Maury County school systems were in session. In addition, it should be noted that the Super Target at the Crossing of Spring Hill was open for business when the counts were performed. The counts were conducted at each intersection for the following hours:

- 7:00 AM to 9:00 AM
- 11:00 AM to 1:00 PM
- 4:00 PM to 6:00 PM

The peak traffic hours tended to vary from intersection to intersection. However, the overall peak hours obtained from combining all the counts collected indicate the AM peak hour of traffic occurs from 7:15 AM to 8:15 AM, the Mid-day peak from 11:45 AM to 12:45 PM, and the PM peak hour of traffic is from 4:30 PM to 5:30 PM. Summary sheets for the existing traffic count data are included in Appendix A.

3. Field Inventory of Traffic Signals

3.1 Signal Timing and Equipment Inventory

A field inventory of the existing nine signalized intersections within the study area was performed. The inventory was conducted to identify the existing traffic signal equipment and signal timing parameters that currently control the operation of each traffic signal. Various signal timing parameters were identified. A brief description of each of these parameters is as follows:

- ***Minimum Green*** is the minimum time a vehicular signal displays a green indication when illuminated.

- ***Passage Time*** is the allowable gap in traffic between actuations before a signal display will normally loose the green indication when other demand is present.

- ***Maximum*** is the maximum allowable green time when a conflicting call is present. Many controllers offer several programmable maximums, which are typically referred to as Max 1, Max 2, and Max 3.

- ***Yellow Clearance*** is the interval during which a yellow signal is displayed indicating to motorists that the green interval has ended.

- ***Red Clearance*** is an additional clearance interval that immediately follows the yellow clearance. The red clearance represents the amount of time that passes when all indications are red prior to the next conflicting phase being displayed.

- ***Walk*** is an interval during which pedestrian movements should be initiated.

- ***Pedestrian Clearance*** is the interval during which pedestrian movements should be completed.

- ***Vehicle Recall*** is a controller function that returns a green indication to a phase without regard to demand. Controllers can be set to Minimum, Maximum, or no recall.

- ***Pedestrian Recall*** allows for the service of a pedestrian phase without regard to demand.

- ***Memory*** is a controller function that defines whether the controller remembers an actuation after it occurs prior to the display of the corresponding phase.

- ***Dual Entry*** is a controller feature that provides for the display of a complimentary green phase in the absence of an activation of that phase.

- ***Phase Omit*** is a programmable function that is utilized to disable unused signal phases.

In addition to the above timing parameters, the following data were recorded for each intersection:

- Intersection Name
- Inventory Date
- Pole Types
- Signal Attachment Types
- Cabinet Mount
- Cabinet Dimension (WxDxH)
- Cabinet Phases
- Cabinet Location
- Local Controller Make and Model
- Master Controller Make and Model
- Conflict Monitor Type (MMU)
- Emergency Vehicle Pre-emption Equipment
- Miscellaneous Equipment
- Loop Detector Number and Type
- Detector Delay Programming
- Notes Regarding Signal Programming
- Signal Phasing and Orientation

The resulting signal timing and equipment inventory sheets are included in appendix B of this report. It should be noted that the intersections of Beechcroft Road and Duplex Road are separate offset intersections that operate off of one traffic signal controller. Since these intersections are not independent of each other, a single inventory sheet was used to record information pertinent to the operation of the traffic signals. From the inventory it was determined that a master controller is located in the signal cabinet for the Crossings Boulevard. Although not fully operational, underground fiber optic cable was installed between the intersection at the Crossings Boulevard and Stephen A. Yokich Parkway.

Also, schematic diagrams were developed for each intersection to indicate various traffic signal and intersection features. These diagrams include the following information:

- Intersection Sketch including Traffic Lanes
- Arrows Indicating Lane Usage
- Controller Cabinet Location
- Signal Pole Locations
- Signal Head Types and Locations
- Signal Head Type Key
- Pedestrian Signal Locations
- Vehicle Detection Placement
- Emergency Vehicle Pre-emption Detector Placement
- Signal Phasing Diagram
- Existing Traffic Signal Interconnect, where applicable

The intersection diagrams are included in Appendix C of this report. Again, it should be noted that the intersections of Beechcroft Road and Duplex Road are separate offset intersections that operate off of one traffic signal controller. Since these intersections are not independent of each other, a single intersection diagram was developed to record information pertinent to the operation of the traffic signals.

Table 1
Signal Equipment Inventory
Local Traffic Controller Types

Intersection	Controller Type
Crossings Boulevard (#1)	Peek 3000 E
Stephen P. Yokich Parkway (#2)	Peek 3000
Kedron Road / Kedron Parkway (#3)	Peek 3000
McLemore Avenue / Depot Street (#4)	Peek 3000 E
Beechcroft Road / Duplex Road (#5 & #6)	Peek 3000 E
Campbell Station Parkway (#7)	Peek 3000 E
Buckner Road (#8)	Peek 3000
Thompson Station Road (#9)	Transyt 1880 EL

3.2 Utility Pole Survey

In addition to the intersection inventory, drive-by observations were made of the existing utility poles located within the study area. Over the approximate 4 mile stretch, it was determined that there are roughly 130 poles that have the potential capacity to support an aerial run of communications cable. The east side of the US 31 by and large has better utility poles in regards to space available for potential attachment. In fact, 120 of the 130 poles identified are located on the east side of US Highway 31. However, in between Depot Street and Kedron Road the recommended pole line crosses US Highway 31 and continues south along the western side until reaching Yokich Parkway, which affects approximately the last 10 utility poles.

3.3 Existing Traffic Observations

During the course of performing the traffic counts and field surveys, the intersections in the study area were observed on several occasions during both peak and off peak traffic conditions. The results of our observations, for each intersection, are summarized as follows:

1. ***Crossings Boulevard*** - The intersection is new and is well under capacity. There are no specific traffic issues that were identified during peak period observations.

2. ***Stephen P. Yokich Parkway*** - During all peak period it was often observed that the northbound left turn phase has an insufficient amount of green time to serve the traffic demand. While not over capacity overall, the lack of coordination between the adjacent traffic signals creates unnecessary stops on US Highway 31.

3. ***Kedron Road / Kedron Parkway*** - The intersection appears to run somewhat sluggishly and would benefit from coordinated operation.

4. ***McLemore Avenue / Depot Street*** - The major issue noticed is the lack of coordination between this signal and the signals at Beechcroft Road and Duplex Road. The yellow clearance intervals (3 seconds for the side street approaches) appear short, given the offset nature of the intersection.

5. ***Beechcroft Road*** - This intersection operates together with the signal at Duplex Road. The offset operation, while needed to maintain safety, is inefficient and long term improvement plans should include the alignment of the two streets. Significant queues were observed on each side street during peak traffic operations.

6. ***Duplex Road*** - The comments for Beechcroft Road, listed above, also apply to Duplex Road since they both operate from the same controller mechanism.

7. ***Campbell Station Parkway*** - Significant southbound congestion was observed during the PM peak period.

8. ***Buckner Road*** - Some congestion was observed during the AM peak period for northbound traffic and during the PM peak for southbound traffic. In addition, as expected, the intersection experienced periods of significant delay at the start of the school day and at dismissal.

9. ***Thompson Station Road*** - The Yellow clearance intervals at this intersection are short for the posted speed limits (3.0 seconds per phase). During the PM peak, a delay of over five minutes was observed for southbound vehicles to clear the intersection. It should also be noted that the controller at this intersection is outdated and apparently was placed into service at this intersection during a repair by a service contractor.

4. Traffic Signal Equipment Improvements

As previously mentioned, part of the scope of services included conducting observations and evaluating the operation of each of the signalized intersections included in the study. From our observations a list of recommended improvements were developed which is shown below in Table 2.

As shown, Table 2 includes an estimate of the probable construction cost for each of the recommended improvements. It should be noted that these recommendations include relatively low cost initiatives and were limited to improvement to the traffic signal equipment. Roadway widening and other more costly improvements were not considered as part of this task. Sketches detailing the recommended improvements can be found in Appendix D of this report.

Table 2
Recommended Signal Equipment Improvements

Intersection	Recommended Improvement	Estimated Cost
Crossings Boulevard (#1)	None	$0
Stephen P. Yokich Parkway (#2)	None	$0
Kedron Road / Kedron Parkway (#3)	Add Overlap Phasing	$6,000
McLemore Avenue / Depot Street (#4)	Add Main Street Detection	$3,000
Beechcroft Road (#5)/ Duplex Road (#6)	Add Detection, Signal Indications	$5,000
Campbell Station Parkway (#7)	Add Overlap Phasing	$2,000
Buckner Road (#8)	Add Overlap Phasing	$6,000
Thompson Station Road (#9)	Replace Signal Controller	$3,000*
Totals		**$25,000**

* - Total Includes $3,000 for Thompson Station Road located in Thompson's Station

5. Signal System Communications

5.1 Communications Overview

To provide for optimized signal timings, adjacent intersections need to run in a similar fashion. This is best accomplished when all intersections are "synchronized" based on the same system time clock. Many different forms of communication media are utilized to provide synchronized timings including radio, fiber optic, and GPS based systems.

5.2 Intersection Grouping

Due to the spacing of the existing traffic signals, the concept of dividing the system into two separate zones was explored. Based on engineering judgment, a logical division point was determined and the signals were assigned to the following two groups:

Group 1

- Crossings Boulevard
- Stephen P. Yokich Parkway
- Kedron Road / Kedron Parkway
- McLemore Avenue / Depot Street
- Beechcroft Road / Duplex Road

Group 2

- Campbell Station Parkway
- Buckner Road
- Thompson Station Road

Group 1 will encompass five traffic signal controllers and span a distance of approximately 0.9 miles. On the northern end of the study area, Group 2 will comprise the remaining three traffic signals which are spread out over 3.3 miles. The results from the Synchro traffic model confirmed that the assumed intersection groupings were appropriate. Based on the present traffic signal locations, an approximate 1.1 mile gap would exist between the two groups of signals.

5.3 Future Traffic Signals

The City has identified two intersections that may become signalized at a future date. Located in the middle portion of the study area, the signal candidates are listed as follows:

- U.S. Highway 31/ S.R. 6 & Miles Johnson Parkway
- U.S. Highway 31/ S.R. 6 & Belshire Way

Miles Johnson Parkway is located approximately 0.6 miles North of Beechcroft Road and would logically become part of the Group 1 sub-system. Belshire Way is located approximately 0.5 miles South of Campbell Station Road and would likely be added to the Group 2 sub-system if a traffic signal were installed.

5.4 Methods of Signal Communication

Numerous traditional methods of traffic signal communication exist including:

- Fiber Optic Cable
- Microwave
- Radio (Fixed Frequency and Spread Spectrum)
- Twisted Pair Copper (Telephone Wire)
- Microwave
- Wireless (Cellular)
- Wide Area Network (Ethernet)

With these media, communication links are provided between "Local" signal controllers and a "Master" controller. Traditionally, the "Master" controller is then linked to an off-site location such as a Traffic Operations Center (TOC) whereby traffic signal timings can be maintained remotely.

In addition, a relatively new low cost device has emerged that utilizes GPS technology to synchronize the time clock at an intersection. These units can be utilized at a series of intersections, thereby providing a uniform method of synchronizing each individual time clock.

5.5 Capability of Selected Communication Methods

The most prevalent methods of traffic signal interconnection in use in the mid-state area are Fiber Optic Cable and Spread Spectrum Radio. In addition, an evaluation of the GPS unit will be presented due to the low cost of the equipment. The following presents an overview of the capabilities of each of the types of communications media considered:

System Capabilities

GPS Device

- Local Time Clock Synchronization

Radio and Fiber Optic Cable

- On-street Master Controllers
- Upload and Download Timings Remotely
- Monitor Intersection Status Remotely

Fiber Optic Cable

- Video Surveillance
- Various ITS device control

The advantages and disadvantages of each are listed as follows:

Fiber Optic Cable

- Excellent reliability, very long life span
- Splicing requires specialized equipment or outside contractor
- Non-conductive (not sensitive to electrical interference)
- High bandwidth for data transfer
- Higher initial cost

Radio (Spread Spectrum)

- Requires line of site
- Relatively low bandwidth for data transfer
- Radio signal has potential to be sensitive to interference
- Lower initial cost than fiber

GPS Time Sync Unit

- Very low initial cost
- Does not require connection between intersections
- Signal timing adjustments cannot be made remotely

5.6 Cost Comparisons

Based on the grouping of intersections that was previously described, planning level estimates for the construction cost of each type of communications media were prepared as shown below in Table 3.

Table 3
Traffic Signal Communication Cost Estimates

Description	Fiber	Radio	GPS
Group 1 (Intersection 1-6)	$46,000	$37,500	$12,500
Group 2 (Intersection 7-9)	$127,000 (1)	$27,500(2)	$7,500(3)
Totals	$173,000(1)	$65,000(2)	$20,000(3)

(1) Includes $32,000 for connection to Thompson Station Road
(2) Includes $8,500 for connection to Thompson Station Road
(3) Includes $2,500 for GPS unit at Thompson Station Road

The cost comparison and other information were presented to the City of Spring Hill at the *Board of Mayor and Alderman Work Session Meeting* held on August 11, 2008. During this meeting it was recommended that the GPS option be installed at this time. On August 18, 2008, the Board voted to pursue the GPS communications alternative.

5.7 Future System Considerations

During the *Board of Mayor and Alderman Work Session Meeting* held on August 11, 2008, it was noted that a Fiber Optic system provides superior capability and should be the long range goal of the City.

It was recommended that the City look for opportunities, should they arise, to accomplish the long term goal of fiber optic connectivity. These opportunities could include:

- Roadway planning projects,
- Roadway design projects,
- Large scale commercial developments,
- Partnering with third parties (i.e. cable/phone/internet providers).

6. Signal System Timing Plans

6.1 Signal Coordination Analyses

The Synchro 7 software package was used to determine the optimal operation for the nine traffic signals located in the study area. The first step in this process was to determine the intersections located within the study area that would significantly benefit from running coordinate cycles. The Synchro 7 software addresses this issue by producing a Coordinatability Factor (CF) for a given analyses period. The CF variable is typically valued from 0 to 100 or more. A high CF number (> 80) indicates a strong need for coordination. Conversely, a low CF (<20) indicates that little, if any, benefit can be achieved by running a common cycle. The results of the coordination analyses are shown below in Table 4. Appendix E contains copies of the coordination reports for each of the three peak periods analyzed.

Table 4
Coordination Analyses Results

Segment	Link Distance	Coordinatability Factor (CF)			Coordination Recommended
		AM Peak	Mid-Day Peak	PM Peak	
Crossings Boulevard to Stephen P. Yokich Parkway	800’	96	99	95	Yes
Stephen P. Yokich Parkway to Kedron Parkway	1,350’	79	79	78	Yes
Kedron Parkway to McLemore Ave / Depot St	2,050’	52	57	62	Yes
McLemore Ave / Depot St to Beechcroft Road	675’	85	92	108	Yes
Beechcroft Road to Duplex Road	75’	108	113	111	Yes
Duplex Road to Campbell Station Parkway	9,025’	0	0	1	No
Campbell Station Parkway to Buckner Road	4,100’	19	4	4	No
Buckner Road to Thompson Station Road	4,850’	3	0	5	No

As a result of these analyses, it is recommended that the six intersections in Group 1 should run coordinated cycles. Although not recommended for coordination, new updated signal timings were developed for the remaining three intersections located in Group 2.

6.2 Signal Timing Operations Plan

The Synchro 7 software package was also utilized to develop optimized signal timings for the various traffic periods that occur throughout a typical week. Specific timing plans were developed for the AM, Mid-day, and PM peaks as well as an "Off-peak" plan. Based on the traffic count data and the results of the traffic simulation model, a general plan of signal operations was developed as follows:

Table 4
Weekday Traffic Signal Operations Plan

Time of Day	Plan	Cycle Length[1]
12:00 AM to 6:00 AM	Free Operation	Variable
6:00 AM to 7:00 AM	Off Peak Plan	90 Seconds
7:00 AM to 9:00 AM	AM Peak Plan	110 Seconds
9:00 AM to 11:00 AM	Off Peak Plan	90 Seconds
11:00 AM to 3:00 PM	Mid-Day Peak Plan	105 Seconds
3:00 PM to 6:00 PM	PM Peak Plan	120 Seconds
6:00 PM to 8:00 PM	Off Peak Plan	90 Seconds
8:00 PM to 12:00 AM	Free Operation	Variable

[1] Cycle length applies for Group 1 signals.

For weekend operation, it is recommended that the signals in Group 1 run the coordinated "Off Peak" plan from 9 AM to 6 PM on Saturday and from 12 noon to 6 PM on Sunday.

6.3 Optimized Signal Timings

As previously discussed, optimized signal timings were developed for various traffic conditions throughout the day. The timings for the AM, Mid-day and PM peak hours were developed based on the traffic counts conducted as part of this study. The "Off-peak" plan was developed utilizing 85% of the mid-day peak hour traffic. The Synchro software reports indicating the recommended timing plans for each intersection are included as Appendix F of this report. It should again be noted that the six intersections included in Group 1 were recommended for coordinated operation.

In addition to the various changes in the signal timing, the Synchro software also recommended reversing the order of the phasing at the intersection of US Highway 31 and Crossing Boulevard. The analyses show a benefit from changing the southbound dual left turn into the shopping center from a "leading" movement to a "lagging" movement. This change in phasing sequence can be achieved electronically through controller programming and will not require any wiring changes in the signal cabinet.

The remaining three signals in Group 2 were recommended to run in "fully actuated" mode based on new updated signal timing plans. To optimize performance at these intersections, the concept of variable maximum green times were applied. This was accomplished by utilizing the function designated as "Max 3" in the Peek brand controllers. Variable maximums allow the traffic signal timings to effectively adapt to traffic conditions with incremental adjustments to the maximum green interval for a particular signal phase.

In addition, it is recommended that the intersection of US Highway 31 and Thompson Station Road operate with "Volume-Density" timing for the northbound and southbound through movements. Volume-Density operation seeks to reward dense platoons of traffic with additional green time. As the green interval is extended, the signal is programmed to accept increasingly smaller gaps in traffic before leaving the phase. The primary reason for this recommendation is the existing configuration of the detection loops for the northbound and southbound approaches.

Finally, although not directly related to optimized signal timings, it was noted that the yellow clearance times at the intersection of Thompson Station Road and US Highway 31 were programmed at 3.0 seconds per phase. While this conforms to minimum legal standards, these clearance times are below what would normally be used considering the approach speed at the intersection. Therefore, to benefit the overall intersection safety, it is recommended that the yellow clearance intervals at the intersection of Thompson Station Road and US Highway 31 be increased from 3.0 seconds to 4.5 seconds per phase.

6.4 Signal Timing Benefits

The Synchro software program provides several Measures of Effectiveness (MOE's) to quantify expected improvements that can be achieved by coordinating traffic signal timing. These measures include comparisons of:

- Overall Delay
- Number of Stops
- Average Travel Speed
- Fuel Consumption
- Vehicle Emissions

These and other MOE's are combined to result in an overall performance index (PI) for a given set of traffic conditions. The results of the "before" and "after" conditions for the peak traffic hours are presented below in Table 5.

Table 5
Signal Timing Plan Comparisons

Time of Day	Performance Index (PI)[1]	
	Existing Signal Timings	Proposed Signal Timings
AM Peak Hour	51.4	40.3
Mid-Day Peak Hour	64.2	49.6
PM Peak Hour	91.5	82.0

[1] - For the PI, lower values represent improved conditions.

To further illustrate the effectiveness of the new coordinated signal timing plans, Table 6 illustrates the reduction in the number of stops expected when comparing the existing timings to the proposed optimized timings. The full results of the signal timing comparison which include the remaining key components of the performance index are shown in Appendix G.

Table 6
Comparison of Total Number of Vehicles Stops

Time of Day	Total Stops		
	Existing Signal Timings	Proposed Signal Timings	Reduction in Stops
AM Peak Hour	3,516	2,601	915
Mid-Day Peak Hour	4,796	3,498	1,298
PM Peak Hour	5,544	4,609	935

7. Summary and Conclusions

From the analyses presented in this report, it is clear that the nine traffic signals included in the study can benefit from optimized signal timings. The specific recommendations for improvements along the corridor are as follows:

- Install GPS synchronization units at each of the intersections in the study area as follows:
    - Crossings Boulevard
    - Stephen P. Yokich Parkway
    - Kedron Road / Kedron Parkway
    - McLemore Avenue / Depot Street
    - Beechcroft Road (SR 247)
    - Duplex Road (SR 247)
    - Campbell Station Parkway
    - Buckner Road
    - Thompson Station Road

- Install overlap phasing at Kedron Road, Campbell Station Parkway and Buckner Road.

- Install additional vehicle detection at the McLemore/Depot and Beechcroft/Duplex intersections.

- Install new protected left turn indications for Beechcroft Road and Duplex Road.

- Install a new controller at the Thompson Station Road intersection. In addition, it is recommended that the yellow clearance intervals be increased from 3.0 seconds to 4.5 seconds per phase to promote overall intersection safety.

- Provide for a “lagging” southbound left turn at Crossing Boulevard by using electronic phase reversal function.

- Install optimized signal timings at each intersection as detailed in the report.

- Consider opportunities, as they arise, to move toward a long term goal of fiber optic connectivity.

In summary, the implementation of the above recommendations will improve the overall traffic flow along the busy US Highway 31/SR 6 corridor in Spring Hill. The coordination and otherwise optimization of the traffic signals will reduce the delay and the number of overall stops and provide for a more efficient transportation system throughout the City of Spring Hill’s main highway corridor.

APPENDIX A

TRAFFIC COUNT DATA

TURNING MOVEMENT COUNTS

INTERSECTION VEHICULAR TURNING MOVEMENT COUNTS

LOCATION: US 31 & Crossings Blvd
DATE: 4/22/2008
RECORDER: RGP

	Southbound			Northbound			Westbound			Eastbound			
LOCATION	US 31			US 31			Crossings Blvd						
TIME	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00-7:15	13	108			107	17	6		7				
7:15-7:30	9	134			145	14	5		9				
7:30-7:45	12	117			147	18	3		8				
7:45-8:00	20	97			196	19	3		4				
8:00-8:15	18	83			154	16	8		7				
8:15-8:30	22	83			130	14	9		6				
8:30-8:45	21	87			146	27	12		14				
8:45-9:00	22	72			135	20	7		16				
11:00-11:15	39	132			136	39	27		48				
11:15-11:30	40	136			139	41	23		49				
11:30-11:45	29	151			160	44	21		42				
11:45-12:00	44	121			155	37	33		64				
12:00-12:15	58	125			143	48	37		57				
12:15-12:30	41	125			144	41	28		51				
12:30-12:45	44	132			152	43	30		54				
12:45-1:00	43	128			148	42	29		52				
4:00-4:15	35	139			128	32	21		29				
4:15-4:30	37	146			137	40	24		38				
4:30-4:45	36	153			151	30	39		49				
4:45-5:00	36	155			187	33	38		39				
5:00-5:15	31	175			173	60	39		27				
5:15-5:30	40	146			164	27	36		36				
5:30-5:45	36	143			135	40	36		35				
5:45-6:00	50	121			123	33	38		44				
TOTAL	776	3,009			3,535	775	552		785				
AM PK HR	59	431			642	67	19		28				7:15 AM - 8:15 AM
MID PK HR	187	503			594	169	128		226				11:45 AM - 12:45 PM
PM PK HR	143	629			675	150	152		151				4:30 PM - 5:30 PM

INTERSECTION VEHICULAR TURNING MOVEMENT COUNTS

LOCATION: US 31 & Stephen P. Yokich Pkwy
DATE: 4/23/2008
RECORDER: RGP

	Southbound			Northbound			Westbound			Eastbound			
LOCATION	US 31			US 31						Stephen P. Yokich Pkwy			
TIME	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00-7:15		98	11	24	90					7		23	
7:15-7:30		121	14	35	119					13		22	
7:30-7:45		107	8	57	98					9		22	
7:45-8:00		86	7	73	127					19		31	
8:00-8:15		72	8	51	110					16		29	
8:15-8:30		78	11	38	98					18		27	
8:30-8:45		82	13	33	127					17		26	
8:45-9:00		60	16	32	119					21		34	
11:00-11:15		135	23	47	138					19		22	
11:15-11:30		138	24	48	141					22		21	
11:30-11:45		162	22	56	146					25		18	
11:45-12:00		137	29	58	161					21		28	
12:00-12:15		156	26	42	158					24		27	
12:15-12:30		143	23	49	146					18		23	
12:30-12:45		151	22	52	154					23		25	
12:45-1:00		147	25	51	150					19		24	
4:00-4:15		147	18	43	114					23		27	
4:15-4:30		158	13	47	128					27		25	
4:30-4:45		163	34	59	141					29		26	
4:45-5:00		159	17	60	166					31		32	
5:00-5:15		172	28	57	143					39		34	
5:15-5:30		164	26	48	152					25		22	
5:30-5:45		162	29	44	126					34		17	
5:45-6:00		152	20	33	134					37		19	
TOTAL		3,150	467	1,137	3,186					536		604	
AM PK HR		386	37	216	454					57		104	7:15 AM - 8:15 AM
MID PK HR		598	100	205	611					88		96	11:30 AM - 12:30 PM
PM PK HR		658	105	224	602					124		114	4:30 PM - 5:30 PM

INTERSECTION VEHICULAR TURNING MOVEMENT COUNTS

LOCATION: US 31 & Kedron Rd/Kedron Pkwy
DATE: 4/24/2008
RECORDER: RGP

	Southbound			Northbound			Westbound			Eastbound			
LOCATION	US 31			US 31			Kedron Rd			Kedron Pkwy			
TIME	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00-7:15	11	84	1	5	88	6	11	17	13	6	11	7	
7:15-7:30	14	101	4	6	94	10	18	17	14	4	14	3	
7:30-7:45	22	104	1	4	114	11	22	21	26	11	7	6	
7:45-8:00	25	95	6	12	121	19	15	27	35	8	15	9	
8:00-8:15	19	97	8	11	112	15	19	24	29	9	11	7	
8:15-8:30	14	93	4	13	107	18	16	26	22	7	14	8	
8:30-8:45	13	95	7	9	103	11	12	21	17	9	13	7	
8:45-9:00	10	101	9	8	109	12	17	28	15	10	6	3	
11:00-11:15	8	123	11	5	127	12	16	21	14	12	10	8	
11:15-11:30	13	131	12	7	118	14	19	16	18	11	13	9	
11:30-11:45	11	128	13	8	108	19	15	14	21	17	8	13	
11:45-12:00	14	124	16	11	106	21	13	18	20	16	7	12	
12:00-12:15	12	130	14	9	111	18	16	19	23	17	9	14	
12:15-12:30	13	119	13	12	102	22	12	16	19	14	7	12	
12:30-12:45	16	121	14	7	97	21	14	13	16	19	11	9	
12:45-1:00	11	126	12	10	114	17	15	17	22	13	8	16	
4:00-4:15	21	141	11	8	137	19	21	18	22	14	15	7	
4:15-4:30	24	147	13	14	142	23	22	16	21	17	17	8	
4:30-4:45	26	159	16	13	149	21	25	17	24	16	13	10	
4:45-5:00	36	174	9	11	125	32	19	27	25	11	11	8	
5:00-5:15	27	157	10	13	130	27	29	33	38	17	22	7	
5:15-5:30	37	189	14	10	148	21	13	21	23	15	15	5	
5:30-5:45	33	166	12	11	142	24	17	19	19	16	16	4	
5:45-6:00	34	161	9	13	139	21	18	18	21	15	13	4	
TOTAL	464	3,066	239	230	2,843	434	414	484	517	304	286	196	
AM PK HR	80	389	19	40	454	63	72	98	112	35	47	30	7:30 AM - 8:30 AM
MID PK HR	50	513	55	35	443	72	63	67	82	61	37	48	11:15 AM - 12:15 PM
PM PK HR	126	679	49	47	552	101	86	98	110	59	61	30	4:30 PM - 5:30 PM

INTERSECTION VEHICULAR TURNING MOVEMENT COUNTS

LOCATION: US 31 & McLemore Ave/Depot St
DATE: 4/9/2008
RECORDER: TD

	Southbound			Northbound			Westbound			Eastbound			
LOCATION	US 31			US 31			McLemore Ave			Depot St			
TIME	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00-7:15	3	70		7	68	5	1	1	3	3	1	8	
7:15-7:30	1	104	1	6	80	3	5	2	3	2	1	8	
7:30-7:45	2	110	1	4	96	1	2	2	3	2	4	6	
7:45-8:00		83	2	3	110	4	8	6	2	4	5	12	
8:00-8:15		90	1	4	121	5	5	4	1	10	6	7	
8:15-8:30	1	94		5	93	5		1	2	2	3	5	
8:30-8:45	3	94	3	5	142	10	7		4	2	1	5	
8:45-9:00	3	98	1	3	132	8	3		3	2	6	6	
11:00-11:15	3	109		7	147	8	10	2	5	3	4	7	
11:15-11:30		148		5	136	6	9	2	1	3	3	7	
11:30-11:45	2	140	1	2	139	7	10	1	1	5	8	5	
11:45-12:00	2	138		6	118	11	8	1	7	3	5	9	
12:00-12:15	2	149	2	4	133	11	10	8	3	3	4	11	
12:15-12:30	3	148		3	126	9	5	2	4	1	3	6	
12:30-12:45	2	137		4	131	10	7	2	6	3	2	3	
12:45-1:00	3	136	2		122	7	3		6	7	2	4	
4:00-4:15	3	184		11	153	15	10	5	4	2	5	17	
4:15-4:30	5	144		7	133	9	5	1	3	4	2	9	
4:30-4:45	4	165		8	156	9	10	4	2	2	2	11	
4:45-5:00	3	180		5	136	7	14	1	3	7	1	9	
5:00-5:15	3	187	3	10	127	14	15	2	1	7	5	7	
5:15-5:30	4	154	3	12	155	11	11	6	3	2	3	7	
5:30-5:45		155		11	143	13	4	5	4	2	1	11	
5:45-6:00	6	154		5	156	13	14	2	3	3	5	5	
TOTAL	58	3,171	20	137	3,053	201	176	60	77	84	82	185	
AM PK HR	7	376	5	17	488	28	15	5	10	16	16	23	8:00 AM - 9:00 AM
MID PK HR	6	575	3	17	526	35	37	12	12	14	20	32	11:15 AM - 12:15 PM
PM PK HR	14	686	6	35	574	41	50	13	9	18	11	34	4:30 PM - 5:30 PM

INTERSECTION VEHICULAR TURNING MOVEMENT COUNTS

LOCATION: US 31 & Beechcroft Rd
DATE: 4/9/2008
RECORDER: TD

	Southbound			Northbound			Westbound			Eastbound			
LOCATION	US 31			US 31						Beechcroft Rd			
TIME	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00-7:15		79	16		72					17		2	
7:15-7:30		106	26	2	82					18		3	
7:30-7:45		108	23	3	90					24		2	
7:45-8:00		85	28	2	111					35		1	
8:00-8:15		90	29	2	136					37		1	
8:15-8:30		90	18		92					20		1	
8:30-8:45		100	9	4	143					33		1	
8:45-9:00		113	17	1	130					19		2	
11:00-11:15		111	14	3	146					26		2	
11:15-11:30		143	19	3	130					32		3	
11:30-11:45		137	25	1	137					23		3	
11:45-12:00		150	32	5	146					15		1	
12:00-12:15		172	31	4	142					24		1	
12:15-12:30		143	27	2	128					28		3	
12:30-12:45		143	31	1	145					22		2	
12:45-1:00		146	27	2	135					21			
4:00-4:15		194	36	3	155					31		2	
4:15-4:30		145	30		132					24		1	
4:30-4:45		167	37	1	161					23			
4:45-5:00		185	37	4	140					23			
5:00-5:15		185	50	1	127					37		2	
5:15-5:30		166	38	3	156					29			
5:30-5:45		162	40	3	150					22		1	
5:45-6:00		165	30	2	150					17		4	
TOTAL		3,285	670	52	3,136					600		38	
AM PK HR		393	73	7	501					109		5	8:00 AM - 9:00 AM
MID PK HR		608	121	12	561					89		7	11:45 AM - 12:45 PM
PM PK HR		703	162	9	584					112		2	4:30 PM - 5:30 PM

INTERSECTION VEHICULAR TURNING MOVEMENT COUNTS

LOCATION: US 31 & Duplex Rd
DATE: 4/9/2008
RECORDER: TD

	Southbound			Northbound			Westbound			Eastbound			
LOCATION	US 31			US 31			Duplex Rd						
TIME	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00-7:15	10	64			79	11	26		11				
7:15-7:30	11	98			77	17	34		17				
7:30-7:45	8	102			104	13	31		9				
7:45-8:00	7	79			131	22	30		15				
8:00-8:15	16	88			145	25	30		17				
8:15-8:30	11	72			105	13	37		20				
8:30-8:45	14	81			160	16	27		23				
8:45-9:00	17	106			120	22	22		26				
11:00-11:15	15	109			148	18	18		17				
11:15-11:30	21	136			147	28	28		21				
11:30-11:45	24	130			134	26	35		28				
11:45-12:00	23	155			139	22	30		29				
12:00-12:15	29	169			140	20	27		22				
12:15-12:30	19	151			146	17	21		20				
12:30-12:45	25	149			142	23	29		31				
12:45-1:00	25	140			128	31	29		18				
4:00-4:15	31	196			159	27	34		17				
4:15-4:30	29	146			124	30	28		17				
4:30-4:45	35	174			165	23	28		12				
4:45-5:00	29	180			136	27	44		20				
5:00-5:15	29	201			128	36	36		21				
5:15-5:30	36	173			161	26	33		21				
5:30-5:45	31	172			136	35	32		15				
5:45-6:00	39	152			138	31	37		21				
TOTAL	534	3,223			3,192	559	726		468				
AM PK HR	58	347			530	76	116		86				8:00 AM - 9:00 AM
MID PK HR	96	624			567	82	107		102				11:45 AM - 12:45 PM
PM PK HR	129	728			590	112	141		74				4:30 PM - 5:30 PM

INTERSECTION VEHICULAR TURNING MOVEMENT COUNTS

LOCATION: US 31 & Campbell Station Rd
DATE: 4/9/2008
RECORDER: TD

	Southbound			Northbound			Westbound			Eastbound			
LOCATION	US 31			US 31			Campbell Station Rd			Campbell Station Rd			
TIME	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00-7:15	18	68	2	2	95	6	19	5	41	10	2	5	
7:15-7:30	20	99	12	3	97	14	16	4	33	6	2	6	
7:30-7:45	20	91	6	1	101	12	18	4	23	7	4	3	
7:45-8:00	17	79	5	1	108	17	21	4	38	19	5	3	
8:00-8:15	9	82	3	2	122	18	19	2	37	11	3	2	
8:15-8:30	19	70	4	3	117	13	26	7	39	7	5	2	
8:30-8:45	7	80	10	2	125	22	34	9	41	13	4	2	
8:45-9:00	24	111	8	4	122	33	31	7	35	8	3	7	
11:00-11:15	23	83	9	3	118	29	40	9	27	11	11	5	
11:15-11:30	27	99	11	4	110	23	30	5	33	15	10	7	
11:30-11:45	19	106	20	1	126	21	58	20	19	11	5	6	
11:45-12:00	11	118	16	7	118	24	49	11	24	15	8	3	
12:00-12:15	16	104	17	5	117	37	63	8	20	16	12	10	
12:15-12:30	17	117	14	7	102	18	38	9	21	21	11	13	
12:30-12:45	18	93	24	2	126	20	52	9	23	21	13	9	
12:45-1:00	24	108	17	3	111	27	50	7	21	14	11	6	
4:00-4:15	58	159	20	1	107	23	57	14	22	18	15	5	
4:15-4:30	40	132	27	4	114	27	55	9	21	11	8	6	
4:30-4:45	49	133	18	5	119	30	59	15	18	16	18	5	
4:45-5:00	46	146	19	7	118	22	79	18	31	14	11	5	
5:00-5:15	42	125	30	4	115	30	85	15	37	24	15	9	
5:15-5:30	43	121	14	4	139	25	75	18	27	20	13	7	
5:30-5:45	55	121	24	6	119	25	59	15	28	24	15	9	
5:45-6:00	44	144	28	3	117	40	59	10	31	21	17	9	
TOTAL	666	2,589	358	84	2,763	556	1,092	234	690	353	221	144	
AM PK HR	59	343	25	11	486	86	110	25	152	39	15	13	8:00 AM - 9:00 AM
MID PK HR	63	445	67	20	463	100	208	48	84	63	36	32	11:30 AM - 12:30 PM
PM PK HR	184	511	96	17	490	120	278	58	123	89	60	34	5:00 PM - 6:00 PM

INTERSECTION VEHICULAR TURNING MOVEMENT COUNTS

LOCATION: US 31 & Buckner Ln
DATE: 4/9/2008
RECORDER: TD

	Southbound			Northbound			Westbound			Eastbound			
LOCATION	US 31			US 31			Buckner Ln			Buckner Ln			
TIME	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00-7:15	21	60	27	14	157	12	9	33	66	27	39	24	
7:15-7:30	22	96	37	9	165	10	27	59	90	48	55	32	
7:30-7:45	10	86	7	6	120	19	34	20	71	30	9	3	
7:45-8:00	13	75	7	11	132	9	38	22	62	14	4	5	
8:00-8:15	13	78	22	22	151	19	24	42	73	19	15	10	
8:15-8:30	8	61	21	35	168	11	29	60	55	42	46	44	
8:30-8:45	11	80	5	4	151	26	32	10	60	14	7	15	
8:45-9:00	7	104	4	4	144	14	39	3	60	6		2	
11:00-11:15	12	97	7	3	110	37	32	2	20	3	1	3	
11:15-11:30	14	107	7	5	101	27	35	5	23	9	8	8	
11:30-11:45	13	116	3	6	123	44	32	3	25	6	4	6	
11:45-12:00	18	127	4	6	107	33	34	4	15	6	3		
12:00-12:15	12	114	2	8	102	23	26	4	14	3	3	4	
12:15-12:30	23	135	5	4	105	29	32	3	9	4	9	5	
12:30-12:45	11	114	4	5	129	52	32	5	24	6	5	5	
12:45-1:00	16	122	3	3	93	30	29	6	20	5	1	1	
4:00-4:15	44	190	10	8	102	44	54	13	20	8	17	18	
4:15-4:30	37	181	14	3	92	52	49	8	24	3	8	13	
4:30-4:45	36	210	16	5	97	49	33	7	24	6	17	7	
4:45-5:00	38	212	13	6	117	52	45	10	36	5	7	9	
5:00-5:15	34	202	17	7	130	57	53	14	26	7	13	6	
5:15-5:30	51	205	11	6	119	63	29	10	29	2	13	12	
5:30-5:45	49	201	11	10	113	64	61	11	30	5	5	11	
5:45-6:00	60	198	10	4	107	50	62	15	43	20	18	13	
TOTAL	573	3,171	267	194	2,935	826	870	369	919	298	307	256	
AM PK HR	66	317	78	40	574	50	108	134	289	119	107	64	7:00 AM - 8:00 AM
MID PK HR	64	490	15	23	443	137	124	16	62	19	20	14	11:45 AM - 12:45 PM
PM PK HR	194	806	49	27	469	234	205	50	128	34	49	42	5:00 PM - 6:00 PM

INTERSECTION VEHICULAR TURNING MOVEMENT COUNTS

LOCATION: US 31 & Thompson Station Rd
DATE: 4/9/2008
RECORDER: TD

	Southbound			Northbound			Westbound			Eastbound			
LOCATION	US 31			US 31			Thompson Station Rd			Thompson Station Rd			
TIME	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00-7:15	7	91	5	11	276	8	6	4	79	18	4	9	
7:15-7:30	8	125	7	13	275	8	14	11	48	15	7	13	
7:30-7:45	13	103	5	16	274	5	7	10	18	14	8	4	
7:45-8:00	8	84	4	5	203	5	5	12	19	8	6	7	
8:00-8:15	4	81	7	11	238	12	12	7	16	12	8	12	
8:15-8:30	3	72	4	15	244	15	5	3	14	12	3	14	
8:30-8:45	5	79	6	9	214	4	7	7	13	4	1	9	
8:45-9:00	4	91	7	19	212	11	8	4	16	18	4	18	
11:00-11:15	8	82	13	20	98	6	8	7	8	8	1	22	
11:15-11:30	6	98	8	14	120	4	7	11	7	12	6	13	
11:30-11:45	10	103	8	23	135	7	17	6	10	11	1	26	
11:45-12:00	6	101	12	19	101	10	26	10	6	14	9	23	
12:00-12:15	7	103	6	17	96	12	21	11	12	9	5	14	
12:15-12:30	12	115	9	20	86	6	11	9	8	12	2	24	
12:30-12:45	9	119	10	20	144	10	10	6	7	12	8	16	
12:45-1:00	9	113	5	17	99	10	12	2	7	11	3	14	
4:00-4:15	7	207	6	11	110	14	16	9	15	1	4	23	
4:15-4:30	5	195	17	18	95	8	11	11	7	13	5	26	
4:30-4:45	9	240	15	15	105	13	12	10	5	6	7	20	
4:45-5:00	7	220	11	12	134	5	15	10	19	12	8	27	
5:00-5:15	7	218	4	10	138	15	11	10	14	6	7	28	
5:15-5:30	2	245	7	7	127	5	13	5	18	26	15	34	
5:30-5:45	4	232	11	20	144	4	15	7	9	5	9	21	
5:45-6:00	17	234	2	20	139	25	31	4	1	3	13	20	
TOTAL	177	3,351	189	362	3,807	222	300	186	376	262	144	437	
AM PK HR	36	403	21	45	1,028	26	32	37	164	55	25	33	7:00 AM - 8:00 AM
MID PK HR	34	438	37	76	427	38	68	36	33	47	24	77	11:45 AM - 12:45 PM
PM PK HR	30	929	24	57	548	49	70	26	42	40	44	103	5:00 PM - 6:00 PM

PEAK HOUR FACTORS

LOCATION: **US 31 & Crossings Blvd**

AM Peak Hour Factors (PHF)												
	S/B			N/B			W/B			E/B		
PHF by Movement	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**
Interval 1	9	134			145	14	5		9			
Interval 2	12	117			147	18	3		8			
Interval 3	20	97			196	19	3		4			
Interval 4	18	83			154	16	8		7			
Peak Hour	59	431			642	67	19		28			
Peak 15 min	20	134			196	19	8		9			
PHF	**0.74**	**0.80**			**0.82**	**0.88**	**0.59**		**0.78**			

PHF by Approach	**S/B**	**N/B**	**W/B**	**E/B**	**Overall**
Interval 1	143	159	14		316
Interval 2	129	165	11		305
Interval 3	117	215	7		339
Interval 4	101	170	15		286
Peak Hour	490	709	47		1,246
Peak 15 min	143	215	15		339
PHF	**0.86**	**0.82**	**0.78**		**0.92**

Mid-day Peak Hour Factors (PHF)												
	S/B			N/B			W/B			E/B		
PHF by Movement	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**
Interval 1	44	121			155	37	33		64			
Interval 2	58	125			143	48	37		57			
Interval 3	41	125			144	41	28		51			
Interval 4	44	132			152	43	30		54			
Peak Hour	187	503			594	169	128		226			
Peak 15 min	58	132			155	48	37		64			
PHF	**0.81**	**0.95**			**0.96**	**0.88**	**0.86**		**0.88**			

PHF by Approach	**S/B**	**N/B**	**W/B**	**E/B**	**Overall**
Interval 1	165	192	97		454
Interval 2	183	191	94		468
Interval 3	166	185	79		430
Interval 4	176	195	84		455
Peak Hour	690	763	354		1,807
Peak 15 min	183	195	97		468
PHF	**0.94**	**0.98**	**0.91**		**0.97**

PM Peak Hour Factors (PHF)												
	S/B			N/B			W/B			E/B		
PHF by Movement	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**
Interval 1	36	153			151	30	39		49			
Interval 2	36	155			187	33	38		39			
Interval 3	31	175			173	60	39		27			
Interval 4	40	146			164	27	36		36			
Peak Hour	143	629			675	150	152		151			
Peak 15 min	40	175			187	60	39		49			
PHF	**0.89**	**0.90**			**0.90**	**0.63**	**0.97**		**0.77**			

PHF by Approach	**S/B**	**N/B**	**W/B**	**E/B**	**Overall**
Interval 1	189	181	88		458
Interval 2	191	220	77		488
Interval 3	206	233	66		505
Interval 4	186	191	72		449
Peak Hour	772	825	303		1,900
Peak 15 min	206	233	88		505
PHF	**0.94**	**0.89**	**0.86**		**0.94**

LOCATION: US 31 & Stephen P. Yokich Pkwy

AM Peak Hour Factors (PHF)												
	S/B			N/B			W/B			E/B		
PHF by Movement	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**
Interval 1		121	14	35	119					13		22
Interval 2		107	8	57	98					9		22
Interval 3		86	7	73	127					19		31
Interval 4		72	8	51	110					16		29
Peak Hour		386	37	216	454					57		104
Peak 15 min		121	14	73	127					19		31
PHF		**0.80**	**0.66**	**0.74**	**0.89**					**0.75**		**0.84**

PHF by Approach	**S/B**	**N/B**	**W/B**	**E/B**	**Overall**
Interval 1	135	154		35	324
Interval 2	115	155		31	301
Interval 3	93	200		50	343
Interval 4	80	161		45	286
Peak Hour	423	670		161	1,254
Peak 15 min	135	200		50	343
PHF	**0.78**	**0.84**		**0.81**	**0.91**

Mid-day Peak Hour Factors (PHF)												
	S/B			N/B			W/B			E/B		
PHF by Movement	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**
Interval 1		162	22	56	146					25		18
Interval 2		137	29	58	161					21		28
Interval 3		156	26	42	158					24		27
Interval 4		143	23	49	146					18		23
Peak Hour		598	100	205	611					88		96
Peak 15 min		162	29	58	161					25		28
PHF		**0.92**	**0.86**	**0.88**	**0.95**					**0.88**		**0.86**

PHF by Approach	**S/B**	**N/B**	**W/B**	**E/B**	**Overall**
Interval 1	184	202		43	429
Interval 2	166	219		49	434
Interval 3	182	200		51	433
Interval 4	166	195		41	402
Peak Hour	698	816		184	1,698
Peak 15 min	184	219		51	434
PHF	**0.95**	**0.93**		**0.90**	**0.98**

PM Peak Hour Factors (PHF)												
	S/B			N/B			W/B			E/B		
PHF by Movement	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**
Interval 1		163	34	59	141					29		26
Interval 2		159	17	60	166					31		32
Interval 3		172	28	57	143					39		34
Interval 4		164	26	48	152					25		22
Peak Hour		658	105	224	602					124		114
Peak 15 min		172	34	60	166					39		34
PHF		**0.96**	**0.77**	**0.93**	**0.91**					**0.79**		**0.84**

PHF by Approach	**S/B**	**N/B**	**W/B**	**E/B**	**Overall**
Interval 1	197	200		55	452
Interval 2	176	226		63	465
Interval 3	200	200		73	473
Interval 4	190	200		47	437
Peak Hour	763	826		238	1,827
Peak 15 min	200	226		73	473
PHF	**0.95**	**0.91**		**0.82**	**0.97**

LOCATION: **US 31 & Kedron Rd/Kedron Pkwy**

AM Peak Hour Factors (PHF)												
	S/B			N/B			W/B			E/B		
PHF by Movement	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**
Interval 1	22	104	1	4	114	11	22	21	26	11	7	6
Interval 2	25	95	6	12	121	19	15	27	35	8	15	9
Interval 3	19	97	8	11	112	15	19	24	29	9	11	7
Interval 4	14	93	4	13	107	18	16	26	22	7	14	8
Peak Hour	80	389	19	40	454	63	72	98	112	35	47	30
Peak 15 min	25	104	8	13	121	19	22	27	35	11	15	9
PHF	**0.80**	**0.94**	**0.59**	**0.77**	**0.94**	**0.83**	**0.82**	**0.91**	**0.80**	**0.80**	**0.78**	**0.83**

PHF by Approach	**S/B**	**N/B**	**W/B**	**E/B**	**Overall**
Interval 1	127	129	69	24	349
Interval 2	126	152	77	32	387
Interval 3	124	138	72	27	361
Interval 4	111	138	64	29	342
Peak Hour	488	557	282	112	1,439
Peak 15 min	127	152	77	32	387
PHF	**0.96**	**0.92**	**0.92**	**0.88**	**0.93**

Mid-day Peak Hour Factors (PHF)												
	S/B			N/B			W/B			E/B		
PHF by Movement	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**
Interval 1	13	131	12	7	118	14	19	16	18	11	13	9
Interval 2	11	128	13	8	108	19	15	14	21	17	8	13
Interval 3	14	124	16	11	106	21	13	18	20	16	7	12
Interval 4	12	130	14	9	111	18	16	19	23	17	9	14
Peak Hour	50	513	55	35	443	72	63	67	82	61	37	48
Peak 15 min	14	131	16	11	118	21	19	19	23	17	13	14
PHF	**0.89**	**0.98**	**0.86**	**0.80**	**0.94**	**0.86**	**0.83**	**0.88**	**0.89**	**0.90**	**0.71**	**0.86**

PHF by Approach	**S/B**	**N/B**	**W/B**	**E/B**	**Overall**
Interval 1	156	139	53	33	381
Interval 2	152	135	50	38	375
Interval 3	154	138	51	35	378
Interval 4	156	138	58	40	392
Peak Hour	618	550	212	146	1,526
Peak 15 min	156	139	58	40	392
PHF	**0.99**	**0.99**	**0.91**	**0.91**	**0.97**

PM Peak Hour Factors (PHF)												
	S/B			N/B			W/B			E/B		
PHF by Movement	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**
Interval 1	26	159	16	13	149	21	25	17	24	16	13	10
Interval 2	36	174	9	11	125	32	19	27	25	11	11	8
Interval 3	27	157	10	13	130	27	29	33	38	17	22	7
Interval 4	37	189	14	10	148	21	13	21	23	15	15	5
Peak Hour	126	679	49	47	552	101	86	98	110	59	61	30
Peak 15 min	37	189	16	13	149	32	29	33	38	17	22	10
PHF	**0.85**	**0.90**	**0.77**	**0.90**	**0.93**	**0.79**	**0.74**	**0.74**	**0.72**	**0.87**	**0.69**	**0.75**

PHF by Approach	**S/B**	**N/B**	**W/B**	**E/B**	**Overall**
Interval 1	201	183	66	39	489
Interval 2	219	168	71	30	488
Interval 3	194	170	100	46	510
Interval 4	240	179	57	35	511
Peak Hour	854	700	294	150	1,998
Peak 15 min	240	183	100	46	511
PHF	**0.89**	**0.96**	**0.74**	**0.82**	**0.98**

LOCATION: **US 31 & McLemore Ave/Depot St**

AM Peak Hour Factors (PHF)												
	S/B			N/B			W/B			E/B		
PHF by Movement	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**
Interval 1		90	1	4	121	5	5	4	1	10	6	7
Interval 2	1	94		5	93	5		1	2	2	3	5
Interval 3	3	94	3	5	142	10	7		4	2	1	5
Interval 4	3	98	1	3	132	8	3		3	2	6	6
Peak Hour	7	376	5	17	488	28	15	5	10	16	16	23
Peak 15 min	3	98	3	5	142	10	7	4	4	10	6	7
PHF	**0.58**	**0.96**	**0.42**	**0.85**	**0.86**	**0.70**	**0.54**	**0.31**	**0.63**	**0.40**	**0.67**	**0.82**

PHF by Approach	**S/B**	**N/B**	**W/B**	**E/B**	**Overall**
Interval 1	91	130	10	23	254
Interval 2	95	103	3	10	211
Interval 3	100	157	11	8	276
Interval 4	102	143	6	14	265
Peak Hour	388	533	30	55	1,006
Peak 15 min	102	157	11	23	276
PHF	**0.95**	**0.85**	**0.68**	**0.60**	**0.91**

Mid-day Peak Hour Factors (PHF)												
	S/B			N/B			W/B			E/B		
PHF by Movement	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**
Interval 1		148		5	136	6	9	2	1	3	3	7
Interval 2	2	140	1	2	139	7	10	1	1	5	8	5
Interval 3	2	138		6	118	11	8	1	7	3	5	9
Interval 4	2	149	2	4	133	11	10	8	3	3	4	11
Peak Hour	6	575	3	17	526	35	37	12	12	14	20	32
Peak 15 min	2	149	2	6	139	11	10	8	7	5	8	11
PHF	**0.75**	**0.96**	**0.38**	**0.71**	**0.95**	**0.80**	**0.93**	**0.38**	**0.43**	**0.70**	**0.63**	**0.73**

PHF by Approach	**S/B**	**N/B**	**W/B**	**E/B**	**Overall**
Interval 1	148	147	12	13	320
Interval 2	143	148	12	18	321
Interval 3	140	135	16	17	308
Interval 4	153	148	21	18	340
Peak Hour	584	578	61	66	1,289
Peak 15 min	153	148	21	18	340
PHF	**0.95**	**0.98**	**0.73**	**0.92**	**0.95**

PM Peak Hour Factors (PHF)												
	S/B			N/B			W/B			E/B		
PHF by Movement	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**
Interval 1	4	165		8	156	9	10	4	2	2	2	11
Interval 2	3	180		5	136	7	14	1	3	7	1	9
Interval 3	3	187	3	10	127	14	15	2	1	7	5	7
Interval 4	4	154	3	12	155	11	11	6	3	2	3	7
Peak Hour	14	686	6	35	574	41	50	13	9	18	11	34
Peak 15 min	4	187	3	12	156	14	15	6	3	7	5	11
PHF	**0.88**	**0.92**	**0.50**	**0.73**	**0.92**	**0.73**	**0.83**	**0.54**	**0.75**	**0.64**	**0.55**	**0.77**

PHF by Approach	**S/B**	**N/B**	**W/B**	**E/B**	**Overall**
Interval 1	169	173	16	15	373
Interval 2	183	148	18	17	366
Interval 3	193	151	18	19	381
Interval 4	161	178	20	12	371
Peak Hour	706	650	72	63	1,491
Peak 15 min	193	178	20	19	381
PHF	**0.91**	**0.91**	**0.90**	**0.83**	**0.98**

LOCATION: US 31 & Beechcroft Rd

AM Peak Hour Factors (PHF)												
	S/B			N/B			W/B			E/B		
PHF by Movement	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**
Interval 1		90	29	2	136					37		1
Interval 2		90	18		92					20		1
Interval 3		100	9	4	143					33		1
Interval 4		113	17	1	130					19		2
Peak Hour		393	73	7	501					109		5
Peak 15 min		113	29	4	143					37		2
PHF		**0.87**	**0.63**	**0.44**	**0.88**					**0.74**		**0.63**

PHF by Approach	**S/B**	**N/B**	**W/B**	**E/B**	**Overall**
Interval 1	119	138		38	295
Interval 2	108	92		21	221
Interval 3	109	147		34	290
Interval 4	130	131		21	282
Peak Hour	466	508		114	1,088
Peak 15 min	130	147		38	295
PHF	**0.90**	**0.86**		**0.75**	**0.92**

Mid-day Peak Hour Factors (PHF)												
	S/B			N/B			W/B			E/B		
PHF by Movement	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**
Interval 1		150	32	5	146					15		1
Interval 2		172	31	4	142					24		1
Interval 3		143	27	2	128					28		3
Interval 4		143	31	1	145					22		2
Peak Hour		608	121	12	561					89		7
Peak 15 min		172	32	5	146					28		3
PHF		**0.88**	**0.95**	**0.60**	**0.96**					**0.79**		**0.58**

PHF by Approach	**S/B**	**N/B**	**W/B**	**E/B**	**Overall**
Interval 1	182	151		16	349
Interval 2	203	146		25	374
Interval 3	170	130		31	331
Interval 4	174	146		24	344
Peak Hour	729	573		96	1,398
Peak 15 min	203	151		31	374
PHF	**0.90**	**0.95**		**0.77**	**0.93**

PM Peak Hour Factors (PHF)												
	S/B			N/B			W/B			E/B		
PHF by Movement	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**
Interval 1		167	37	1	161					23		
Interval 2		185	37	4	140					23		
Interval 3		185	50	1	127					37		2
Interval 4		166	38	3	156					29		
Peak Hour		703	162	9	584					112		2
Peak 15 min		185	50	4	161					37		2
PHF		**0.95**	**0.81**	**0.56**	**0.91**					**0.76**		**0.25**

PHF by Approach	**S/B**	**N/B**	**W/B**	**E/B**	**Overall**
Interval 1	204	162		23	389
Interval 2	222	144		23	389
Interval 3	235	128		39	402
Interval 4	204	159		29	392
Peak Hour	865	593		114	1,572
Peak 15 min	235	162		39	402
PHF	**0.92**	**0.92**		**0.73**	**0.98**

LOCATION: US 31 & Duplex Rd

AM Peak Hour Factors (PHF)												
	S/B			N/B			W/B			E/B		
PHF by Movement	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**
Interval 1	16	88			145	25	30		17			
Interval 2	11	72			105	13	37		20			
Interval 3	14	81			160	16	27		23			
Interval 4	17	106			120	22	22		26			
Peak Hour	58	347			530	76	116		86			
Peak 15 min	17	106			160	25	37		26			
PHF	**0.85**	**0.82**			**0.83**	**0.76**	**0.78**		**0.83**			

PHF by Approach	**S/B**	**N/B**	**W/B**	**E/B**	**Overall**
Interval 1	104	170	47		321
Interval 2	83	118	57		258
Interval 3	95	176	50		321
Interval 4	123	142	48		313
Peak Hour	405	606	202		1,213
Peak 15 min	123	176	57		321
PHF	**0.82**	**0.86**	**0.89**		**0.94**

Mid-day Peak Hour Factors (PHF)												
	S/B			N/B			W/B			E/B		
PHF by Movement	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**
Interval 1	23	155			139	22	30		29			
Interval 2	29	169			140	20	27		22			
Interval 3	19	151			146	17	21		20			
Interval 4	25	149			142	23	29		31			
Peak Hour	96	624			567	82	107		102			
Peak 15 min	29	169			146	23	30		31			
PHF	**0.83**	**0.92**			**0.97**	**0.89**	**0.89**		**0.82**			

PHF by Approach	**S/B**	**N/B**	**W/B**	**E/B**	**Overall**
Interval 1	178	161	59		398
Interval 2	198	160	49		407
Interval 3	170	163	41		374
Interval 4	174	165	60		399
Peak Hour	720	649	209		1,578
Peak 15 min	198	165	60		407
PHF	**0.91**	**0.98**	**0.87**		**0.97**

PM Peak Hour Factors (PHF)												
	S/B			N/B			W/B			E/B		
PHF by Movement	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**
Interval 1	35	174			165	23	28		12			
Interval 2	29	180			136	27	44		20			
Interval 3	29	201			128	36	36		21			
Interval 4	36	173			161	26	33		21			
Peak Hour	129	728			590	112	141		74			
Peak 15 min	36	201			165	36	44		21			
PHF	**0.90**	**0.91**			**0.89**	**0.78**	**0.80**		**0.88**			

PHF by Approach	**S/B**	**N/B**	**W/B**	**E/B**	**Overall**
Interval 1	209	188	40		437
Interval 2	209	163	64		436
Interval 3	230	164	57		451
Interval 4	209	187	54		450
Peak Hour	857	702	215		1,774
Peak 15 min	230	188	64		451
PHF	**0.93**	**0.93**	**0.84**		**0.98**

LOCATION: **US 31 & Campbell Station Rd**

AM Peak Hour Factors (PHF)												
	S/B			N/B			W/B			E/B		
PHF by Movement	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**
Interval 1	9	82	3	2	122	18	19	2	37	11	3	2
Interval 2	19	70	4	3	117	13	26	7	39	7	5	2
Interval 3	7	80	10	2	125	22	34	9	41	13	4	2
Interval 4	24	111	8	4	122	33	31	7	35	8	3	7
Peak Hour	59	343	25	11	486	86	110	25	152	39	15	13
Peak 15 min	24	111	10	4	125	33	34	9	41	13	5	7
PHF	**0.61**	**0.77**	**0.63**	**0.69**	**0.97**	**0.65**	**0.81**	**0.69**	**0.93**	**0.75**	**0.75**	**0.46**

PHF by Approach	**S/B**	**N/B**	**W/B**	**E/B**	**Overall**
Interval 1	94	142	58	16	310
Interval 2	93	133	72	14	312
Interval 3	97	149	84	19	349
Interval 4	143	159	73	18	393
Peak Hour	427	583	287	67	1,364
Peak 15 min	143	159	84	19	393
PHF	**0.75**	**0.92**	**0.85**	**0.88**	**0.87**

Mid-day Peak Hour Factors (PHF)												
	S/B			N/B			W/B			E/B		
PHF by Movement	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**
Interval 1	19	106	20	1	126	21	58	20	19	11	5	6
Interval 2	11	118	16	7	118	24	49	11	24	15	8	3
Interval 3	16	104	17	5	117	37	63	8	20	16	12	10
Interval 4	17	117	14	7	102	18	38	9	21	21	11	13
Peak Hour	63	445	67	20	463	100	208	48	84	63	36	32
Peak 15 min	19	118	20	7	126	37	63	20	24	21	12	13
PHF	**0.83**	**0.94**	**0.84**	**0.71**	**0.92**	**0.68**	**0.83**	**0.60**	**0.88**	**0.75**	**0.75**	**0.62**

PHF by Approach	**S/B**	**N/B**	**W/B**	**E/B**	**Overall**
Interval 1	145	148	97	22	412
Interval 2	145	149	84	26	404
Interval 3	137	159	91	38	425
Interval 4	148	127	68	45	388
Peak Hour	575	583	340	131	1,629
Peak 15 min	148	159	97	45	425
PHF	**0.97**	**0.92**	**0.88**	**0.73**	**0.96**

PM Peak Hour Factors (PHF)												
	S/B			N/B			W/B			E/B		
PHF by Movement	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**
Interval 1	42	125	30	4	115	30	85	15	37	24	15	9
Interval 2	43	121	14	4	139	25	75	18	27	20	13	7
Interval 3	55	121	24	6	119	25	59	15	28	24	15	9
Interval 4	44	144	28	3	117	40	59	10	31	21	17	9
Peak Hour	184	511	96	17	490	120	278	58	123	89	60	34
Peak 15 min	55	144	30	6	139	40	85	18	37	24	17	9
PHF	**0.84**	**0.89**	**0.80**	**0.71**	**0.88**	**0.75**	**0.82**	**0.81**	**0.83**	**0.93**	**0.88**	**0.94**

PHF by Approach	**S/B**	**N/B**	**W/B**	**E/B**	**Overall**
Interval 1	197	149	137	48	531
Interval 2	178	168	120	40	506
Interval 3	200	150	102	48	500
Interval 4	216	160	100	47	523
Peak Hour	791	627	459	183	2,060
Peak 15 min	216	168	137	48	531
PHF	**0.92**	**0.93**	**0.84**	**0.95**	**0.97**

LOCATION: **US 31 & Buckner Ln**

AM Peak Hour Factors (PHF)												
	S/B			N/B			W/B			E/B		
PHF by Movement	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**
Interval 1	21	60	27	14	157	12	9	33	66	27	39	24
Interval 2	22	96	37	9	165	10	27	59	90	48	55	32
Interval 3	10	86	7	6	120	19	34	20	71	30	9	3
Interval 4	13	75	7	11	132	9	38	22	62	14	4	5
Peak Hour	66	317	78	40	574	50	108	134	289	119	107	64
Peak 15 min	22	96	37	14	165	19	38	59	90	48	55	32
PHF	**0.75**	**0.83**	**0.53**	**0.71**	**0.87**	**0.66**	**0.71**	**0.57**	**0.80**	**0.62**	**0.49**	**0.50**

PHF by Approach	**S/B**	**N/B**	**W/B**	**E/B**	**Overall**
Interval 1	108	183	108	90	489
Interval 2	155	184	176	135	650
Interval 3	103	145	125	42	415
Interval 4	95	152	122	23	392
Peak Hour	461	664	531	290	1,946
Peak 15 min	155	184	176	135	650
PHF	**0.74**	**0.90**	**0.75**	**0.54**	**0.75**

Mid-day Peak Hour Factors (PHF)												
	S/B			N/B			W/B			E/B		
PHF by Movement	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**
Interval 1	18	127	4	6	107	33	34	4	15	6	3	
Interval 2	12	114	2	8	102	23	26	4	14	3	3	4
Interval 3	23	135	5	4	105	29	32	3	9	4	9	5
Interval 4	11	114	4	5	129	52	32	5	24	6	5	5
Peak Hour	64	490	15	23	443	137	124	16	62	19	20	14
Peak 15 min	23	135	5	8	129	52	34	5	24	6	9	5
PHF	**0.70**	**0.91**	**0.75**	**0.72**	**0.86**	**0.66**	**0.91**	**0.80**	**0.65**	**0.79**	**0.56**	**0.70**

PHF by Approach	**S/B**	**N/B**	**W/B**	**E/B**	**Overall**
Interval 1	149	146	53	9	357
Interval 2	128	133	44	10	315
Interval 3	163	138	44	18	363
Interval 4	129	186	61	16	392
Peak Hour	569	603	202	53	1,427
Peak 15 min	163	186	61	18	392
PHF	**0.87**	**0.81**	**0.83**	**0.74**	**0.91**

PM Peak Hour Factors (PHF)												
	S/B			N/B			W/B			E/B		
PHF by Movement	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**
Interval 1	34	202	17	7	130	57	53	14	26	7	13	6
Interval 2	51	205	11	6	119	63	29	10	29	2	13	12
Interval 3	49	201	11	10	113	64	61	11	30	5	5	11
Interval 4	60	198	10	4	107	50	62	15	43	20	18	13
Peak Hour	194	806	49	27	469	234	205	50	128	34	49	42
Peak 15 min	60	205	17	10	130	64	62	15	43	20	18	13
PHF	**0.81**	**0.98**	**0.72**	**0.68**	**0.90**	**0.91**	**0.83**	**0.83**	**0.74**	**0.43**	**0.68**	**0.81**

PHF by Approach	**S/B**	**N/B**	**W/B**	**E/B**	**Overall**
Interval 1	253	194	93	26	566
Interval 2	267	188	68	27	550
Interval 3	261	187	102	21	571
Interval 4	268	161	120	51	600
Peak Hour	1,049	730	383	125	2,287
Peak 15 min	268	194	120	51	600
PHF	**0.98**	**0.94**	**0.80**	**0.61**	**0.95**

LOCATION: **US 31 & Thompson Station Rd**

AM Peak Hour Factors (PHF)												
	S/B			N/B			W/B			E/B		
PHF by Movement	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**
Interval 1	7	91	5	11	276	8	6	4	79	18	4	9
Interval 2	8	125	7	13	275	8	14	11	48	15	7	13
Interval 3	13	103	5	16	274	5	7	10	18	14	8	4
Interval 4	8	84	4	5	203	5	5	12	19	8	6	7
Peak Hour	36	403	21	45	1,028	26	32	37	164	55	25	33
Peak 15 min	13	125	7	16	276	8	14	12	79	18	8	13
PHF	**0.69**	**0.81**	**0.75**	**0.70**	**0.93**	**0.81**	**0.57**	**0.77**	**0.52**	**0.76**	**0.78**	**0.63**

PHF by Approach	**S/B**	**N/B**	**W/B**	**E/B**	**Overall**
Interval 1	103	295	89	31	518
Interval 2	140	296	73	35	544
Interval 3	121	295	35	26	477
Interval 4	96	213	36	21	366
Peak Hour	460	1,099	233	113	1,905
Peak 15 min	140	296	89	35	544
PHF	**0.82**	**0.93**	**0.65**	**0.81**	**0.88**

Mid-day Peak Hour Factors (PHF)												
	S/B			N/B			W/B			E/B		
PHF by Movement	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**
Interval 1	6	101	12	19	101	10	26	10	6	14	9	23
Interval 2	7	103	6	17	96	12	21	11	12	9	5	14
Interval 3	12	115	9	20	86	6	11	9	8	12	2	24
Interval 4	9	119	10	20	144	10	10	6	7	12	8	16
Peak Hour	34	438	37	76	427	38	68	36	33	47	24	77
Peak 15 min	12	119	12	20	144	12	26	11	12	14	9	24
PHF	**0.71**	**0.92**	**0.77**	**0.95**	**0.74**	**0.79**	**0.65**	**0.82**	**0.69**	**0.84**	**0.67**	**0.80**

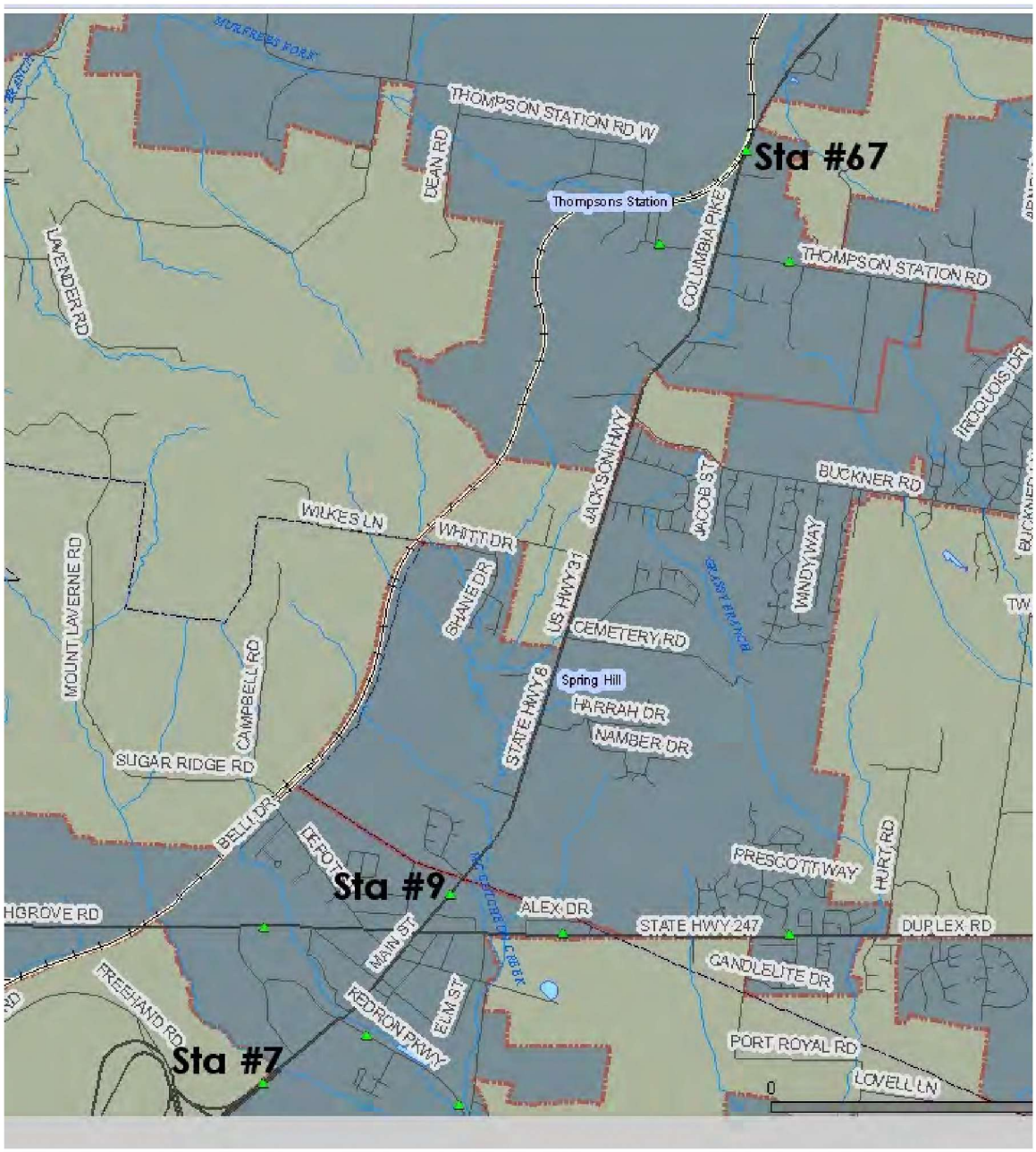
PHF by Approach	**S/B**	**N/B**	**W/B**	**E/B**	**Overall**
Interval 1	119	130	42	46	337
Interval 2	116	125	44	28	313
Interval 3	136	112	28	38	314
Interval 4	138	174	23	36	371
Peak Hour	509	541	137	148	1,335
Peak 15 min	138	174	44	46	371
PHF	**0.92**	**0.78**	**0.78**	**0.80**	**0.90**

PM Peak Hour Factors (PHF)												
	S/B			N/B			W/B			E/B		
PHF by Movement	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**
Interval 1	7	218	4	10	138	15	11	10	14	6	7	28
Interval 2	2	245	7	7	127	5	13	5	18	26	15	34
Interval 3	4	232	11	20	144	4	15	7	9	5	9	21
Interval 4	17	234	2	20	139	25	31	4	1	3	13	20
Peak Hour	30	929	24	57	548	49	70	26	42	40	44	103
Peak 15 min	17	245	11	20	144	25	31	10	18	26	15	34
PHF	**0.44**	**0.95**	**0.55**	**0.71**	**0.95**	**0.49**	**0.56**	**0.65**	**0.58**	**0.38**	**0.73**	**0.76**

PHF by Approach	**S/B**	**N/B**	**W/B**	**E/B**	**Overall**
Interval 1	229	163	35	41	468
Interval 2	254	139	36	75	504
Interval 3	247	168	31	35	481
Interval 4	253	184	36	36	509
Peak Hour	983	654	138	187	1,962
Peak 15 min	254	184	36	75	509
PHF	**0.97**	**0.89**	**0.96**	**0.62**	**0.96**

TDOT ADT COUNTS

TDOT COUNT STATIONS



COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000007 **County:** 60 Maury
Start Date: 06 / 11 / 2007 **End Date:** 06 / 12 / 2007
Start Time: 12 : 00 **End Time:** 12 : 00
Direction: 6 (Coverage)

Time	
12:00 - 13:00	1,094
13:00 - 14:00	1,060
14:00 - 15:00	1,223
15:00 - 16:00	1,225
16:00 - 17:00	1,235
17:00 - 18:00	1,170
18:00 - 19:00	869
19:00 - 20:00	620
20:00 - 21:00	433
21:00 - 22:00	388
22:00 - 23:00	278
23:00 - 24:00	109
24:00 - 01:00	98
01:00 - 02:00	26
02:00 - 03:00	33
03:00 - 04:00	48
04:00 - 05:00	90
05:00 - 06:00	562
06:00 - 07:00	1,018
07:00 - 08:00	1,103
08:00 - 09:00	1,028
09:00 - 10:00	990
10:00 - 11:00	1,053
11:00 - 12:00	1,318

Total: 17,071x Variation Factor: 0.95 = 16,217 x Truck Factor: 0.95 = AADT: 15,406.5

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
11:00 - 12:00	1318	0.96	15:15 - 16:15	1250	0.87

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
8	50	7	56	8	50

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000007 **County:** 60 Maury
Start Date: 06 / 11 / 2007 **End Date:** 06 / 12 / 2007
Start Time: 12 : 00 **End Time:** 12 : 00
Direction: 1 (Coverage)

Time	
12:00 - 13:00	525
13:00 - 14:00	492
14:00 - 15:00	648
15:00 - 16:00	577
16:00 - 17:00	528
17:00 - 18:00	497
18:00 - 19:00	409
19:00 - 20:00	234
20:00 - 21:00	173
21:00 - 22:00	143
22:00 - 23:00	138
23:00 - 24:00	44
24:00 - 01:00	36
01:00 - 02:00	16
02:00 - 03:00	19
03:00 - 04:00	32
04:00 - 05:00	58
05:00 - 06:00	320
06:00 - 07:00	634
07:00 - 08:00	650
08:00 - 09:00	599
09:00 - 10:00	532
10:00 - 11:00	550
11:00 - 12:00	654
Total:	8,508

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
11:00 - 12:00	1318	0.96	15:15 - 16:15	1250	0.87

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
8	50	7	56	8	50

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000007 **County:** 60 Maury
Start Date: 06 / 11 / 2007 **End Date:** 06 / 12 / 2007
Start Time: 12 : 00 **End Time:** 12 : 00
Direction: 2 (Coverage)

Time	
12:00 - 13:00	569
13:00 - 14:00	568
14:00 - 15:00	575
15:00 - 16:00	648
16:00 - 17:00	707
17:00 - 18:00	673
18:00 - 19:00	460
19:00 - 20:00	386
20:00 - 21:00	260
21:00 - 22:00	245
22:00 - 23:00	140
23:00 - 24:00	65
24:00 - 01:00	62
01:00 - 02:00	10
02:00 - 03:00	14
03:00 - 04:00	16
04:00 - 05:00	32
05:00 - 06:00	242
06:00 - 07:00	384
07:00 - 08:00	453
08:00 - 09:00	429
09:00 - 10:00	458
10:00 - 11:00	503
11:00 - 12:00	664
Total:	8,563

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
11:00 - 12:00	1318	0.96	15:15 - 16:15	1250	0.87

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
8	50	7	56	8	50

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number: 000009 **County:** 60 Maury
Start Date: 07 / 17 / 2007 **End Date:** 07 / 18 / 2007
Start Time: 11 : 00 **End Time:** 11 : 00
Direction: 0 (Coverage)

Time	
11:00 - 12:00	1,396
12:00 - 13:00	1,429
13:00 - 14:00	1,397
14:00 - 15:00	1,324
15:00 - 16:00	1,449
16:00 - 17:00	1,467
17:00 - 18:00	1,490
18:00 - 19:00	1,444
19:00 - 20:00	1,070
20:00 - 21:00	781
21:00 - 22:00	651
22:00 - 23:00	369
23:00 - 24:00	176
24:00 - 01:00	154
01:00 - 02:00	32
02:00 - 03:00	19
03:00 - 04:00	49
04:00 - 05:00	93
05:00 - 06:00	425
06:00 - 07:00	873
07:00 - 08:00	994
08:00 - 09:00	1,053
09:00 - 10:00	1,106
10:00 - 11:00	1,195

Total: 20,436x Variation Factor: 0.97 = 19,823 x Truck Factor: 0.95 = AADT: 18,831.7

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
11:45 - 12:45	1422	0.99	15:15 - 16:15	1533	0.95

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
7	65	8	65	8	65

COVERAGE COUNT DATA WITH 24 HOUR TOTALS

Station Number:	000067	**County:**	94 Williamson
Start Date:	03 / 07 / 2007	**End Date:**	03 / 08 / 2007
Start Time:	12 : 00	**End Time:**	12 : 00
Direction:	0 (Coverage)		

Time	
12:00 - 13:00	1,066
13:00 - 14:00	1,172
14:00 - 15:00	1,329
15:00 - 16:00	1,738
16:00 - 17:00	1,634
17:00 - 18:00	1,719
18:00 - 19:00	1,749
19:00 - 20:00	983
20:00 - 21:00	858
21:00 - 22:00	623
22:00 - 23:00	448
23:00 - 24:00	215
24:00 - 01:00	148
01:00 - 02:00	77
02:00 - 03:00	54
03:00 - 04:00	56
04:00 - 05:00	106
05:00 - 06:00	436
06:00 - 07:00	1,231
07:00 - 08:00	1,918
08:00 - 09:00	1,572
09:00 - 10:00	1,209
10:00 - 11:00	1,063
11:00 - 12:00	1,061

Total: 22,465x Variation Factor: 0.96 = 21,566 x Truck Factor: 0.95 = AADT: 20,488.0

Peak AM	Peak Total	Peak Hour Factor	Peak PM	Peak Total	Peak Hour Factor
07:00 - 08:00	1918	0.96	17:15 - 18:15	1766	0.96

Peak AM %	Dir Dist AM %	Peak PM %	Dir Dist PM %	Daily Peak %	Daily Dir Dist %
9	65	8	65	9	65

HISTORICAL TRAFFIC GROWTH

Rec	Station Number	County	Location	Year	Annual Average Daily Count	Average Growth per Year
1	7	Maury	SOUTHWEST SPRING HILL	2007	15407	
2	7	Maury	SOUTHWEST SPRING HILL	2006	14621	
3	7	Maury	SOUTHWEST SPRING HILL	2005	16544	
4	7	Maury	SOUTHWEST SPRING HILL	2004	14920	
5	7	Maury	SOUTHWEST SPRING HILL	2003	14298	
6	7	Maury	SOUTHWEST SPRING HILL	2002	15343	0.1%
7	7	Maury	SOUTHWEST SPRING HILL	2001	16180	
8	7	Maury	SOUTHWEST SPRING HILL	2000	14847	
9	7	Maury	SOUTHWEST SPRING HILL	1999	14334	
10	7	Maury	SOUTHWEST SPRING HILL	1998	14720	
11	7	Maury	SOUTHWEST SPRING HILL	1997	13758	
12	7	Maury	SOUTHWEST SPRING HILL	1996	12521	
13	7	Maury	SOUTHWEST SPRING HILL	1995	12016	
14	7	Maury	SOUTHWEST SPRING HILL	1994	10789	
15	7	Maury	SOUTHWEST SPRING HILL	1993	9626	
16	7	Maury	SOUTHWEST SPRING HILL	1992	8847	
17	7	Maury	SOUTHWEST SPRING HILL	1991	9820	
18	7	Maury	SOUTHWEST SPRING HILL	1990	8431	
19	7	Maury	SOUTHWEST SPRING HILL	1989	8570	
20	7	Maury	SOUTHWEST SPRING HILL	1988	10461	
21	7	Maury	SOUTHWEST SPRING HILL	1987	9048	
22	7	Maury	SOUTHWEST SPRING HILL	1986	10000	
23	7	Maury	SOUTHWEST SPRING HILL	1985	6734	

Rec	Station Number	County	Location	Year	Annual Average Daily C ount	Average Growth per Year
1	9	Maury	NORTHEAST SPRING HILL	2007	18832	
2	9	Maury	NORTHEAST SPRING HILL	2006	18007	
3	9	Maury	NORTHEAST SPRING HILL	2005	17483	
4	9	Maury	NORTHEAST SPRING HILL	2004	13311	
5	9	Maury	NORTHEAST SPRING HILL	2003	12924	
6	9	Maury	NORTHEAST SPRING HILL	2002	11965	11%
7	9	Maury	NORTHEAST SPRING HILL	2001	12862	
8	9	Maury	NORTHEAST SPRING HILL	2000	9902	
9	9	Maury	NORTHEAST SPRING HILL	1999	9797	
10	9	Maury	NORTHEAST SPRING HILL	1998	10806	
11	9	Maury	NORTHEAST SPRING HILL	1997	11042	
12	9	Maury	NORTHEAST SPRING HILL	1996	10237	
13	9	Maury	NORTHEAST SPRING HILL	1995	9184	
14	9	Maury	NORTHEAST SPRING HILL	1994	8880	
15	9	Maury	NORTHEAST SPRING HILL	1993	7521	
16	9	Maury	NORTHEAST SPRING HILL	1992	8000	
17	9	Maury	NORTHEAST SPRING HILL	1991	7895	
18	9	Maury	NORTHEAST SPRING HILL	1990	6895	
19	9	Maury	NORTHEAST SPRING HILL	1989	6400	
20	9	Maury	NORTHEAST SPRING HILL	1988	10016	
21	9	Maury	NORTHEAST SPRING HILL	1987	8935	
22	9	Maury	NORTHEAST SPRING HILL	1986	10832	
23	9	Maury	NORTHEAST SPRING HILL	1985	8626	

Rec	Station Number	County	Location	Year	Annual Average Daily Count	Average Growth per Year
1	67	Williamson	NEAR THOMPSON STATION	2007	20488	
2	67	Williamson	NEAR THOMPSON STATION	2006	21645	
3	67	Williamson	NEAR THOMPSON STATION	2005	15488	
4	67	Williamson	NEAR THOMPSON STATION	2004	15037	
5	67	Williamson	NEAR THOMPSON STATION	2003	14599	
6	67	Williamson	NEAR THOMPSON STATION	2002	14037	9.2%
7	67	Williamson	NEAR THOMPSON STATION	2001	15108	
8	67	Williamson	NEAR THOMPSON STATION	2000	13289	
9	67	Williamson	NEAR THOMPSON STATION	1999	10915	
10	67	Williamson	NEAR THOMPSON STATION	1998	11015	
11	67	Williamson	NEAR THOMPSON STATION	1997	9499	
12	67	Williamson	NEAR THOMPSON STATION	1996	9418	
13	67	Williamson	NEAR THOMPSON STATION	1995	9079	
14	67	Williamson	NEAR THOMPSON STATION	1994	10337	
15	67	Williamson	NEAR THOMPSON STATION	1993	8121	
16	67	Williamson	NEAR THOMPSON STATION	1992	7654	

APPENDIX B

SIGNAL TIMING INVENTORY SHEETS

Intersection:	**Highway 31 and Crossings Driveway (#1)**		
Inspected By:	RGP/ECM	**Date Inventory Completed:**	5/13/2008
Pole Type:	Steel Strain Pole	**Signal Attachment Type:**	Span Wire with Hangers
Cabinet Mount:	Pad	**Cabinet Dimensions: (WxDxH):**	40" x 27" x 58"
Cabinet Phases:	8	**Cabinet Location:**	SW Corner
Controller Make:	Peek	**Controller Comm Module:**	Fiber Optic
Controller Model:	3000 E	**Conflict Monitor (MMU) Type:**	Peek - Double Diamond
Misc. Equipment:	Peek M3000 E Master	**Emergency Vehicle Pre-emption:**	None

CONTROLLER PHASE TIMINGS AND FUNCTIONS

	Phase	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
	Description	---	SB TR	---	WB	SB LT	NB TR	---	---
	Phase Orientation	---	⇩	---	⇦	⇨	⇧	---	---
Vehicle Times	Min. Green	---	15	---	10	10	15	---	---
	Passage	---	2	---	3	3	2	---	---
	Max 1	---	60	---	30	40	60	---	---
	Max 2	---	30	---	30	30	30	---	---
	Yellow Clear	---	4.5	---	4.5	4.5	4.5	---	---
	Red Clear	---	2	---	2	2	2	---	---
Ped Times	Walk	---	---	---	---	---	---	---	---
	Ped Clear	---	---	---	---	---	---	---	---
Recall	Veh Recall	---	MIN	---	OFF	OFF	MIN	---	---
	Ped Recall	---	---	---	---	---	---	---	---
Misc	Non-Locking Memory	---	ON	---	ON	ON	ON	---	---
	Dual Entry	---	ON	---	---	---	ON	---	---
	Phase Omit	ON	---	ON	---	---	---	ON	ON

LOOP DETECTOR DATA

Phase	**Make**	**Model**	**Operating Mode**	**Programmed Delay**	**Comments**
2A	Northstar	NT11-E	Pulse	None	Advance Loops
2B	Northstar	NT11-E	Presence	None	Stop Bar Loops
4A	Northstar	NT11-E	Presence	10 Seconds	Right Turn Lane
4B	Northstar	NT11-E	Presence	None	None
5	Northstar	NT11-E	Presence	None	None
6A	Northstar	NT11-E	Pulse	None	Advance Loops
6B	Northstar	NT11-E	Presence	None	Stop Bar Loops

Notes: No AC Power to Master Controller

Max II Timings Not Used

Intersection:	**Highway 31 and Stephen A. Yokich Parkway (#2)**		
Inspected By:	RGP/ECM	**Date Inventory Completed:**	5/13/2008
Pole Type:	Steel Strain Pole	**Signal Attachment Type:**	Span Wire with Hangers
Cabinet Mount:	Pole	**Cabinet Dimensions: (WxDxH):**	30" x 17" x 50"
Cabinet Phases:	4	**Cabinet Location:**	NW Corner
Controller Make:	Peek	**Controller Comm Module:**	None
Controller Model:	3000	**Conflict Monitor (MMU) Type:**	Transyt - 12ELRA
Misc. Equipment:		**Emergency Vehicle Pre-emption:**	Sonem 2000

CONTROLLER PHASE TIMINGS AND FUNCTIONS

	Phase	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
	Description	NB LT	SB/NB TR	---	EB	---	---	---	---
	Phase Orientation	↰	⇩ ⇧	---	⇨	---	---	---	---
Vehicle Times	Min. Green	6	10	---	6	---	---	---	---
	Passage	3.5	3.5	---	3.5	---	---	---	---
	Max 1	10	45	---	15	---	---	---	---
	Max 2	10	80	---	15	---	---	---	---
	Yellow Clear	4	4	---	4	---	---	---	---
	Red Clear	2	2	---	2	---	---	---	---
Ped Times	Walk	---	---	---	---	---	---	---	---
	Ped Clear	---	---	---	---	---	---	---	---
Recall	Veh Recall	OFF	MIN	---	OFF	---	---	---	---
	Ped Recall	---	---	---	---	---	---	---	---
Misc	Non-Locking Memory	ON	OFF	---	ON	---	---	---	---
	Dual Entry	---	---	---	---	---	---	---	---
	Phase Omit	---	---	ON	---	ON	ON	ON	ON

LOOP DETECTOR DATA

Phase	**Make**	**Model**	**Operating Mode**	**Programmed Delay**	**Comments**
1	Sarasota	535T	Presence	None	None
2A	Sarasota	535T	Presence	None	None
2B	Sarasota	535T	Presence	None	None
4A	Sarasota	535T	Presence	None	None
4B	Sarasota	535T	Presence	10 Seconds	Right Turn Lane

Notes: Fiber Optic Communications Not Connected to Controller (No Comm Port)

Sonem appears non-operational (no power indication)

Intersection:	**Highway 31 and Kedron Road / Kedron Parkway (#3)**		
Inspected By:	RGP/ECM	**Date Inventory Completed:**	5/13/2008
Pole Type:	Steel Strain Pole	**Signal Attachment Type:**	Span Wire with Hangers
Cabinet Mount:	Pad	**Cabinet Dimensions: (WxDxH):**	40" x 27" x 58"
Cabinet Phases:	8	**Cabinet Location:**	SW Corner
Controller Make:	Peek	**Controller Comm Module:**	None
Controller Model:	3000	**Conflict Monitor (MMU) Type:**	EDI - SSM-12LE
Misc. Equipment:		**Emergency Vehicle Pre-emption:**	Sonem 2000

CONTROLLER PHASE TIMINGS AND FUNCTIONS

	Phase	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
	Description	SB LT	NB TR	EB LT	WB TR	NB LT	SB TR	WB LT	EB TR
	Phase Orientation	↳	↑	⇧	←	↰	↓	⇩	→
Vehicle Times	Min. Green	5	10	5	8	5	10	5	8
	Passage	3	6	3	3	3	6	3	3
	Max 1	15	40	15	40	15	40	15	25
	Max 2	15	80	15	20	15	80	15	20
	Yellow Clear	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
	Red Clear	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0
Ped Times	Walk	---	---	---	---	---	---	---	---
	Ped Clear	---	---	---	---	---	---	---	---
Recall	Veh Recall	OFF	MIN	OFF	OFF	OFF	MIN	OFF	OFF
	Ped Recall	---	---	---	---	---	---	---	---
Misc	Non-Locking Memory	ON	OFF	ON	ON	ON	OFF	ON	ON
	Dual Entry	---	ON	---	ON	---	ON	---	ON
	Phase Omit	---	---	---	---	---	---	---	---

LOOP DETECTOR DATA

Phase	**Make**	**Model**	**Operating Mode**	**Programmed Delay**	**Comments**
1	Sarasota	535T	Presence	5 Seconds	Left Turn Lane
2	Sarasota	535T	Presence	None	None
3	Northstar	NT11	Presence	None	None
4	Northstar	NT11	Presence	None	None
5	Sarasota	535T	Presence	5 Seconds	Left Turn Lane
6	Sarasota	535T	Presence	None	None
7	Sarasota	535T	Presence	10 Seconds	Left Turn Lane
8	Sarasota	535T	Presence	None	None

Notes: Max 2 programmed to run from 6-8 AM and 4-6 PM

Intersection:	**Highway 31 and Depot / McLemore (#4)**		
Inspected By:	RGP/ECM	**Date Inventory Completed:**	5/13/2008
Pole Type:	Steel Cantilevered Pole	**Signal Attachment Type:**	Hangers on Mast Arms
Cabinet Mount:	Pole	**Cabinet Dimensions: (WxDxH):**	36" x 17" x 50"
Cabinet Phases:	8	**Cabinet Location:**	NW Corner
Controller Make:	Peek	**Controller Comm Module:**	None
Controller Model:	3000 E	**Conflict Monitor (MMU) Type:**	Peek - Double Diamond
Misc. Equipment:		**Emergency Vehicle Pre-emption:**	EPS-II

CONTROLLER PHASE TIMINGS AND FUNCTIONS

	Phase	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
	Description	NB LT	SB TR	EB	WB	SB LT	NB TR	---	---
	Phase Orientation	↰	⇩	⇨	⇦	↳	⇧	---	---
Vehicle Times	Min. Green	5	10	5	5	5	10	---	---
	Passage	2	4	2	2	2	4	---	---
	Max 1	10	60	15	15	10	60	---	---
	Max 2	10	90	15	15	10	90	---	---
	Yellow Clear	3.0	4.0	3.0	3.0	3.0	4.0	---	---
	Red Clear	1.0	2.0	1.0	1.0	1.0	2.0	---	---
Ped Times	Walk	---	---	---	---	---	---	---	---
	Ped Clear	---	---	---	---	---	---	---	---
Recall	Veh Recall	OFF	MAX	OFF	OFF	OFF	MAX	---	---
	Ped Recall	---	---	---	---	---	---	---	---
Misc	Non-Locking Memory	ON	---	ON	ON	ON	---	---	---
	Dual Entry	---	ON	---	---	---	ON	---	---
	Phase Omit	---	---	---	---	---	---	ON	ON

LOOP DETECTOR DATA

Phase	**Make**	**Model**	**Operating Mode**	**Programmed Delay**	**Comments**
1	Northstar	NT11	Presence	None	None
3	Northstar	NT11-E	Presence	4 Seconds	None
4	Northstar	NT11-E	Presence	4 Seconds	None
5	Northstar	NT11	Presence	None	None

Notes: Max 2 programmed to run from 6-8 AM and 4-6 PM

Intersection:	**Highway 31 and Beechcroft (#5) & Duplex (#6)**		
Inspected By:	RGP/ECM	**Date Inventory Completed:**	5/13/2008
Pole Type:	Steel Cantilevered Pole	**Signal Attachment Type:**	Hangers on Mast Arms
Cabinet Mount:	Pole	**Cabinet Dimensions: (WxDxH):**	36" x 17" x 50"
Cabinet Phases:	8	**Cabinet Location:**	NW Corner
Controller Make:	Peek	**Controller Comm Module:**	None
Controller Model:	3000 E	**Conflict Monitor (MMU) Type:**	Peek - Double Diamond
Misc. Equipment:		**Emergency Vehicle Pre-emption:**	Sonem 2000

CONTROLLER PHASE TIMINGS AND FUNCTIONS

	Phase	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
	Description	SB LT	NB TR	WB	EB	NB LT	SB TR	---	---
	Phase Orientation	↳	↑	←	→	↰	↓	---	---
Vehicle Times	Min. Green	5	10	5	5	5	10	---	---
	Passage	2	4	2	2	2	4	---	---
	Max 1	15	60	25	15	10	60	---	---
	Max 2	15	90	25	15	10	90	---	---
	Yellow Clear	3.0	4.0	3.0	4.0	3.0	4.0	---	---
	Red Clear	1.0	2.5	3.0	5.0	1.0	2.5	---	---
Ped Times	Walk	---	---	---	---	---	---	---	---
	Ped Clear	---	---	---	---	---	---	---	---
Recall	Veh Recall	OFF	MAX	OFF	OFF	OFF	MAX	---	---
	Ped Recall	---	---	---	---	---	---	---	---
Misc	Non-Locking Memory	ON	---	ON	ON	ON	---	---	---
	Dual Entry	---	ON	---	---	---	ON	---	---
	Phase Omit	---	---	---	---	---	---	ON	ON

LOOP DETECTOR DATA

Phase	**Make**	**Model**	**Operating Mode**	**Programmed Delay**	**Comments**
1	Sarasota	535T	Presence	4 Seconds	Left Turn Lane
3	Northstar	NT11	Presence	None	Side Street
4	Northstar	NT11-E	Presence	3 Seconds	Side Street
5	Northstar	NT11-E	Presence	3 Seconds	Left Turn Lane

Notes: Max 2 programmed to run from 6-8 AM and 4-6 PM

Intersection:	**Highway 31 and Campbell Station Road (#7)**		
Inspected By:	RGP/ECM	**Date Inventory Completed:**	5/13/2008
Pole Type:	Steel Strain Pole	**Signal Attachment Type:**	Span Wire with Hangers
Cabinet Mount:	Pad	**Cabinet Dimensions: (WxDxH):**	40" x 27" x 58"
Cabinet Phases:	8	**Cabinet Location:**	SE Corner
Controller Make:	Peek	**Controller Comm Module:**	None
Controller Model:	3000 E	**Conflict Monitor (MMU) Type:**	Peek - Double Diamond
Misc. Equipment:		**Emergency Vehicle Pre-emption:**	Sonem 2000

CONTROLLER PHASE TIMINGS AND FUNCTIONS

	Phase	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
	Description	SB LT	NB TR	EB LT	WB TR	NB LT	SB TR	WB LT	EB TR
	Phase Orientation	↳	↑	⤴	←	↰	↓	⤵	→
Vehicle Times	Min. Green	5	10	5	5	5	10	5	5
	Passage	4	5	4	4	4	5	4	4
	Max 1	15	50	15	25	15	50	15	20
	Max 2	15	70	15	20	15	70	15	20
	Yellow Clear	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
	Red Clear	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ped Times	Walk	---	---	---	---	---	---	---	---
	Ped Clear	---	---	---	---	---	---	---	---
Recall	Veh Recall	OFF	MIN	OFF	OFF	OFF	MIN	OFF	OFF
	Ped Recall	---	---	---	---	---	---	---	---
Misc	Non-Locking Memory	ON	ON	OFF	ON	ON	OFF	ON	ON
	Dual Entry	---	ON	---	ON	---	ON	---	ON
	Phase Omit	---	---	---	---	---	---	---	---

LOOP DETECTOR DATA

Phase	**Make**	**Model**	**Operating Mode**	**Programmed Delay**	**Comments**
1	IDC	---	Presence	5 Seconds	Left Turn Lane
2	IDC	---	Presence	None	None
3	Northstar	NT11	Presence	None	None
4	IDC	---	Presence	8 Seconds	Thru + Right Lanes
5	Northstar	NT11-E	Presence	None	None
6	IDC	---	Presence	None	None
7	Northstar	NT11-E	Presence	4 Seconds	Left Turn Lane
8	Sarasota	535T	Presence	3 Seconds	Thru/Right Lanes

Notes: Max 2 programmed to run from 7-9 AM and 3:30-6 PM

Intersection:	**Highway 31 and Buckner Road / Thompson Ridge Road (#8)**		
Inspected By:	RGP/ECM	**Date Inventory Completed:**	5/21/2008
Pole Type:	Steel Strain Pole	**Signal Attachment Type:**	Span Wire with Hangers
Cabinet Mount:	Pole	**Cabinet Dimensions: (WxDxH):**	36" x 17" x 50"
Cabinet Phases:	8	**Cabinet Location:**	NW Corner
Controller Make:	Peek	**Controller Comm Module:**	None
Controller Model:	3000	**Conflict Monitor (MMU) Type:**	Transyt - 12ELRA
Misc. Equipment:		**Emergency Vehicle Pre-emption:**	EPS-II

CONTROLLER PHASE TIMINGS AND FUNCTIONS

	Phase	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
	Description	SB LT	NB TR	EB LT	WB TR	NB LT	SB TR	WB LT	EB TR
	Phase Orientation	↳	↑	⤴	←	↰	↓	⤵	→
Vehicle Times	Min. Green	5	10	5	5	5	10	5	7
	Passage	3	4	3	4	3	4	3	4
	Max 1	20	55	25	30	25	55	20	35
	Max 2	15	70	15	20	10	70	15	20
	Yellow Clear	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
	Red Clear	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0
Ped Times	Walk	---	---	---	---	---	---	---	8
	Ped Clear	---	---	---	---	---	---	---	15
Recall	Veh Recall	OFF	MIN	OFF	OFF	OFF	MIN	OFF	OFF
	Ped Recall	---	---	---	---	---	---	---	---
Misc	Non-Locking Memory	ON	OFF	ON	ON	ON	OFF	ON	ON
	Dual Entry	---	ON	---	ON	---	ON	---	ON
	Phase Omit	---	---	---	---	---	---	---	---

LOOP DETECTOR DATA

Phase	**Make**	**Model**	**Operating Mode**	**Programmed Delay**	**Comments**
1	Sarasota	535T	Presence	5 Seconds	None
2	Sarasota	535T	Presence	None	None
3	Sarasota	535T	Presence	12 Seconds	None
4	Sarasota	535T	Presence	7 Seconds	None
5	Sarasota	535T	Presence	5 Seconds	None
6	IDC	LM301	Presence	None	None
7	Sarasota	535T	Presence	12 Seconds	None
8	Sarasota	535T	Presence	7 Seconds	None

Notes: Max 2 programmed to run from 7-9 AM and 4-6 PM

Intersection:	**Highway 31 and Thompson Station Road (#9)**		
Inspected By:	RGP/ECM	**Date Inventory Completed:**	5/21/2008
Pole Type:	Steel Cantilevered Pole	**Signal Attachment Type:**	Brackets on Mast Arms
Cabinet Mount:	Pole	**Cabinet Dimensions: (WxDxH):**	36" x 17" x 50"
Cabinet Phases:	8	**Cabinet Location:**	NE Corner
Controller Make:	Transyt	**Controller Comm Module:**	None
Controller Model:	1880 EL	**Conflict Monitor (MMU) Type:**	Transyt - 12ELRA
Misc. Equipment:	None	**Emergency Vehicle Pre-emption:**	EPS-II

CONTROLLER PHASE TIMINGS AND FUNCTIONS

	Phase	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
	Description	SB LT	NB TR	WB LT	EB TR	NB LT	SB TR	EB LT	WB TR
	Phase Orientation	↳	↑	⤵	→	↰	↓	⤴	←
Vehicle Times	Min. Green	5	30	5	5	5	30	5	5
	Passage	2	10	3	3	2	10	3	3
	Max 1	15	60	15	20	15	60	15	20
	Max 2	10	70	15	20	10	70	15	20
	Yellow Clear	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	Red Clear	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ped Times	Walk	---	---	---	---	---	---	---	---
	Ped Clear	---	---	---	---	---	---	---	---
Recall	Veh Recall	OFF	MIN	OFF	OFF	OFF	MIN	OFF	OFF
	Ped Recall	---	---	---	---	---	---	---	---
Misc	Non-Locking Memory	ON	OFF	ON	ON	ON	OFF	ON	ON
	Dual Entry	---	ON	---	ON	---	ON	---	ON
	Phase Omit	---	---	---	---	---	---	---	---

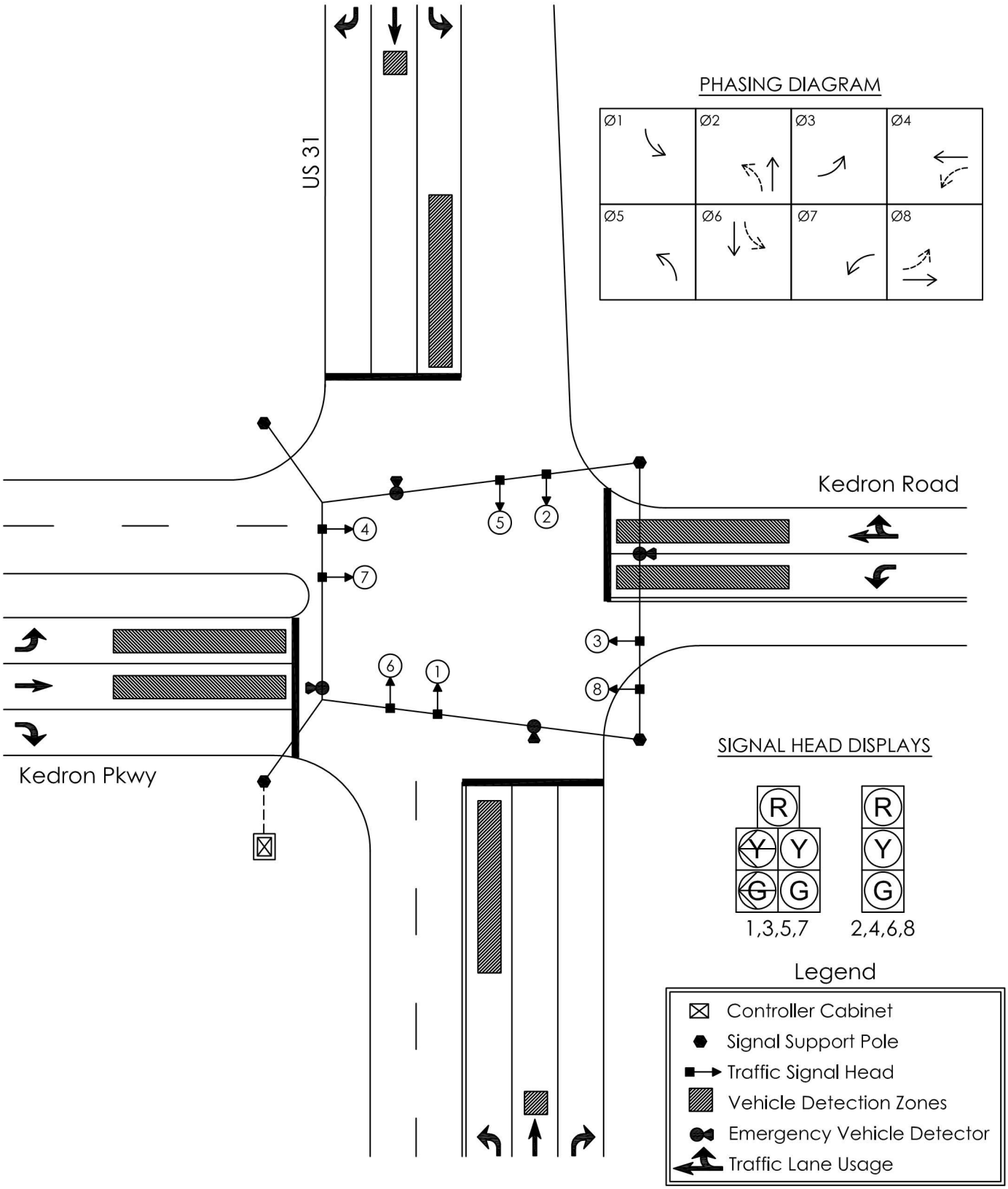
LOOP DETECTOR DATA

Phase	**Make**	**Model**	**Operating Mode**	**Programmed Delay**	**Comments**
1	Sarasota	535T	Presence	5 Seconds	None
2	Sarasota	535T	Presence	None	None
3	EDI	LM301t	Presence	5 Seconds	None
4	Sarasota	535T	Presence	5 Seconds	None
5	Sarasota	535T	Presence	5 Seconds	None
6	Sarasota	535T	Presence	None	None
7	EDI	LM301t	Presence	5 Seconds	None
8	Sarasota	535T	Presence	5 Seconds	None

Notes: No Max II or other time of day programming.

APPENDIX C

SCHEMATIC INTERSECTION DIAGRAMS FOR SIGNAL INVENTORY

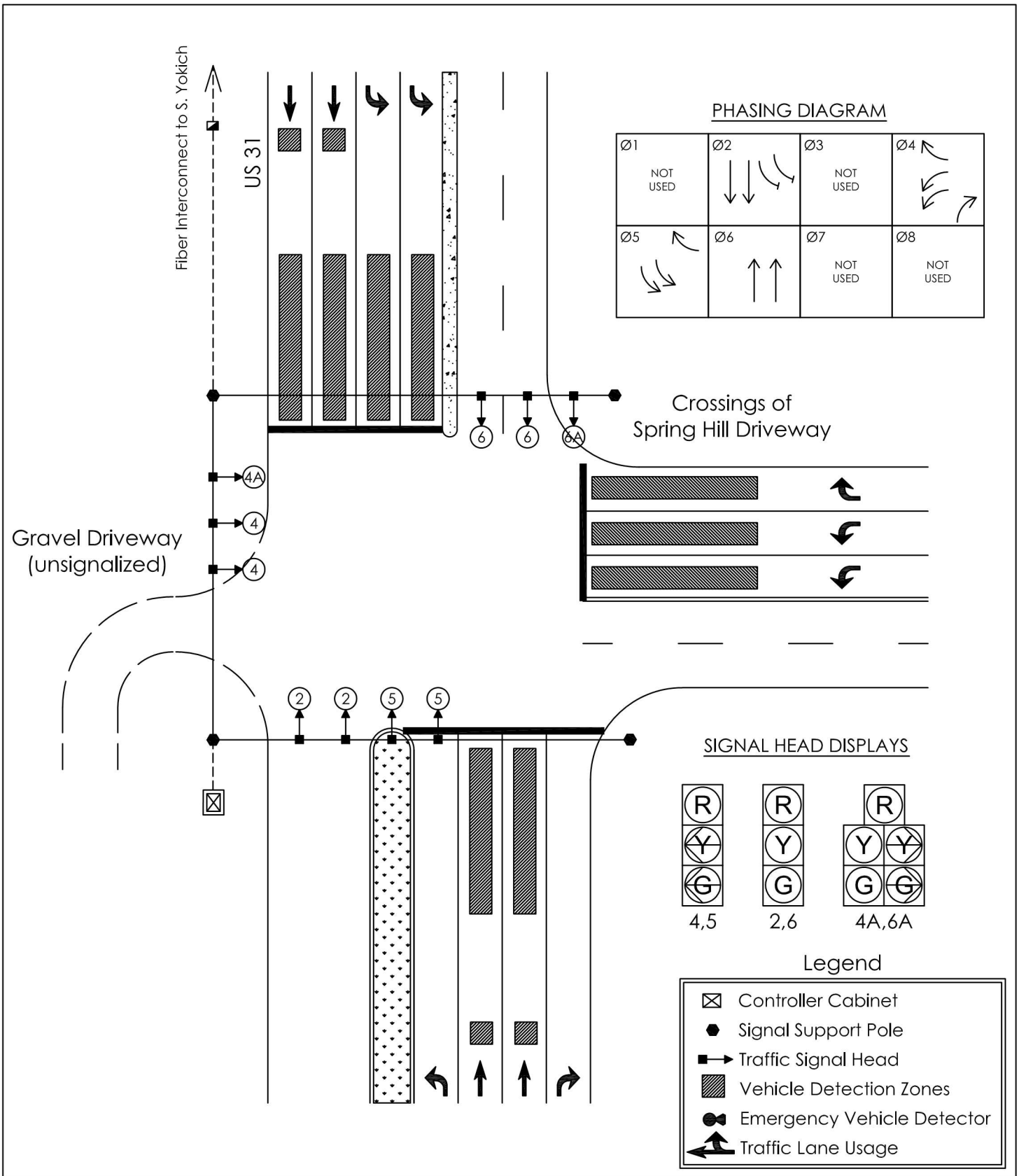


EXISTING CONDITIONS SCHEMATIC

US 31 AND KEDRON (#3)

NEEL-SCHAFFER Solutions you can build upon

RGPHILLIPS CONSULTING TRAFFIC ENGINEERING & TRANSPORTATION PLANNING

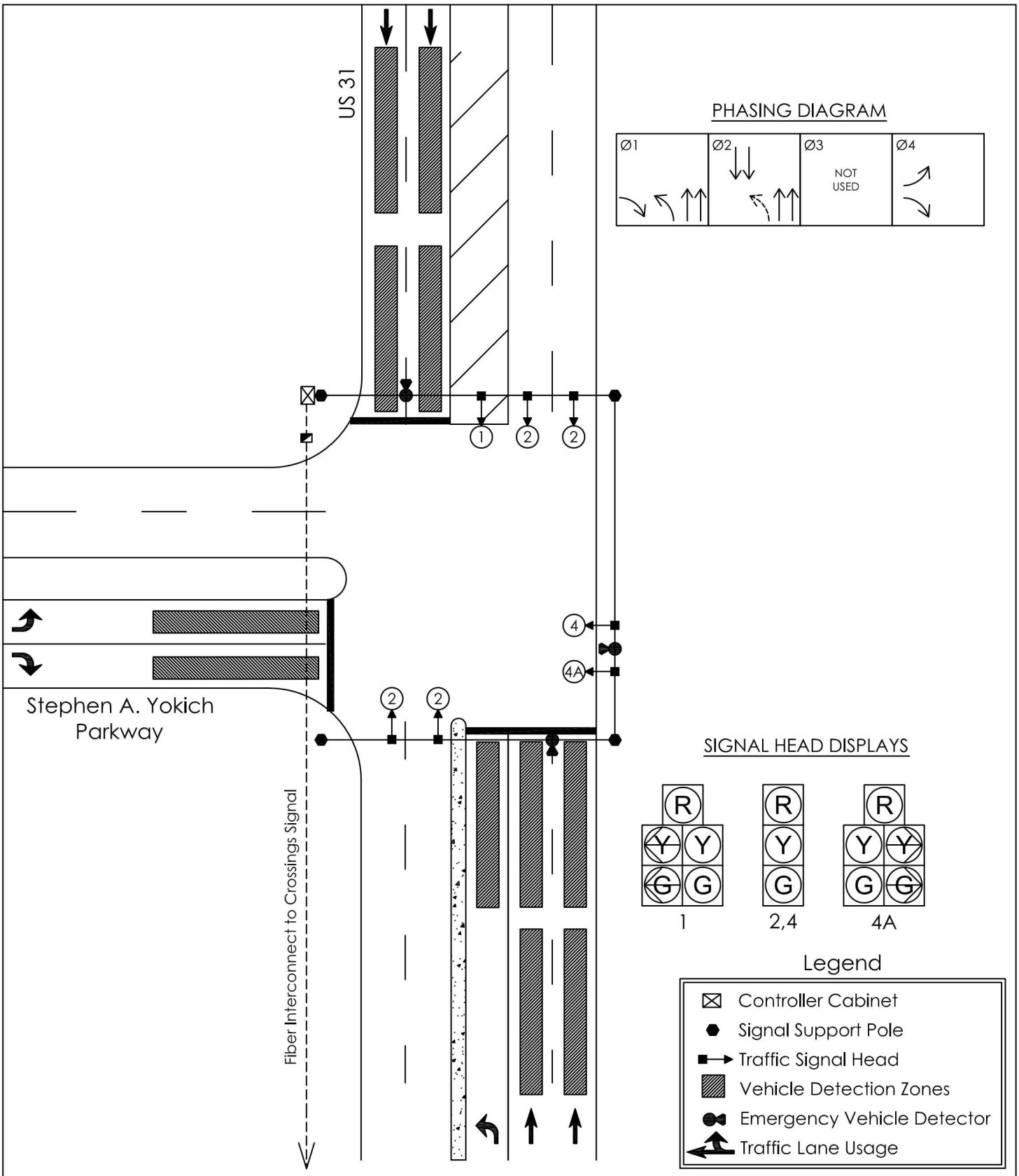


EXISTING CONDITIONS SCHEMATIC

US 31 AND CROSSINGS DRIVEWAY (#1)

NEEL-SCHAFFER Solutions you can build upon

RGPHILLIPS CONSULTING TRAFFIC ENGINEERING & TRANSPORTATION PLANNING

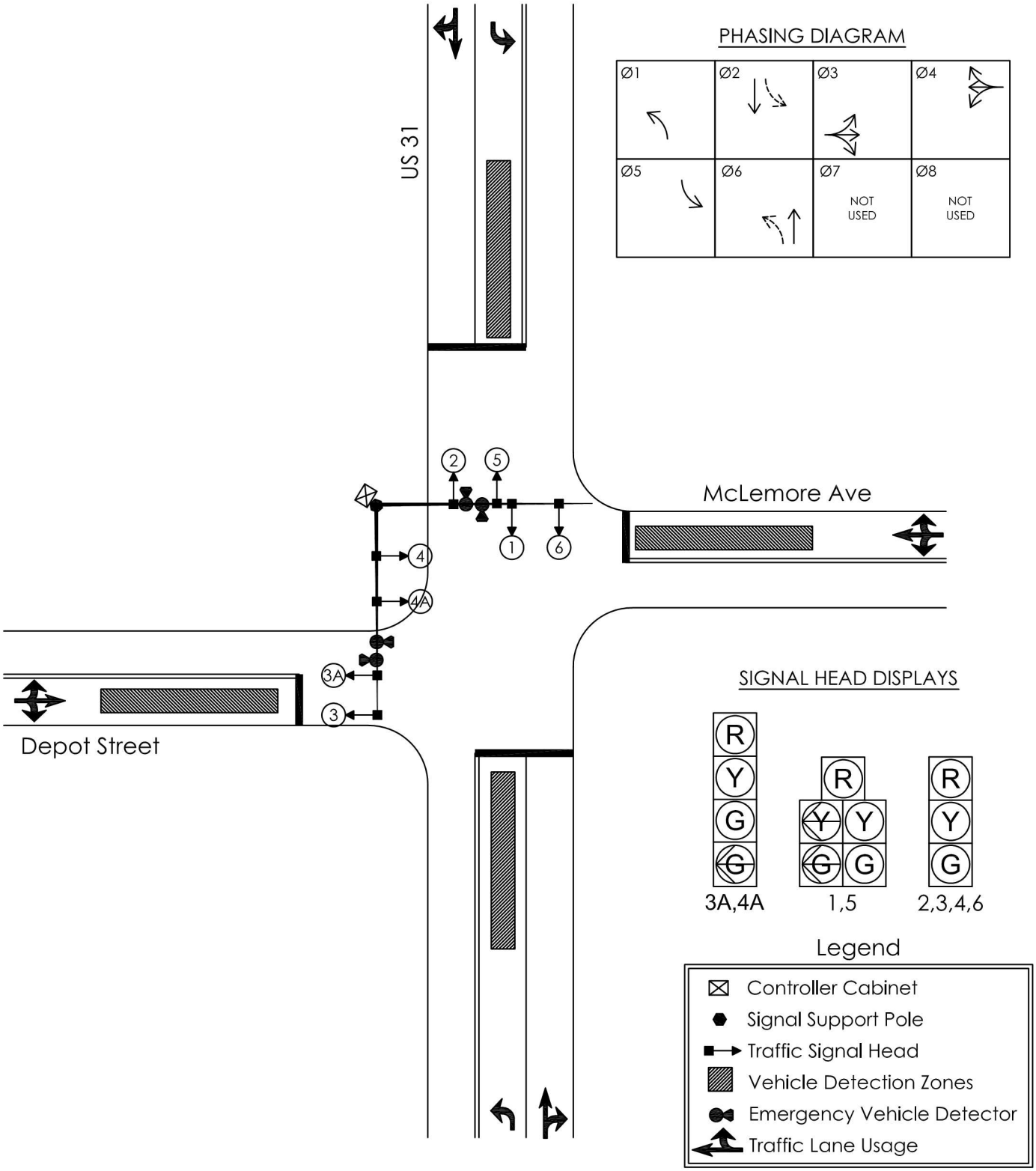


EXISTING CONDITIONS SCHEMATIC

US 31 AND STEPHEN A. YOKICH PKWY (#2)

NEEL-SCHAFFER Solutions you can build upon

RGPHILLIPS CONSULTING TRAFFIC ENGINEERING & TRANSPORTATION PLANNING



EXISTING CONDITIONS SCHEMATIC

US 31 AND DEPOT/McLEMORE (#4)

NEEL-SCHAFFER Solutions you can build upon

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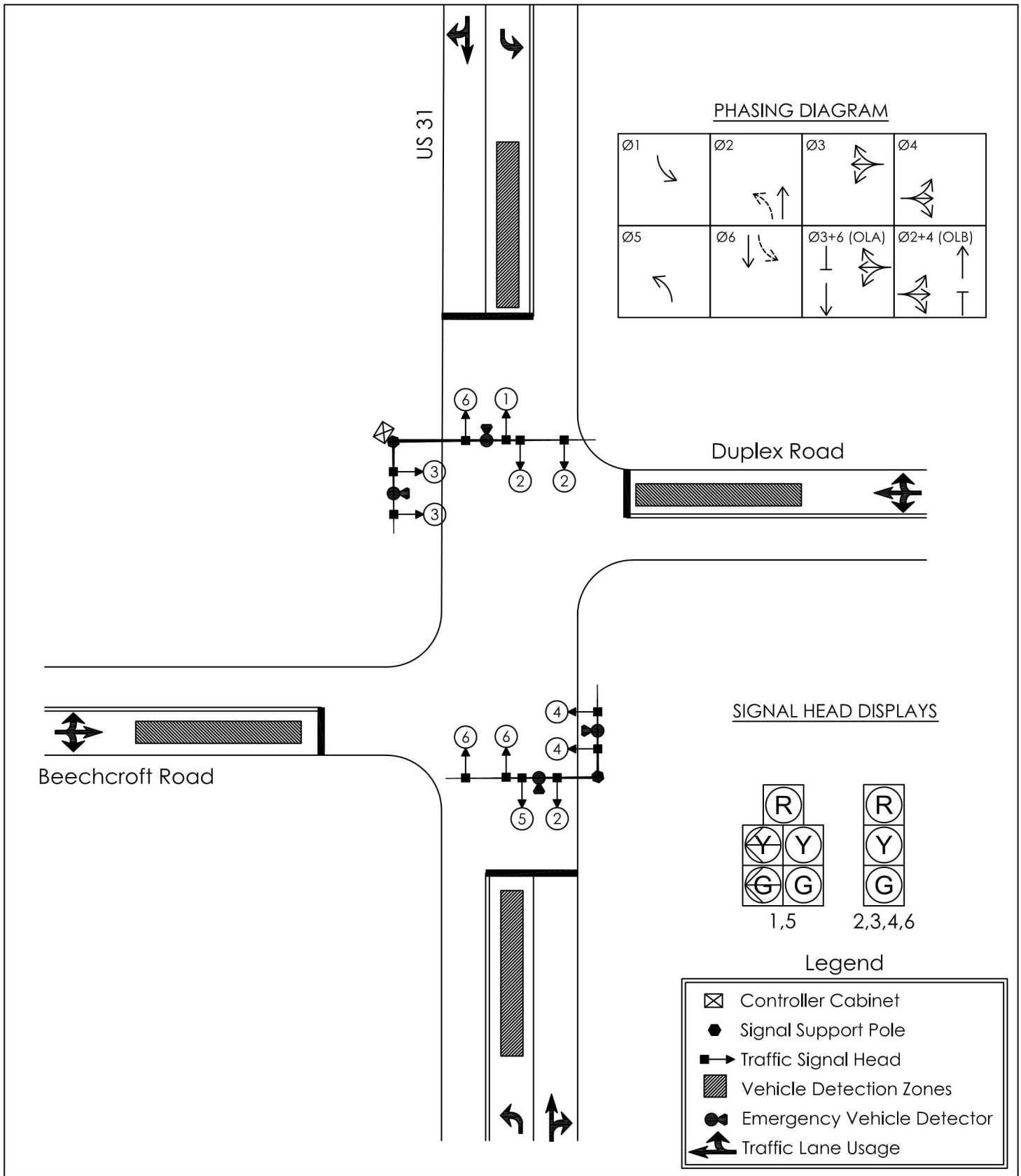
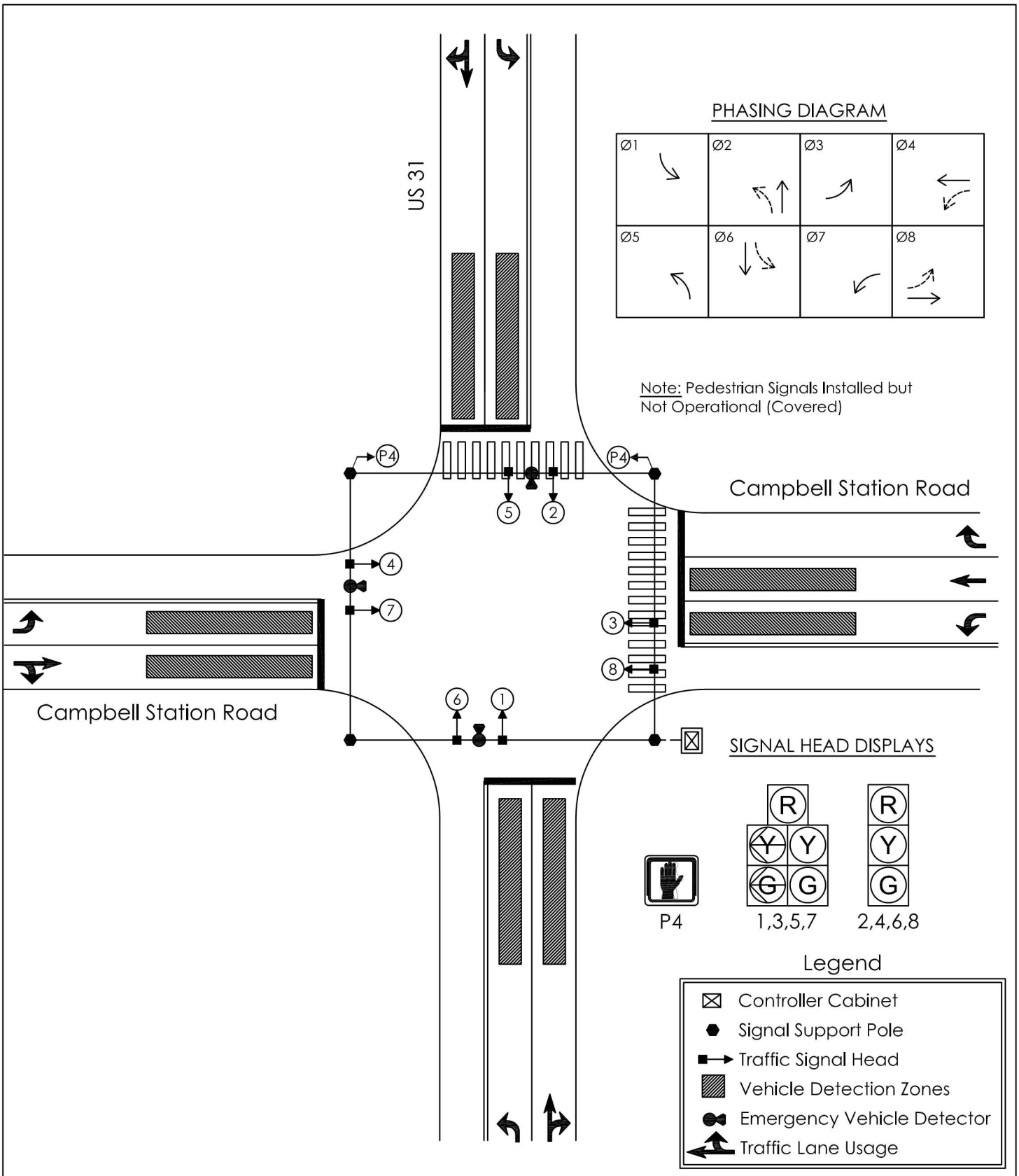


EXISTING CONDITIONS SCHEMATIC

US 31 AND BEECHCROFT/DUPLEX (#5&#6)

NEEL-SCHAFFER Solutions you can build upon

RGPHILLIPS CONSULTING TRAFFIC ENGINEERING & TRANSPORTATION PLANNING

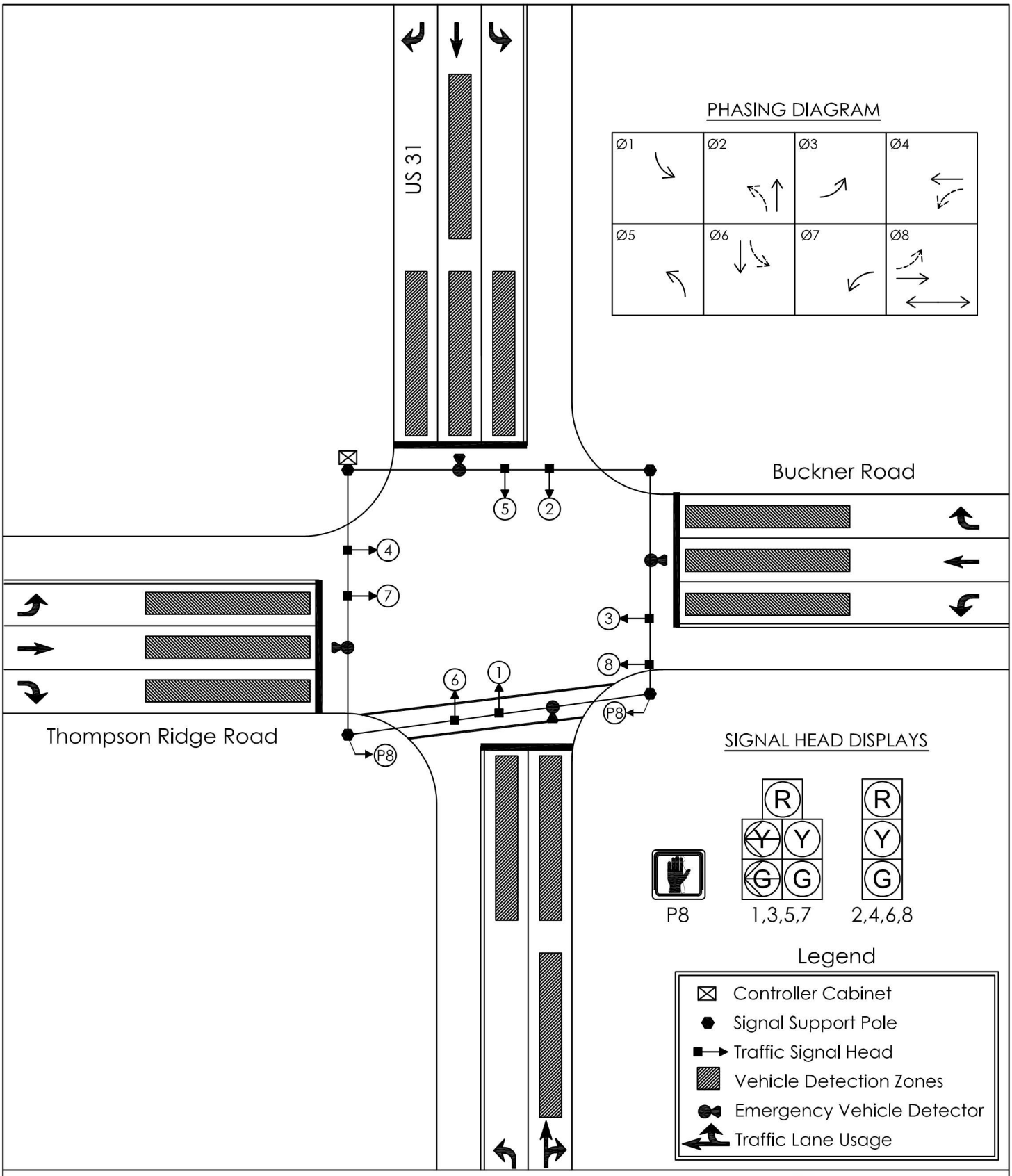


EXISTING CONDITIONS SCHEMATIC

US 31 AND CAMPBELL STATION ROAD (#7)

NEEL-SCHAFFER Solutions you can build upon

RGPHILLIPS CONSULTING TRAFFIC ENGINEERING & TRANSPORTATION PLANNING

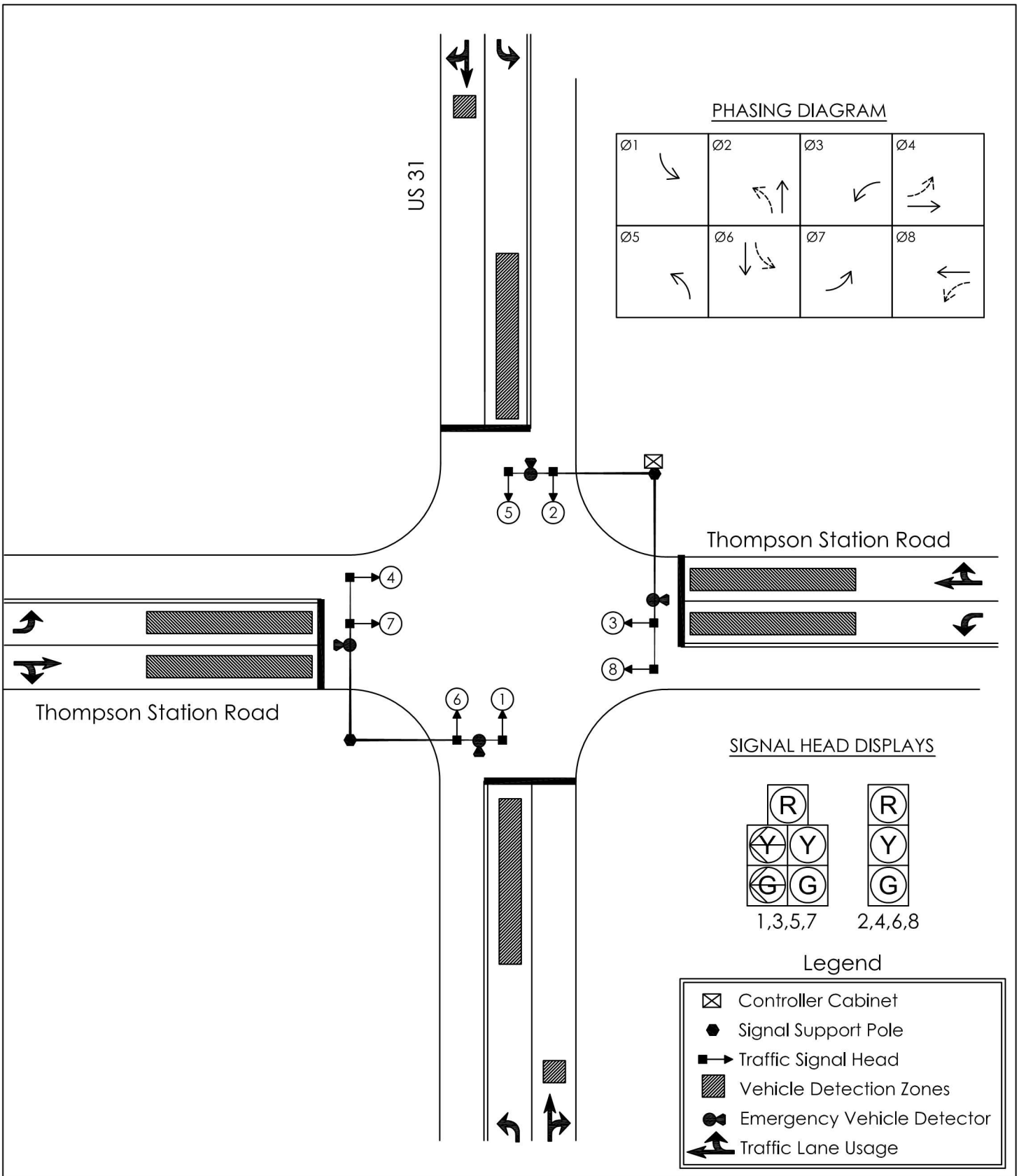


EXISTING CONDITIONS SCHEMATIC

US 31 AND BUCKNER ROAD (#8)

NEEL-SCHAFFER Solutions you can build upon

RGPHILLIPS CONSULTING TRAFFIC ENGINEERING & TRANSPORTATION PLANNING



EXISTING CONDITIONS SCHEMATIC

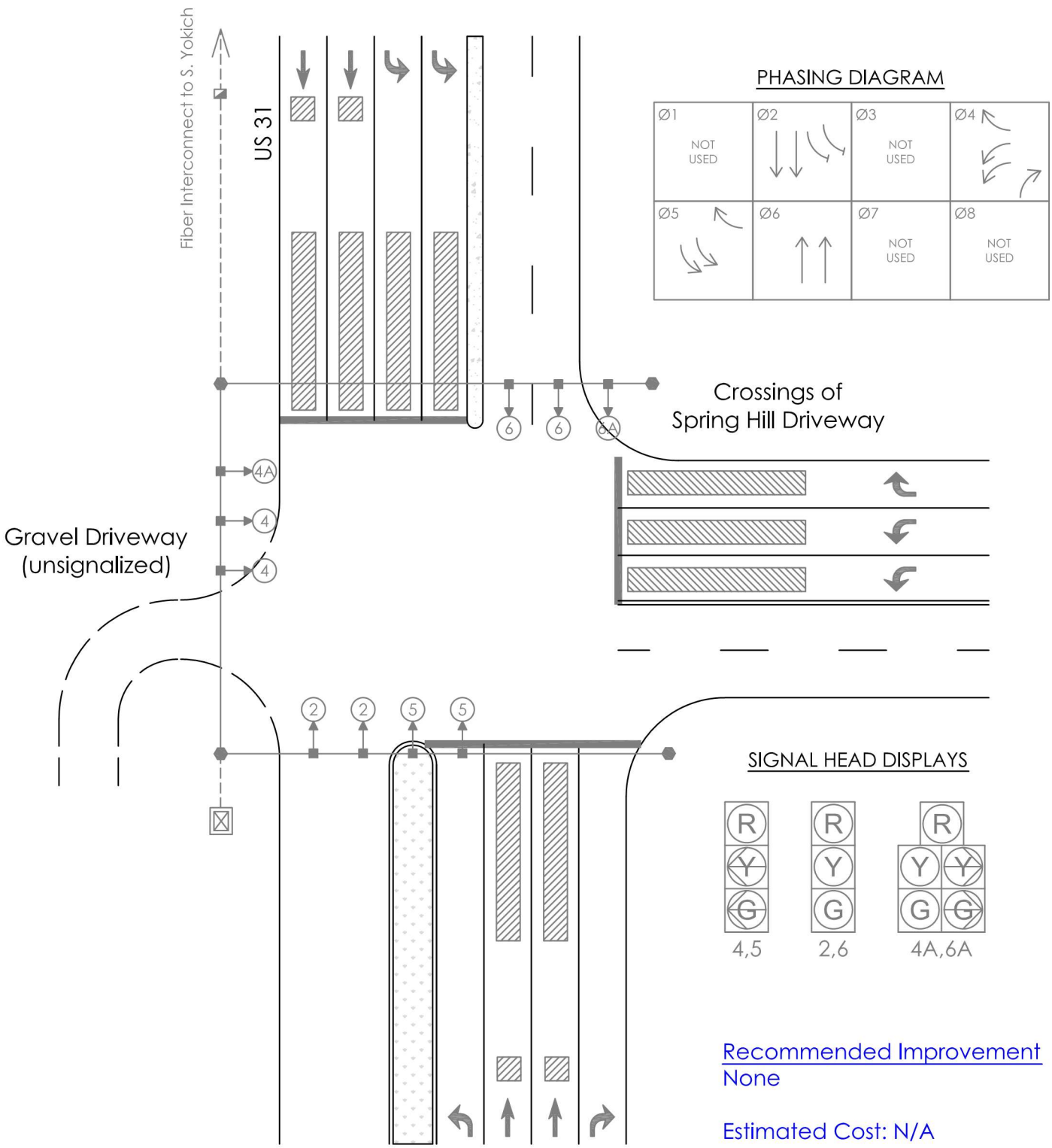
US 31 AND THOMPSON STATION ROAD (#9)

NEEL-SCHAFFER Solutions you can build upon

RGPHILLIPS CONSULTING TRAFFIC ENGINEERING & TRANSPORTATION PLANNING

APPENDIX D

TRAFFIC SIGNAL EQUIPMENT IMPROVEMENTS

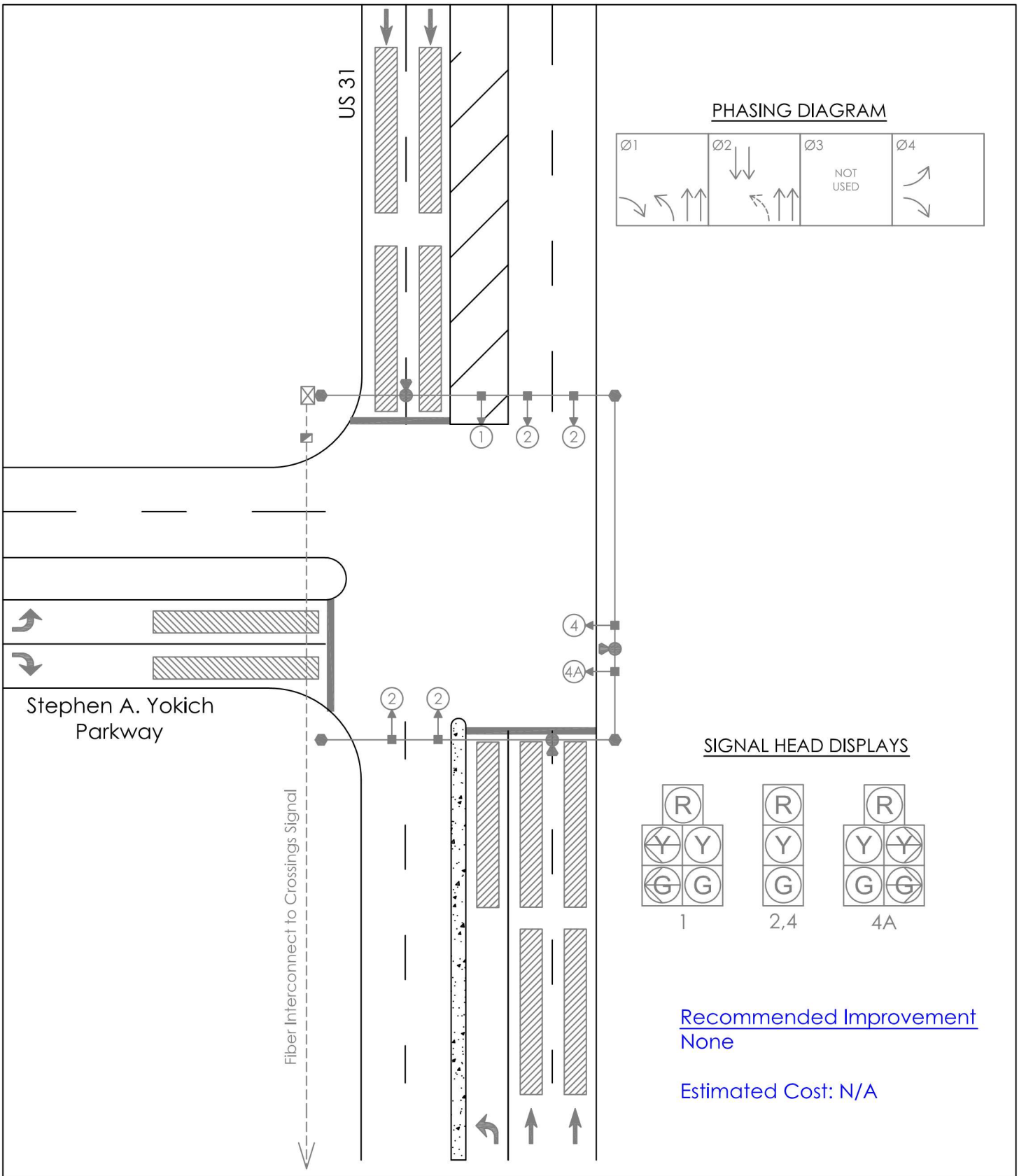


PROPOSED SIGNAL IMPROVEMENTS

US 31 AND CROSSINGS DRIVEWAY (#1)

NEEL-SCHAFFER Solutions you can build upon

RGPHILLIPS CONSULTING TRAFFIC ENGINEERING & TRANSPORTATION PLANNING



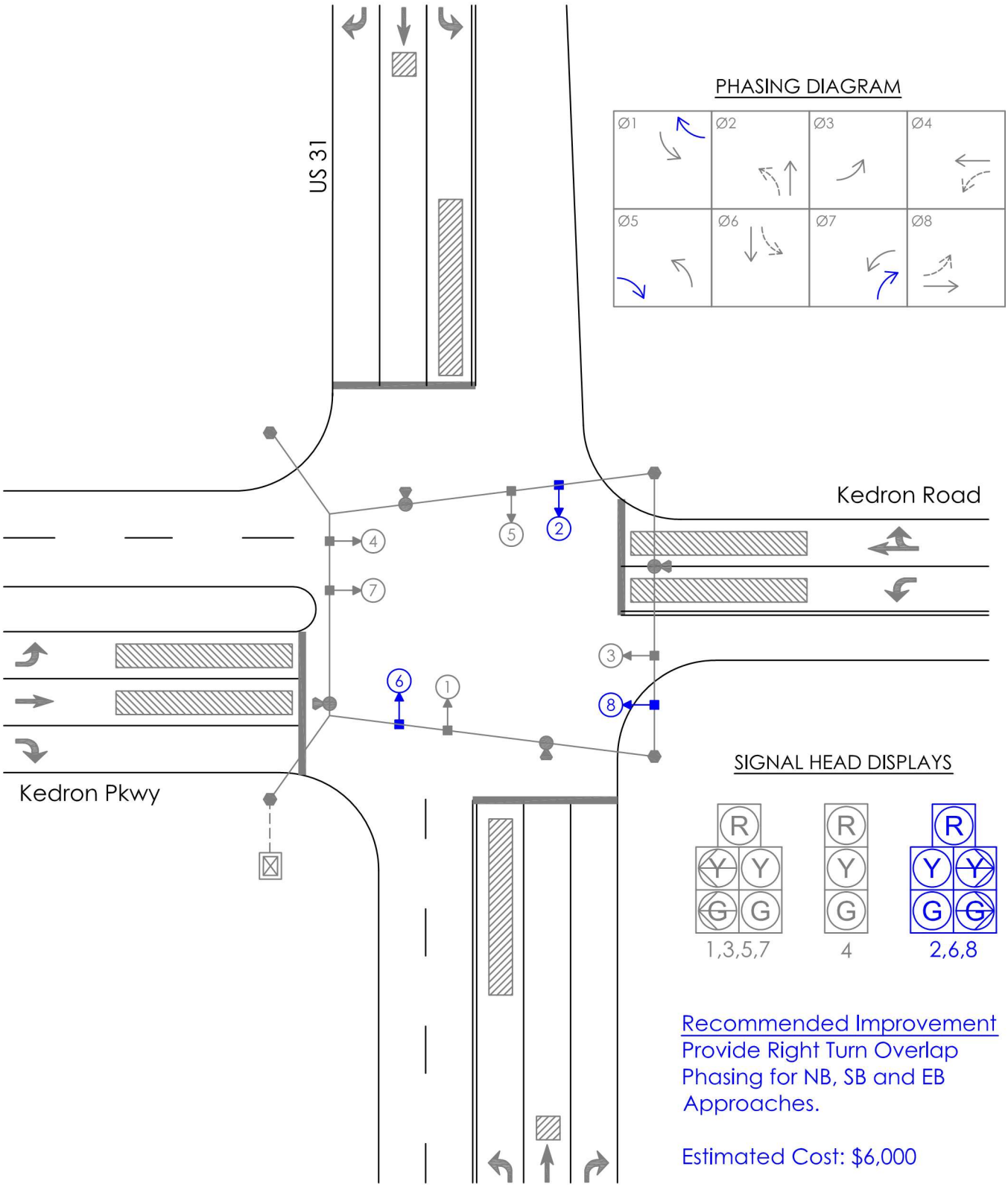
Recommended Improvement
None

Estimated Cost: N/A

PROPOSED SIGNAL IMPROVEMENTS
US 31 AND STEPHEN A. YOKICH PKWY (#2)

NEEL-SCHAFFER
Solutions you can build upon

RGPHILLIPS CONSULTING
TRAFFIC ENGINEERING & TRANSPORTATION PLANNING

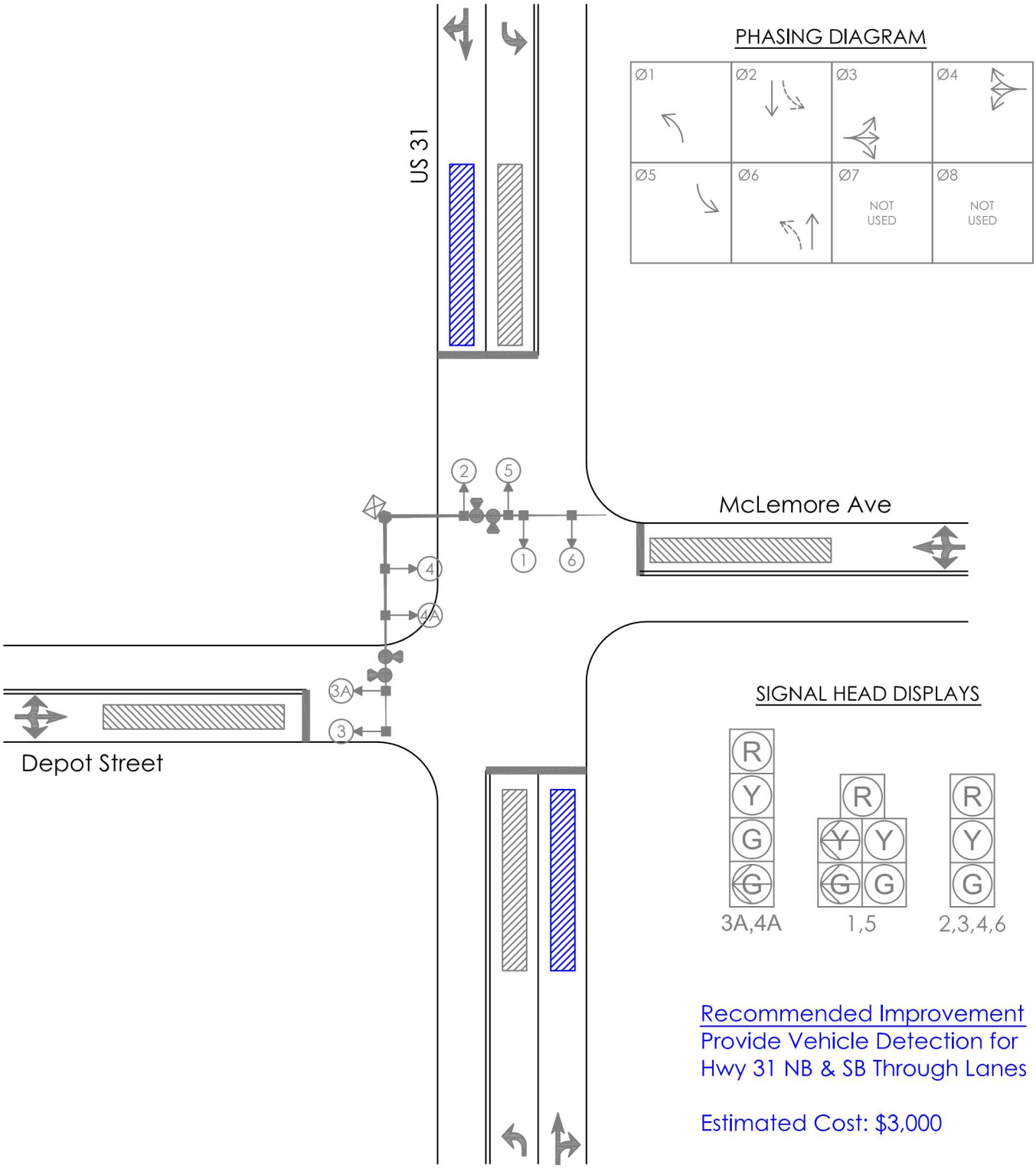


PROPOSED SIGNAL IMPROVEMENTS

US 31 AND KEDRON (#3)

NEEL-SCHAFFER Solutions you can build upon

RGPHILLIPS CONSULTING TRAFFIC ENGINEERING & TRANSPORTATION PLANNING



Recommended Improvement
Provide Vehicle Detection for
Hwy 31 NB & SB Through Lanes

Estimated Cost: $3,000

PROPOSED SIGNAL IMPROVEMENTS
US 31 AND DEPOT/McLEMORE (#4)

NEEL-SCHAFFER
Solutions you can build upon

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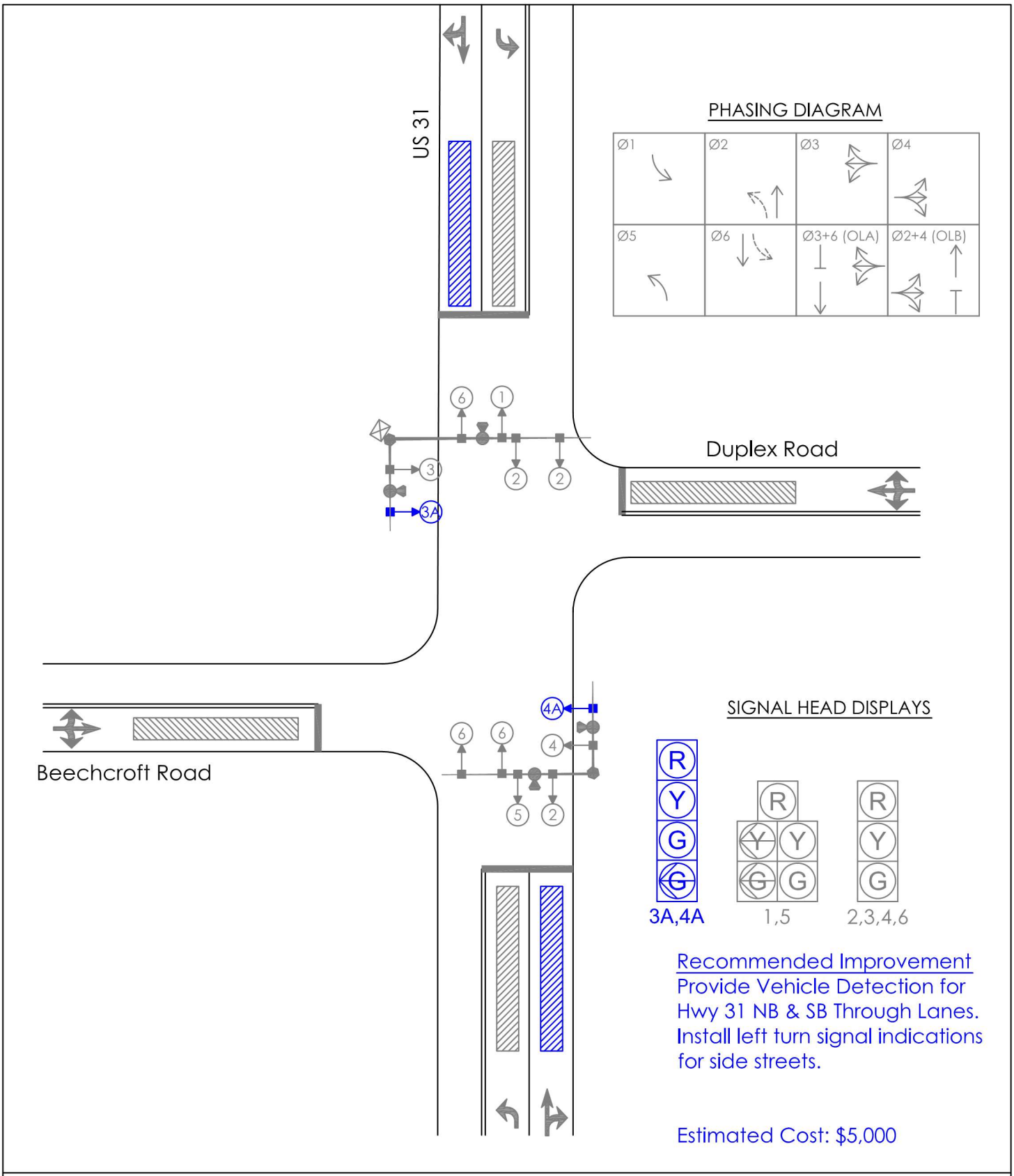
TRAFFIC ENGINEERING & TRANSPORTATION PLANNING

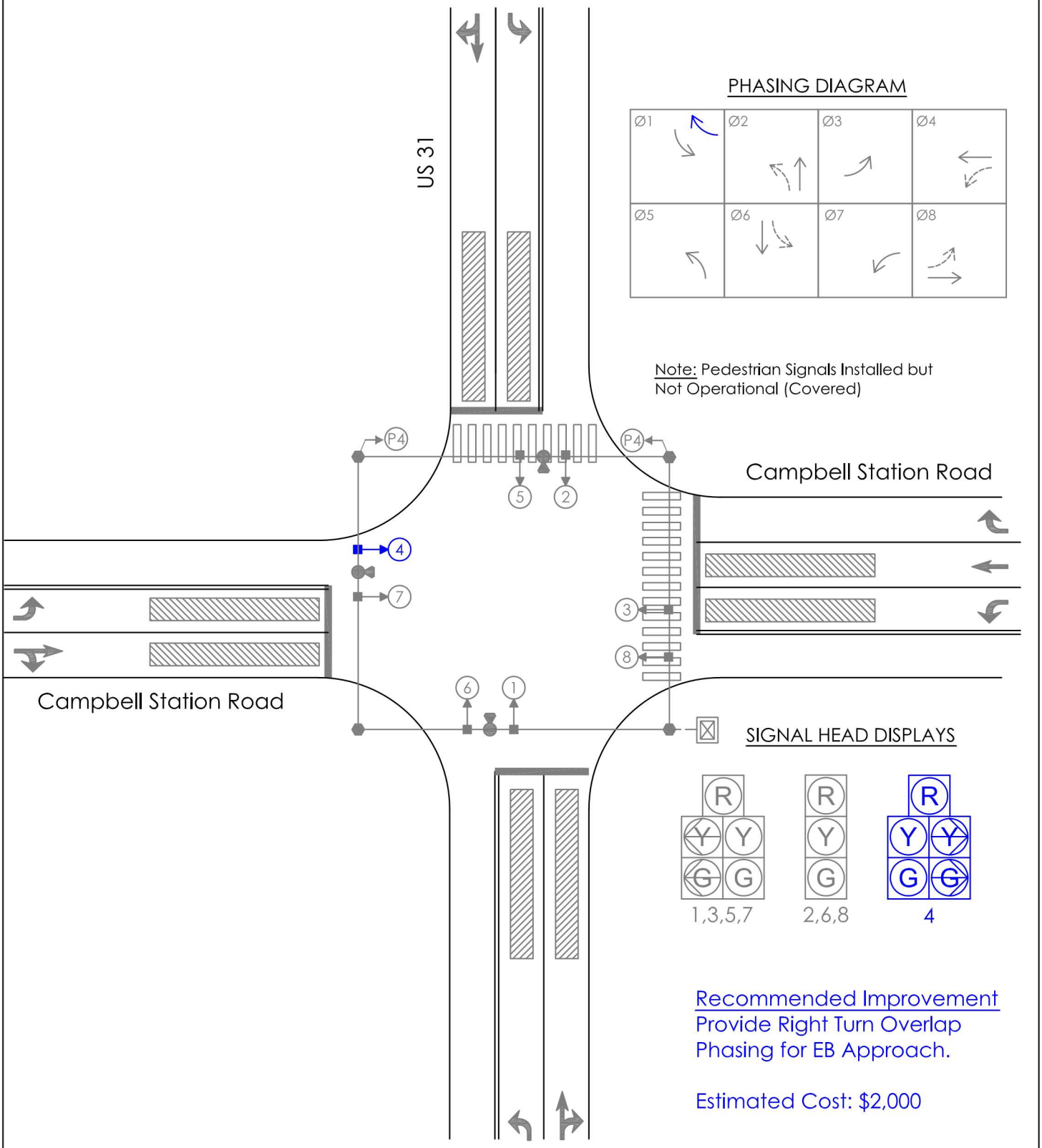


PROPOSED SIGNAL IMPROVEMENTS

US 31 AND BEECHCROFT/DUPLEX (#5&#6)

NEEL-SCHAFFER Solutions you can build upon

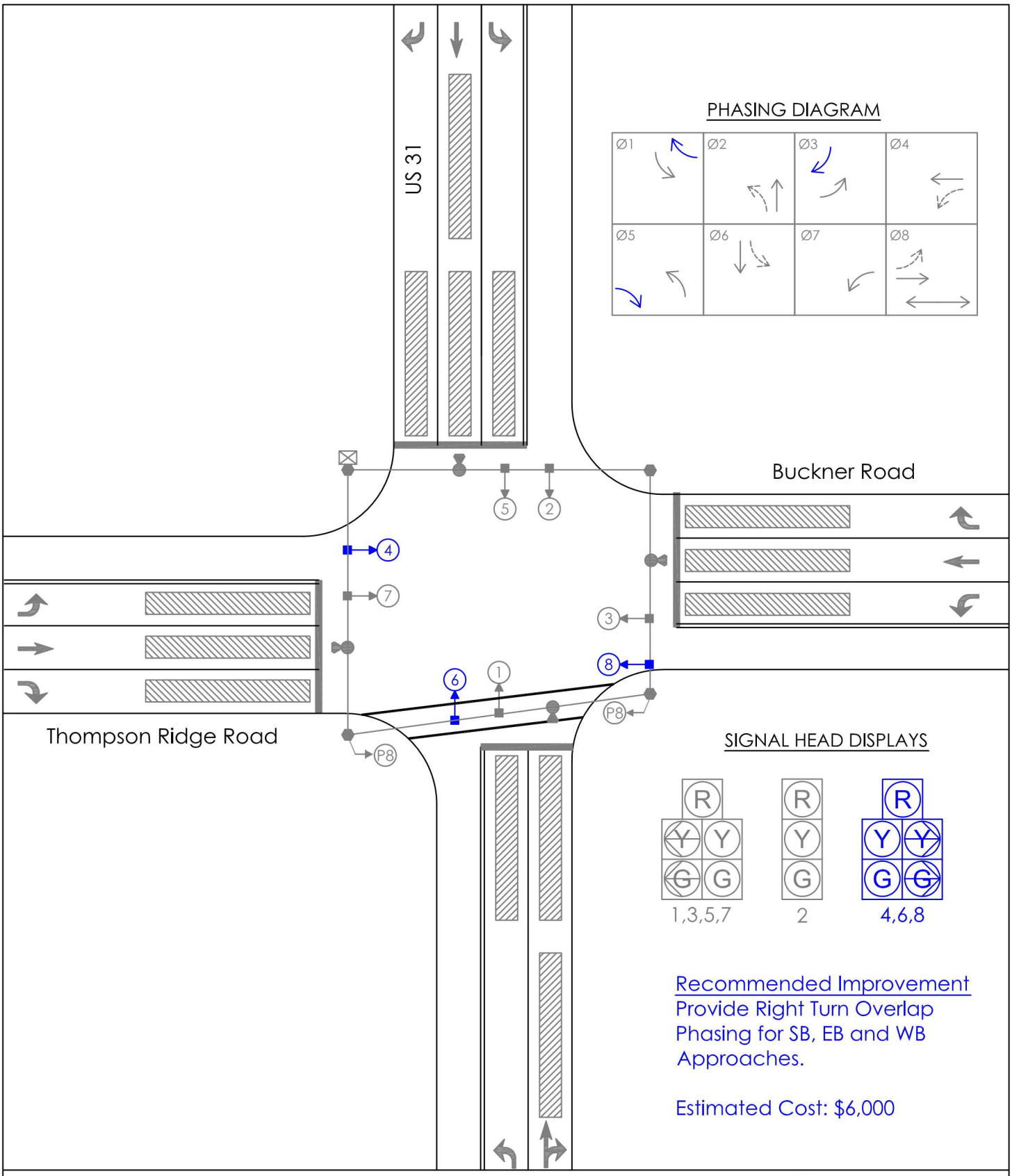
RGPHILLIPS CONSULTING TRAFFIC ENGINEERING & TRANSPORTATION PLANNING



PROPOSED SIGNAL IMPROVEMENTS
US 31 AND CAMPBELL STATION ROAD (#7)

NEEL-SCHAFFER
Solutions you can build upon

RGPHILLIPS CONSULTING
TRAFFIC ENGINEERING & TRANSPORTATION PLANNING



PROPOSED SIGNAL IMPROVEMENTS

US 31 AND BUCKNER ROAD (#8)

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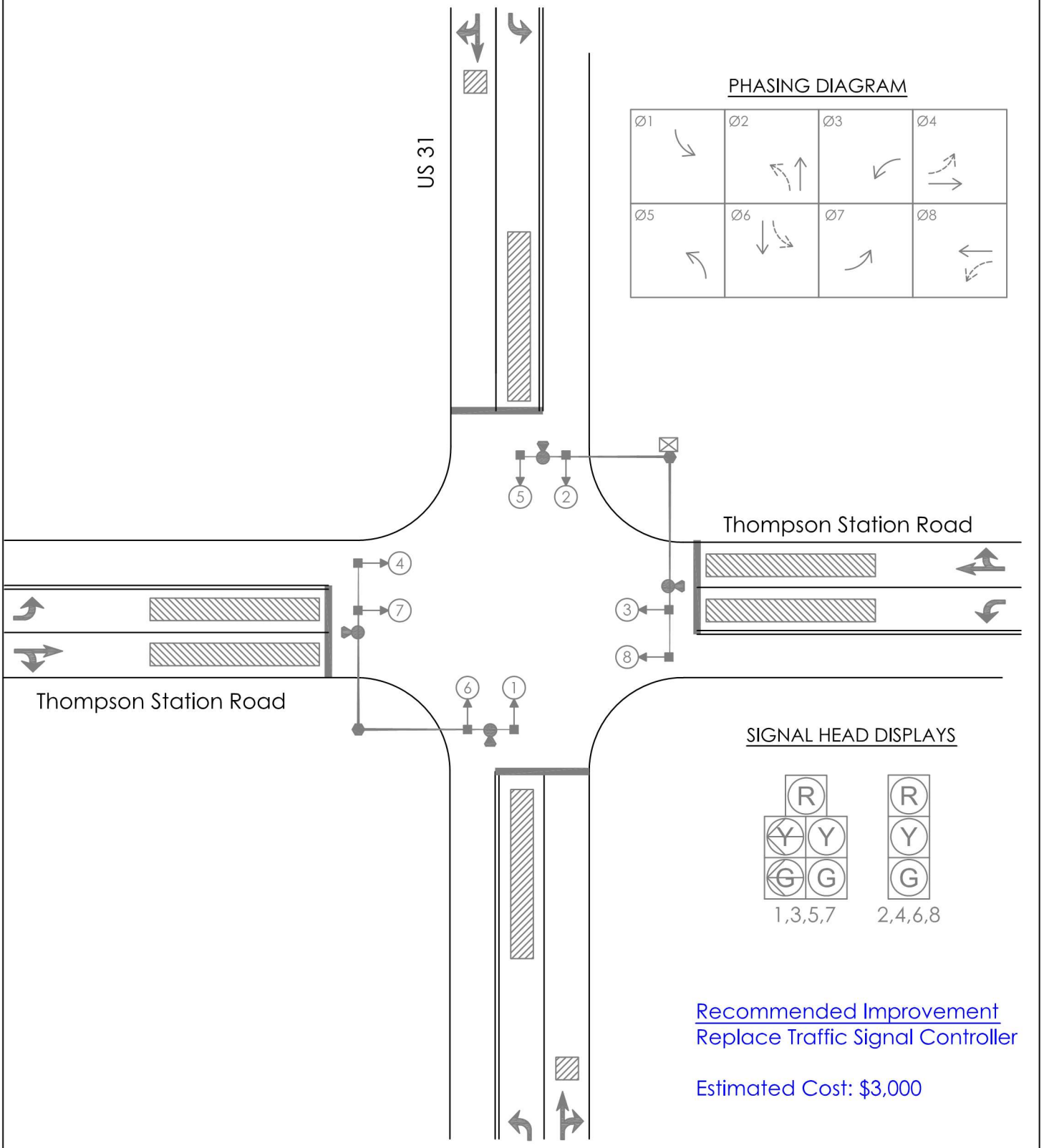

PROPOSED SIGNAL IMPROVEMENTS

US 31 AND THOMPSON STATION ROAD (#9)

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APPENDIX E

COORDINATION ANALYSES

Link: US 31, CROSSINGS BLVD to S. P. YOKICH PKWY

Variable	Value	Comments
Travel Time (s)	15	Travel Time okay For Coordination
CF1	85	
Traffic / Storage Space	0.32	Storage Space is adequate
CF2	32	
Proportion of Traffic In Platoon	0.79	Traffic moderately platooned
Ap, platoon adjustment	-1	
Main Street Volume (vph)	1367	High Volumes, coordination is high priority
Av, volume adjustment	12	
Cycle Length	110	at CROSSINGS BLVD
Cycle Length	110	at S. P. YOKICH PKWY
Combined Cycle Length	110	
Cycle Length Increase	0	
Ac, Cycle Adjustment	0	
CF, Coordinatability Factor	96	Coordination definitely recommended

Link: US 31, S. P. YOKICH PKWY to KEDRON RD

Variable	Value	Comments
Travel Time (s)	26	Travel Time okay For Coordination
CF1	70	
Traffic / Storage Space	0.31	Storage Space is adequate
CF2	31	
Proportion of Traffic In Platoon	0.81	Traffic heavily platooned, coordination is appropriate
Ap, platoon adjustment	0	
Main Street Volume (vph)	1146	High Volumes, coordination is high priority
Av, volume adjustment	9	
Cycle Length	110	at S. P. YOKICH PKWY
Cycle Length	110	at KEDRON RD
Combined Cycle Length	110	
Cycle Length Increase	0	
Ac, Cycle Adjustment	0	
CF, Coordinatability Factor	79	Coordination definitely recommended

Link: US 31, KEDRON PKWY to McLEMORE AVE

Variable	Value	Comments
Travel Time (s)	39	Travel Time okay For Coordination
CF1	53	
Traffic / Storage Space	0.24	Storage Space is adequate
CF2	24	
Proportion of Traffic In Platoon	0.64	Traffic moderately platooned
Ap, platoon adjustment	-10	
Main Street Volume (vph)	1140	High Volumes, coordination is high priority
Av, volume adjustment	9	
Cycle Length	110	at KEDRON PKWY
Cycle Length	110	at McLEMORE AVE
Combined Cycle Length	110	
Cycle Length Increase	0	
Ac, Cycle Adjustment	0	
CF, Coordinatability Factor	52	Coordination probably recommended

Link: US 31, DEPOT ST to BEECHCROFT RD

Variable	Value	Comments
Travel Time (s)	14	Travel Time okay For Coordination
CF1	86	
Traffic / Storage Space	0.73	Storage Space is adequate
CF2	73	
Proportion of Traffic In Platoon	0.68	Traffic moderately platooned
Ap, platoon adjustment	-7	
Main Street Volume (vph)	999	Moderate Volumes
Av, volume adjustment	6	
Cycle Length	110	at DEPOT ST
Cycle Length	110	at BEECHCROFT RD
Combined Cycle Length	110	
Cycle Length Increase	0	
Ac, Cycle Adjustment	0	
CF, Coordinatability Factor	85	Coordination definitely recommended

Link: US 31, BEECHCROFT RD to DUPLEX RD

Variable	Value	Comments
Travel Time (s)	1	Distance small enough to require coordination
CF1	100	
Traffic / Storage Space	537.00	Traffic exceeds 80% of storage, coordination needed
CF2	100	
Proportion of Traffic In Platoon	0.78	Traffic moderately platooned
Ap, platoon adjustment	-2	
Main Street Volume (vph)	1222	High Volumes, coordination is high priority
Av, volume adjustment	10	
Cycle Length	110	at BEECHCROFT RD
Cycle Length	110	at DUPLEX RD
Combined Cycle Length	110	
Cycle Length Increase	0	
Ac, Cycle Adjustment	0	
CF, Coordinatability Factor	108	Coordination definitely recommended

Link: US 31, DUPLEX RD to CAMPBELL STATION PKWY

Variable	Value	Comments
Travel Time (s)	175	Travel Time too far for coordination
CF1	0	
Traffic / Storage Space	0.04	Storage Space is adequate
CF2	4	
Proportion of Traffic In Platoon	0.68	Traffic moderately platooned
Ap, platoon adjustment	-7	
Main Street Volume (vph)	1127	High Volumes, coordination is high priority
Av, volume adjustment	9	
Cycle Length	110	at DUPLEX RD
Cycle Length	70	at CAMPBELL STATION PKWY
Combined Cycle Length	110	
Cycle Length Increase	40	Large increase in cycle length
Ac, Cycle Adjustment	-20	
CF, Coordinatability Factor	-14	Coordination definitely not recommended

Link: US 31, CAMPBELL STATION PKWY to BUCKNER RD

Variable	Value	Comments
Travel Time (s)	62	Travel Time okay For Coordination
CF1	24	
Traffic / Storage Space	0.11	Storage Space is adequate
CF2	11	
Proportion of Traffic In Platoon	0.71	Traffic moderately platooned
Ap, platoon adjustment	-6	
Main Street Volume (vph)	1307	High Volumes, coordination is high priority
Av, volume adjustment	11	
Cycle Length	70	at CAMPBELL STATION PKWY
Cycle Length	90	at BUCKNER RD
Combined Cycle Length	90	
Cycle Length Increase	20	Moderate increase in cycle length
Ac, Cycle Adjustment	-10	
CF, Coordinatability Factor	19	Coordination definitely not recommended

Link: US 31, BUCKNER RD to THOMPSON STATION RD

Variable	Value	Comments
Travel Time (s)	89	Travel Time too far for coordination
CF1	0	
Traffic / Storage Space	0.25	Storage Space is adequate
CF2	25	
Proportion of Traffic In Platoon	0.67	Traffic moderately platooned
Ap, platoon adjustment	-8	
Main Street Volume (vph)	1803	High Volumes, coordination is high priority
Av, volume adjustment	16	
Cycle Length	90	at BUCKNER RD
Cycle Length	150	at THOMPSON STATION RD
Combined Cycle Length	150	
Cycle Length Increase	60	Large increase in cycle length
Ac, Cycle Adjustment	-30	
CF, Coordinatability Factor	3	Coordination definitely not recommended

Link: US 31, CROSSINGS BLVD to S. P. YOKICH PKWY

Variable	Value	Comments
Travel Time (s)	15	Travel Time okay For Coordination
CF1	85	
Traffic / Storage Space	0.37	Storage Space is adequate
CF2	37	
Proportion of Traffic In Platoon	0.82	Traffic heavily platooned, coordination is appropriate
Ap, platoon adjustment	0	
Main Street Volume (vph)	1611	High Volumes, coordination is high priority
Av, volume adjustment	14	
Cycle Length	105	at CROSSINGS BLVD
Cycle Length	105	at S. P. YOKICH PKWY
Combined Cycle Length	105	
Cycle Length Increase	0	
Ac, Cycle Adjustment	0	
CF, Coordinatability Factor	99	Coordination definitely recommended

Link: US 31, S. P. YOKICH PKWY to KEDRON PKWY

Variable	Value	Comments
Travel Time (s)	26	Travel Time okay For Coordination
CF1	70	
Traffic / Storage Space	0.28	Storage Space is adequate
CF2	28	
Proportion of Traffic In Platoon	0.78	Traffic moderately platooned
Ap, platoon adjustment	-2	
Main Street Volume (vph)	1313	High Volumes, coordination is high priority
Av, volume adjustment	11	
Cycle Length	105	at S. P. YOKICH PKWY
Cycle Length	105	at KEDRON PKWY
Combined Cycle Length	105	
Cycle Length Increase	0	
Ac, Cycle Adjustment	0	
CF, Coordinatability Factor	79	Coordination definitely recommended

Link: US 31, KEDRON PKWY to McLEMORE AVE

Variable	Value	Comments
Travel Time (s)	39	Travel Time okay For Coordination
CF1	53	
Traffic / Storage Space	0.23	Storage Space is adequate
CF2	23	
Proportion of Traffic In Platoon	0.69	Traffic moderately platooned
Ap, platoon adjustment	-7	
Main Street Volume (vph)	1260	High Volumes, coordination is high priority
Av, volume adjustment	11	
Cycle Length	105	at KEDRON PKWY
Cycle Length	105	at McLEMORE AVE
Combined Cycle Length	105	
Cycle Length Increase	0	
Ac, Cycle Adjustment	0	
CF, Coordinatability Factor	57	Coordination probably recommended

Link: US 31, DEPOT ST to BEECHCROFT RD

Variable	Value	Comments
Travel Time (s)	14	Travel Time okay For Coordination
CF1	86	
Traffic / Storage Space	0.73	Storage Space is adequate
CF2	73	
Proportion of Traffic In Platoon	0.75	Traffic moderately platooned
Ap, platoon adjustment	-4	
Main Street Volume (vph)	1218	High Volumes, coordination is high priority
Av, volume adjustment	10	
Cycle Length	105	at DEPOT ST
Cycle Length	105	at BEECHCROFT RD
Combined Cycle Length	105	
Cycle Length Increase	0	
Ac, Cycle Adjustment	0	
CF, Coordinatability Factor	92	Coordination definitely recommended

Link: US 31, BEECHCROFT RD to DUPLEX RD

Variable	Value	Comments
Travel Time (s)	1	Distance small enough to require coordination
CF1	100	
Traffic / Storage Space	590.00	Traffic exceeds 80% of storage, coordination needed
CF2	100	
Proportion of Traffic In Platoon	0.81	Traffic heavily platooned, coordination is appropriate
Ap, platoon adjustment	0	
Main Street Volume (vph)	1493	High Volumes, coordination is high priority
Av, volume adjustment	13	
Cycle Length	105	at BEECHCROFT RD
Cycle Length	105	at DUPLEX RD
Combined Cycle Length	105	
Cycle Length Increase	0	
Ac, Cycle Adjustment	0	
CF, Coordinatability Factor	113	Coordination definitely recommended

Link: US 31, DUPLEX RD to CAMPBELL STATION PKWY

Variable	Value	Comments
Travel Time (s)	175	Travel Time too far for coordination
CF1	0	
Traffic / Storage Space	0.06	Storage Space is adequate
CF2	6	
Proportion of Traffic In Platoon	0.70	Traffic moderately platooned
Ap, platoon adjustment	-6	
Main Street Volume (vph)	1425	High Volumes, coordination is high priority
Av, volume adjustment	12	
Cycle Length	105	at DUPLEX RD
Cycle Length	73.2	at CAMPBELL STATION PKWY
Combined Cycle Length	105	
Cycle Length Increase	31.8	Moderate increase in cycle length
Ac, Cycle Adjustment	-15	
CF, Coordinatability Factor	-3	Coordination definitely not recommended

Link: US 31, CAMPBELL STATION PKWY to BUCKNER RD

Variable	Value	Comments
Travel Time (s)	62	Travel Time okay For Coordination
CF1	24	
Traffic / Storage Space	0.20	Storage Space is adequate
CF2	20	
Proportion of Traffic In Platoon	0.76	Traffic moderately platooned
Ap, platoon adjustment	-3	
Main Street Volume (vph)	1349	High Volumes, coordination is high priority
Av, volume adjustment	11	
Cycle Length	73.2	at CAMPBELL STATION PKWY
Cycle Length	110	at BUCKNER RD
Combined Cycle Length	160	
Cycle Length Increase	56.8	Large increase in cycle length
Ac, Cycle Adjustment	-28	
CF, Coordinatability Factor	4	Coordination definitely not recommended

Link: US 31, BUCKNER RD to THOMPSON STATION RD

Variable	Value	Comments
Travel Time (s)	89	Travel Time too far for coordination
CF1	0	
Traffic / Storage Space	0.13	Storage Space is adequate
CF2	13	
Proportion of Traffic In Platoon	0.80	Traffic heavily platooned, coordination is appropriate
Ap, platoon adjustment	-1	
Main Street Volume (vph)	1347	High Volumes, coordination is high priority
Av, volume adjustment	11	
Cycle Length	110	at BUCKNER RD
Cycle Length	57	at THOMPSON STATION RD
Combined Cycle Length	160	
Cycle Length Increase	73	Large increase in cycle length
Ac, Cycle Adjustment	-30	
CF, Coordinatability Factor	-7	Coordination definitely not recommended

Link: US 31, CROSSINGS BLVD to S. P. YOKICH PKWY

Variable	Value	Comments
Travel Time (s)	15	Travel Time okay For Coordination
CF1	85	
Traffic / Storage Space	0.43	Storage Space is adequate
CF2	43	
Proportion of Traffic In Platoon	0.73	Traffic moderately platooned
Ap, platoon adjustment	-5	
Main Street Volume (vph)	1729	High Volumes, coordination is high priority
Av, volume adjustment	15	
Cycle Length	120	at CROSSINGS BLVD
Cycle Length	120	at S. P. YOKICH PKWY
Combined Cycle Length	120	
Cycle Length Increase	0	
Ac, Cycle Adjustment	0	
CF, Coordinatability Factor	95	Coordination definitely recommended

Link: US 31, S. P. YOKICH PKWY to KEDRON RD

Variable	Value	Comments
Travel Time (s)	26	Travel Time okay For Coordination
CF1	70	
Traffic / Storage Space	0.40	Storage Space is adequate
CF2	40	
Proportion of Traffic In Platoon	0.73	Traffic moderately platooned
Ap, platoon adjustment	-5	
Main Street Volume (vph)	1540	High Volumes, coordination is high priority
Av, volume adjustment	13	
Cycle Length	120	at S. P. YOKICH PKWY
Cycle Length	120	at KEDRON RD
Combined Cycle Length	120	
Cycle Length Increase	0	
Ac, Cycle Adjustment	0	
CF, Coordinatability Factor	78	Coordination definitely recommended

Link: US 31, KEDRON PKWY to McLEMORE AVE

Variable	Value	Comments
Travel Time (s)	39	Travel Time okay For Coordination
CF1	53	
Traffic / Storage Space	0.34	Storage Space is adequate
CF2	34	
Proportion of Traffic In Platoon	0.70	Traffic moderately platooned
Ap, platoon adjustment	-6	
Main Street Volume (vph)	1674	High Volumes, coordination is high priority
Av, volume adjustment	15	
Cycle Length	120	at KEDRON PKWY
Cycle Length	120	at McLEMORE AVE
Combined Cycle Length	120	
Cycle Length Increase	0	
Ac, Cycle Adjustment	0	
CF, Coordinatability Factor	62	Coordination probably recommended

Link: US 31, DEPOT ST to BEECHCROFT RD

Variable	Value	Comments
Travel Time (s)	14	Travel Time okay For Coordination
CF1	86	
Traffic / Storage Space	1.04	Traffic exceeds 80% of storage, coordination needed
CF2	100	
Proportion of Traffic In Platoon	0.75	Traffic moderately platooned
Ap, platoon adjustment	-4	
Main Street Volume (vph)	1421	High Volumes, coordination is high priority
Av, volume adjustment	12	
Cycle Length	120	at DEPOT ST
Cycle Length	120	at BEECHCROFT RD
Combined Cycle Length	120	
Cycle Length Increase	0	
Ac, Cycle Adjustment	0	
CF, Coordinatability Factor	108	Coordination definitely recommended

Link: US 31, BEECHCROFT RD to DUPLEX RD

Variable	Value	Comments
Travel Time (s)	1	Distance small enough to require coordination
CF1	100	
Traffic / Storage Space	783.00	Traffic exceeds 80% of storage, coordination needed
CF2	100	
Proportion of Traffic In Platoon	0.75	Traffic moderately platooned
Ap, platoon adjustment	-4	
Main Street Volume (vph)	1694	High Volumes, coordination is high priority
Av, volume adjustment	15	
Cycle Length	120	at BEECHCROFT RD
Cycle Length	120	at DUPLEX RD
Combined Cycle Length	120	
Cycle Length Increase	0	
Ac, Cycle Adjustment	0	
CF, Coordinatability Factor	111	Coordination definitely recommended

Link: US 31, DUPLEX RD to CAMPBELL STATION PKWY

Variable	Value	Comments
Travel Time (s)	175	Travel Time too far for coordination
CF1	0	
Traffic / Storage Space	0.07	Storage Space is adequate
CF2	7	
Proportion of Traffic In Platoon	0.67	Traffic moderately platooned
Ap, platoon adjustment	-8	
Main Street Volume (vph)	1596	High Volumes, coordination is high priority
Av, volume adjustment	14	
Cycle Length	120	at DUPLEX RD
Cycle Length	95.2	at CAMPBELL STATION PKWY
Combined Cycle Length	120	
Cycle Length Increase	24.8	Moderate increase in cycle length
Ac, Cycle Adjustment	-12	
CF, Coordinatability Factor	1	Coordination definitely not recommended

Link: US 31, CAMPBELL STATION PKWY to BUCKNER RD

Variable	Value	Comments
Travel Time (s)	62	Travel Time okay For Coordination
CF1	24	
Traffic / Storage Space	0.21	Storage Space is adequate
CF2	21	
Proportion of Traffic In Platoon	0.74	Traffic moderately platooned
Ap, platoon adjustment	-4	
Main Street Volume (vph)	1636	High Volumes, coordination is high priority
Av, volume adjustment	14	
Cycle Length	95.2	at CAMPBELL STATION PKWY
Cycle Length	134.5	at BUCKNER RD
Combined Cycle Length	160	
Cycle Length Increase	90.3	Large increase in cycle length
Ac, Cycle Adjustment	-30	
CF, Coordinatability Factor	4	Coordination definitely not recommended

Link: US 31, BUCKNER RD to THOMPSON STATION RD

Variable	Value	Comments
Travel Time (s)	89	Travel Time too far for coordination
CF1	0	
Traffic / Storage Space	0.20	Storage Space is adequate
CF2	20	
Proportion of Traffic In Platoon	0.70	Traffic moderately platooned
Ap, platoon adjustment	-6	
Main Street Volume (vph)	1839	High Volumes, coordination is high priority
Av, volume adjustment	16	
Cycle Length	134.5	at BUCKNER RD
Cycle Length	135.2	at THOMPSON STATION RD
Combined Cycle Length	160	
Cycle Length Increase	50.3	Large increase in cycle length
Ac, Cycle Adjustment	-25	
CF, Coordinatability Factor	5	Coordination definitely not recommended

APPENDIX F

OPTIMIZED
SIGNAL TIMINGS

AM PEAK HOUR
SIGNAL TIMING PLANS

Phase Number	2	4	5	6
Movement	SWT	NWL	SWL	NET
Lead/Lag			Lag	Lead
Lead-Lag Optimize			Yes	Yes
Recall Mode	C-Min	None	None	C-Min
Maximum Split (s)	90	20	21	69
Maximum Split (%)	81.8%	18.2%	19.1%	62.7%
Minimum Split (s)	21.5	16.5	16.5	21.5
Yellow Time (s)	4.5	4.5	4.5	4.5
All-Red Time (s)	2	2	2	2
Minimum Initial (s)	15	10	10	15
Vehicle Extension (s)	2	3	3	2
Minimum Gap (s)	2	3	3	2
Time Before Reduce (s)	20	0	0	20
Time To Reduce (s)	30	0	0	30
Walk Time (s)				
Flash Dont Walk (s)				
Dual Entry	Yes	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	47.5	27.5	6.5	47.5
End Time (s)	27.5	47.5	27.5	6.5
Yield/Force Off (s)	21	41	21	0
Yield/Force Off 170(s)	21	41	21	0
Local Start Time (s)	47.5	27.5	6.5	47.5
Local Yield (s)	21	41	21	0
Local Yield 170(s)	21	41	21	0

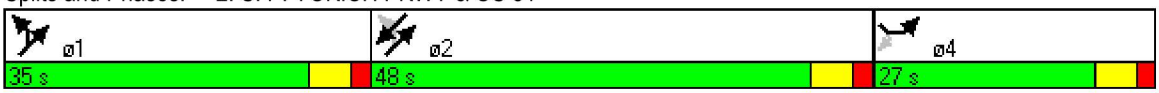
Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 0 (0%), Referenced to phase 2:SWT and 6:NET, Start of Yellow, Master Intersection	

Splits and Phases: 1: CROSSINGS BLVD & US 31

Phase Number	1	2	4
Movement	NETL	NESW	SEL
Lead/Lag	Lead	Lag	
Lead-Lag Optimize			
Recall Mode	None	C-Min	None
Maximum Split (s)	35	48	27
Maximum Split (%)	31.8%	43.6%	24.5%
Minimum Split (s)	12	16	12
Yellow Time (s)	4	4	4
All-Red Time (s)	2	2	2
Minimum Initial (s)	6	10	6
Vehicle Extension (s)	3.5	3.5	3.5
Minimum Gap (s)	3	3	3
Time Before Reduce (s)	0	0	0
Time To Reduce (s)	0	0	0
Walk Time (s)			
Flash Dont Walk (s)			
Dual Entry	No	Yes	Yes
Inhibit Max	Yes	Yes	Yes
Start Time (s)	40	75	13
End Time (s)	75	13	40
Yield/Force Off (s)	69	7	34
Yield/Force Off 170(s)	69	7	34
Local Start Time (s)	33	68	6
Local Yield (s)	62	0	27
Local Yield 170(s)	62	0	27

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	45
Offset: 7 (6%), Referenced to phase 2:NESW, Start of Yellow	

Splits and Phases: 2: S. P. YOKICH PKWY & US 31



Phase Number	1	2	3	4	5	6	7	8
Movement	SWL	NETL	EBL	WBTL	NEL	SWTL	WBL	EBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Min	None	None	None	C-Min	None	None
Maximum Split (s)	17	52	15	26	17	52	15	26
Maximum Split (%)	15.5%	47.3%	13.6%	23.6%	15.5%	47.3%	13.6%	23.6%
Minimum Split (s)	17	16	15	14	17	16	15	14
Yellow Time (s)	4	4	4	4	4	4	4	4
All-Red Time (s)	1	2	1	2	1	2	1	2
Minimum Initial (s)	5	10	5	8	5	10	5	8
Vehicle Extension (s)	3	6	3	3	3	6	3	3
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)								
Flash Dont Walk (s)								
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	11	28	80	95	11	28	80	95
End Time (s)	28	80	95	11	28	80	95	11
Yield/Force Off (s)	23	74	90	5	23	74	90	5
Yield/Force Off 170(s)	23	74	90	5	23	74	90	5
Local Start Time (s)	47	64	6	21	47	64	6	21
Local Yield (s)	59	0	16	41	59	0	16	41
Local Yield 170(s)	59	0	16	41	59	0	16	41

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	90
Offset: 74 (67%), Referenced to phase 2:NETL and 6:SWTL, Start of Yellow	

Splits and Phases: 3: KEDRON PKWY & US 31

Phase Number	1	2	3	4	5	6
Movement	NEL	SWTL	SETL	NWTL	SWL	NETL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	C-Max	None	None	None	C-Max
Maximum Split (s)	10	71	17	12	10	71
Maximum Split (%)	9.1%	64.5%	15.5%	10.9%	9.1%	64.5%
Minimum Split (s)	10	16	10	10	10	16
Yellow Time (s)	4	4	4	4	4	4
All-Red Time (s)	1	2	1	1	1	2
Minimum Initial (s)	5	10	5	5	5	10
Vehicle Extension (s)	2	4	2	2	2	4
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)						
Flash Dont Walk (s)						
Dual Entry	Yes	Yes	Yes	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	49	59	20	37	49	59
End Time (s)	59	20	37	49	59	20
Yield/Force Off (s)	54	14	32	44	54	14
Yield/Force Off 170(s)	54	14	32	44	54	14
Local Start Time (s)	35	45	6	23	35	45
Local Yield (s)	40	0	18	30	40	0
Local Yield 170(s)	40	0	18	30	40	0

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 14 (13%), Referenced to phase 2:SWTL and 6:NETL, Start of Yellow	

Splits and Phases: 4: DEPOT ST & US 31

Phase Number	1	2	3	4	5	6
Node Number	6	5	5	5	5	5
Movement	SWL	NETL	SWT	EBL	NEL	SWT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	C-Max	None	None	None	C-Max
Maximum Split (s)	19	50	22	19	10	59
Maximum Split (%)	17.3%	45.5%	20.0%	17.3%	9.1%	53.6%
Minimum Split (s)	19	16.5	11	14	10	16.5
Yellow Time (s)	3	4	3	4	3	4
All-Red Time (s)	1	2.5	3	5	1	2.5
Minimum Initial (s)	5	10	5	5	5	10
Vehicle Extension (s)	2	4	2	2	2	4
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)						
Flash Dont Walk (s)						
Dual Entry	No	Yes	Yes	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	61.5	80.5	20.5	42.5	61.5	71.5
End Time (s)	80.5	20.5	42.5	61.5	71.5	20.5
Yield/Force Off (s)	76.5	14	36.5	52.5	67.5	14
Yield/Force Off 170(s)	76.5	14	36.5	52.5	67.5	14
Local Start Time (s)	47.5	66.5	6.5	28.5	47.5	57.5
Local Yield (s)	62.5	0	22.5	38.5	53.5	0
Local Yield 170(s)	62.5	0	22.5	38.5	53.5	0

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	100

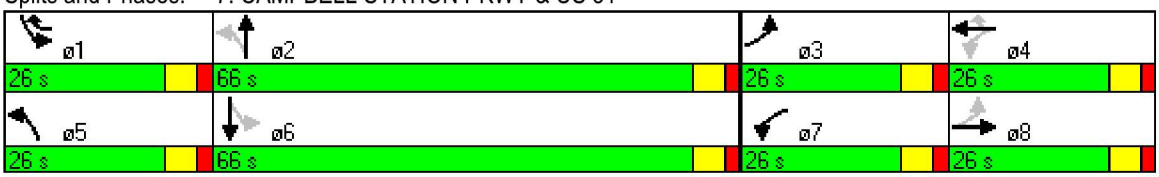
Offset: 14 (13%), Referenced to phase 2:NETL and 6:SWT, Start of Yellow

Splits and Phases: 5: BEECHCROFT RD & US 31

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBTL	EBL	WBTL	NBL	SBTL	WBL	EBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	26	66	26	26	26	66	26	26
Maximum Split (%)	18.1%	45.8%	18.1%	18.1%	18.1%	45.8%	18.1%	18.1%
Minimum Split (s)	26	66	26	26	26	66	26	26
Yellow Time (s)	4	4	4	4	4	4	4	4
All-Red Time (s)	2	2	2	2	2	2	2	2
Minimum Initial (s)	5	9	5	1	5	4	5	5
Vehicle Extension (s)	4	5	4	4	4	5	4	4
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)								
Flash Dont Walk (s)								
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	26	92	118	0	26	92	118
End Time (s)	26	92	118	0	26	92	118	0
Yield/Force Off (s)	20	86	112	138	20	86	112	138
Yield/Force Off 170(s)	20	86	112	138	20	86	112	138
Local Start Time (s)	58	84	6	32	58	84	6	32
Local Yield (s)	78	0	26	52	78	0	26	52
Local Yield 170(s)	78	0	26	52	78	0	26	52

Intersection Summary	
Cycle Length	144
Control Type	Actuated-Uncoordinated
Natural Cycle	145

Splits and Phases: 7: CAMPBELL STATION PKWY & US 31



Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBTL	EBL	WBTL	NBL	SBTL	WBL	EBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	25	66	25	26	25	66	25	26
Maximum Split (%)	17.6%	46.5%	17.6%	18.3%	17.6%	46.5%	17.6%	18.3%
Minimum Split (s)	25	66	25	26	25	66	25	26
Yellow Time (s)	4	4	4	4	4	4	4	4
All-Red Time (s)	1	2	1	2	1	2	1	2
Minimum Initial (s)	5	9	5	5	5	9	5	7
Vehicle Extension (s)	3	5	3	3	3	5	3	3
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)								8
Flash Dont Walk (s)								15
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	25	91	116	0	25	91	116
End Time (s)	25	91	116	0	25	91	116	0
Yield/Force Off (s)	20	85	111	136	20	85	111	136
Yield/Force Off 170(s)	20	85	111	136	20	85	111	121
Local Start Time (s)	57	82	6	31	57	82	6	31
Local Yield (s)	77	0	26	51	77	0	26	51
Local Yield 170(s)	77	0	26	51	77	0	26	36

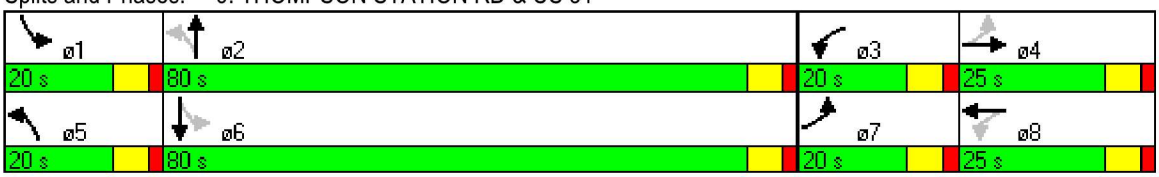
Intersection Summary	
Cycle Length	142
Control Type	Actuated-Uncoordinated
Natural Cycle	145

Splits and Phases: 8: BUCKNER RD & US 31

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBTL	WBL	EBTL	NBL	SBTL	EBL	WBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	20	80	20	25	20	80	20	25
Maximum Split (%)	13.8%	55.2%	13.8%	17.2%	13.8%	55.2%	13.8%	17.2%
Minimum Split (s)	20	80	20	25	20	80	20	25
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
All-Red Time (s)	2	2	2	2	2	2	2	2
Minimum Initial (s)	5	30	5	5	5	30	5	5
Vehicle Extension (s)	2	5	3	3	2	5	3	3
Minimum Gap (s)	2	3	3	3	2	3	3	3
Time Before Reduce (s)	0	20	0	0	0	20	0	0
Time To Reduce (s)	0	20	0	0	0	20	0	0
Walk Time (s)								
Flash Dont Walk (s)								
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	20	100	120	0	20	100	120
End Time (s)	20	100	120	0	20	100	120	0
Yield/Force Off (s)	13.5	93.5	113.5	138.5	13.5	93.5	113.5	138.5
Yield/Force Off 170(s)	13.5	93.5	113.5	138.5	13.5	93.5	113.5	138.5
Local Start Time (s)	51.5	71.5	6.5	26.5	51.5	71.5	6.5	26.5
Local Yield (s)	65	0	20	45	65	0	20	45
Local Yield 170(s)	65	0	20	45	65	0	20	45

Intersection Summary	
Cycle Length	145
Control Type	Actuated-Uncoordinated
Natural Cycle	145

Splits and Phases: 9: THOMPSON STATION RD & US 31

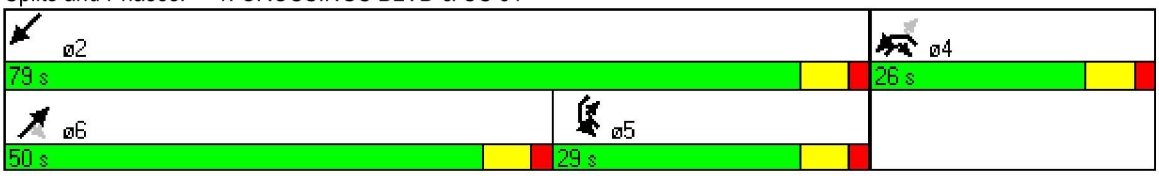


MID-DAY PEAK HOUR
SIGNAL TIMING PLANS

Phase Number	2	4	5	6
Movement	SWT	NWL	SWL	NET
Lead/Lag			Lag	Lead
Lead-Lag Optimize			Yes	Yes
Recall Mode	C-Min	None	None	C-Min
Maximum Split (s)	79	26	29	50
Maximum Split (%)	75.2%	24.8%	27.6%	47.6%
Minimum Split (s)	21.5	21.5	16.5	21.5
Yellow Time (s)	4.5	4.5	4.5	4.5
All-Red Time (s)	2	2	2	2
Minimum Initial (s)	15	10	10	15
Vehicle Extension (s)	2	3	3	2
Minimum Gap (s)	2	3	3	2
Time Before Reduce (s)	20	0	0	20
Time To Reduce (s)	30	0	0	30
Walk Time (s)				
Flash Dont Walk (s)				
Dual Entry	Yes	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	61.5	35.5	6.5	61.5
End Time (s)	35.5	61.5	35.5	6.5
Yield/Force Off (s)	29	55	29	0
Yield/Force Off 170(s)	29	55	29	0
Local Start Time (s)	61.5	35.5	6.5	61.5
Local Yield (s)	29	55	29	0
Local Yield 170(s)	29	55	29	0

Intersection Summary	
Cycle Length	105
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 0 (0%), Referenced to phase 2:SWT and 6:NET, Start of Yellow, Master Intersection	

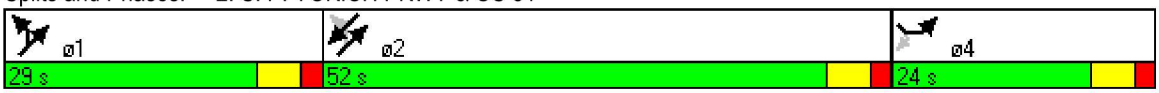
Splits and Phases: 1: CROSSINGS BLVD & US 31



Phase Number	1	2	4
Movement	NETL	NESW	SEL
Lead/Lag	Lead	Lag	
Lead-Lag Optimize			
Recall Mode	None	C-Min	None
Maximum Split (s)	29	52	24
Maximum Split (%)	27.6%	49.5%	22.9%
Minimum Split (s)	12	16	12
Yellow Time (s)	4	4	4
All-Red Time (s)	2	2	2
Minimum Initial (s)	6	10	6
Vehicle Extension (s)	3.5	3.5	3.5
Minimum Gap (s)	3	3	3
Time Before Reduce (s)	0	0	0
Time To Reduce (s)	0	0	0
Walk Time (s)			
Flash Dont Walk (s)			
Dual Entry	No	Yes	Yes
Inhibit Max	Yes	Yes	Yes
Start Time (s)	51	80	27
End Time (s)	80	27	51
Yield/Force Off (s)	74	21	45
Yield/Force Off 170(s)	74	21	45
Local Start Time (s)	30	59	6
Local Yield (s)	53	0	24
Local Yield 170(s)	53	0	24

Intersection Summary	
Cycle Length	105
Control Type	Actuated-Coordinated
Natural Cycle	45
Offset: 21 (20%), Referenced to phase 2:NESW, Start of Yellow	

Splits and Phases: 2: S. P. YOKICH PKWY & US 31



Phase Number	1	2	3	4	5	6	7	8
Movement	SWL	NETL	EBL	WBTL	NEL	SWTL	WBL	EBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Min	None	None	None	C-Min	None	None
Maximum Split (s)	17	52	17	19	17	52	17	19
Maximum Split (%)	16.2%	49.5%	16.2%	18.1%	16.2%	49.5%	16.2%	18.1%
Minimum Split (s)	17	20	17	18	17	20	17	18
Yellow Time (s)	4	4	4	4	4	4	4	4
All-Red Time (s)	1	2	1	2	1	2	1	2
Minimum Initial (s)	5	9	5	8	5	9	5	8
Vehicle Extension (s)	3	6	3	3	3	6	3	3
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)								
Flash Dont Walk (s)								
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	36	53	0	17	36	53	0	17
End Time (s)	53	0	17	36	53	0	17	36
Yield/Force Off (s)	48	99	12	30	48	99	12	30
Yield/Force Off 170(s)	48	99	12	30	48	99	12	30
Local Start Time (s)	42	59	6	23	42	59	6	23
Local Yield (s)	54	0	18	36	54	0	18	36
Local Yield 170(s)	54	0	18	36	54	0	18	36

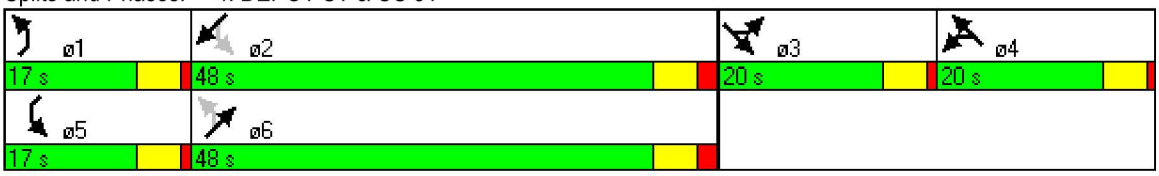
Intersection Summary	
Cycle Length	105
Control Type	Actuated-Coordinated
Natural Cycle	90
Offset: 99 (94%), Referenced to phase 2:NETL and 6:SWTL, Start of Yellow	

Splits and Phases: 3: KEDRON PKWY & US 31

Phase Number	1	2	3	4	5	6
Movement	NEL	SWTL	SETL	NWTL	SWL	NETL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	C-Max	None	None	None	C-Max
Maximum Split (s)	17	48	20	20	17	48
Maximum Split (%)	16.2%	45.7%	19.0%	19.0%	16.2%	45.7%
Minimum Split (s)	17	16	20	20	17	16
Yellow Time (s)	4	4	4	4	4	4
All-Red Time (s)	1	2	1	1	1	2
Minimum Initial (s)	5	10	5	5	5	10
Vehicle Extension (s)	2	4	2	2	2	4
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)						
Flash Dont Walk (s)						
Dual Entry	Yes	Yes	Yes	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	93	5	53	73	93	5
End Time (s)	5	53	73	93	5	53
Yield/Force Off (s)	0	47	68	88	0	47
Yield/Force Off 170(s)	0	47	68	88	0	47
Local Start Time (s)	46	63	6	26	46	63
Local Yield (s)	58	0	21	41	58	0
Local Yield 170(s)	58	0	21	41	58	0

Intersection Summary	
Cycle Length	105
Control Type	Actuated-Coordinated
Natural Cycle	90
Offset: 47 (45%), Referenced to phase 2:SWTL and 6:NETL, Start of Yellow	

Splits and Phases: 4: DEPOT ST & US 31



Phase Number	1	2	3	4	5	6
Node Number	6	5	5	5	5	5
Movement	SWL	NETL	SWT	EBL	NEL	SWT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	C-Max	None	None	None	C-Max
Maximum Split (s)	19	48	21	17	15	52
Maximum Split (%)	18.1%	45.7%	20.0%	16.2%	14.3%	49.5%
Minimum Split (s)	19	16.5	11	14	15	16.5
Yellow Time (s)	3	4	3	4	3	4
All-Red Time (s)	1	2.5	3	5	1	2.5
Minimum Initial (s)	5	10	5	5	5	10
Vehicle Extension (s)	2	4	2	2	2	4
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)						
Flash Dont Walk (s)						
Dual Entry	No	Yes	Yes	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	75.5	94.5	37.5	58.5	75.5	90.5
End Time (s)	94.5	37.5	58.5	75.5	90.5	37.5
Yield/Force Off (s)	90.5	31	52.5	66.5	86.5	31
Yield/Force Off 170(s)	90.5	31	52.5	66.5	86.5	31
Local Start Time (s)	44.5	63.5	6.5	27.5	44.5	59.5
Local Yield (s)	59.5	0	21.5	35.5	55.5	0
Local Yield 170(s)	59.5	0	21.5	35.5	55.5	0

Intersection Summary	
Cycle Length	105
Control Type	Actuated-Coordinated
Natural Cycle	90

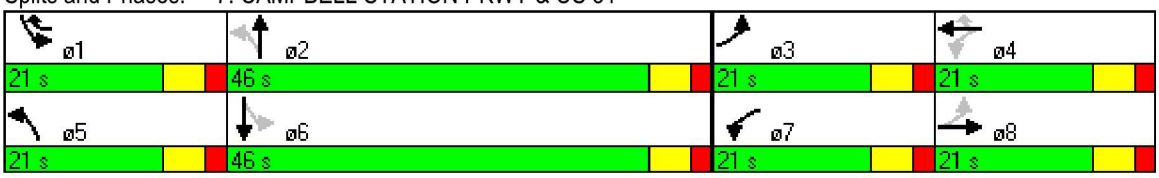
Offset: 31 (30%), Referenced to phase 2:NETL and 6:SWT, Start of Yellow

Splits and Phases: 5: BEECHCROFT RD & US 31

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBTL	EBL	WBTL	NBL	SBTL	WBL	EBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	21	46	21	21	21	46	21	21
Maximum Split (%)	19.3%	42.2%	19.3%	19.3%	19.3%	42.2%	19.3%	19.3%
Minimum Split (s)	21	46	21	21	21	46	21	21
Yellow Time (s)	4	4	4	4	4	4	4	4
All-Red Time (s)	2	2	2	2	2	2	2	2
Minimum Initial (s)	5	9	5	5	5	4	5	5
Vehicle Extension (s)	4	5	4	4	4	5	4	4
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)								
Flash Dont Walk (s)								
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	21	67	88	0	21	67	88
End Time (s)	21	67	88	0	21	67	88	0
Yield/Force Off (s)	15	61	82	103	15	61	82	103
Yield/Force Off 170(s)	15	61	82	103	15	61	82	103
Local Start Time (s)	48	69	6	27	48	69	6	27
Local Yield (s)	63	0	21	42	63	0	21	42
Local Yield 170(s)	63	0	21	42	63	0	21	42

Intersection Summary	
Cycle Length	109
Control Type	Actuated-Uncoordinated
Natural Cycle	110

Splits and Phases: 7: CAMPBELL STATION PKWY & US 31



Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBTL	EBL	WBTL	NBL	SBTL	WBL	EBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	20	46	20	21	20	46	20	21
Maximum Split (%)	18.7%	43.0%	18.7%	19.6%	18.7%	43.0%	18.7%	19.6%
Minimum Split (s)	20	46	20	21	20	46	20	21
Yellow Time (s)	4	4	4	4	4	4	4	4
All-Red Time (s)	1	2	1	2	1	2	1	2
Minimum Initial (s)	5	10	5	5	5	10	5	7
Vehicle Extension (s)	3	5	3	3	3	5	3	3
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)								8
Flash Dont Walk (s)								15
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	20	66	86	0	20	66	86
End Time (s)	20	66	86	0	20	66	86	0
Yield/Force Off (s)	15	60	81	101	15	60	81	101
Yield/Force Off 170(s)	15	60	81	101	15	60	81	86
Local Start Time (s)	47	67	6	26	47	67	6	26
Local Yield (s)	62	0	21	41	62	0	21	41
Local Yield 170(s)	62	0	21	41	62	0	21	26

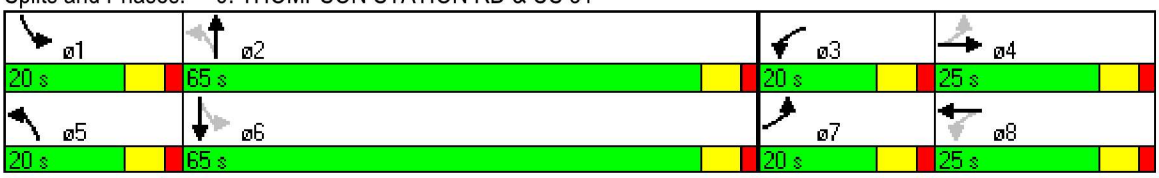
Intersection Summary	
Cycle Length	107
Control Type	Actuated-Uncoordinated
Natural Cycle	110

Splits and Phases: 8: BUCKNER RD & US 31

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBTL	WBL	EBTL	NBL	SBTL	EBL	WBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	20	65	20	25	20	65	20	25
Maximum Split (%)	15.4%	50.0%	15.4%	19.2%	15.4%	50.0%	15.4%	19.2%
Minimum Split (s)	20	65	20	25	20	65	20	25
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
All-Red Time (s)	2	2	2	2	2	2	2	2
Minimum Initial (s)	5	15	5	5	5	15	5	5
Vehicle Extension (s)	2	5	3	3	2	5	3	3
Minimum Gap (s)	2	3	3	3	2	3	3	3
Time Before Reduce (s)	0	20	0	0	0	20	0	0
Time To Reduce (s)	0	20	0	0	0	20	0	0
Walk Time (s)								
Flash Dont Walk (s)								
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	20	85	105	0	20	85	105
End Time (s)	20	85	105	0	20	85	105	0
Yield/Force Off (s)	13.5	78.5	98.5	123.5	13.5	78.5	98.5	123.5
Yield/Force Off 170(s)	13.5	78.5	98.5	123.5	13.5	78.5	98.5	123.5
Local Start Time (s)	51.5	71.5	6.5	26.5	51.5	71.5	6.5	26.5
Local Yield (s)	65	0	20	45	65	0	20	45
Local Yield 170(s)	65	0	20	45	65	0	20	45

Intersection Summary	
Cycle Length	130
Control Type	Actuated-Uncoordinated
Natural Cycle	130

Splits and Phases: 9: THOMPSON STATION RD & US 31

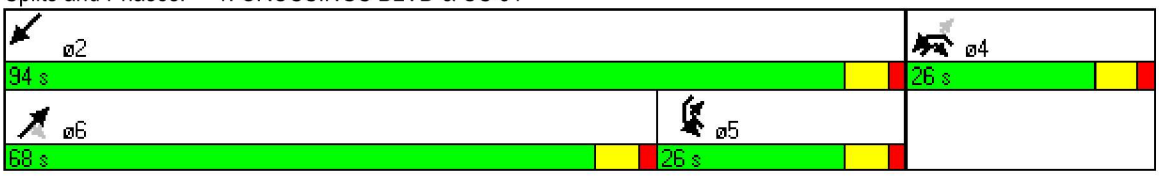


PM PEAK HOUR
SIGNAL TIMING PLANS

Phase Number	2	4	5	6
Movement	SWT	NWL	SWL	NET
Lead/Lag			Lag	Lead
Lead-Lag Optimize			Yes	Yes
Recall Mode	C-Min	None	None	C-Min
Maximum Split (s)	94	26	26	68
Maximum Split (%)	78.3%	21.7%	21.7%	56.7%
Minimum Split (s)	21.5	16.5	16.5	21.5
Yellow Time (s)	4.5	4.5	4.5	4.5
All-Red Time (s)	2	2	2	2
Minimum Initial (s)	15	10	10	15
Vehicle Extension (s)	2	3	3	2
Minimum Gap (s)	2	3	3	2
Time Before Reduce (s)	20	0	0	20
Time To Reduce (s)	30	0	0	30
Walk Time (s)				
Flash Dont Walk (s)				
Dual Entry	Yes	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	58.5	32.5	6.5	58.5
End Time (s)	32.5	58.5	32.5	6.5
Yield/Force Off (s)	26	52	26	0
Yield/Force Off 170(s)	26	52	26	0
Local Start Time (s)	58.5	32.5	6.5	58.5
Local Yield (s)	26	52	26	0
Local Yield 170(s)	26	52	26	0

Intersection Summary	
Cycle Length	120
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 0 (0%), Referenced to phase 2:SWT and 6:NET, Start of Yellow, Master Intersection	

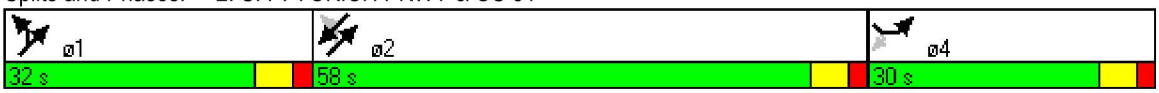
Splits and Phases: 1: CROSSINGS BLVD & US 31



Phase Number	1	2	4
Movement	NETL	NESW	SEL
Lead/Lag	Lead	Lag	
Lead-Lag Optimize			
Recall Mode	None	C-Min	None
Maximum Split (s)	32	58	30
Maximum Split (%)	26.7%	48.3%	25.0%
Minimum Split (s)	12	16	12
Yellow Time (s)	4	4	4
All-Red Time (s)	2	2	2
Minimum Initial (s)	6	10	6
Vehicle Extension (s)	3.5	3.5	3.5
Minimum Gap (s)	3	3	3
Time Before Reduce (s)	0	0	0
Time To Reduce (s)	0	0	0
Walk Time (s)			
Flash Dont Walk (s)			
Dual Entry	No	Yes	Yes
Inhibit Max	Yes	Yes	Yes
Start Time (s)	39	71	9
End Time (s)	71	9	39
Yield/Force Off (s)	65	3	33
Yield/Force Off 170(s)	65	3	33
Local Start Time (s)	36	68	6
Local Yield (s)	62	0	30
Local Yield 170(s)	62	0	30

Intersection Summary	
Cycle Length	120
Control Type	Actuated-Coordinated
Natural Cycle	55
Offset: 3 (3%), Referenced to phase 2:NESW, Start of Yellow	

Splits and Phases: 2: S. P. YOKICH PKWY & US 31



Phase Number	1	2	3	4	5	6	7	8
Movement	SWL	NETL	EBL	WBTL	NEL	SWTL	WBL	EBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Min	None	None	None	C-Min	None	None
Maximum Split (s)	17	64	15	24	17	64	15	24
Maximum Split (%)	14.2%	53.3%	12.5%	20.0%	14.2%	53.3%	12.5%	20.0%
Minimum Split (s)	17	16	15	14	17	16	15	14
Yellow Time (s)	4	4	4	4	4	4	4	4
All-Red Time (s)	1	2	1	2	1	2	1	2
Minimum Initial (s)	5	10	5	8	5	10	5	8
Vehicle Extension (s)	3	6	3	3	3	6	3	3
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)								
Flash Dont Walk (s)								
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	19	36	100	115	19	36	100	115
End Time (s)	36	100	115	19	36	100	115	19
Yield/Force Off (s)	31	94	110	13	31	94	110	13
Yield/Force Off 170(s)	31	94	110	13	31	94	110	13
Local Start Time (s)	45	62	6	21	45	62	6	21
Local Yield (s)	57	0	16	39	57	0	16	39
Local Yield 170(s)	57	0	16	39	57	0	16	39

Intersection Summary	
Cycle Length	120
Control Type	Actuated-Coordinated
Natural Cycle	120
Offset: 94 (78%), Referenced to phase 2:NETL and 6:SWTL, Start of Yellow	

Splits and Phases: 3: KEDRON PKWY & US 31

Phase Number	1	2	3	4	5	6
Movement	NEL	SWTL	SETL	NWTL	SWL	NETL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	C-Max	None	None	None	C-Max
Maximum Split (s)	10	80	14	16	10	80
Maximum Split (%)	8.3%	66.7%	11.7%	13.3%	8.3%	66.7%
Minimum Split (s)	10	16	10	10	10	16
Yellow Time (s)	4	4	4	4	4	4
All-Red Time (s)	1	2	1	1	1	2
Minimum Initial (s)	5	10	5	5	5	10
Vehicle Extension (s)	2	4	2	2	2	4
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)						
Flash Dont Walk (s)						
Dual Entry	Yes	Yes	Yes	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	91	101	61	75	91	101
End Time (s)	101	61	75	91	101	61
Yield/Force Off (s)	96	55	70	86	96	55
Yield/Force Off 170(s)	96	55	70	86	96	55
Local Start Time (s)	36	46	6	20	36	46
Local Yield (s)	41	0	15	31	41	0
Local Yield 170(s)	41	0	15	31	41	0

Intersection Summary	
Cycle Length	120
Control Type	Actuated-Coordinated
Natural Cycle	80
Offset: 55 (46%), Referenced to phase 2:SWTL and 6:NETL, Start of Yellow	

Splits and Phases: 4: DEPOT ST & US 31

Phase Number	1	2	3	4	5	6
Node Number	6	5	5	5	5	5
Movement	SWL	NETL	SWT	EBL	NEL	SWT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	C-Max	None	None	None	C-Max
Maximum Split (s)	19	56	25	20	10	65
Maximum Split (%)	15.8%	46.7%	20.8%	16.7%	8.3%	54.2%
Minimum Split (s)	19	16.5	11	14	10	16.5
Yellow Time (s)	3	4	3	4	3	4
All-Red Time (s)	1	2.5	3	5	1	2.5
Minimum Initial (s)	5	10	5	5	5	10
Vehicle Extension (s)	2	4	2	2	2	4
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)						
Flash Dont Walk (s)						
Dual Entry	No	Yes	Yes	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	90.5	109.5	45.5	70.5	90.5	100.5
End Time (s)	109.5	45.5	70.5	90.5	100.5	45.5
Yield/Force Off (s)	105.5	39	64.5	81.5	96.5	39
Yield/Force Off 170(s)	105.5	39	64.5	81.5	96.5	39
Local Start Time (s)	51.5	70.5	6.5	31.5	51.5	61.5
Local Yield (s)	66.5	0	25.5	42.5	57.5	0
Local Yield 170(s)	66.5	0	25.5	42.5	57.5	0

Intersection Summary	
Cycle Length	120
Control Type	Actuated-Coordinated
Natural Cycle	130

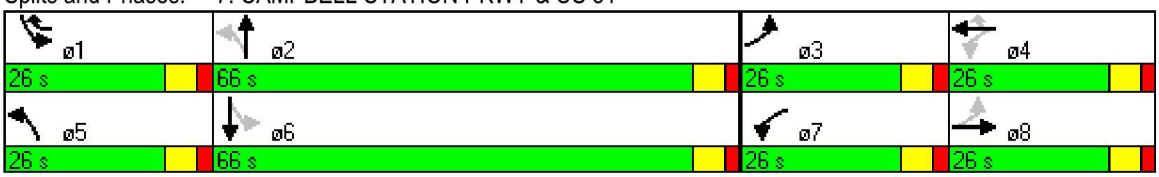
Offset: 39 (33%), Referenced to phase 2:NETL and 6:SWT, Start of Yellow

Splits and Phases: 5: BEECHCROFT RD & US 31

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBTL	EBL	WBTL	NBL	SBTL	WBL	EBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	26	66	26	26	26	66	26	26
Maximum Split (%)	18.1%	45.8%	18.1%	18.1%	18.1%	45.8%	18.1%	18.1%
Minimum Split (s)	26	66	26	26	26	66	26	26
Yellow Time (s)	4	4	4	4	4	4	4	4
All-Red Time (s)	2	2	2	2	2	2	2	2
Minimum Initial (s)	5	9	5	1	5	4	5	5
Vehicle Extension (s)	4	5	4	4	4	5	4	4
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)								
Flash Dont Walk (s)								
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	26	92	118	0	26	92	118
End Time (s)	26	92	118	0	26	92	118	0
Yield/Force Off (s)	20	86	112	138	20	86	112	138
Yield/Force Off 170(s)	20	86	112	138	20	86	112	138
Local Start Time (s)	58	84	6	32	58	84	6	32
Local Yield (s)	78	0	26	52	78	0	26	52
Local Yield 170(s)	78	0	26	52	78	0	26	52

Intersection Summary	
Cycle Length	144
Control Type	Actuated-Uncoordinated
Natural Cycle	145

Splits and Phases: 7: CAMPBELL STATION PKWY & US 31



Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBTL	EBL	WBTL	NBL	SBTL	WBL	EBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	25	66	25	26	25	66	25	26
Maximum Split (%)	17.6%	46.5%	17.6%	18.3%	17.6%	46.5%	17.6%	18.3%
Minimum Split (s)	25	66	25	26	25	66	25	26
Yellow Time (s)	4	4	4	4	4	4	4	4
All-Red Time (s)	1	2	1	2	1	2	1	2
Minimum Initial (s)	5	9	5	5	5	9	5	7
Vehicle Extension (s)	3	5	3	3	3	5	3	3
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)								8
Flash Dont Walk (s)								15
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	25	91	116	0	25	91	116
End Time (s)	25	91	116	0	25	91	116	0
Yield/Force Off (s)	20	85	111	136	20	85	111	136
Yield/Force Off 170(s)	20	85	111	136	20	85	111	121
Local Start Time (s)	57	82	6	31	57	82	6	31
Local Yield (s)	77	0	26	51	77	0	26	51
Local Yield 170(s)	77	0	26	51	77	0	26	36

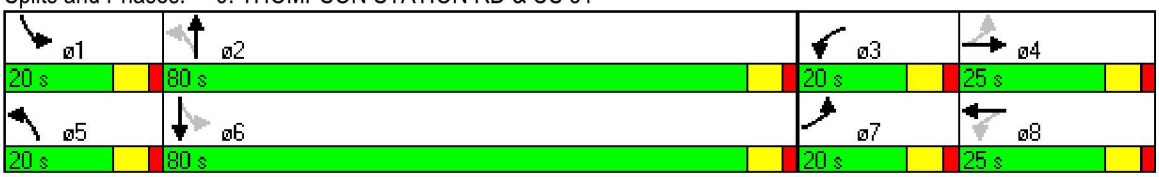
Intersection Summary	
Cycle Length	142
Control Type	Actuated-Uncoordinated
Natural Cycle	145

Splits and Phases: 8: BUCKNER RD & US 31

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBTL	WBL	EBTL	NBL	SBTL	EBL	WBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	20	80	20	25	20	80	20	25
Maximum Split (%)	13.8%	55.2%	13.8%	17.2%	13.8%	55.2%	13.8%	17.2%
Minimum Split (s)	20	80	20	25	20	80	20	25
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
All-Red Time (s)	2	2	2	2	2	2	2	2
Minimum Initial (s)	5	30	5	5	5	30	5	5
Vehicle Extension (s)	2	5	3	3	2	5	3	3
Minimum Gap (s)	2	3	3	3	2	3	3	3
Time Before Reduce (s)	0	20	0	0	0	20	0	0
Time To Reduce (s)	0	20	0	0	0	20	0	0
Walk Time (s)								
Flash Dont Walk (s)								
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	20	100	120	0	20	100	120
End Time (s)	20	100	120	0	20	100	120	0
Yield/Force Off (s)	13.5	93.5	113.5	138.5	13.5	93.5	113.5	138.5
Yield/Force Off 170(s)	13.5	93.5	113.5	138.5	13.5	93.5	113.5	138.5
Local Start Time (s)	51.5	71.5	6.5	26.5	51.5	71.5	6.5	26.5
Local Yield (s)	65	0	20	45	65	0	20	45
Local Yield 170(s)	65	0	20	45	65	0	20	45

Intersection Summary	
Cycle Length	145
Control Type	Actuated-Uncoordinated
Natural Cycle	145

Splits and Phases: 9: THOMPSON STATION RD & US 31

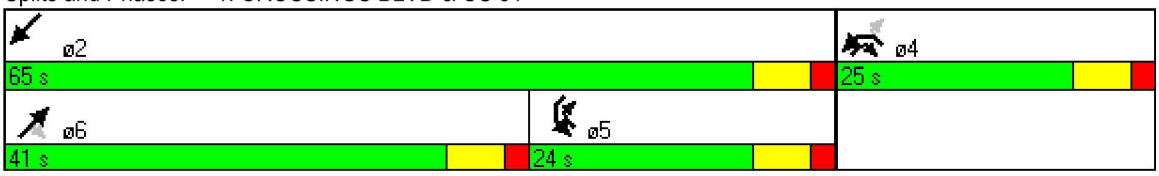


OFF-PEAK
SIGNAL TIMING PLANS

Phase Number	2	4	5	6
Movement	SWT	NWL	SWL	NET
Lead/Lag			Lag	Lead
Lead-Lag Optimize			Yes	Yes
Recall Mode	C-Min	None	None	C-Min
Maximum Split (s)	65	25	24	41
Maximum Split (%)	72.2%	27.8%	26.7%	45.6%
Minimum Split (s)	21.5	21.5	16.5	21.5
Yellow Time (s)	4.5	4.5	4.5	4.5
All-Red Time (s)	2	2	2	2
Minimum Initial (s)	15	10	10	15
Vehicle Extension (s)	2	3	3	2
Minimum Gap (s)	2	3	3	2
Time Before Reduce (s)	20	0	0	20
Time To Reduce (s)	30	0	0	30
Walk Time (s)				
Flash Dont Walk (s)				
Dual Entry	Yes	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	55.5	30.5	6.5	55.5
End Time (s)	30.5	55.5	30.5	6.5
Yield/Force Off (s)	24	49	24	0
Yield/Force Off 170(s)	24	49	24	0
Local Start Time (s)	55.5	30.5	6.5	55.5
Local Yield (s)	24	49	24	0
Local Yield 170(s)	24	49	24	0

Intersection Summary	
Cycle Length	90
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 0 (0%), Referenced to phase 2:SWT and 6:NET, Start of Yellow, Master Intersection	

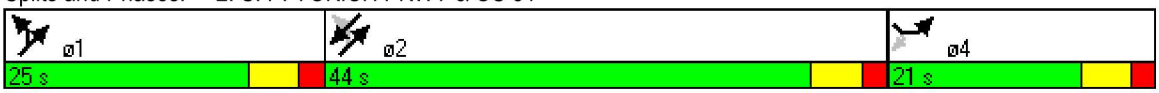
Splits and Phases: 1: CROSSINGS BLVD & US 31



Phase Number	1	2	4
Movement	NETL	NESW	SEL
Lead/Lag	Lead	Lag	
Lead-Lag Optimize			
Recall Mode	None	C-Min	None
Maximum Split (s)	25	44	21
Maximum Split (%)	27.8%	48.9%	23.3%
Minimum Split (s)	12	16	12
Yellow Time (s)	4	4	4
All-Red Time (s)	2	2	2
Minimum Initial (s)	6	10	6
Vehicle Extension (s)	3.5	3.5	3.5
Minimum Gap (s)	3	3	3
Time Before Reduce (s)	0	0	0
Time To Reduce (s)	0	0	0
Walk Time (s)			
Flash Dont Walk (s)			
Dual Entry	No	Yes	Yes
Inhibit Max	Yes	Yes	Yes
Start Time (s)	52	77	31
End Time (s)	77	31	52
Yield/Force Off (s)	71	25	46
Yield/Force Off 170(s)	71	25	46
Local Start Time (s)	27	52	6
Local Yield (s)	46	0	21
Local Yield 170(s)	46	0	21

Intersection Summary	
Cycle Length	90
Control Type	Actuated-Coordinated
Natural Cycle	40
Offset: 25 (28%), Referenced to phase 2:NESW, Start of Yellow	

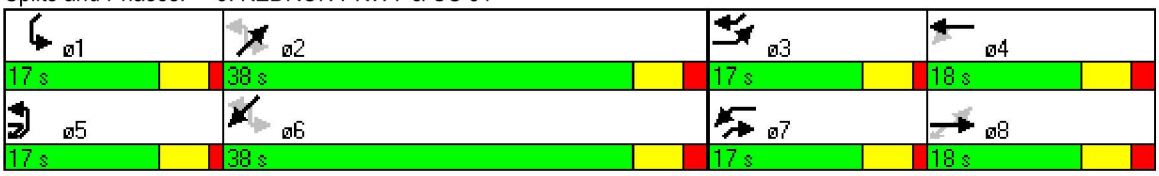
Splits and Phases: 2: S. P. YOKICH PKWY & US 31



Phase Number	1	2	3	4	5	6	7	8
Movement	SWL	NETL	EBL	WBTL	NEL	SWTL	WBL	EBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Min	None	None	None	C-Min	None	None
Maximum Split (s)	17	38	17	18	17	38	17	18
Maximum Split (%)	18.9%	42.2%	18.9%	20.0%	18.9%	42.2%	18.9%	20.0%
Minimum Split (s)	17	20	17	18	17	20	17	18
Yellow Time (s)	4	4	4	4	4	4	4	4
All-Red Time (s)	1	2	1	2	1	2	1	2
Minimum Initial (s)	5	9	5	8	5	9	5	8
Vehicle Extension (s)	3	6	3	3	3	6	3	3
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)								
Flash Dont Walk (s)								
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	44	61	9	26	44	61	9	26
End Time (s)	61	9	26	44	61	9	26	44
Yield/Force Off (s)	56	3	21	38	56	3	21	38
Yield/Force Off 170(s)	56	3	21	38	56	3	21	38
Local Start Time (s)	41	58	6	23	41	58	6	23
Local Yield (s)	53	0	18	35	53	0	18	35
Local Yield 170(s)	53	0	18	35	53	0	18	35

Intersection Summary	
Cycle Length	90
Control Type	Actuated-Coordinated
Natural Cycle	80
Offset: 3 (3%), Referenced to phase 2:NETL and 6:SWTL, Start of Yellow	

Splits and Phases: 3: KEDRON PKWY & US 31



Phase Number	1	2	3	4	5	6
Movement	NEL	SWTL	SETL	NWTL	SWL	NETL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	C-Max	None	None	None	C-Max
Maximum Split (s)	17	33	20	20	17	33
Maximum Split (%)	18.9%	36.7%	22.2%	22.2%	18.9%	36.7%
Minimum Split (s)	17	16	20	20	17	16
Yellow Time (s)	4	4	4	4	4	4
All-Red Time (s)	1	2	1	1	1	2
Minimum Initial (s)	5	10	5	5	5	10
Vehicle Extension (s)	2	4	2	2	2	4
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)						
Flash Dont Walk (s)						
Dual Entry	Yes	Yes	Yes	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	9	26	59	79	9	26
End Time (s)	26	59	79	9	26	59
Yield/Force Off (s)	21	53	74	4	21	53
Yield/Force Off 170(s)	21	53	74	4	21	53
Local Start Time (s)	46	63	6	26	46	63
Local Yield (s)	58	0	21	41	58	0
Local Yield 170(s)	58	0	21	41	58	0

Intersection Summary	
Cycle Length	90
Control Type	Actuated-Coordinated
Natural Cycle	90
Offset: 53 (59%), Referenced to phase 2:SWTL and 6:NETL, Start of Yellow	

Splits and Phases: 4: DEPOT ST & US 31

Phase Number	1	2	3	4	5	6
Node Number	6	5	5	5	5	5
Movement	SWL	NETL	SWT	EBL	NEL	SWT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	C-Max	None	None	None	C-Max
Maximum Split (s)	19	39	17	15	15	43
Maximum Split (%)	21.1%	43.3%	18.9%	16.7%	16.7%	47.8%
Minimum Split (s)	19	16.5	11	14	15	16.5
Yellow Time (s)	3	4	3	4	3	4
All-Red Time (s)	1	2.5	3	5	1	2.5
Minimum Initial (s)	5	10	5	5	5	10
Vehicle Extension (s)	2	4	2	2	2	4
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)						
Flash Dont Walk (s)						
Dual Entry	No	Yes	Yes	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	84.5	13.5	52.5	69.5	84.5	9.5
End Time (s)	13.5	52.5	69.5	84.5	9.5	52.5
Yield/Force Off (s)	9.5	46	63.5	75.5	5.5	46
Yield/Force Off 170(s)	9.5	46	63.5	75.5	5.5	46
Local Start Time (s)	38.5	57.5	6.5	23.5	38.5	53.5
Local Yield (s)	53.5	0	17.5	29.5	49.5	0
Local Yield 170(s)	53.5	0	17.5	29.5	49.5	0

Intersection Summary	
Cycle Length	90
Control Type	Actuated-Coordinated
Natural Cycle	90

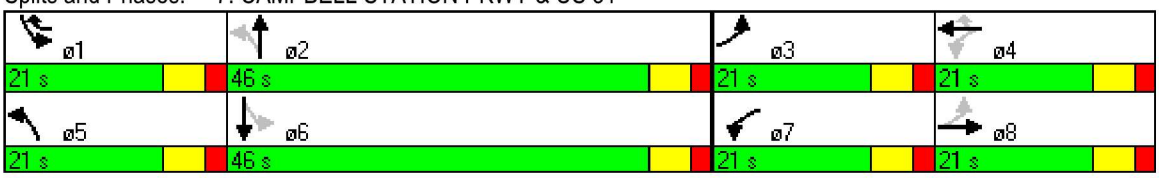
Offset: 46 (51%), Referenced to phase 2:NETL and 6:SWT, Start of Yellow

Splits and Phases: 5: BEECHCROFT RD & US 31

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBTL	EBL	WBTL	NBL	SBTL	WBL	EBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	21	46	21	21	21	46	21	21
Maximum Split (%)	19.3%	42.2%	19.3%	19.3%	19.3%	42.2%	19.3%	19.3%
Minimum Split (s)	21	46	21	21	21	46	21	21
Yellow Time (s)	4	4	4	4	4	4	4	4
All-Red Time (s)	2	2	2	2	2	2	2	2
Minimum Initial (s)	5	9	5	5	5	4	5	5
Vehicle Extension (s)	4	5	4	4	4	5	4	4
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)								
Flash Dont Walk (s)								
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	21	67	88	0	21	67	88
End Time (s)	21	67	88	0	21	67	88	0
Yield/Force Off (s)	15	61	82	103	15	61	82	103
Yield/Force Off 170(s)	15	61	82	103	15	61	82	103
Local Start Time (s)	48	69	6	27	48	69	6	27
Local Yield (s)	63	0	21	42	63	0	21	42
Local Yield 170(s)	63	0	21	42	63	0	21	42

Intersection Summary	
Cycle Length	109
Control Type	Actuated-Uncoordinated
Natural Cycle	110

Splits and Phases: 7: CAMPBELL STATION PKWY & US 31



Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBTL	EBL	WBTL	NBL	SBTL	WBL	EBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	20	65	25	25	20	65	20	25
Maximum Split (%)	14.8%	48.1%	18.5%	18.5%	14.8%	48.1%	14.8%	18.5%
Minimum Split (s)	20	65	20	25	20	65	20	25
Yellow Time (s)	4	4	4	4	4	4	4	4
All-Red Time (s)	1	2	1	2	1	2	1	2
Minimum Initial (s)	5	10	5	5	5	10	5	7
Vehicle Extension (s)	2	5	3	3	2	5	3	3
Minimum Gap (s)	2	3	3	3	2	3	3	3
Time Before Reduce (s)	0	30	0	0	0	30	0	0
Time To Reduce (s)	0	30	0	0	0	30	0	0
Walk Time (s)								8
Flash Dont Walk (s)								15
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	20	85	110	0	20	85	105
End Time (s)	20	85	110	0	20	85	105	0
Yield/Force Off (s)	15	79	105	129	15	79	100	129
Yield/Force Off 170(s)	15	79	105	129	15	79	100	114
Local Start Time (s)	56	76	6	31	56	76	6	26
Local Yield (s)	71	0	26	50	71	0	21	50
Local Yield 170(s)	71	0	26	50	71	0	21	35

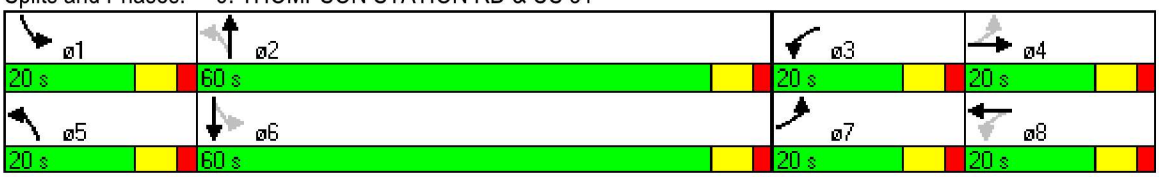
Intersection Summary	
Cycle Length	135
Control Type	Actuated-Uncoordinated
Natural Cycle	130

Splits and Phases: 8: BUCKNER RD & US 31

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBTL	WBL	EBTL	NBL	SBTL	EBL	WBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	20	60	20	20	20	60	20	20
Maximum Split (%)	16.7%	50.0%	16.7%	16.7%	16.7%	50.0%	16.7%	16.7%
Minimum Split (s)	20	60	20	20	20	60	20	20
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
All-Red Time (s)	2	2	2	2	2	2	2	2
Minimum Initial (s)	5	15	5	5	5	15	5	5
Vehicle Extension (s)	2	8	3	3	2	8	3	3
Minimum Gap (s)	2	5	3	3	2	5	3	3
Time Before Reduce (s)	0	30	0	0	0	30	0	0
Time To Reduce (s)	0	30	0	0	0	30	0	0
Walk Time (s)								
Flash Dont Walk (s)								
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	20	80	100	0	20	80	100
End Time (s)	20	80	100	0	20	80	100	0
Yield/Force Off (s)	13.5	73.5	93.5	113.5	13.5	73.5	93.5	113.5
Yield/Force Off 170(s)	13.5	73.5	93.5	113.5	13.5	73.5	93.5	113.5
Local Start Time (s)	46.5	66.5	6.5	26.5	46.5	66.5	6.5	26.5
Local Yield (s)	60	0	20	40	60	0	20	40
Local Yield 170(s)	60	0	20	40	60	0	20	40

Intersection Summary	
Cycle Length	120
Control Type	Actuated-Uncoordinated
Natural Cycle	120

Splits and Phases: 9: THOMPSON STATION RD & US 31



APPENDIX G

SIGNAL TIMING COMPARISIONS

Zone 1 Totals

Scenario #	1	2
Number of Intersections	6	6
Most Popular Cycle (s)	170.5	110
Alternative	Existing	Optimize
Timing Plan ID		
Data Time		
Control Delay / Veh (s/v)	20	16
Queue Delay / Veh (s/v)	0	0
Total Delay / Veh (s/v)	21	16
Total Delay (hr)	42	33
Stops / Veh	0.49	0.36
Stops (#)	3516	2601
Average Speed (mph)	21	23
Total Travel Time (hr)	106	98
Distance Traveled (mi)	2256	2256
Fuel Consumed (gal)	143	130
Fuel Economy (mpg)	15.8	17.4
CO Emissions (kg)	9.99	9.07
NOx Emissions (kg)	1.94	1.77
VOC Emissions (kg)	2.32	2.10
Unserved Vehicles (#)	8	8
Vehicles in dilemma zone (#)	165	218
Performance Index	51.4	40.3

Zone 1 Totals

Scenario #	1	2
Number of Intersections	6	6
Most Popular Cycle (s)	140.5	105
Alternative	Existing	Optimize
Timing Plan ID		
Data Time		
Control Delay / Veh (s/v)	20	15
Queue Delay / Veh (s/v)	0	0
Total Delay / Veh (s/v)	20	15
Total Delay (hr)	51	40
Stops / Veh	0.52	0.38
Stops (#)	4796	3498
Average Speed (mph)	22	24
Total Travel Time (hr)	139	128
Distance Traveled (mi)	3078	3078
Fuel Consumed (gal)	191	173
Fuel Economy (mpg)	16.1	17.8
CO Emissions (kg)	13.33	12.09
NOx Emissions (kg)	2.59	2.35
VOC Emissions (kg)	3.09	2.80
Unserved Vehicles (#)	0	0
Vehicles in dilemma zone (#)	248	257
Performance Index	64.2	49.6

Zone 1 Totals

Scenario #	1	2
Number of Intersections	6	6
Most Popular Cycle (s)	170.5	120
Alternative	Existing	Optimize
Timing Plan ID		
Data Time		
Control Delay / Veh (s/v)	25	23
Queue Delay / Veh (s/v)	0	1
Total Delay / Veh (s/v)	26	24
Total Delay (hr)	76	69
Stops / Veh	0.52	0.44
Stops (#)	5544	4609
Average Speed (mph)	20	21
Total Travel Time (hr)	179	172
Distance Traveled (mi)	3594	3594
Fuel Consumed (gal)	234	222
Fuel Economy (mpg)	15.3	16.2
CO Emissions (kg)	16.39	15.54
NOx Emissions (kg)	3.19	3.02
VOC Emissions (kg)	3.80	3.60
Unserved Vehicles (#)	40	54
Vehicles in dilemma zone (#)	222	329
Performance Index	91.5	82.0

PROJECT NO.	SHEET NO.
00.06966.001	1

TRAFFIC SIGNAL COORDINATION PROJECT

MAIN STREET (U.S. 31, SR-6)

CROSSINGS BLVD TO THOMPSON STATION RD

CITY OF SPRING HILL, TENNESSEE

PROJECT LOCATION

LOCATION MAP
SCALE: 1" = 1 MILE

PLANS PREPARED BY

NEEL-SCHAFFER
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RGPHILLIPS CONSULTING
TRAFFIC ENGINEERING & TRANSPORTATION PLANNING

NOTE :
UNLESS OTHERWISE SPECIFIED WITHIN THIS PLAN SET, ALL MATERIAL SPECIFICATIONS, CONSTRUCTION METHODS, AND OTHER MATTERS RELATED TO THIS PROJECT SHALL FOLLOW CURRENT TDOT SPECIFICATIONS AND DETAILS.

PLANS HAVE BEEN DEVELOPED WITH EXISTING DATA AVAILABLE FROM OUTSIDE SOURCES AND FIELD VISITS. ALL ITEMS INCLUDED AND SHOWN HEREIN ARE BELIEVED TO REFLECT EXISTING CONDITIONS TO A REASONABLE DEGREE OF ACCURACY. HOWEVER, THE CONTRACTOR HAS FINAL RESPONSIBILITY TO VERIFY ALL EXISTING CONDITIONS, INCLUDING BUT NOT LIMITED TO, UNDERGROUND UTILITIES, PROPERTY LINES AND DRAINAGE STRUCTURES. CONTRACTOR SHALL CONTACT LOCAL UTILITY OWNERS TO LOCATE ALL KNOWN UTILITIES PRIOR TO BEGINNING CONSTRUCTION.

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TITLE SHEET

TRAFFIC SIGNAL COORDINATION PROJECT
MAIN STREET (U.S. 31, SR-6)
CITY OF SPRING HILL, TENNESSEE

DATE: 10/2008

REVISIONS

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INDEX

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PROPOSED LAYOUT	4 - 9
SIGNAL TIMING DETAIL	4A – 9A
TRAFFIC CONTROL DETAILS	10 – 10B

STANDARD ROADWAY DRAWINGS

DWG. NO	REV.	DESCRIPTION
ROADWAY DESIGN STANDARDS		
RD-A-1	12-18-99	STANDARD ABBREVIATIONS
RD-L-1	10-26-94	STANDARD LEGEND
RD-L-3	04-15-04	STANDARD LEGEND FOR SIGNALIZATION AND LIGHTING
RD-L-4	04-15-04	STANDARD LEGEND FOR SIGNALIZATION AND LIGHTING
TRAFFIC CONTROL APPURTENANCES		
T-FAB-1	05-27-97	FLASHING YELLOW ARROW BOARD
T-SG-2	07-29-04	LOOP LEAD-INS CONDUIT AND PULL BOXES
T-SG-3	11-11-04	NOTES AND DETAILS OF INDUCTIVE LOOPS
T-SG-7	07-29-04	SIGNAL HEAD ASSEMBLIES AND PEDESTRIAN PUSH BUTTON SIGNS
T-SG-7A	07-29-04	TYPICAL SIGN HEAD PLACEMENT
T-SG-8	07-29-04	STRAIN POLE DETAILS FOR SPAN MOUNTED SIGNALS
T-SG-9	11-16-07	DETAILS OF CANTILEVER SIGNAL SUPPORT
T-SG-9A		MISCELLANEOUS SIGNAL DETAILS
T-SG-12	07-29-04	TYPICAL WIRING FOR SIGNAL HEADS AND DETECTION LOOPS
T-WZ-40	09-01-05	RIGHT LANE CLOSURES AT NEAR SIDE OF INTERSECTIONS
T-WZ-50	07-29-03	TRAFFIC CONTROL FOR SIGNALS ONLY PROJECTS ON 2 OR 3 LANE MAJOR ROUTES
T-WZ-51	07-29-03	TRAFFIC CONTROL FOR SIGNALS ONLY PROJECTS ON 4 OR 5 LANE MAJOR ROUTES

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INDEX AND STANDARD DRAWINGS

TRAFFIC SIGNAL COORDINATION PROJECT
MAIN STREET (U.S. 31, SR-6)
CITY OF SPRING HILL, TENNESSEE

GREGORY D. JUDY
STATE OF TENNESSEE

DSGN: GDJ		REVISIONS
DRWN: LRD		
CHKD:		
SCALE: NONE		
PROJ. NO: 6966.001		

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SHEET NO.
1A

GENERAL NOTES

UTILITIES

(1) THE LOCATIONS OF UTILITIES SHOWN, WHERE SHOWN WITHIN THESE PLANS, ARE APPROXIMATE ONLY. EXACT LOCATIONS SHALL BE DETERMINED IN THE FIELD BY CONTACTING THE UTILITY COMPANIES INVOLVED. NOTIFICATION BY CALLING THE TENNESSEE ONE CALL SYSTEM, INC., AT 1-800-351-1111 AS REQUIRED BY TCA 65-31-106 WILL BE REQUIRED.

(2) THE CONTRACTOR WILL PROVIDE ALL NECESSARY PROTECTIVE MEASURES TO SAFEGUARD EXISTING UTILITIES FROM DAMAGE DURING CONSTRUCTION OF THIS PROJECT. IN THE EVENT THAT SPECIAL EQUIPMENT IS REQUIRED TO WORK OVER AND AROUND THE UTILITIES, THE CONTRACTOR WILL BE REQUIRED TO FURNISH SUCH EQUIPMENT. THE COST OF PROTECTING UTILITIES FROM DAMAGE AND FURNISHING SPECIAL EQUIPMENT WILL BE INCLUDED IN THE PRICE BID FOR OTHER ITEMS OF CONSTRUCTION.

(3) THE CONTRACTOR SHALL NOTIFY EACH INDIVIDUAL UTILITY OWNER OF HIS PLAN OF OPERATION IN THE AREA OF THE UTILITIES. PRIOR TO COMMENCING WORK, THE CONTRACTOR SHALL CONTACT THE UTILITY OWNERS AND REQUEST THEM TO PROPERLY LOCATE THEIR RESPECTIVE UTILITY ON THE GROUND. THIS NOTIFICATION SHALL BE GIVEN AT LEAST THREE (3) BUSINESS DAYS PRIOR TO COMMENCEMENT OF OPERATIONS AROUND THE UTILITY IN ACCORDANCE WITH TCA 65-31-106.

MISCELLANEOUS

(4) NOTHING IN THE GENERAL NOTES OR SPECIAL PROVISIONS SHALL RELIEVE THE CONTRACTOR FROM HIS RESPONSIBILITIES TOWARD THE SAFETY AND CONVENIENCE OF THE GENERAL PUBLIC AND THE RESIDENTS ALONG THE PROPOSED CONSTRUCTION AREA

SIGNALIZATION

(5) EQUIPMENT AND INSTALLATION OF TRAFFIC SIGNALS SHALL COMPLY WITH TDOT STANDARD SPECIFICATIONS, SECTION 730.

(6) SALVAGEABLE EQUIPMENT SHALL BECOME THE PROPERTY OF THE CITY OF SPRING HILL AND SHALL BE STOCKPILED AT A LOCATION DESIGNATED BY THE ENGINEER FOR PICKUP BY THE CITY.

(7) ANY SIGNAL HEADS, WHEN VISIBLE TO DRIVERS BUT NOT OPERATIONAL, SHALL BE COMPLETELY COVERED.

(8) LOOP REPLACEMENT SHALL BE IN ACCORDANCE WITH SECTION 730 OF THE STANDARD SPECIFICATIONS.

CONSTRUCTION WORK ZONE & TRAFFIC CONTROL NOTES

(9) ADVANCED WARNING SIGNS SHALL NOT BE DISPLAYED MORE THAN FORTY-EIGHT (48) HOURS BEFORE PHYSICAL CONSTRUCTION BEGINS. SIGNS MAY BE ERECTED UP TO ONE WEEK BEFORE NEEDED, IF THE SIGN FACE IS FULLY COVERED.

(10) IF THE CONTRACTOR MOVES OFF THE PROJECT, HE SHALL COVER OR REMOVE ALL UNNEEDED SIGNS AS DIRECTED BY THE ENGINEER. COSTS OF REMOVAL, COVERING, AND REINSTALLING SIGNS SHALL NOT BE MEASURED AND PAID FOR SEPARATELY, BUT ALL COSTS SHALL BE INCLUDED IN THE ORIGINAL UNIT PRICE BID FOR ITEM NO 712-01, TRAFFIC CONTROL (LUMP SUM).

(11) A LONG TERM BUT SPORADIC USE WARNING SIGN, SUCH AS A FLAGGER SIGN, MAY REMAIN IN PLACE WHEN NOT REQUIRED PROVIDED THE SIGN FACE IS FULLY COVERED.

(12) TRAFFIC CONTROL DEVICES SHALL NOT BE DISPLAYED OR ERECTED UNLESS RELATED CONDITIONS ARE PRESENT NECESSITATING WARNING.

(13) USE OF BARRICADES, PORTABLE BARRIER RAILS, VERTICAL PANELS, AND DRUMS SHALL BE LIMITED TO THE IMMEDIATE AREAS OF CONSTRUCTION WHERE A HAZARD IS PRESENT. THESE DEVICES SHALL NOT BE STORED ALONG THE ROADWAY WITHIN THIRTY (30) FEET OF THE EDGE OF THE TRAVELED WAY BEFORE OR AFTER USE UNLESS PROTECTED BY GUARDRAIL, BRIDGE RAIL, AND/OR BARRIERS INSTALLED FOR OTHER PURPOSES FOR ROADWAYS WITH CURRENT ADT'S LESS THAN 1500 AND DESIGN SPEED OF LESS THAN 60 MPH. THIS DISTANCE SHALL INCREASE TO FORTY-FIVE (45) FEET FOR ROADWAYS WITH CURRENT ADT'S OF 1500 OR GREATER AND DESIGN SPEED OF 60 MPH OR GREATER OR ON THE OUTSIDE OF A HORIZONTAL CURVE. THESE DEVICES SHALL BE REMOVED FROM THE CONSTRUCTION WORK ZONE WHEN THE ENGINEER DETERMINES THEY ARE NO LONGER NEEDED. WHERE THERE IS INSUFFICIENT RIGHT-OF-WAY TO PROVIDE FOR THIS REQUIRED SETBACK, THE CONTRACTOR SHALL DETERMINE THE ALTERNATE LOCATIONS AND REQUEST THE ENGINEER'S APPROVAL TO USE THEM.

(14) THE CONTRACTOR SHALL NOT BE PERMITTED TO PARK ANY VEHICLES OR CONSTRUCTION EQUIPMENT DURING PERIODS OF INACTIVITY, WITHIN THIRTY (30) FEET OF THE EDGE OF PAVEMENT WHEN THE LANE IS OPEN TO TRAFFIC UNLESS PROTECTED BY GUARDRAIL, BRIDGE RAIL, AND/OR BARRIERS INSTALLED FOR OTHER PURPOSES FOR ROADWAYS WITH CURRENT ADT'S LESS THAN 1500 AND DESIGN SPEED OF LESS THAN 60 MPH. THIS DISTANCE SHALL BE INCREASED TO FORTY-FIVE (45) FEET FOR ROADWAYS WITH CURRENT ADT'S OF 1500 OR GREATER AND DESIGN SPEED OF 60 MPH OR GREATER OR ON THE OUTSIDE OF A HORIZONTAL CURVE. PRIVATELY OWNED VEHICLES SHALL NOT BE ALLOWED TO PARK WITHIN THIRTY (30) FEET OF A OPEN TRAFFIC LANE AT ANY TIME UNLESS PROTECTED AS DESCRIBED ABOVE FOR ROADWAYS WITH CURRENT ADT'S LESS THAN 1500 AND DESIGN SPEED OF LESS THAN 60 MPH. THIS DISTANCE SHALL BE INCREASED TO FORTY-FIVE (45) FEET FOR ROADWAYS WITH CURRENT ADT'S OF 1500 OR GREATER AND DESIGN SPEED OF 60 MPH OR GREATER OR ON THE OUTSIDE OF A HORIZONTAL CURVE.. WHERE THERE IS INSUFFICIENT RIGHT-OF-WAY TO PROVIDE FOR THIS REQUIRED SETBACK, THE CONTRACTOR SHALL DETERMINE THE ALTERNATE LOCATIONS AND REQUEST THE ENGINEER'S APPROVAL TO USE THEM.

(15) ALL DETOUR AND CONSTRUCTION SIGNING SHALL BE IN STRICT ACCORDANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.

EROSION PREVENTION AND SEDIMENT CONTROL NOTES

(16) IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO PROTECT FROM EROSION ANY EXPOSED EARTH RESULTING FROM TRENCHING AND EXCAVATION, AND TO PROVIDE FOR CONTAINMENT OF SEDIMENT THAT MAY RESULT FROM THIS WORK. PRIOR TO BEGINNING WORK, ADEQUATE MEASURES MUST BE IN PLACE TO TRAP ANY SEDIMENT THAT MAY TRAVEL OFF-SITE IN THE EVENT OF RAIN. DURING THE PROGRESSION OF THE WORK, EXPOSED EARTH AREAS SHALL BE STABILIZED AS SOON AS POSSIBLE TO PREVENT EROSION. AT NO TIME SHALL EXPOSED EARTH RESULTING FROM THESE OPERATIONS HAVE UNPROTECTED ACCESS TO FLOWING OFF-SITE AND ENTERING WATERS OF THE STATE/U.S.

(17) SILT FENCE SHALL BE INSTALLED ON THE DOWNHILL SIDE OF STOCKPILED SOIL. POLYETHYLENE SHEETING MAY BE USED TO COVER SPOILS FROM EXCAVATION.

(18) RAIN WATER WHICH COLLECTS IN THE EXCAVATIONS (TRENCHES OR FOUNDATION EXCAVATIONS) SHALL BE PUMPED INTO A TEMPORARY DEWATERING STRUCTURE OR SEDIMENT FILTER BAG AND MAINTAINED.

(19) TRENCHING ACROSS WET WEATHER CONVEYANCES SHALL BE DONE DURING NO FLOW CONDITIONS AND STABILIZED BY THE END OF THE WORK DAY.

(20) THE CONTRACTOR SHALL RESTORE ALL AFFECTED WET WEATHER CONVEYANCES TO THE EXISTING TOPOGRAPHIC CONDITIONS (AS INDICATED BY THE APPROVED EROSION PREVENTION AND SEDIMENT CONTROL OR THE TDOT PROJECT ENGINEER).

(21) FOR THE INSTALLATION OF CONDUITS AND CABLES, TRENCHES SHALL BE BACKFILLED DAILY AS CONSTRUCTION PROCEEDS. BACKFILLED TRENCHES SHALL BE SEEDED AND MULCHED OR SODDED DAILY IF POSSIBLE, BUT NO LATER THAN SEVEN DAYS AFTER BEING BACKFILLED, OR IMMEDIATELY AFTER ANY INSPECTION. ANY TEMPORARY SPOIL OF EXCAVATED EARTH SHALL BE LOCATED WITHIN TDOT EROSION PREVENTION AND SEDIMENT CONTROL MEASURES. IF TRENCHES ARE NOT BACKFILLED OVERNIGHT, APPROPRIATE EPSC MEASURES WILL BE INSTALLED BY THE CONTRACTOR UNTIL SUCH TIME AS THE TRENCH IS BACKFILLED.

(22) SPOILS FROM FOUNDATION EXCAVATIONS SHALL BE PICKED UP AS BORING PROGRESSES, OR CONTAINED WITHIN APPROPRIATE EROSION CONTROL DEVICES.

SPECIAL NOTES

GPS SYNCHRONIZATION EQUIPMENT SPECIAL PROVISIONS

(1) CONTRACTOR SHALL INSTALL GPS SYNCHRONIZATION UNIT AND PROGRAM DAILY CONTROLLER TIME CLOCK RESET, TIME-OF-DAY CONTROLLER COORDINATED TIMINGS AND SETTINGS AS SHOWN IN PLANS. CONTRACTOR SHALL FOLLOW MANUFACTURER RECOMMENDATIONS AND INSTRUCTIONS FOR INSTALLATION AND CONFIGURATION OF EQUIPMENT. EXISTING SIGNAL CABINETS SHALL BE MODIFIED PER TDOT STANDARDS AND MANUFACTURER RECOMMENDATIONS TO ACCEPT AND IMPLEMENT GPS CLOCK SYNCHRONIZATION.

(2) CONTRACTOR TO PROVIDE AND INSTALL A GPS-BASED TIME SYNCHRONIZATION UNIT (MODEL TR-3 BY RTC MANUFACTURING, INC, OR APPROVED EQUIVALENT). UNIT SHALL INCLUDE GPS ANTENNA, PROGRAMMABLE GPS RECEIVER (TIME SWITCH) ANCILLARY CABLES AND HARNESSES, AND OTHER APPURTENANCES NECESSARY FOR INSTALLATION AND FULL FUNCTIONALITY. ALL COMPONENTS SHALL BE DESIGNED IN ACCORDANCE WITH NEMA STANDARDS FOR THE ENVIRONMENTAL CONDITIONS PRESENT WITHIN AND NEAR A TRAFFIC SIGNAL CABINET. PAYMENT FOR PROVIDING THE GPS UNIT EQUIPMENT WILL BE PAID AND MEASURED UNDER ITEM NUMBER 730-19.01 TIME BASE COORDINATION UNIT.

(3) THE PROPOSED GPS ANTENNA SHALL BE EXTERNALLY MOUNTED ON THE SIDE OF THE TRAFFIC SIGNAL CABINET. PENETRATION OF THE TOP OF THE CABINET WILL NOT BE ALLOWED. THE MODIFICATIONS TO THE CABINET AND THE MOUNTING OF THE GPS ANTENNA SHALL BE A WATERPROOF CONNECTION. PRIOR TO FINAL MOUNTING, CONTRACTOR SHALL ENSURE THE MOUNTING POSITION RESULTS IN THE GPS UNIT SUCCESSFULLY RECEIVING A GPS COMMUNICATION SIGNAL. MANUFACTURER DIRECTIONS AND RECOMMENDATIONS SHALL BE FOLLOWED FOR TESTING AND MOUNTING THE GPS UNIT.

(4) THE GPS RECEIVER SHALL BE ABLE TO SEND AN ELECTRICAL CONTACT CLOSURE SIGNAL TO THE SIGNAL CONTROLLER THAT RESETS THE SIGNAL CONTROLLERS TIME CLOCK TO A TIME PROGRAMMED IN THE SIGNAL CONTROLLER. THE GPS RECEIVER SHALL BE CAPABLE OF SYNCHRONIZING THE SIGNAL CONTROLLER CLOCK TO A GPS TIME REFERENCE SIGNAL A MINIMUM OF ONCE PER DAY. THE TIME AT WHICH THE CLOCK SYNCHRONIZATION OCCURS SHALL BE USER PROGRAMMABLE UP TO A 30 MINUTE INTERVAL ON THE GPS RECEIVER. WHEN THE SIGNAL CONTROLLER RECEIVES THE CONTACT CLOSURE SIGNAL, THE SIGNAL CONTROLLER SHALL AUTOMATICALLY UPDATE ITS TIME CLOCK TO THE TIME PRE-PROGRAMMED IN THE SIGNAL CONTROLLER. TYPICALLY, THIS SETTING IS FOUND UNDER THE TIME OF DAY-SYNC REFERENCE MENU ON A PEEK 3000/3000E SIGNAL CONTROLLER. THE EXTERNAL TIME CLOCK RESET SETTING SHALL BE PROGRAMMED ON EACH SIGNAL CONTROLLER TO THE DESIRED SYNCHRONIZATION TIME. THE RESET TIME PROGRAMMED IN THE SIGNAL CONTROLLER SHALL MATCH THE TIME SET ON THE GPS RECEIVER. ALL SIGNAL CONTROLLERS AND GPS UNIT RECEIVERS SHALL BE PROGRAMMED, CONFIGURED AND INSTALLED SO THAT THE TIME CLOCK SYNCHRONIZATION OCCURS AT 3:00 AM EVERY DAY.

(5) THE GPS UNIT RECEIVER SHALL MEET THE FOLLOWING OPERATIONAL PARAMETERS. THE GPS RECEIVER SHALL BE ABLE TO BE PROGRAMMED MANUALLY WITHOUT THE USE OF A SOFTWARE PROGRAM, COMPUTER OR SPECIALIZED TOOLS OR EQUIPMENT. THE UNIT SHALL BE CONFIGURABLE FOR DAYLIGHT SAVINGS TIME ADJUSTMENT (TOGGLE ON/OFF) AND TIME ZONE. THE DAYLIGHT SAVINGS TIME SETTING SHALL BE SET TO "ON" SO THAT IT WILL BE ACCOUNTED FOR. THE TIME ZONE SETTING SHALL BE SET FOR LOCAL TIME (CENTRAL ZONE). THE GPS RECEIVER SHALL BE ABLE TO BE PROGRAMMED WITH THE DESIRED TIME FOR THE TIME CLOCK SYNCHRONIZATION. IT SHALL ALSO BE POSSIBLE TO PROGRAM THE GPS RECEIVER FOR A SPECIFIC DAY OF WEEK OR BE PROGRAMMED TO AN "EVERY DAY" SETTING. FOR PURPOSES OF THIS PROJECT, THE RECEIVER SHALL BE PROGRAMMED TO SYNCHRONIZE EVERY DAY OF THE WEEK (I.E. DAILY) AT 3:00 AM. THE GPS RECEIVER SHALL PROVIDE AND HAVE A LCD DISPLAY CAPABLE OF SHOWING CURRENT SYNCHRONIZATION PROGRAM AND ACQUISITION OF SATELLITE SIGNAL.

(6) THE GPS SYNCHRONIZATION UNIT SHALL BE CONFIGURED TO PROVIDE COMPATIBILITY WITH THE EXISTING SIGNAL CONTROLLER. A MANUFACTURER'S USER REFERENCE MANUAL SHALL BE PROVIDED TO THE CITY OF SPRING HILL'S PUBLIC WORKS DEPARTMENT. A 12 MONTH MINIMUM WARRANTY SHALL BE PROVIDED FOR LABOR AND MATERIALS FOR ALL WORK AND EQUIPMENT RELATED TO THE GPS SYNCHRONIZATION UNIT AND ITS OPERATION.

GENERAL NOTES AND SPECIAL NOTES

TRAFFIC SIGNAL COORDINATION PROJECT
MAIN STREET (U.S. 31, SR-6)
CITY OF SPRING HILL, TENNESSEE

DSGN: GDJ		REVISIONS
DRWN: LRD		
CHKD:		
SCALE: NONE		
PROJ. NO: 6966.001		

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SPECIAL NOTES

GPS SYNCHRONIZATION EQUIPMENT SPECIAL PROVISIONS (CONTINUED)

(7) THE CONTRACTOR SHALL MODIFY THE CABINET AS NECESSARY TO INSTALL AND IMPLEMENT THE GPS SYNCHRONIZATION UNIT AND ITS CONNECTION TO THE SIGNAL CONTROLLER. THE CONTRACTOR SHALL REFER TO THE GPS UNIT AND SIGNAL CONTROLLER'S MANUFACTURER FOR DIRECTIONS AND METHOD TO IMPLEMENT THE CONNECTION BETWEEN THE GPS RECEIVER AND THE APPLICABLE INPUT SIGNAL TO THE SIGNAL CONTROLLER. THE CONTRACTOR SHALL SELECT THE APPROPRIATE PIN INPUT OF THE EXISTING SIGNAL CONTROLLER THAT ACTIVATES AND ACCEPTS AN EXTERNAL HARD TIME-CLOCK RESET FUNCTION. WHEN THE EXTERNAL TIME RESET (CONTACT CLOSURE) SIGNAL IS RECEIVED BY THE SIGNAL CONTROLLER FROM THE GPS RECEIVER, THE SIGNAL CONTROLLER SHALL AUTOMATICALLY RESET ITS TIME CLOCK TO THE TIME PROGRAMMED IN ITS SYNC REFERENCE (TIME CLOCK RESET) SETTINGS. THE CONTRACTOR SHALL MAKE ALL NEEDED SETTINGS AND EQUIPMENT MODIFICATIONS TO THE SIGNAL CONTROLLER TO IMPLEMENT THE TIME CLOCK SYNCHRONIZATION. THE CORRECT DAYLIGHT SAVINGS TIME SETTINGS SHALL BE PROGRAMMED AND CONFIRMED IN THE SIGNAL CONTROLLER BY THE CONTRACTOR. PAYMENT FOR LABOR AND MISCELLANEOUS MATERIALS REQUIRED TO ALLOW THE CABINET TO ACCEPT AND IMPLEMENT THE GPS UNIT AND SYNCHRONIZATION SIGNAL SHALL BE PAID UNDER 730-15.10 MODIFY CABINET (INSTALL COORDINATION UNIT)

MISCELLANEOUS

(8) PROJECT INCLUDES PROGRAMMING AND IMPLEMENTATION OF PROPOSED COORDINATED SIGNAL TIMINGS. CONTRACTOR IS RESPONSIBLE FOR ENTERING COORDINATED SIGNAL TIMING PLANS. THIS INCLUDES PROGRAMMING MISCELLANEOUS SIGNAL CONTROLLER SETTINGS AND PARAMETERS THAT ARE REQUIRED TO INITIATE AND OPERATE TIME-OF-DAY COORDINATION. CONTRACTOR HAS FINAL RESPONSIBILITY TO COMPLETE ALL CONTROLLERS PROGRAMMING AND CONFIRM SIGNAL CONTROLLERS ARE OPERATING TIME-OF-DAY COORDINATION AS SHOWN IN THE PLANS.

(9) THE CONTRACTOR IS RESPONSIBLE FOR ENTERING AND PROGRAMMING THE EXISTING SIGNAL CONTROLLERS WITH THE TIME-OF-DAY COORDINATION SETTINGS SHOWN IN THE PLANS. THIS INCLUDES APPLICABLE CYCLE-OFFSET-SPLIT ASSIGNMENTS, TIME OF DAY PLAN SETTINGS AND COORDINATION SET-UP AND CONFIGURATION SETTINGS. LABOR FOR THIS EFFORT WILL BE PAID FOR UNDER ITEM NUMBER 730-15.11 MODIFY CABINET (PROGRAM CONTROLLER COORDINATION SETTINGS).

(10) THE CONTRACTOR SHALL PROVIDE UP TO TWO (2) HOURS OF INSTRUCTIONAL TRAINING BY QUALIFIED REPRESENTATIVE OF THE MANUFACTURER OR DISTRIBUTOR TO THE CITY OF SPRING HILL PUBLIC WORKS STAFF ON THE PROGRAMMING OF THE GPS SYNCHRONIZATION UNIT AND ITS CONNECTION AND OPERATION WITH THE SIGNAL CONTROLLER. THE TRAINING SHOULD FOLLOW THE MATERIALS AND RECOMMENDATIONS AVAILABLE FROM THE GPS UNIT MANUFACTURER. PAYMENT TO BE MADE UNDER ITEM NUMBER 725-03.76 TRAINING.

(11) ALL CIRCULAR AND ARROW INDICATIONS WITHIN ALL VEHICULAR SIGNAL HEADS PROPOSED FOR THIS PROJECT SHALL CONSIST OF AN LED (LIGHT EMITTING DIODE) SIGNAL MODULE UNLESS OTHERWISE NOTED IN THE PLANS

(12) CIRCULAR INDICATIONS SHALL MEET "ITE VTCSH-LED CIRCULAR SIGNAL SUPPLEMENT" FOR EXPANDED/EXTENDED VIEW. ARROW INDICATIONS SHALL MEET "ITE VTCSH-3 LED ARROW SPECIFICATION" FOR EXPANDED/EXTENDED VIEW. PEDESTRIAN INDICATIONS SHALL MEET "ITE PTCSI PART 2".

(13) INCANDESCENT OR SCREW-IN MODULES ARE NOT ACCEPTABLE.

(14) COMPATIBILITY WITH CONFLICT MONITORS AND LOAD SWITCHES SHALL BE TESTED AND CONFIRMED.

(15) MANUFACTURER SHALL PROVIDE A MINIMUM FIVE YEAR WARRANTY FOR OPERATION OF THE UNIT.

(16) ALL SPAN WIRE MOUNTED SIGNAL HEADS SHALL INCLUDE SWIVEL BALANCE ADJUSTERS TO MAINTAIN THE PROPER VISIBILITY. COSTS OF ADJUSTERS TO BE INCLUDED IN COSTS OF SIGNAL HEADS.

(17) THE ATTACHMENT OF THE TETHER WIRE TO THE POLE SHALL BE LOCATED BELOW THE LOWEST ELEVATION OF THE SIGNAL HEADS.

(18) INTERSECTION LAYOUT SCHEMATICS ARE FOR GUIDANCE ONLY. NO FIELD SURVEY WAS PERFORMED AS PART OF PROJECT. INFORMATION SHOWN IS BASED ON FIELD INSPECTION AND THIRD-PARTY CAD/GIS DATA. ACTUAL CONDITIONS MAY VARY FROM THAT SHOWN ON PLANS. CONTRACTOR SHALL VERIFY EXISTING FIELD CONDITIONS BEFORE BEGINNING CONSTRUCTION AND REPORT ANY DISCREPANCIES TO THE ENGINEER IMMEDIATELY.

(19) CONTRACTOR SHALL INSPECT AND CONFIRM ALL EXISTING INDUCTIVE LOOPS AND VEHICLE LOOP DETECTORS ARE FUNCTIONING PROPERLY. IF ANY MALFUNCTIONS OR FAULTS ARE FOUND, INDUCTIVE LOOPS AND/OR VEHICLE LOOP DETECTORS SHALL BE REPLACED AT THE CONTRACT BID PRICE PER TDOT SPECIFICATIONS. CONTRACTOR SHALL COORDINATE AND RECEIVE PRIOR APPROVAL FROM CITY ENGINEER BEFORE REPAIRING OR REPLACING EXISTING LOOPS.

(20) EXCEPT FOR THE PROPOSED EQUIPMENT TO BE INSTALLED AND THE PROGRAMMING / IMPLEMENTATION OF THE COORDINATED SIGNAL TIMINGS, THE EXISTING OPERATION OF THE PROJECT TRAFFIC SIGNALS SHALL BE MAINTAINED. NO ADDITIONAL WORK IS PERMITTED WITHOUT PROPER AUTHORIZATION FROM THE CITY ENGINEER.

(21) WHERE SPECIFIED IN PLANS, CONTRACTOR SHALL INSTALL PROPOSED SIGNAL HEADS TO IMPLEMENT NEW SIGNAL HEAD INDICATIONS. EXISTING SIGNAL HEADS SHALL BE REMOVED AS SHOWN IN PLANS. CONTRACTOR SHALL MODIFY EXISTING CABINET AND CONTROLLER AS REQUIRED TO IMPLEMENT NEW SIGNAL HEADS. WHERE POSSIBLE CONTRACTOR SHOULD UTILIZE EXISTING UN-USED SPARE OR EXISTING CONDUIT STUBS IN CABINET FOR NEW WIRING. LABOR AND ANCILLARY MATERIALS REQUIRED TO REPLACE SIGNAL HEADS WILL BE PAID PER INTERSECTION UNDER ITEM NUMBER 730-15.12. MODIFY CABINET (REPLACEMENT OF SIGNAL HEADS). CONTRACTOR SHALL FIELD VERIFY EXISTING WIRING AND INSTALL/REPLACE REQUIRED WIRING AS NEEDED. WIRING QUANTITIES SHOWN IN PLANS SHOULD BE CONSIDERED ESTIMATES ONLY.

(22) CONTRACTOR SHALL INSTALL NEW INDUCTIVE VEHICLE LOOPS AND VEHICLE DETECTORS AS SHOWN IN PLANS PER TDOT SPECIFICATIONS. CONTRACTOR SHALL MODIFY CABINET AND CONTROLLER PROGRAMMING AS NEEDED TO ACCEPT AND IMPLEMENT PROPOSED DETECTION. IN SOME CASES, NEW ELBOW BEND OR ACCESS INTO CABINET MAY BE REQUIRED. LABOR AND ANCILLARY MATERIALS REQUIRED TO COMPLETE CABINET MODIFICATIONS FOR NEW LOOP INSTALLATION WILL BE PAID UNDER 730-15.13. MODIFY CABINET (INSTALL INDUCTIVE LOOPS). ALL NEW LOOP DETECTORS SHALL BE SHELF MOUNT TYPE WITH EXTEND-DELAY TIMING FEATURES.

(23) PROPOSED SIGNAL HEADS SHALL BE INSTALLED AND ALIGNED WITH ITS RESPECTIVE TRAVEL LANE PER TDOT SPECIFICATIONS AND STANDARD DRAWINGS (T-SG-7A).

(24) IF EPSC MEASURES ARE REQUIRED, CONTRACTOR SHALL INCLUDE COST OF EROSION PREVENTION AND SEDIMENT CONTROL IN OTHER ITEMS. EPSC SHALL FOLLOW CURRENT TDOT STANDARDS AND SPECIFICATIONS.

(25) WHERE APPLICABLE, CONTRACTOR SHOULD USE 1" CONDUIT STUB FOR INSTALLATION OF LOOP LEAD-IN CABLE. 1" CONDUIT STUB SHOULD BE INSTALLED BETWEEN EDGE-OF-PAVEMENT AND PULL BOX/POLE BASE. DIRECT BURIAL OF LOOP WIRE IS NOT ALLOWED.

(26) WHERE APPLICABLE, CONTRACTOR SHALL ADJUST TENSION IN SPAN WIRES AS NECESSARY TO MAINTAIN REQUIRED MINIMUM VERTICAL CLEARANCE WHERE SIGNAL HEADS ARE REPLACED.

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SPECIAL NOTES

TRAFFIC SIGNAL COORDINATION PROJECT
MAIN STREET (U.S. 31, SR-6)
CITY OF SPRING HILL, TENNESSEE

DSGN: GDJ		REVISIONS
DRWN: LRD		
CHKD:		
SCALE: NONE		
PROJ. NO: 6966.001		

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ESTIMATED ROADWAY QUANTITIES

	ITEM NO.	DESCRIPTION	UNIT	QUANTITY
5	712-01	TRAFFIC CONTROL	LS	1
	717-01	MOBILIZATION	LS	1
4	725-03.76	TRAINING	LS	1
1	730-01.02	REMOVAL OF SIGNAL EQUIPMENT	LS	1
	730-02.17	SIGNAL HEAD ASSEMBLY (150 A2H WITH BACKPLATE)	EACH	7
7	730-02.30	SIGNAL HEAD ASSEMBLY (140A1L W/ BACKPLATE)	EACH	2
	730-08.04	SIGNAL CABLE - 9 CONDUCTOR	L.F.	1100
3	730-12.01	CONDUIT 1" DIAMETER (PVC)	L.F.	100
	730-13.05	VEHICLE DETECTOR (EXT. CALL - DELAY CALL)	EACH	4
	730-14.01	SHIELDED DETECTOR CABLE	L.F.	290
	730-14.02	SAW SLOT	L.F.	600
	730-14.03	LOOP WIRE	L.F.	1200
4	730-15.10	MODIFY CABINET (INSTALL COORDINATION UNIT)	EACH	8
4	730-15.11	MODIFY CABINET (PROGRAM CONTROLLER SETTINGS)	EACH	8
	730-15.12	MODIFY CABINET (REPLACEMENT OF SIGNAL HEADS)	EACH	4
4	730-15.13	MODIFY CABINET (ADD DETECTION CHANNELS)	EACH	2
2	730-16.02	EIGHT PHASE ACTUATED CONTROLLER	EACH	1
6	730-19.01	TIME BASE COORDINATION UNIT	EACH	8

1. ITEM TO INCLUDE REMOVAL OF EXISTING SIGNAL HEADS (9 TOTAL) AT INTERSECTIONS SHOWN IN PLANS AND EXISTING SIGNAL CONTROLLER AT THOMPSON STATION RD
2. TO BE PEEK 3000E CONTROLLER AND COMPATIBLE WITH EXISTING THOMPSON STATION RD CABINET EQUIPMENT AND OTHER CONTROLLERS WITHIN PROJECT LIMITS
3. TO BE USED FOR LOOP LEAD-INS OR AS NEEDED FOR PROPOSED SIGNAL CABLE
4. SEE SPECIAL NOTES
5. CONTRACTOR SHALL FOLLOW TDOT STANDARD DRAWINGS AND PART VI OF THE MUTCD (CURRENT EDITION). ALL TRAFFIC CONTROL SHALL BE REVIEWED AND APPROVED BY ENGINEER. REQUIRED SIGNS INCLUDE, BUT ARE NOT LIMITED TO, "ROAD WORK AHEAD", "ROAD WORK 1000FT", "END ROAD WORK", AND FLAGGER SIGNS. SIGNS ARE CONSIDERED MOBILE AND SHALL BE RELOCATED AS REQUIRED FOR DURATION OF PROJECT. CONTRACTOR HAS FINAL RESPONSIBILITY FOR IMPLEMENTING AND MAINTAINING TRAFFIC CONTROL MEASURES PER TDOT AND MUTCD STANDARDS
6. ITEM FOR GPS RECEIVER, ANTENNA AND ANCILLARY MATERIALS. SEE SPECIAL NOTES FOR GPS SYNCHRONIZATION EQUIPMENT SPECIAL PROVISIONS
7. TO BE INSTALLED AT MAIN ST & BEECHCROFT RD / DUPLEX RD INTERSECTION

PROJECT DESCRIPTION

THE CONTRACTOR IS COMPLETELY RESPONSIBLE FOR INSTALLATION AND IMPLEMENTATION OF ALL EQUIPMENT AND PROGRAMMING SHOWN IN PLANS. CONTRACTOR SHALL PROVIDE FULLY- FUNCTIONING GPS SYNCRONIZED SIGNAL COORDINATION SYSTEM INCLUDING UPGRADES TO SIGNAL HEAD DISPLAYS, NEW INDUCTIVE LOOPS AND ASSOCIATED TRAFFIC SIGNAL MODIFICATIONS.

CONTRACTOR SHALL INSTALL AND IMPLEMENT TIME-BASED SIGNAL COORDINATION USING GPS EQUIPMENT. GPS EQUIPMENT SHALL MEET SPECIFICATIONS OUTLINED IN SPECIAL PROVISION DESCRIPTION. INSTALLATION METHODS AND MATERIALS SHALL MEET TENNESSEE DEPT OF TRANSPORTATION AND MANUFACTURER SPECIFICATIONS AND PROJECT SPECIAL PROVISIONS. CONTRACTOR IS RESPONSIBLE FOR ALL REQUIRED CONTROLLER PROGRAMMING NECESSARY TO INITIALIZE, SET-UP AND IMPLEMENT GPS SYNCHRONIZATION, CONTROLLER TIME CLOCK RESET, AND CONTROLLER SET -UP/ PROGRAMMING OF COORDINATION SETTINGS AND SIGNAL TIMINGS. CONTRACTOR SHALL FIELD VERIFY EXISTING SIGNAL CABINET AND CONTROLLER CONDITIONS PRIOR TO CONSTRUCTION. CONTRACTOR HAS FINAL RESPONSIBILTY FOR ALL CABINET MODIFICATIONS NECESSARY TO INSTALL AND IMPLEMENT PROPOSED EQUIPMENT.

ESTIMATED ROADWAY QUANTITIES

TRAFFIC SIGNAL COORDINATION PROJECT
MAIN STREET (U.S. 31, SR-6)
CITY OF SPRING HILL, TENNESSEE

GREGORY D. JUDY
STATE OF TENNESSEE

DSGN: GDJ		REVISIONS
DRWN: LRD		
CHKD:		
SCALE: NONE		
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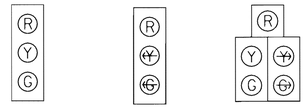
SIGNAL PHASING DIAGRAM (MAIN ST AT CROSSINGS BLVD)

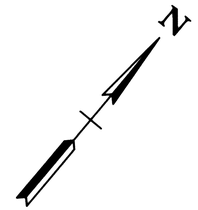
NOT USED Ø1	← Ø2	NOT USED Ø3	↑ Ø4
↰ Ø5	→ Ø6	NOT USED Ø7	NOT USED Ø8

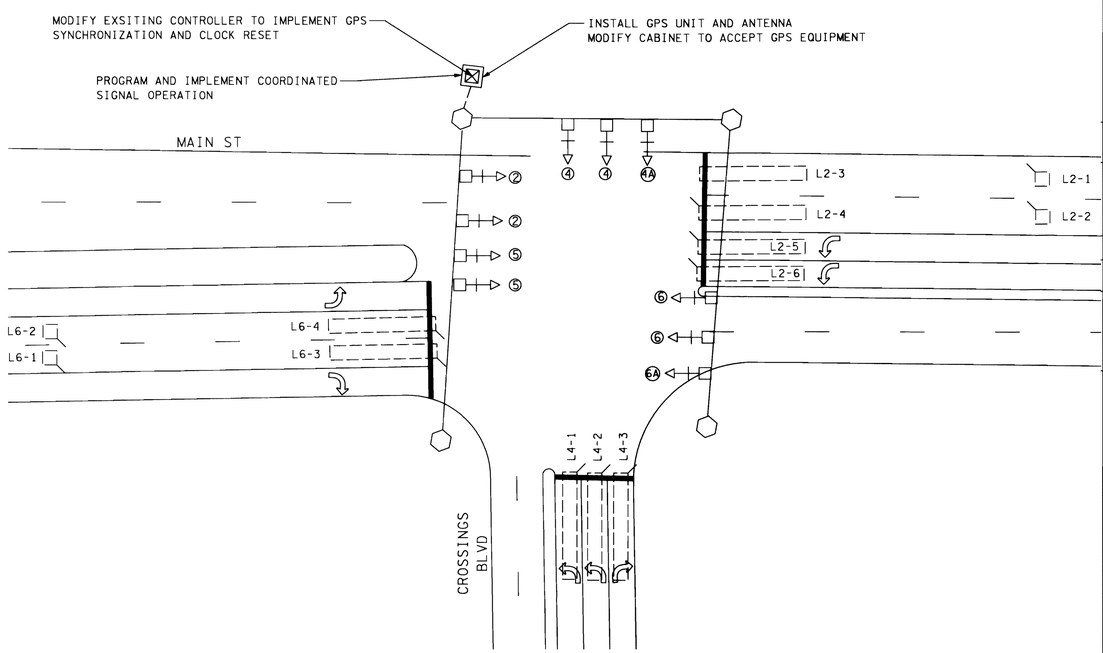
- MIN RECALL: Ø2,Ø6
- DUAL ENTRY: Ø2,Ø6
- PROT ONLY LEFT-TURN: Ø5
- CONCURRENT NB RT TURN ARROW WITH Ø4
  CONCURRENT WB RT TURN ARROW WITH Ø5
- COORD PHASE: Ø2,Ø6

SIGNAL HEADS



TYPE 130 EXISTING 2,6 | TYPE 130A2L EXISTING 4,5 | TYPE 150A2H EXISTING 4A,6A





NOTES

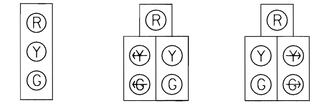
1. INSTALL GPS UNIT AND ALL ANCILLARY EQUIPMENT. MODIFY CABINET TO ACCEPT GPS SYNCHRONIZATION EQUIPMENT. PROGRAM EXISTING PEEK 3000E CONTROLLER TO ACCEPT, OPERATE AND IMPLEMENT GPS TIME CLOCK RESET TO TIME DESIGNATED IN PLANS. IMPLEMENT GPS SYNCHRONIZATION.

2. PROGRAM EXISTING CONTROLLER WITH COORDINATED TIMINGS AND SETTINGS, INCLUDING BUT NOT LIMITED TO, COORD SET-UP SETTINGS, CYCLE-OFFSET-SPLIT ASSIGNMENTS AND TIME-OF-DAY PLAN ASSIGNMENTS. IMPLEMENT AND CONFIRM COORDINATION OPERATION AS SPECIFIED IN PLANS.

3. EXISTING CABINET DOES NOT INCLUDE "PREEMPT" SIDE RELAY WIRING PANEL.

4. THE SOUTHBOUND PROTECTED-ONLY DUAL LEFT MOVEMENT (PHASE 5) SHALL BE PROGRAMMED FOR PHASE REVERSAL OPERATION. PHASE 2 AND 5 SHALL BE REVERSED ELECTRONICALLY TO CREATE A LAGGING LEFT-TURN FOR THE SOUTHBOUND APPROACH. THE CONTROLLER SHALL BE PROGRAMMED TO INDICATE THIS ALTERNATE PHASE SEQUENCE IS "ALWAYS ACTIVATED" WHICH IS SPECIFIED AS AS MODE 4 IN PEEK 3000 CONTROLLERS.

SIGNAL HEADS

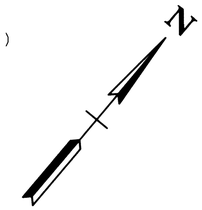


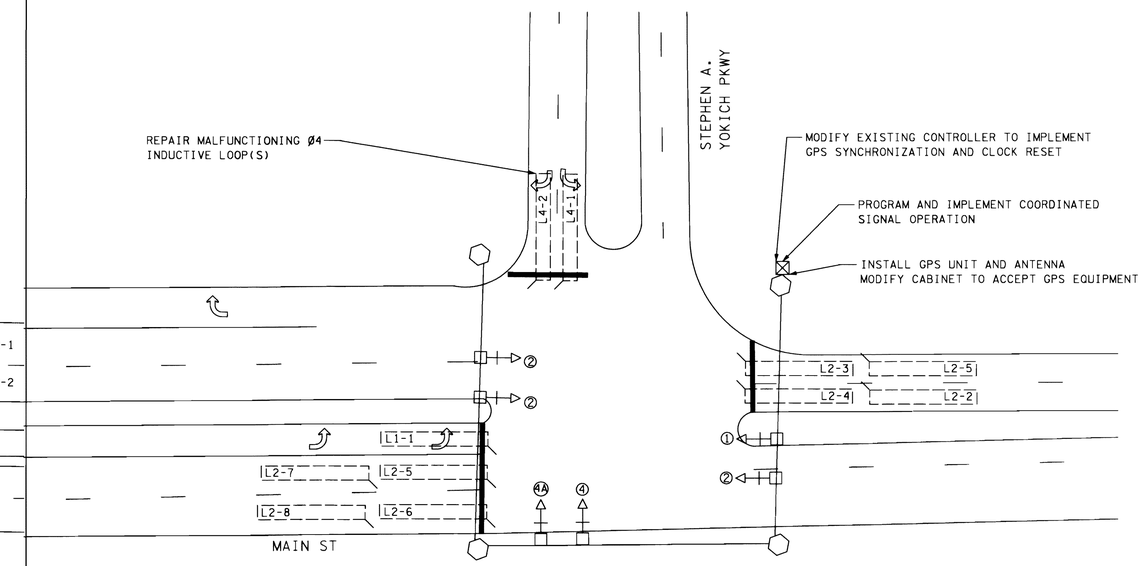
TYPE 130 EXISTING 2,4 | TYPE 150A2L EXISTING 1 | TYPE 150A2R EXISTING 4A

SIGNAL PHASING DIAGRAM (MAIN ST AT STEPHEN A. YOKICH PKWY)

↰ Ø1	← → Ø2	NOT USED Ø3	↓ Ø4

- MIN RECALL: Ø2
- PROT-PERM LEFT-TURN: Ø1
- CONCURRENT EB RT TURN ARROW WITH Ø1
- COORD PHASE: Ø2





NOTES

1. INSTALL GPS UNIT AND ALL ANCILLARY EQUIPMENT. MODIFY CABINET TO ACCEPT GPS SYNCHRONIZATION EQUIPMENT. PROGRAM EXISTING PEEK 3000 CONTROLLER TO ACCEPT, OPERATE AND IMPLEMENT GPS TIME CLOCK RESET TO TIME DESIGNATED IN PLANS. IMPLEMENT GPS SYNCHRONIZATION.

2. PROGRAM EXISTING CONTROLLER WITH COORDINATED TIMINGS AND SETTINGS, INCLUDING BUT NOT LIMITED TO, COORD SET-UP SETTINGS, CYCLE-OFFSET-SPLIT ASSIGNMENTS AND TIME-OF-DAY PLAN ASSIGNMENTS. IMPLEMENT AND CONFIRM COORDINATION OPERATION AS SPECIFIED IN PLANS.

3. FIELD INSPECTION FOUND PHASE 4 INDUCTIVE LOOP DETECTOR ON "FAULT". CONTRACTOR SHALL IDENTIFY CAUSE OF MALFUNCTION, REPAIR/REPLACE DEFECTIVE EQUIPMENT AND CONFIRM PROPER OPERATION OF PHASE 4 DETECTION.

4. EXISTING CABINET INCLUDES "PREEMPT" SIDE RELAY WIRING PANEL.

PROPOSED LAYOUT

TRAFFIC SIGNAL COORDINATION PROJECT
MAIN STREET (U.S. 31, SR-6)
CITY OF SPRING HILL, TENNESSEE

GREGORY D. JUDY REGISTERED ENGINEER COMMERCE STATE OF TENNESSEE

		REVISIONS
DSGN: GDJ		
DRWN: LRD		
CHKD:		
SCALE: 1" = 30'		
PROJ. NO: 6966.001		

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CONTROLLER PROGRAMMING DATA								
	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5	PHASE 6	PHASE 7	PHASE 8
MOVEMENT	-	SB	-	WB	SBL	NB	-	-
PHASE DATA								
MIN GREEN		15.0		8.0	8.0	15.0		
PASSAGE TIME				2.5	2.5			
MAXIMUM I		50.0		30.0	25.0	50.0		
MAXIMUM II								
YELLOW								
RED								
WALK								
PED CLEAR								
ADDED INITIAL								
MAX INITIAL								
TIME BEFORE REDUC								
TIME TO REDUCE								
MIN GAP								
PHASE FUNCTIONS								
NON-LOCK MEMORY		YES		YES	NO	YES		
DUAL ENTRY								
COND SERVICE								
SIMULT GAP								
VEHICLE RECALL		MIN				MIN		
PEDESTRIAN RECALL								
DETECTOR CONTROL								
DETECTOR	1 2	3 4	5 6	7 8	9 10	11 12	13 14	15 16
ASSIGNED PHASE								
SWITCH PHASE								

NOTE:

- VALUES/SETTINGS IN TABLE SHALL BE FIELD VERIFIED AND/OR UPDATED AS NECESSARY BY CONTRACTOR.

- SIGNAL TIMING SETTINGS THAT ARE "BLANK" IN THE ABOVE TABLE SHALL BE RETAINED AS CURRENTLY PROGRAMMED IN EXISTING CONTROLLER WHERE APPLICABLE.

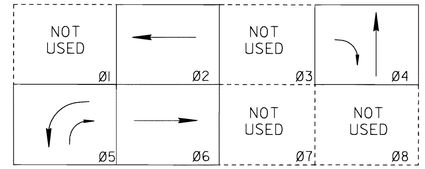
- SETTINGS MAY BE ADJUSTED BASED ON FIELD CONDITIONS WITH APPROVAL FROM ENGINEER.

- THE SOUTHBOUND PROTECTED-ONLY DUAL LEFT MOVEMENT (PHASE 5) SHALL BE PROGRAMMED FOR PHASE REVERSAL OPERATION. PHASE 2 AND 5 SHALL BE REVERSED ELECTRONICALLY TO CREATE A LAGGING LEFT-TURN FOR THE SOUTHBOUND APPROACH. THE CONTROLLER SHALL BE PROGRAMMED TO INDICATE THIS ALTERNATE PHASE SEQUENCE IS "ALWAYS ACTIVATED" WHICH IS SPECIFIED AS AS MODE 4 IN PEEK 3000 CONTROLLERS.

COORD SETUP	
COORD SOURCE:	TOD
BEGIN OR END OF MAIN ST GREEN:	END
USE % FOR PHASE ALLOCATION:	NO (SEC)
USE % FOR OFFSET:	NO (SEC)
USE FIXED OR FLOATING FORCE OFFS:	FLOATING
PERMISSIVE TYPE:	YIELD
OFFSET SEEK	SHORT RTE
AUTO PERM & FO	YES
COORD PHASE (ALL CYCLES)	2 & 6
DAYLIGHT SAVINGS	3-2 / 11-1
SYNC REFERENCE / TIME CLOCK RESET	03:00AM

COORD TIMING PLANS												
PLAN ID			PHASE SPLIT TIMES (SEC)								CYCLE LENGTH (SEC)	OFFSET (SEC)
CYCLE	SPLIT	OFFSET	1	2	3	4	5	6	7	8	(SEC)	(SEC)
1	1	1		65		25	24	41		25	90	0
2	1	1		79		26	29	50		26	105	0
3	1	1		90		20	21	69		20	110	0
4	1	1		94		26	26	68		26	120	0

SIGNAL PHASING DIAGRAM (MAIN ST AT CROSSINGS BLVD)



ACTIVE PHASE

INACTIVE PHASE (NOT USED)

- PROT ONLY LEFT-TURN: Ø5

- CONCURRENT NB RT TURN ARROW WITH Ø4
  CONCURRENT WB RT TURN ARROW WITH Ø5

EIGHT PHASE SEQUENCING

- ALL SIGNAL DISPLAYS AND CLEARANCES SHALL BE IN ACCORDANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.

LOOP AND DETECTOR ASSIGNMENTS							
DETECTOR CHANNEL	ASSOCIATED PHASE	MODE	TIMING		MAKE	MODEL	COMMENTS
			EXTEND	DELAY			
1	2	PULSE			NORTHSTAR	NT11-E	EXISTING; L2-1, L2-2 IN SERIES
2	2	PRES			NORTHSTAR	NT11-E	EXISTING; L2-3, L2-4 IN SERIES
3	4	PRES			NORTHSTAR	NT11-E	EXISTING; L4-1, L4-2 IN SERIES
4	4	PRES		10.0 SEC	NORTHSTAR	NT11-E	EXISTING; L4-3
5	5	PRES			NORTHSTAR	NT11-E	EXISTING; L5-1, L5-2 IN SERIES
6	6	PULSE			NORTHSTAR	NT11-E	EXISTING; L6-1, L6-2 IN SERIES
7	6	PRES			NORTHSTAR	NT11-E	EXISTING; L6-3, L6-4 IN SERIES

TIME BASE PROGRAMMING			
DAY	TIME	PLAN	Cycle Length
2,3,4,5,6	12:00 AM to 6:00 AM	Free	-
	6:00 AM to 7:00 AM	1/1/1	90 sec
	7:00 AM to 9:00 AM	3/1/1	110 sec
	9:00 AM to 11:00 AM	1/1/1	90 sec
	11:00 AM to 3:00 PM	2/1/1	105 sec
	3:00 PM to 6:00 PM	4/1/1	120 sec
	6:00 PM to 8:00 PM	1/1/1	90 sec
	8:00 PM to 12:00 AM	Free	-
7	12:00 AM to 9:00 AM	Free	-
	9:00 AM to 6:00 PM	1/1/1	90 sec
	6:00 PM to 12:00 AM	Free	-
1	12:00 AM to 12:00 PM	Free	-
	12:00 PM to 6:00 PM	1/1/1	90 sec
	6:00 PM to 12:00 AM	Free	-

SIGNAL TIMING DETAIL - CROSSINGS BLVD

TRAFFIC SIGNAL COORDINATION PROJECT
MAIN STREET (U.S. 31, SR-6)
CITY OF SPRING HILL, TENNESSEE

GREGORY D. JUDY
STATE OF TENNESSEE

DSGN: GDJ
DRWN: LRD
CHKD:
SCALE: NONE
PROJ. NO: 6966.001

REVISIONS

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SHEET NO.
4A

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CONTROLLER PROGRAMMING DATA

	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5	PHASE 6	PHASE 7	PHASE 8
MOVEMENT	NB LT	NB/SB	-	EB	-	-	-	-
PHASE DATA								
MIN GREEN	6.0	15.0		6.0				
PASSAGE TIME	2.5	3.5		2.5				
MAXIMUM I	25.0	50.0		30.0				
MAXIMUM II								
YELLOW								
RED								
WALK								
PED CLEAR								
ADDED INITIAL								
MAX INITIAL								
TIME BEFORE REDUC								
TIME TO REDUCE								
MIN GAP								
PHASE FUNCTIONS								
NON-LOCK MEMORY	YES	YES		YES				
DUAL ENTRY								
COND SERVICE								
SIMULT GAP								
VEHICLE RECALL		MIN						
PEDESTRIAN RECALL								

DETECTOR CONTROL																
DETECTOR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
ASSIGNED PHASE																
SWITCH PHASE																

NOTE:

- VALUES/SETTINGS IN TABLE SHALL BE FIELD VERIFIED AND/OR UPDATED AS NECESSARY BY CONTRACTOR.

- SIGNAL TIMING SETTINGS THAT ARE "BLANK" IN THE ABOVE TABLE SHALL BE RETAINED AS CURRENTLY PROGRAMMED IN EXISTING CONTROLLER WHERE APPLICABLE.

- SETTINGS MAY BE ADJUSTED BASED ON FIELD CONDITIONS WITH APPROVAL FROM ENGINEER.

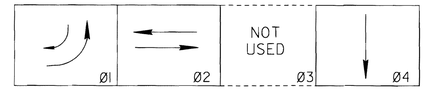
COORD SETUP

COORD SOURCE:	TOD
BEGIN OR END OF MAIN ST GREEN:	END
USE % FOR PHASE ALLOCATION:	NO (SEC)
USE % FOR OFFSET:	NO (SEC)
USE FIXED OR FLOATING FORCE OFFS:	FLOATING
PERMISSIVE TYPE:	YIELD
OFFSET SEEK	SHORT RTE
AUTO PERM & FO	YES
COORD PHASE (ALL CYCLES)	2
DAYLIGHT SAVINGS	3-2 / 11-1
SYNC REFERENCE / TIME CLOCK RESET	03:00AM

COORD TIMING PLANS

PLAN ID			PHASE SPLIT TIMES (SEC)								CYCLE LENGTH (SEC)	OFFSET (SEC)
CYCLE	SPLIT	OFFSET	1	2	3	4	5	6	7	8	(SEC)	(SEC)
1	1	1	25	44		21					90	22
2	1	1	29	52		24					105	24
3	1	1	35	48		27					110	9
4	1	1	32	58		30					120	2

SIGNAL PHASING DIAGRAM
(MAIN ST AT STEPHEN A. YOKICH PKWY)



FOUR PHASE SEQUENCING

☐ ACTIVE PHASE

⬚ INACTIVE PHASE (NOT USED)

- PROT-PERM LEFT-TURN: Ø1

- CONCURRENT EB RT TURN ARROW WITH Ø1

- ALL SIGNAL DISPLAYS AND CLEARANCES SHALL BE IN ACCORDANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.

LOOP AND DETECTOR ASSIGNMENTS

DETECTOR CHANNEL	ASSOCIATED PHASE	MODE	TIMING EXTEND	TIMING DELAY	MAKE	MODEL	COMMENTS
1	1			3.0	SARASOTA	535T	EXISTING; L1-1
2	2				SARASOTA	535T	EXISTING; L2-1 THRU L2-4 IN SERIES
3	2				SARASOTA	535T	EXISTING; L2-5 THRU L2-8 IN SERIES
4	4				SARASOTA	535T	EXISTING; L4-1
5	4			10.0	SARASOTA	535T	EXISTING; L4-2

TIME BASE PROGRAMMING

DAY	TIME	PLAN	Cycle Length
2,3,4,5,6	12:00 AM to 6:00 AM	Free	-
	6:00 AM to 7:00 AM	1/1/1	90 sec
	7:00 AM to 9:00 AM	3/1/1	110 sec
	9:00 AM to 11:00 AM	1/1/1	90 sec
	11:00 AM to 3:00 PM	2/1/1	105 sec
	3:00 PM to 6:00 PM	4/1/1	120 sec
	6:00 PM to 8:00 PM	1/1/1	90 sec
	8:00 PM to 12:00 AM	Free	-
7	12:00 AM to 9:00 AM	Free	-
	9:00 AM to 6:00 PM	1/1/1	90 sec
	6:00 PM to 12:00 AM	Free	-
1	12:00 AM to 12:00 PM	Free	-
	12:00 PM to 6:00 PM	1/1/1	90 sec
	6:00 PM to 12:00 AM	Free	-

SIGNAL TIMING DETAIL - STEPHEN YOKICH PKWY

TRAFFIC SIGNAL COORDINATION PROJECT
MAIN STREET (U.S. 31, SR-6)
CITY OF SPRING HILL, TENNESSEE

GREGORY D. JUDY
STATE OF TENNESSEE

DSGN: GDJ	REVISIONS
DRWN: LRD	
CHKD:	
SCALE: NONE	
PROJ. NO: 6966.001	

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SHEET NO. 4B

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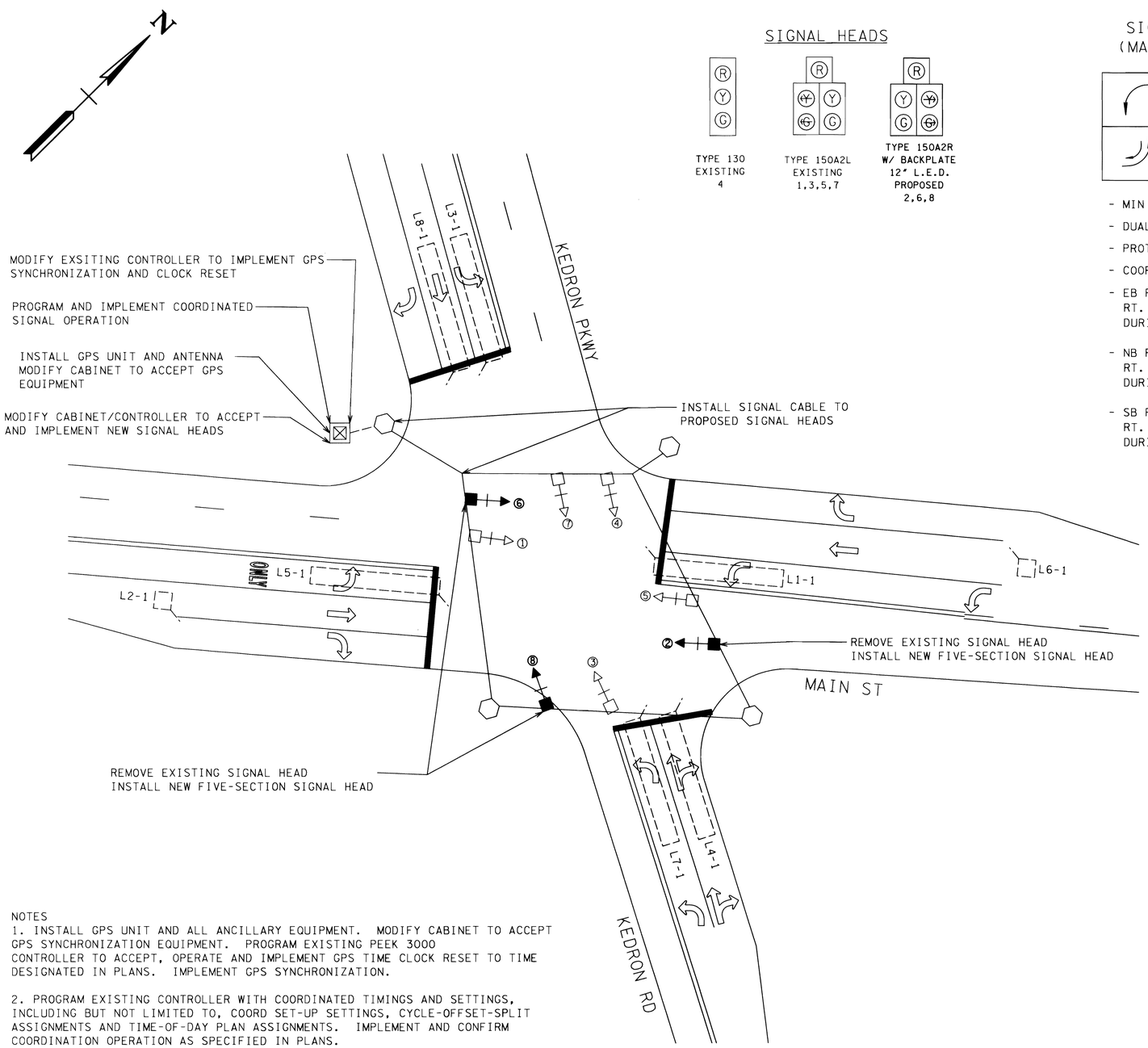


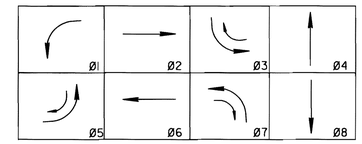
SIGNAL HEADS

TYPE 130
EXISTING
4

TYPE 150A2L
EXISTING
1,3,5,7

TYPE 150A2R
W/ BACKPLATE
12" L.E.D.
PROPOSED
2,6,8

SIGNAL PHASING DIAGRAM
(MAIN ST AT KEDRON PKWY)



- MIN RECALL: Ø2,Ø6
- DUAL ENTRY: Ø2,Ø6; Ø4,Ø8
- PROT-PERM LEFT-TURN: Ø1,Ø3,Ø5,Ø7
- COORD PHASE: Ø2,Ø6
- EB RIGHT PROTECTED PHASE WITH Ø5 ONLY. RT. TURN ARROW SHALL NOT BE ACTIVE DURING Ø8
- NB RIGHT PROTECTED PHASE WITH Ø7 ONLY. RT. TURN ARROW SHALL NOT BE ACTIVE DURING Ø2
- SB RIGHT PROTECTED PHASE WITH Ø3 ONLY. RT. TURN ARROW SHALL NOT BE ACTIVE DURING Ø6

NOTES

1. INSTALL GPS UNIT AND ALL ANCILLARY EQUIPMENT. MODIFY CABINET TO ACCEPT GPS SYNCHRONIZATION EQUIPMENT. PROGRAM EXISTING PEEK 3000 CONTROLLER TO ACCEPT, OPERATE AND IMPLEMENT GPS TIME CLOCK RESET TO TIME DESIGNATED IN PLANS. IMPLEMENT GPS SYNCHRONIZATION.

2. PROGRAM EXISTING CONTROLLER WITH COORDINATED TIMINGS AND SETTINGS, INCLUDING BUT NOT LIMITED TO, COORD SET-UP SETTINGS, CYCLE-OFFSET-SPLIT ASSIGNMENTS AND TIME-OF-DAY PLAN ASSIGNMENTS. IMPLEMENT AND CONFIRM COORDINATION OPERATION AS SPECIFIED IN PLANS.

3. EXISTING CABINET INCLUDES "PREEMPT" SIDE RELAY WIRING PANEL.

4. REMOVE EXISTING PHASE 2, 6 AND 8 THREE-SECTION SIGNAL HEADS AND REPLACE WITH PROPOSED FIVE-SECTION SIGNAL HEADS. INSTALL NEW SIGNAL CABLE TO PROPOSED SIGNAL HEADS. EXISTING SPARE 2" CONDUIT STUBS IN CABINET MAY BE UTILIZED. MODIFY CABINET WIRING AS REQUIRED TO IMPLEMENT NEW FIVE-SECTION SIGNAL HEADS.

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PROPOSED LAYOUT

TRAFFIC SIGNAL COORDINATION PROJECT
MAIN STREET (U.S. 31, SR-6)
CITY OF SPRING HILL, TENNESSEE

		REVISIONS
DSGN: GDJ		
DRWN: LRD		
CHKD:		
SCALE: 1" = 20'		
PROJ. NO: 6966.001		

GREGORY D. JUDY — STATE OF TENNESSEE

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5

CONTROLLER PROGRAMMING DATA

	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5	PHASE 6	PHASE 7	PHASE 8
MOVEMENT	SB LT	NB	EB LT	WB	NB LT	SB	WB LT	EB
PHASE DATA								
MIN GREEN	5.0	15.0	5.0	8.0	5.0	15.0	5.0	8.0
PASSAGE TIME	2.5	6.0	2.5	2.5	2.5	6.0	3.0	3.0
MAXIMUM I	20.0	50.0	20.0	25.0	20.0	50.0	20.0	25.0
MAXIMUM II								
YELLOW								
RED								
WALK								
PED CLEAR								
ADDED INITIAL								
MAX INITIAL								
TIME BEFORE REDUC								
TIME TO REDUCE								
MIN GAP								
PHASE FUNCTIONS								
NON-LOCK MEMORY	YES	NO	YES	YES	YES	NO	YES	YES
DUAL ENTRY		ON		ON		ON		ON
COND SERVICE								
SIMULT GAP								
VEHICLE RECALL		MIN				MIN		
PEDESTRIAN RECALL								
DETECTOR CONTROL								
DETECTOR	1 2	3 4	5 6	7 8	9 10	11 12	13 14	15 16
ASSIGNED PHASE								
SWITCH PHASE								

NOTE:

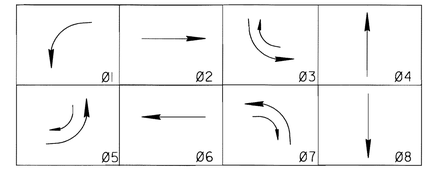
- VALUES/SETTINGS IN TABLE SHALL BE FIELD VERIFIED AND/OR UPDATED AS NECESSARY BY CONTRACTOR.
- SIGNAL TIMING SETTINGS THAT ARE "BLANK" IN THE ABOVE TABLE SHALL BE RETAINED AS CURRENTLY PROGRAMMED IN EXISTING CONTROLLER WHERE APPLICABLE.
- SETTINGS MAY BE ADJUSTED BASED ON FIELD CONDITIONS WITH APPROVAL FROM ENGINEER.

COORD SETUP	
COORD SOURCE:	TOD
BEGIN OR END OF MAIN ST GREEN:	END
USE % FOR PHASE ALLOCATION:	NO (SEC)
USE % FOR OFFSET:	NO (SEC)
USE FIXED OR FLOATING FORCE OFFS:	FLOATING
PERMISSIVE TYPE:	YIELD
OFFSET SEEK	SHORT RTE
AUTO PERM & FO	YES
COORD PHASE (ALL CYCLES)	2 & 6
DAYLIGHT SAVINGS	3-2 / 11-1
SYNC REFERENCE / TIME CLOCK RESET	03:00AM

COORD TIMING PLANS

PLAN ID			PHASE SPLIT TIMES (SEC)								CYCLE LENGTH (SEC)	OFFSET (SEC)
CYCLE	SPLIT	OFFSET	1	2	3	4	5	6	7	8	(SEC)	(SEC)
1	1	1	17	38	17	18	17	38	17	18	90	1
2	1	1	17	52	17	19	17	52	17	19	105	102
3	1	1	17	52	15	26	17	52	15	26	110	89
4	1	1	17	62	17	24	17	62	17	24	120	84

SIGNAL PHASING DIAGRAM
(MAIN ST AT KEDRON PKWY)



EIGHT PHASE SEQUENCING

☐ ACTIVE PHASE

⬚ INACTIVE PHASE (NOT USED)

- PROT LEFT-TURN: Ø1,Ø3,Ø5,Ø7
- CONCURRENT NB RT TURN ARROW WITH Ø7
- CONCURRENT SB RT TURN ARROW WITH Ø3
- CONCURRENT EB RT TURN ARROW WITH Ø5

- ALL SIGNAL DISPLAYS AND CLEARANCES SHALL BE IN ACCORDANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.

LOOP AND DETECTOR ASSIGNMENTS

DETECTOR CHANNEL	ASSOCIATED PHASE	MODE	TIMING EXTEND	TIMING DELAY	MAKE	MODEL	COMMENTS
1	1	PRES		3.0	SARASOTA	535T	EXISTING, L1-1
2	2	PRES			SARASOTA	535T	EXISTING, L2-1
3	3	PRES		3.0	NORTHSTAR	NT11	EXISTING, L3-1
4	4	PRES			NORTHSTAR	NT11	EXISTING, L4-1
5	5	PRES		3.0	SARASOTA	535T	EXISTING, L5-1
6	6	PRES			SARASOTA	535T	EXISTING, L6-1
7	7	PRES		3.0	SARASOTA	535T	EXISTING, L7-1
8	8	PRES			SARASOTA	535T	EXISTING, L8-1

TIME BASE PROGRAMMING

DAY	TIME	PLAN	Cycle Length
2,3,4,5,6	12:00 AM to 6:00 AM	Free	-
	6:00 AM to 7:00 AM	1/1/1	90 sec
	7:00 AM to 9:00 AM	3/1/1	110 sec
	9:00 AM to 11:00 AM	1/1/1	90 sec
	11:00 AM to 3:00 PM	2/1/1	105 sec
	3:00 PM to 6:00 PM	4/1/1	120 sec
	6:00 PM to 8:00 PM	1/1/1	90 sec
	8:00 PM to 12:00 AM	Free	-
7	12:00 AM to 9:00 AM	Free	-
	9:00 AM to 6:00 PM	1/1/1	90 sec
	6:00 PM to 12:00 AM	Free	-
1	12:00 AM to 12:00 PM	Free	-
	12:00 PM to 6:00 PM	1/1/1	90 sec
	6:00 PM to 12:00 AM	Free	-

SIGNAL TIMING DETAIL - KEDRON PKWY

TRAFFIC SIGNAL COORDINATION PROJECT
MAIN STREET (U.S. 31, SR-6)
CITY OF SPRING HILL, TENNESSEE

GREGORY D. JUDY REGISTERED ENGINEER ARCHITECTURE COMMERCE STATE OF TENNESSEE

DSGN: GDJ
DRWN: LRD
CHKD:
SCALE: NONE
PROJ. NO: 6966.001

REVISIONS

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5A

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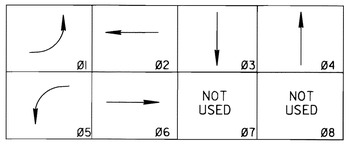
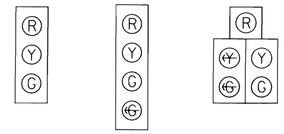
SIGNAL PHASING DIAGRAM
(MAIN ST AT DEPOT ST/MCLEMORE AVE)

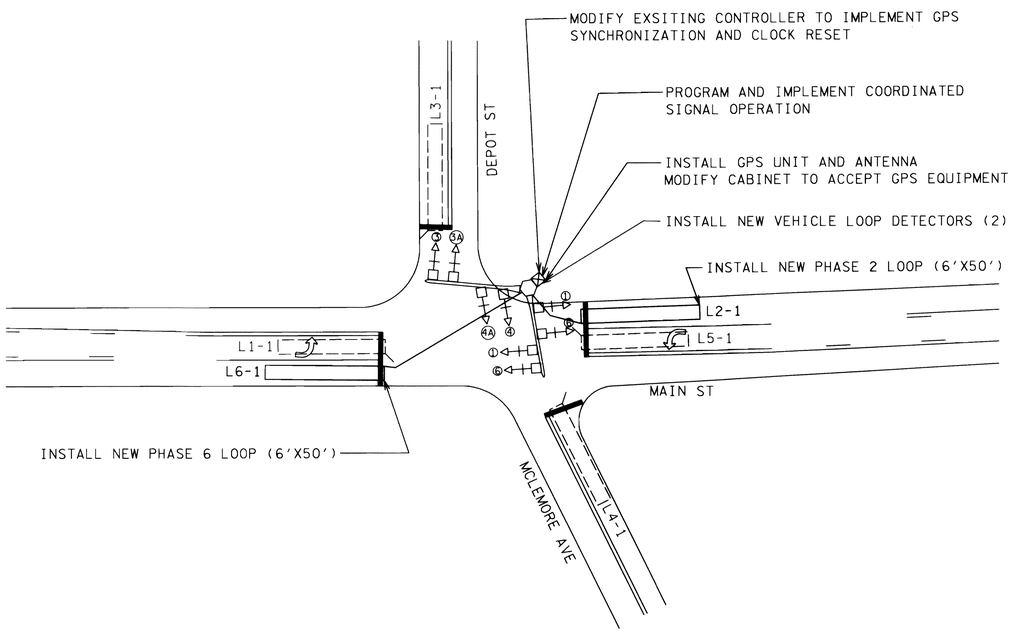


SIGNAL HEADS



TYPE 130 EXISTING 2,3,4,6 | TYPE 140A1L EXISTING 3A,4A | TYPE 150A2L EXISTING 1,5

- DUAL ENTRY: Ø2,Ø6
- PROT-PERM LEFT-TURN: Ø1,Ø5
- SPLIT PHASE: Ø3,Ø4
- COORD PHASE: Ø2,Ø6



NOTES

1. INSTALL GPS UNIT AND ALL ANCILLARY EQUIPMENT. MODIFY CABINET TO ACCEPT GPS SYNCHRONIZATION EQUIPMENT. PROGRAM EXISTING PEEK 3000E CONTROLLER TO ACCEPT, OPERATE AND IMPLEMENT GPS TIME CLOCK RESET TO TIME DESIGNATED IN PLANS. IMPLEMENT GPS SYNCHRONIZATION.

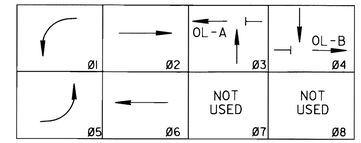
2. PROGRAM EXISTING CONTROLLER WITH COORDINATED TIMINGS AND SETTINGS, INCLUDING BUT NOT LIMITED TO, COORD SET-UP SETTINGS, CYCLE-OFFSET-SPLIT ASSIGNMENTS AND TIME-OF-DAY PLAN ASSIGNMENTS. IMPLEMENT AND CONFIRM COORDINATION OPERATION AS SPECIFIED IN PLANS.

3. EXISTING CABINET INCLUDES "PREEMPT" SIDE RELAY WIRING PANEL.

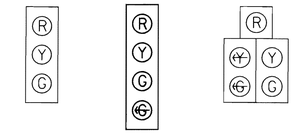
4. INSTALL NEW INDUCTIVE LOOPS FOR PHASE 2 AND PHASE 6. METHODS AND MATERIALS SHALL FOLLOW TDOT SPECIFICATIONS AND STANDARD DRAWINGS. LOOP LEAD-INS SHOULD BE INSTALLED TO EXISTING POLE BASE. MODIFY CABINET AND CONTROLLER TO ACCEPT AND IMPLEMENT NEW LOOP DETECTION AND ACTUATION.

5. UPON IMPLEMENTING NEW PHASE 2 AND 6 LOOP DETECTION, REVISE PHASE 2 AND 6 FROM "MAX RECALL" TO "MIN RECALL" IN CONTROLLER PROGRAMMING.

SIGNAL PHASING DIAGRAM
(MAIN ST AT BEECHCROFT RD/DUPLEX RD)

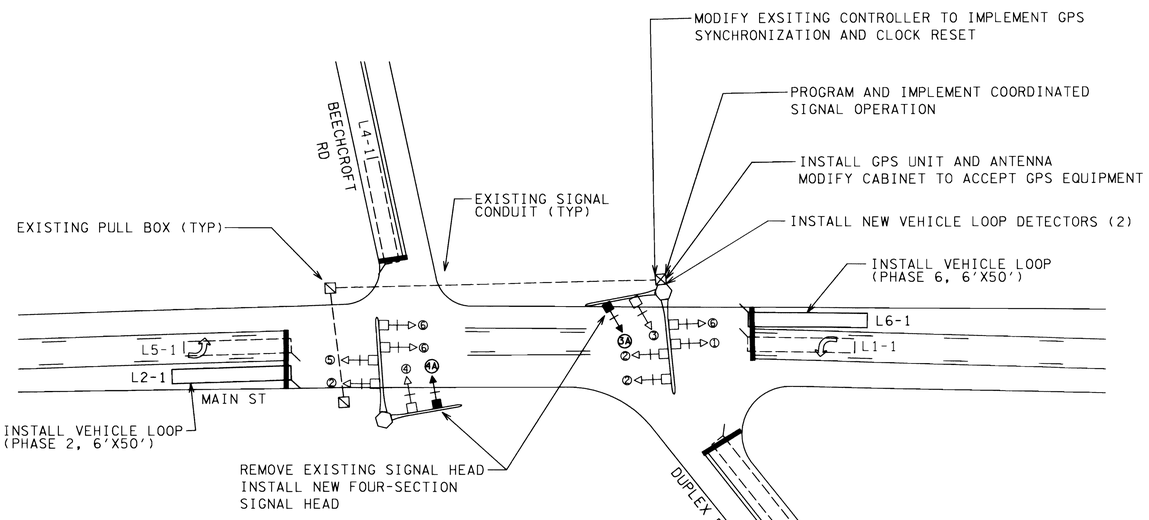


SIGNAL HEADS



TYPE 130 EXISTING 2,3,4,6 | **TYPE 140A1L W/ BACKPLATE 12" L.E.D PROPOSED 3A,4A** | TYPE 150A2L EXISTING 1,5

- DUAL ENTRY: Ø2,Ø6
- PROT-PERM LEFT-TURN: Ø1,Ø5
- SPLIT PHASE: Ø3,Ø4
- OVERLAP A = Ø3 + Ø6
  OVERLAP B = Ø4 + Ø2
- COORD PHASE: Ø2,Ø6



NOTES

1. INSTALL GPS UNIT AND ALL ANCILLARY EQUIPMENT. MODIFY CABINET TO ACCEPT GPS SYNCHRONIZATION EQUIPMENT. PROGRAM EXISTING PEEK 3000E CONTROLLER TO ACCEPT, OPERATE AND IMPLEMENT GPS TIME CLOCK RESET TO TIME DESIGNATED IN PLANS. IMPLEMENT GPS SYNCHRONIZATION.

2. PROGRAM EXISTING CONTROLLER WITH COORDINATED TIMINGS AND SETTINGS, INCLUDING BUT NOT LIMITED TO, COORD SET-UP SETTINGS, CYCLE-OFFSET-SPLIT ASSIGNMENTS AND TIME-OF-DAY PLAN ASSIGNMENTS. IMPLEMENT AND CONFIRM COORDINATION OPERATION AS SPECIFIED IN PLANS.

3. EXISTING CABINET INCLUDES "PREEMPT" SIDE RELAY WIRING PANEL. CONTRACTOR SHALL VERIFY NEED FOR MODIFICATIONS TO PANEL TO IMPLEMENT GPS UNIT SYNCHRONIZATION.

4. REMOVE EXISTING IDENTIFIED THREE-SECTION SIGNAL HEADS FOR PHASES 3 AND 4. INSTALL NEW FOUR-SECTION SIGNAL HEADS. CONTRACTOR SHALL ATTEMPT TO UTILIZE EXISTING SIGNAL CABLES FOR PROPOSED SIGNAL HEAD OPERATIONS. MODIFY CABINET WIRING AS REQUIRED TO IMPLEMENT FOUR-SECTION SIGNAL HEADS.

5. INSTALL NEW INDUCTIVE LOOPS FOR PHASE 2 AND 6. METHODS AND MATERIALS SHALL FOLLOW TDOT SPECIFICATIONS AND STANDARD DRAWINGS. PHASE 6 LOOP LEAD-IN SHOULD BE INSTALLED DIRECTLY TO POLE BASE. PHASE 2 LOOP LEAD IN SHOULD BE INSTALLED TO ADJACENT EXISTING PULL BOX. INSTALL PHASE 2 SHIELDED DETECTOR CABLE THROUGH EXISTING PULL BOX AND CONDUIT TO CABINET POLE BASE. CONTRACTOR SHALL CONFIRM NEED FOR NEW CABINET ACCESS.

6.UPON IMPLEMENTING NEW PHASE 2 AND 6 LOOP ACTUATION, REVISE PHASE 2 AND 6 FROM "MAX RECALL" TO "MIN RECALL" IN CONTROLLER PROGRAMMING.

PROPOSED LAYOUT

TRAFFIC SIGNAL COORDINATION PROJECT
MAIN STREET (U.S. 31, SR-6)
CITY OF SPRING HILL, TENNESSEE

GREGORY D. JUDY — STATE OF TENNESSEE

		REVISIONS
DSGN: GDJ		
DRWN: LRD		
CHKD:		
SCALE: 1" = 30'		
PROJ. NO: 6966.001		

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CONTROLLER PROGRAMMING DATA								
	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5	PHASE 6	PHASE 7	PHASE 8
MOVEMENT	NB LT	SB	EB	WB	SB LT	NB	-	-
PHASE DATA								
MIN GREEN	5.0	15.0	5.0	5.0	5.0	15.0		
PASSAGE TIME	2.5	4.0	2.5	2.5	2.5	4.0		
MAXIMUM I	15.0	50.0	25.0	25.0	15.0	50.0		
MAXIMUM II								
YELLOW								
RED								
WALK								
PED CLEAR								
ADDED INITIAL								
MAX INITIAL								
TIME BEFORE REDUC								
TIME TO REDUCE								
MIN GAP								
PHASE FUNCTIONS								
NON-LOCK MEMORY	YES	YES	YES	YES	YES	YES		
DUAL ENTRY		YES				YES		
COND SERVICE								
SIMULT GAP								
VEHICLE RECALL		MIN				MIN		
PEDESTRIAN RECALL								

DETECTOR CONTROL																
DETECTOR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
ASSIGNED PHASE																
SWITCH PHASE																

NOTE:

- VALUES/SETTINGS IN TABLE SHALL BE FIELD VERIFIED AND/OR UPDATED AS NECESSARY BY CONTRACTOR.

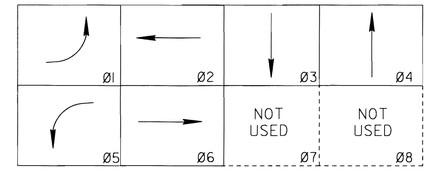
- SIGNAL TIMING SETTINGS THAT ARE "BLANK" IN THE ABOVE TABLE SHALL BE RETAINED AS CURRENTLY PROGRAMMED IN EXISTING CONTROLLER WHERE APPLICABLE.

- SETTINGS MAY BE ADJUSTED BASED ON FIELD CONDITIONS WITH APPROVAL FROM ENGINEER.

COORD SETUP	
COORD SOURCE:	TOD
BEGIN OR END OF MAIN ST GREEN:	END
USE % FOR PHASE ALLOCATION:	NO (SEC)
USE % FOR OFFSET:	NO (SEC)
USE FIXED OR FLOATING FORCE OFFS:	FLOATING
PERMISSIVE TYPE:	YIELD
OFFSET SEEK	SHORT RTE
AUTO PERM & FO	YES
COORD PHASE (ALL CYCLES)	2 & 6
DAYLIGHT SAVINGS	3-2 / 11-1
SYNC REFERENCE / TIME CLOCK RESET	03:00AM

COORD TIMING PLANS												
PLAN ID			PHASE SPLIT TIMES (SEC)								CYCLE LENGTH (SEC)	OFFSET (SEC)
CYCLE	SPLIT	OFFSET	1	2	3	4	5	6	7	8	(SEC)	(SEC)
1	1	1	17	33	20	20	17	33	20	20	90	50
2	1	1	17	48	20	20	17	48	20	20	105	50
3	1	1	13	68	16	13	13	68	16	13	110	29
4	1	1	17	63	20	20	17	63	20	20	120	44

SIGNAL PHASING DIAGRAM
(MAIN ST AT DEPOT ST/MCLEMORE AVE)



EIGHT PHASE SEQUENCING

ACTIVE PHASE

INACTIVE PHASE (NOT USED)

- PROT-PERM LEFT-TURN: Ø1,Ø5
- SPLIT PHASE: Ø3,Ø4

- ALL SIGNAL DISPLAYS AND CLEARANCES SHALL BE IN ACCORDANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.

LOOP AND DETECTOR ASSIGNMENTS							
DETECTOR CHANNEL	ASSOCIATED PHASE	MODE	TIMING		MAKE	MODEL	COMMENTS
			EXTEND	DELAY			
1	1	PRES			NORTHSTAR	NT11	EXISTING; L1-1
2	3	PRES		4.0	NORTHSTAR	NT11-E	EXISTING; L3-1
3	4	PRES		4.0	NORTHSTAR	NT11-E	EXISTING; L4-1
4	5	PRES			NORTHSTAR	NT11	EXISTING; L5-1
5	2	PRES					PROPOSED; L2-1
6	6	PRES					PROPOSED; L6-1

NOTE: PROPOSED VEHICLE DETECTORS SHALL INCLUDE EXTENSION-DELAY TIMING FEATURES.

ALL PROPOSED LOOPS SHALL BE 6FT IN WIDTH, CENTERED IN TRAFFIC LANE. INDUCTIVE LOOP WIRE CONNECTIONS SHALL BE WIRED TO PROVIDE APPROPRIATE INDUCTANCE AS REQUIRED BY TDOT STD DRAWINGS T-SG-3.

TIME BASE PROGRAMMING			
DAY	TIME	PLAN	Cycle Length
2,3,4,5,6	12:00 AM to 6:00 AM	Free	-
	6:00 AM to 7:00 AM	1/1/1	90 sec
	7:00 AM to 9:00 AM	3/1/1	110 sec
	9:00 AM to 11:00 AM	1/1/1	90 sec
	11:00 AM to 3:00 PM	2/1/1	105 sec
	3:00 PM to 6:00 PM	4/1/1	120 sec
	6:00 PM to 8:00 PM	1/1/1	90 sec
	8:00 PM to 12:00 AM	Free	-
7	12:00 AM to 9:00 AM	Free	-
	9:00 AM to 6:00 PM	1/1/1	90 sec
	6:00 PM to 12:00 AM	Free	-
1	12:00 AM to 12:00 PM	Free	-
	12:00 PM to 6:00 PM	1/1/1	90 sec
	6:00 PM to 12:00 AM	Free	-

SIGNAL TIMING DETAIL - DEPOT ST

TRAFFIC SIGNAL COORDINATION PROJECT
MAIN STREET (U.S. 31, SR-6)
CITY OF SPRING HILL, TENNESSEE

GREGORY D. JUDY
STATE OF TENNESSEE
11/20/08

DSGN: GDJ
DRWN: LRD
CHKD:
SCALE: NONE
PROJ. NO: 6966.001

REVISIONS

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6A

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CONTROLLER PROGRAMMING DATA								
	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5	PHASE 6	PHASE 7	PHASE 8
MOVEMENT	SB LT	NB	WB	EB	NB LT	SB	-	-
PHASE DATA								
MIN GREEN	5.0	15.0	5.0	5.0	5.0	15.0		
PASSAGE TIME	2.5	4.0	2.5	2.5	2.5	4.0		
MAXIMUM I	15.0	50.0	25.0	25.0	15.0	50.0		
MAXIMUM II								
YELLOW								
RED								
WALK								
PED CLEAR								
ADDED INITIAL								
MAX INITIAL								
TIME BEFORE REDUC								
TIME TO REDUCE								
MIN GAP								
PHASE FUNCTIONS								
NON-LOCK MEMORY	YES	YES	YES	YES	YES	YES		
DUAL ENTRY		YES				YES		
COND SERVICE								
SIMULT GAP								
VEHICLE RECALL		MIN				MIN		
PEDESTRIAN RECALL								

DETECTOR CONTROL																
DETECTOR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
ASSIGNED PHASE																
SWITCH PHASE																

NOTE:

- VALUES/SETTINGS IN TABLE SHALL BE FIELD VERIFIED AND/OR UPDATED AS NECESSARY BY CONTRACTOR.

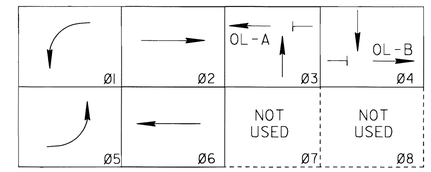
- SIGNAL TIMING SETTINGS THAT ARE "BLANK" IN THE ABOVE TABLE SHALL BE RETAINED AS CURRENTLY PROGRAMMED IN EXISTING CONTROLLER WHERE APPLICABLE.

- SETTINGS MAY BE ADJUSTED BASED ON FIELD CONDITIONS WITH APPROVAL FROM ENGINEER.

COORD SETUP	
COORD SOURCE:	TOD
BEGIN OR END OF MAIN ST GREEN:	END
USE % FOR PHASE ALLOCATION:	NO (SEC)
USE % FOR OFFSET:	NO (SEC)
USE FIXED OR FLOATING FORCE OFFS:	FLOATING
PERMISSIVE TYPE:	YIELD
OFFSET SEEK	SHORT RTE
AUTO PERM & FO	YES
COORD PHASE (ALL CYCLES)	2 & 6
DAYLIGHT SAVINGS	3-2 / 11-1
SYNC REFERENCE / TIME CLOCK RESET	03:00AM

COORD TIMING PLANS												
PLAN ID			PHASE SPLIT TIMES (SEC)								CYCLE LENGTH (SEC)	OFFSET (SEC)
CYCLE	SPLIT	OFFSET	1	2	3	4	5	6	7	8	(SEC)	(SEC)
1	1	1	19	39	17	15	15	43	17	15	90	43
2	1	1	19	48	21	17	15	52	21	17	105	34
3	1	1	19	50	22	19	12	57	22	19	110	23
4	1	1	19	60	23	18	15	64	23	18	120	29

SIGNAL PHASING DIAGRAM
(MAIN ST AT BEECHCROFT RD/DUPLEX RD)



EIGHT PHASE SEQUENCING

ACTIVE PHASE

INACTIVE PHASE (NOT USED)

- PROT-PERM LEFT-TURN: Ø1,Ø5

- SPLIT PHASE: Ø3,Ø4

- OVERLAP A = Ø3 + Ø6
  OVERLAP B = Ø4 + Ø2

- ALL SIGNAL DISPLAYS AND CLEARANCES SHALL BE IN ACCORDANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.

LOOP AND DETECTOR ASSIGNMENTS							
DETECTOR CHANNEL	ASSOCIATED PHASE	MODE	TIMING		MAKE	MODEL	COMMENTS
			EXTEND	DELAY			
1	1	PRES		3.0	SARASOTA	535T	EXISTING; L1-1
2	3	PRES			NORTHSTAR	NT11	EXISTING; L3-1
3	4	PRES		3.0	NORTHSTAR	NT11-E	EXISTING; L4-1
4	5	PRES		3.0	NORTHSTAR	NT11-E	EXISTING; L5-1
5	2	PRES					PROPOSED; L2-1
6	6	PRES					PROPOSED; L6-1

NOTE: PROPOSED VEHICLE DETECTORS SHALL INCLUDE EXTENSION-DELAY TIMING FEATURES.

ALL PROPOSED LOOPS SHALL BE 6FT IN WIDTH, CENTERED IN TRAFFIC LANE. INDUCTIVE LOOP WIRE CONNECTIONS SHALL BE WIRED TO PROVIDE APPROPRIATE INDUCTANCE AS REQUIRED BY TDOT STD DRAWINGS T-SG-3.

TIME BASE PROGRAMMING			
DAY	TIME	PLAN	Cycle Length
2,3,4,5,6	12:00 AM to 6:00 AM	Free	-
	6:00 AM to 7:00 AM	1/1/1	90 sec
	7:00 AM to 9:00 AM	3/1/1	110 sec
	9:00 AM to 11:00 AM	1/1/1	90 sec
	11:00 AM to 3:00 PM	2/1/1	105 sec
	3:00 PM to 6:00 PM	4/1/1	120 sec
	6:00 PM to 8:00 PM	1/1/1	90 sec
	8:00 PM to 12:00 AM	Free	-
7	12:00 AM to 9:00 AM	Free	-
	9:00 AM to 6:00 PM	1/1/1	90 sec
	6:00 PM to 12:00 AM	Free	-
1	12:00 AM to 12:00 PM	Free	-
	12:00 PM to 6:00 PM	1/1/1	90 sec
	6:00 PM to 12:00 AM	Free	-

SIGNAL TIMING DETAIL - BEECHCROFT RD

TRAFFIC SIGNAL COORDINATION PROJECT
MAIN STREET (U.S. 31, SR-6)
CITY OF SPRING HILL, TENNESSEE

GREGORY D. JUDY REGISTERED ENGINEER NO. 109027 STATE OF TENNESSEE

DSGN: GDJ
DRWN: LRD
CHKD:
SCALE: NONE
PROJ. NO: 6966.001

REVISIONS

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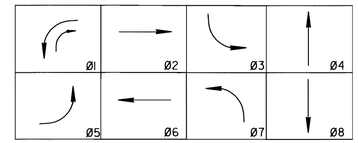
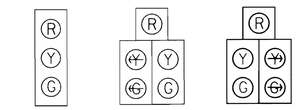
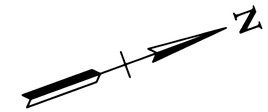
SIGNAL PHASING DIAGRAM
(MAIN ST AT CAMPBELL STATION RD)

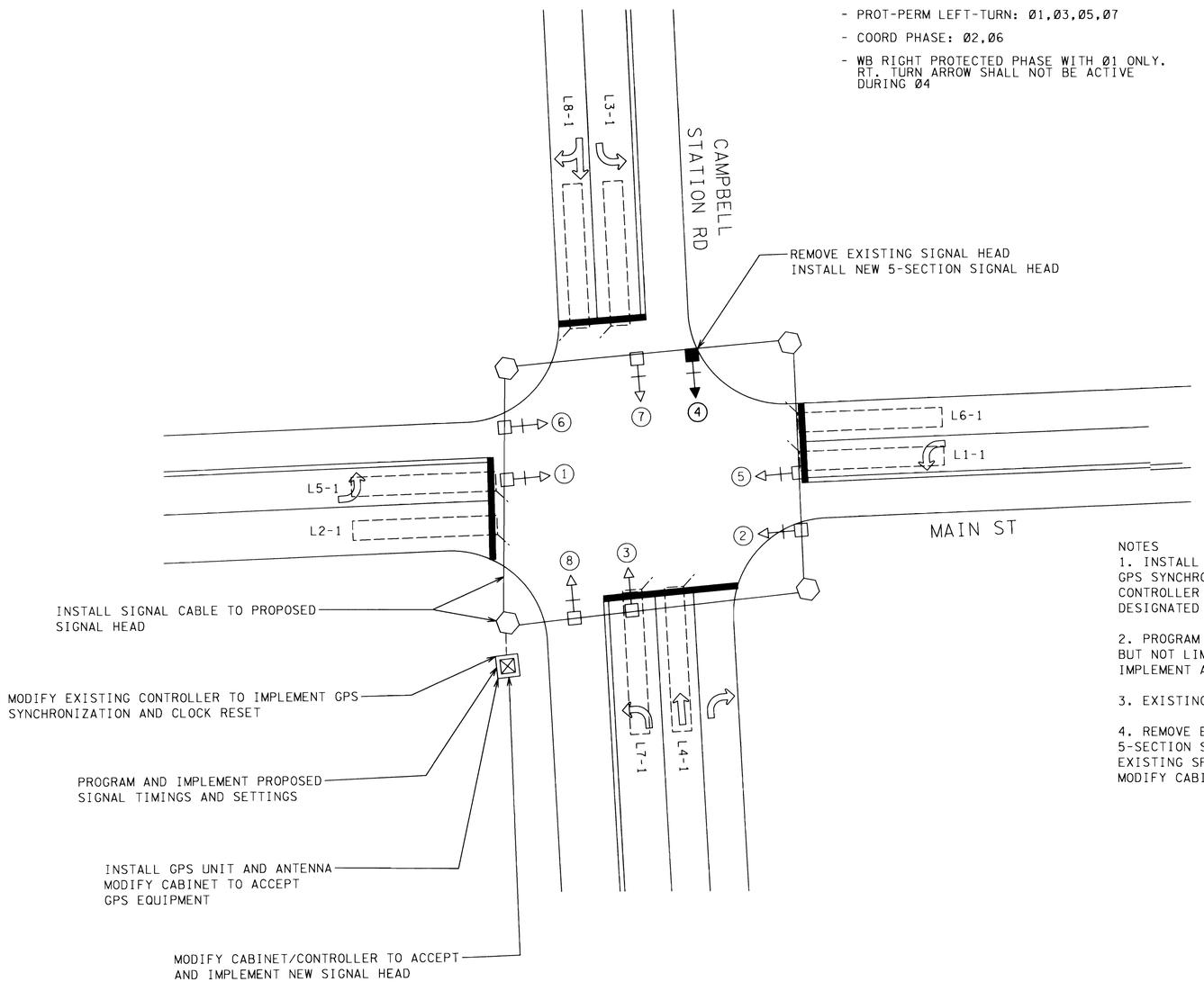


- MIN RECALL: Ø2,Ø6
- DUAL ENTRY: Ø2,Ø6; Ø4,Ø8
- PROT-PERM LEFT-TURN: Ø1,Ø3,Ø5,Ø7
- COORD PHASE: Ø2,Ø6
- WB RIGHT PROTECTED PHASE WITH Ø1 ONLY. RT. TURN ARROW SHALL NOT BE ACTIVE DURING Ø4

SIGNAL HEADS







NOTES

1. INSTALL GPS UNIT AND ALL ANCILLARY EQUIPMENT. MODIFY CABINET TO ACCEPT GPS SYNCHRONIZATION EQUIPMENT. PROGRAM EXISTING PEEK 3000E CONTROLLER TO ACCEPT, OPERATE AND IMPLEMENT GPS TIME CLOCK RESET TO TIME DESIGNATED IN PLANS. IMPLEMENT GPS SYNCHRONIZATION.

2. PROGRAM EXISTING CONTROLLER WITH PROPOSED TIMINGS AND SETTINGS, INCLUDING BUT NOT LIMITED TO, COORD SET-UP SETTINGS AND TIME-OF-DAY PLAN ASSIGNMENTS. IMPLEMENT AND CONFIRM "MAX 2" & "MAX 3" OPERATION AS SPECIFIED IN PLANS.

3. EXISTING CABINET INCLUDES "PREEMPT" SIDE RELAY WIRING PANEL.

4. REMOVE EXISTING PHASE 4 3-SECTION SIGNAL HEAD, AND REPLACE WITH PROPOSED 5-SECTION SIGNAL HEAD. INSTALL NEW SIGNAL CABLE TO PROPOSED SIGNAL HEAD. EXISTING SPARE 2" CONDUIT STUB IN CABINET MAY BE UTILIZED. MODIFY CABINET WIRING AS REQUIRED TO IMPLEMENT NEW 5-SECTION SIGNAL HEAD.

PROPOSED LAYOUT

TRAFFIC SIGNAL COORDINATION PROJECT
MAIN STREET (U.S. 31, SR-6)
CITY OF SPRING HILL, TENNESSEE

GREGORY D. JUDY
REGISTERED ENGINEER
104157
STATE OF TENNESSEE

		REVISIONS
DSGN: GDJ		
DRWN: LRD		
CHKD:		
SCALE: 1" = 20'		
PROJ. NO: 6966.001		

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7

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CONTROLLER PROGRAMMING DATA

	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5	PHASE 6	PHASE 7	PHASE 8
MOVEMENT	SB LT	NB	EB LT	WB	NB LT	SB	WB LT	EB
PHASE DATA								
MIN GREEN	5.0	15.0	5.0	5.0	5.0	15.0	5.0	5.0
PASSAGE TIME	2.5	5.0	2.5	2.5	2.5	5.0	2.5	2.5
MAXIMUM I	15.0	50.0	15.0	18.0	15.0	50.0	15.0	18.0
MAXIMUM II	20.0	60.0	20.0	20.0	20.0	60.0	20.0	20.0
YELLOW								
RED								
WALK								
PED CLEAR								
ADDED INITIAL								
MAX INITIAL								
TIME BEFORE REDUC								
TIME TO REDUCE								
MIN GAP								
PHASE FUNCTIONS								
NON-LOCK MEMORY	YES	YES	YES	YES	YES	YES	YES	YES
DUAL ENTRY		ON		ON		ON		ON
COND SERVICE								
SIMULT GAP								
VEHICLE RECALL		MIN				MIN		
PEDESTRIAN RECALL								

DETECTOR CONTROL																
DETECTOR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
ASSIGNED PHASE																
SWITCH PHASE																

NOTE:

- VALUES/SETTINGS IN TABLE SHALL BE FIELD VERIFIED AND/OR UPDATED AS NECESSARY BY CONTRACTOR.

- SIGNAL TIMING SETTINGS THAT ARE "BLANK" IN THE ABOVE TABLE SHALL BE RETAINED AS CURRENTLY PROGRAMMED IN EXISTING CONTROLLER WHERE APPLICABLE.

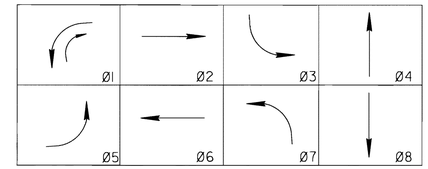
- SETTINGS MAY BE ADJUSTED BASED ON FIELD CONDITIONS WITH APPROVAL FROM ENGINEER.

COORD SETUP	
COORD SOURCE:	TOD
DAYLIGHT SAVINGS	3-2 / 11-1
SYNC REFERENCE / TIME CLOCK RESET	03:00AM

VARIABLE MAXIMUM PROGRAMMING (MAX 3)								
Phase	1	2	3	4	5	6	7	8
Description	SB LT	NB TR	EB LT	WB TR	NB LT	SB TR	WB LT	EB TR
Max 3 Limit	25	80	30	25	25	80	30	25
Max 3 Adjust Value	5	5	5	5	5	5	5	5
Max Outs Before Adjustment	1	1	1	1	1	1	1	1
Gap Outs Before Reduction	2	2	2	2	2	2	2	2

TIME BASE PROGRAMMING			
DAY	TIME	PLAN	Cycle Length
2,3,4,5,6	12:00 AM to 7:00 AM	Free	-
	7:00 AM to 9:00 AM	MAX 2	-
	9:00 AM to 11:00 AM	Free	-
	11:00 AM to 1:00 PM	MAX 2	-
	1:00 PM to 3:00 PM	Free	-
	3:00 PM to 6:00 PM	MAX 2	-
	6:00 PM to 12:00 AM	Free	-
1,7	12:00 AM to 12:00 AM	Free	-

SIGNAL PHASING DIAGRAM
(MAIN ST AT CAMPBELL STATION RD)



EIGHT PHASE SEQUENCING

ACTIVE PHASE

INACTIVE PHASE (NOT USED)

- PROT-PERM LEFT-TURN: Ø1,Ø3,Ø5,Ø7

- CONCURRENT WB RT TURN ARROW WITH Ø1

- ALL SIGNAL DISPLAYS AND CLEARANCES SHALL BE IN ACCORDANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.

LOOP AND DETECTOR ASSIGNMENTS

DETECTOR CHANNEL	ASSOCIATED PHASE	MODE	TIMING EXTEND	TIMING DELAY	MAKE	MODEL	COMMENTS
1	1	PRES		3.0	IDC		EXISTING; L1-1
2	2	PRES			IDC		EXISTING; L2-1
3	3	PRES			NORTHSTAR	NT11	EXISTING; L3-1
4	4	PRES		0.0	IDC		EXISTING; L4-1
5	5	PRES		3.0	NORTHSTAR	NT11-E	EXISTING; L5-1
6	6	PRES			IDC		EXISTING; L6-1
7	7	PRES		3.0	NORTHSTAR	NT11-E	EXISTING; L7-1
8	8	PRES			SARASOTA	535T	EXISTING; L8-1

SIGNAL TIMING DETAIL - CAMPBELL STATION RD

TRAFFIC SIGNAL COORDINATION PROJECT
MAIN STREET (U.S. 31, SR-6)
CITY OF SPRING HILL, TENNESSEE

GREGORY D. JUDY — STATE OF TENNESSEE

DSGN: GDJ
DRWN: LRD
CHKD:
SCALE: NONE
PROJ. NO: 6966.001

REVISIONS

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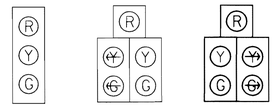
SIGNAL HEADS

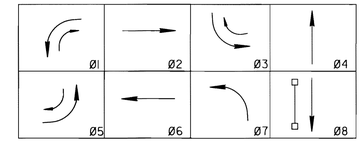


TYPE 130
EXISTING
2

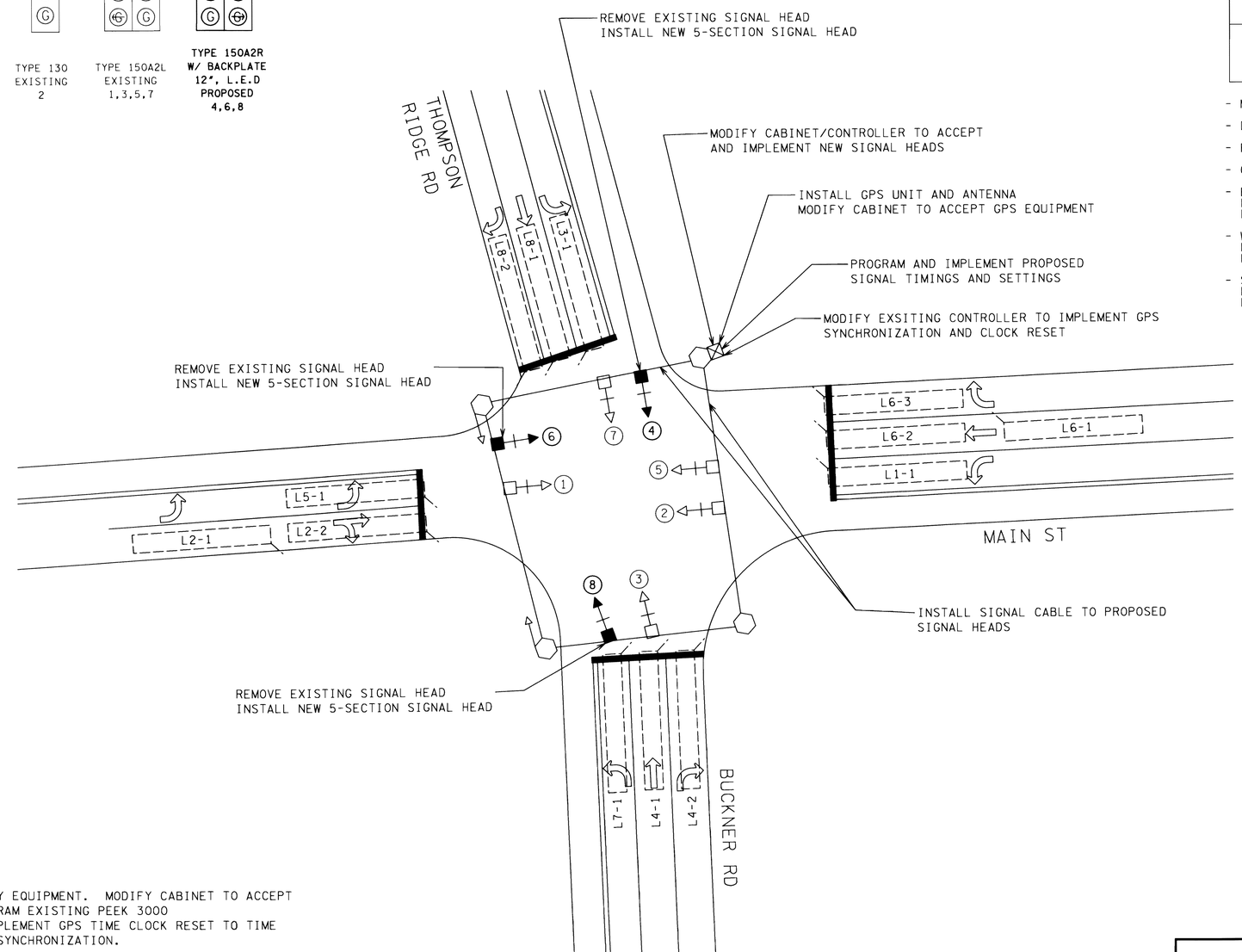
TYPE 150A2L
EXISTING
1,3,5,7

TYPE 150A2R
W/ BACKPLATE
12", L.E.D
PROPOSED
4,6,8

SIGNAL PHASING DIAGRAM
(MAIN ST AT BUCKNER RD)



- MIN RECALL: Ø2,Ø6
- DUAL ENTRY: Ø2,Ø6; Ø4,Ø8
- PROT-PERM LEFT-TURN: Ø1,Ø3,Ø5,Ø7
- COORD PHASE: Ø2,Ø6
- EB RIGHT PROTECTED PHASE WITH Ø5 ONLY. RT. TURN ARROW SHALL NOT BE ACTIVE DURING Ø8
- WB RIGHT PROTECTED PHASE WITH Ø1 ONLY. RT. TURN ARROW SHALL NOT BE ACTIVE DURING Ø4
- SB RIGHT PROTECTED PHASE WITH Ø3 ONLY. RT. TURN ARROW SHALL NOT BE ACTIVE DURING Ø6



NOTES

1. INSTALL GPS UNIT AND ALL ANCILLARY EQUIPMENT. MODIFY CABINET TO ACCEPT GPS SYNCHRONIZATION EQUIPMENT. PROGRAM EXISTING PEEK 3000 CONTROLLER TO ACCEPT, OPERATE AND IMPLEMENT GPS TIME CLOCK RESET TO TIME DESIGNATED IN PLANS. IMPLEMENT GPS SYNCHRONIZATION.

2. PROGRAM EXISTING CONTROLLER WITH PROPOSED TIMINGS AND SETTINGS, INCLUDING BUT NOT LIMITED TO, COORD SET-UP SETTINGS AND TIME-OF-DAY PLAN ASSIGNMENTS. IMPLEMENT AND CONFIRM "MAX 2" & "MAX 3" OPERATION AS SPECIFIED IN PLANS.

3. EXISTING CABINET INCLUDES "PREEMPT" SIDE RELAY WIRING PANEL.

4. REMOVE EXISTING PHASE 4, 6 AND 8 THREE-SECTION SIGNAL HEADS AND REPLACE WITH FIVE-SECTION SIGNAL HEADS. INSTALL NEW SIGNAL CABLE TO PROPOSED SIGNAL HEADS. CONTRACTOR TO CONFIRM NEED FOR NEW ELBOW BEND ACCESS INTO BOTTOM OF CABINET. MODIFY CABINET WIRING AS REQUIRED TO IMPLEMENT NEW FIVE-SECTION SIGNAL HEAD.

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PROPOSED LAYOUT

TRAFFIC SIGNAL COORDINATION PROJECT
MAIN STREET (U.S. 31, SR-6)
CITY OF SPRING HILL, TENNESSEE

GREGORY D. JUDY
STATE OF TENNESSEE

DSGN: GDJ		REVISIONS
DRWN: LRD		
CHKD:		
SCALE: 1" = 20'		
PROJ. NO: 6966.001		

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DRAWING NO.
8

CONTROLLER PROGRAMMING DATA

	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5	PHASE 6	PHASE 7	PHASE 8
MOVEMENT	SB LT	NB	EB LT	WB	NB LT	SB	WB LT	EB
PHASE DATA								
MIN GREEN	5.0	15.0	5.0	8.0	5.0	15.0	5.0	8.0
PASSAGE TIME	2.5	4.0	2.5	2.5	2.5	4.0	2.5	2.5
MAXIMUM I	15.0	45.0	15.0	20.0	15.0	45.0	15.0	20.0
MAXIMUM II	20.0	65.0	20.0	20.0	20.0	65.0	20.0	20.0
YELLOW								
RED								
WALK								
PED CLEAR								
ADDED INITIAL								
MAX INITIAL								
TIME BEFORE REDUC								
TIME TO REDUCE								
MIN GAP								
PHASE FUNCTIONS								
NON-LOCK MEMORY	YES	YES	YES	YES	YES	YES	YES	YES
DUAL ENTRY		ON		ON		ON		ON
COND SERVICE								
SIMULT GAP								
VEHICLE RECALL		MIN				MIN		
PEDESTRIAN RECALL								
DETECTOR CONTROL								
DETECTOR	1 2	3 4	5 6	7 8	9 10	11 12	13 14	15 16
ASSIGNED PHASE								
SWITCH PHASE								

NOTE:

- VALUES/SETTINGS IN TABLE SHALL BE FIELD VERIFIED AND/OR UPDATED AS NECESSARY BY CONTRACTOR.

- SIGNAL TIMING SETTINGS THAT ARE "BLANK" IN THE ABOVE TABLE SHALL BE RETAINED AS CURRENTLY PROGRAMMED IN EXISTING CONTROLLER WHERE APPLICABLE.

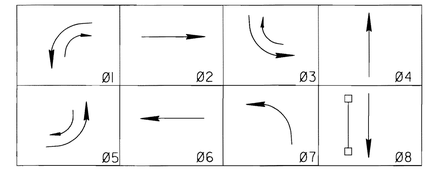
- SETTINGS MAY BE ADJUSTED BASED ON FIELD CONDITIONS WITH APPROVAL FROM ENGINEER.

COORD SETUP	
COORD SOURCE:	TOD
DAYLIGHT SAVINGS	3-2 / 11-1
SYNC REFERENCE / TIME CLOCK RESET	03:00AM

VARIABLE MAXIMUM PROGRAMMING (MAX 3)								
Phase	1	2	3	4	5	6	7	8
Description	SB LT	NB TR	EB LT	WB TR	NB LT	SB TR	WB LT	EB TR
Max 3 Limit	30	80	30	40	30	80	30	40
Max 3 Adjust Value	5	5	5	5	5	5	5	5
Max Outs Before Adjustment	1	1	1	1	1	1	1	1
Gap Outs Before Reduction	2	2	2	2	2	2	2	2

TIME BASE PROGRAMMING			
DAY	TIME	PLAN	Cycle Length
2,3,4,5,6	12:00 AM to 7:00 AM	Free	-
	7:00 AM to 9:00 AM	MAX 2	-
	9:00 AM to 11:00 AM	Free	-
	11:00 AM to 1:00 PM	MAX 2	-
	1:00 PM to 3:00 PM	Free	-
	3:00 PM to 6:00 PM	MAX 2	-
	6:00 PM to 12:00 AM	Free	-
1,7	12:00 AM to 12:00 AM	Free	-

SIGNAL PHASING DIAGRAM (MAIN ST AT BUCKNER RD)



EIGHT PHASE SEQUENCING

ACTIVE PHASE

INACTIVE PHASE (NOT USED)

- PROT-PERM LEFT-TURN: Ø1,Ø3,Ø5,Ø7

- CONCURRENT SB RT TURN ARROW WITH Ø3

- CONCURRENT EB RT TURN ARROW WITH Ø5

- CONCURRENT WB RT TURN ARROW WITH Ø1

- ALL SIGNAL DISPLAYS AND CLEARANCES SHALL BE IN ACCORDANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.

LOOP AND DETECTOR ASSIGNMENTS							
			TIMING				
DETECTOR CHANNEL	ASSOCIATED PHASE	MODE	EXTEND	DELAY	MAKE	MODEL	COMMENTS
1	1	PRES		3.0	SARASOTA	535T	EXISTING; L1-1
2	2	PRES			SARASOTA	535T	EXISTING; L2-1, L2-2 IN SERIES
3	3	PRES		5.0	SARASOTA	535T	EXISTING; L3-1
4	4	PRES		7.0	SARASOTA	535T	EXISTING; L4-1, L4-2 IN SERIES
5	5	PRES		3.0	SARASOTA	535T	EXISTING; L5-1
6	6	PRES			IDC	LM301	EXISTING; L6-1, L6-2, L6-3 IN SERIES
7	7	PRES		5.0	SARASOTA	535T	EXISTING; L7-1
8	8	PRES		7.0	SARASOTA	535T	EXISTING; L8-1, L8-2 IN SERIES

SIGNAL TIMING DETAIL - BUCKNER RD

TRAFFIC SIGNAL COORDINATION PROJECT
MAIN STREET (U.S. 31, SR-6)
CITY OF SPRING HILL, TENNESSEE

GREGORY D. JUDY
REGISTERED ENGINEER
AGRICULTURE
11-20-08
10611
STATE OF TENNESSEE

		REVISIONS
DSGN: GDJ		
DRWN: LRD		
CHKD:		
SCALE: NONE		
PROJ. NO: 6966.001		

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SHEET NO.
8A

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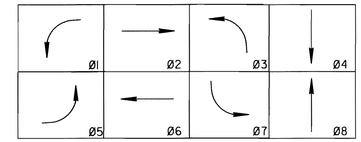
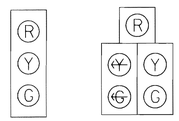
SIGNAL PHASING DIAGRAM
(COLUMBIA HWY (SR-6) AT THOMPSON STATION RD)



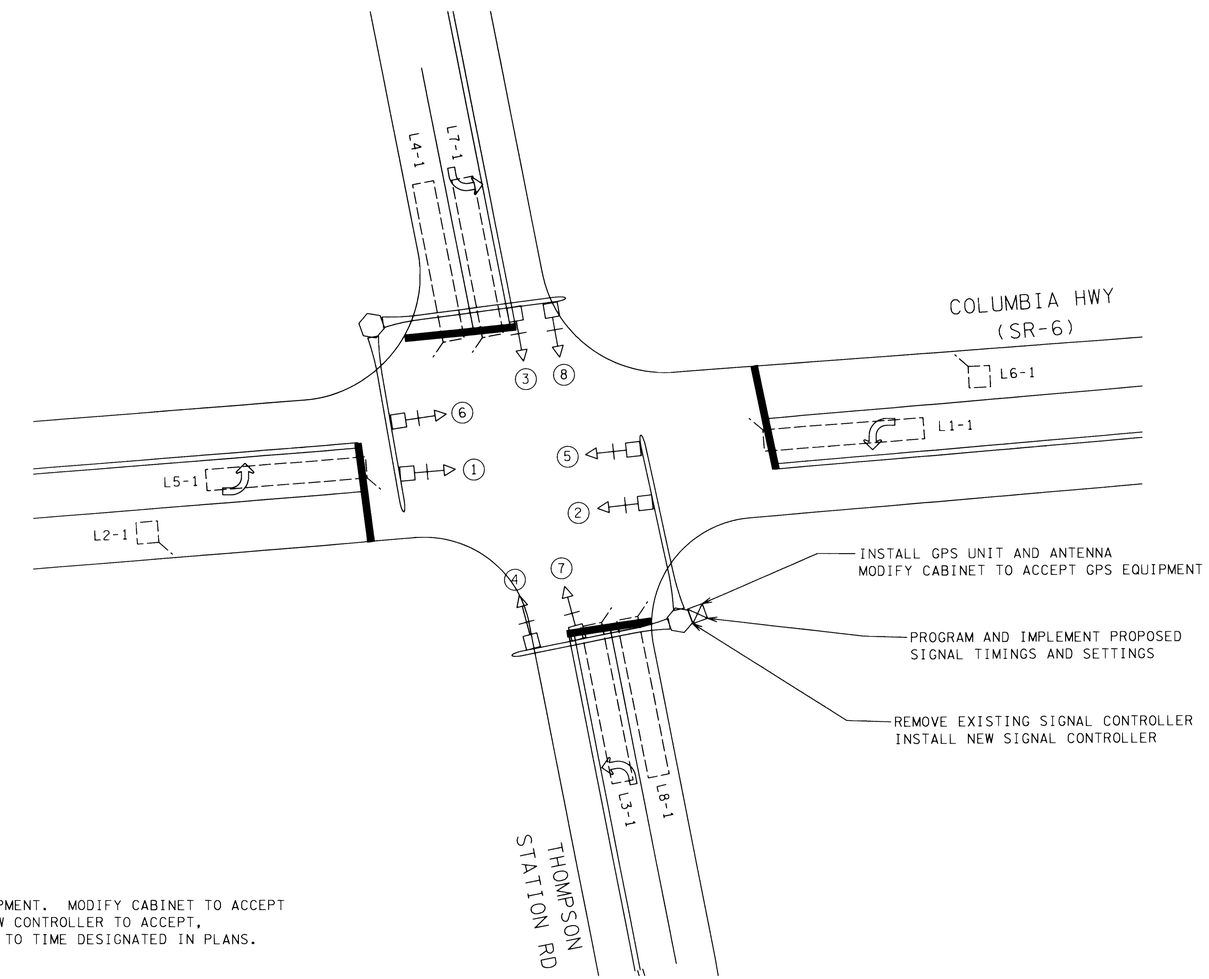
- MIN RECALL: Ø2,Ø6
- DUAL ENTRY: Ø2,Ø6; Ø4,Ø8
- PROT-PERM LEFT-TURN: Ø1,Ø3,Ø5,Ø7
- COORD PHASE: Ø2,Ø6

SIGNAL HEADS



TYPE 130
EXISTING
2,4,6,8

TYPE 150A2L
EXISTING
1,3,5,7



CAUTION !
PRELIMINARY PLANS
SUBJECT TO
CHANGE

NOTES

1. INSTALL GPS UNIT AND ALL ANCILLARY EQUIPMENT. MODIFY CABINET TO ACCEPT GPS SYNCHRONIZATION EQUIPMENT. PROGRAM NEW CONTROLLER TO ACCEPT, OPERATE AND IMPLEMENT GPS TIME CLOCK RESET TO TIME DESIGNATED IN PLANS. IMPLEMENT GPS SYNCHRONIZATION.

2. PROGRAM EXISTING CONTROLLER WITH PROPOSED TIMINGS AND SETTINGS, INCLUDING BUT NOT LIMITED TO, COORD SET-UP SETTINGS AND TIME-OF-DAY PLAN ASSIGNMENTS. IMPLEMENT AND CONFIRM "MAX 2" & "MAX 3" OPERATION AS SPECIFIED IN PLANS.

3. EXISTING CABINET INCLUDES "PREEMPT" SIDE RELAY WIRING PANEL.

4. REPLACE EXISTING SIGNAL CONTROLLER. NEW CONTROLLER SHALL MAINTAIN TIMINGS AND SETTINGS FROM CURRENT CONTROLLER, EXCEPT AS SHOWN ON DETAIL SHEET (SHEET 9A). MODIFY EXISTING CABINET TO ACCEPT NEW CONTROLLER AND PROGRAM NEW CONTROLLER WITH REQUIRED SETTINGS (COST ABSORBED).

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PROPOSED LAYOUT

TRAFFIC SIGNAL COORDINATION PROJECT
MAIN STREET (U.S. 31, SR-6)
CITY OF SPRING HILL, TENNESSEE

DSGN: GDJ		REVISIONS
DRWN: LRD		
CHKD:		
SCALE: 1" = 20'		
PROJ. NO: 6966.001		

GREGORY D. JUDD — STATE OF TENNESSEE

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DRAWING NO.
9

CONTROLLER PROGRAMMING DATA

	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5	PHASE 6	PHASE 7	PHASE 8
MOVEMENT	SB LT	NB	WB LT	EB	NB LT	SB	EB LT	WB
PHASE DATA								
MIN GREEN	5.0	15.0	5.0	5.0	5.0	15.0	5.0	5.0
PASSAGE TIME								
MAXIMUM I	15.0	50.0	15.0	20.0	15.0	50.0	15.0	20.0
MAXIMUM II	15.0	75.0	15.0	20.0	15.0	75.0	15.0	20.0
YELLOW	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
RED	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
WALK								
PED CLEAR								
ADDED INITIAL		2.5				2.5		
MAX INITIAL		30.0				30.0		
TIME BEFORE REDUC		20.0				20.0		
TIME TO REDUCE		20.0				20.0		
MIN GAP		3.0				3.0		
PHASE FUNCTIONS								
NON-LOCK MEMORY								
DUAL ENTRY		YES		YES		YES		YES
COND SERVICE								
SIMULT GAP								
VEHICLE RECALL		MIN				MIN		
PEDESTRIAN RECALL								
DETECTOR CONTROL								
DETECTOR	1 2	3 4	5 6	7 8	9 10	11 12	13 14	15 16
ASSIGNED PHASE								
SWITCH PHASE								

NOTE:

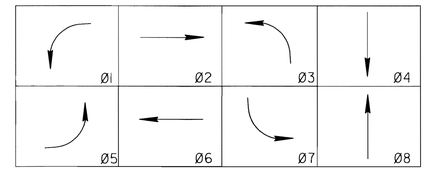
- VALUES/SETTINGS IN TABLE SHALL BE FIELD VERIFIED AND/OR UPDATED AS NECESSARY BY CONTRACTOR.
- SIGNAL TIMING SETTINGS THAT ARE "BLANK" IN THE ABOVE TABLE SHALL BE RETAINED AS CURRENTLY PROGRAMMED IN EXISTING CONTROLLER WHERE APPLICABLE.
- SETTINGS MAY BE ADJUSTED BASED ON FIELD CONDITIONS WITH APPROVAL FROM ENGINEER.

COORD SETUP	
COORD SOURCE:	TOD
DAYLIGHT SAVINGS	3-2 / 11-1
SYNC REFERENCE / TIME CLOCK RESET	03:00AM

VARIABLE MAXIMUM PROGRAMMING (MAX 3)								
Phase	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Description	SB LT	NB TR	WB LT	EB TR	NB LT	SB TR	EB LT	WB TR
Max 3 Limit	20	90	20	25	20	90	20	25
Max 3 Adjust Value	2	5	2	2	2	5	2	2
Max Outs Before Adjustment	1	1	1	1	1	1	1	1
Gap Outs Before Reduction	2	2	2	2	2	2	2	2

TIME BASE PROGRAMMING			
DAY	TIME	PLAN	Cycle Length
2,3,4,5,6	12:00 AM to 7:00 AM	Free	-
	7:00 AM to 9:00 AM	MAX 2	-
	9:00 AM to 11:00 AM	Free	-
	11:00 AM to 1:00 PM	MAX 2	-
	1:00 PM to 3:00 PM	Free	-
	3:00 PM to 6:00 PM	MAX 2	-
	6:00 PM to 12:00 AM	Free	-
1,7	12:00 AM to 12:00 AM	Free	-

SIGNAL PHASING DIAGRAM
(COLUMBIA HWY (SR-6) AT THOMPSON STATION RD)



EIGHT PHASE SEQUENCING

ACTIVE PHASE

INACTIVE PHASE (NOT USED)

- PROT-PERM LEFT-TURN: Ø1,Ø3,Ø5,Ø7

- ALL SIGNAL DISPLAYS AND CLEARANCES SHALL BE IN ACCORDANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.

LOOP AND DETECTOR ASSIGNMENTS							
			TIMING				
DETECTOR CHANNEL	ASSOCIATED PHASE	MODE	EXTEND	DELAY	MAKE	MODEL	COMMENTS
1	1	PRES		5.0	SARASOTA	535T	EXISTING; L1-1
2	2	PRES			SARASOTA	535T	EXISTING; L2-1
3	3	PRES		5.0	EDI	LM301T	EXISTING; L3-1
4	4	PRES		5.0	SARASOTA	535T	EXISTING; L4-1
5	5	PRES		5.0	SARASOTA	535T	EXISTING; L5-1
6	6	PRES			SARASOTA	535T	EXISTING; L6-1
7	7	PRES		5.0	EDI	LM301T	EXISTING; L7-1
8	8	PRES		5.0	SARASOTA	535T	EXISTING; L8-1

SIGNAL TIMING DETAIL - THOMPSON STATION RD

TRAFFIC SIGNAL COORDINATION PROJECT
MAIN STREET (U.S. 31, SR-6)
CITY OF SPRING HILL, TENNESSEE

GREGORY D. JUDY
STATE OF TENNESSEE

DSGN: GDJ
DRWN: LRD
CHKD:
SCALE: NONE
PROJ. NO: 6966.001

REVISIONS

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SHEET NO.
9A

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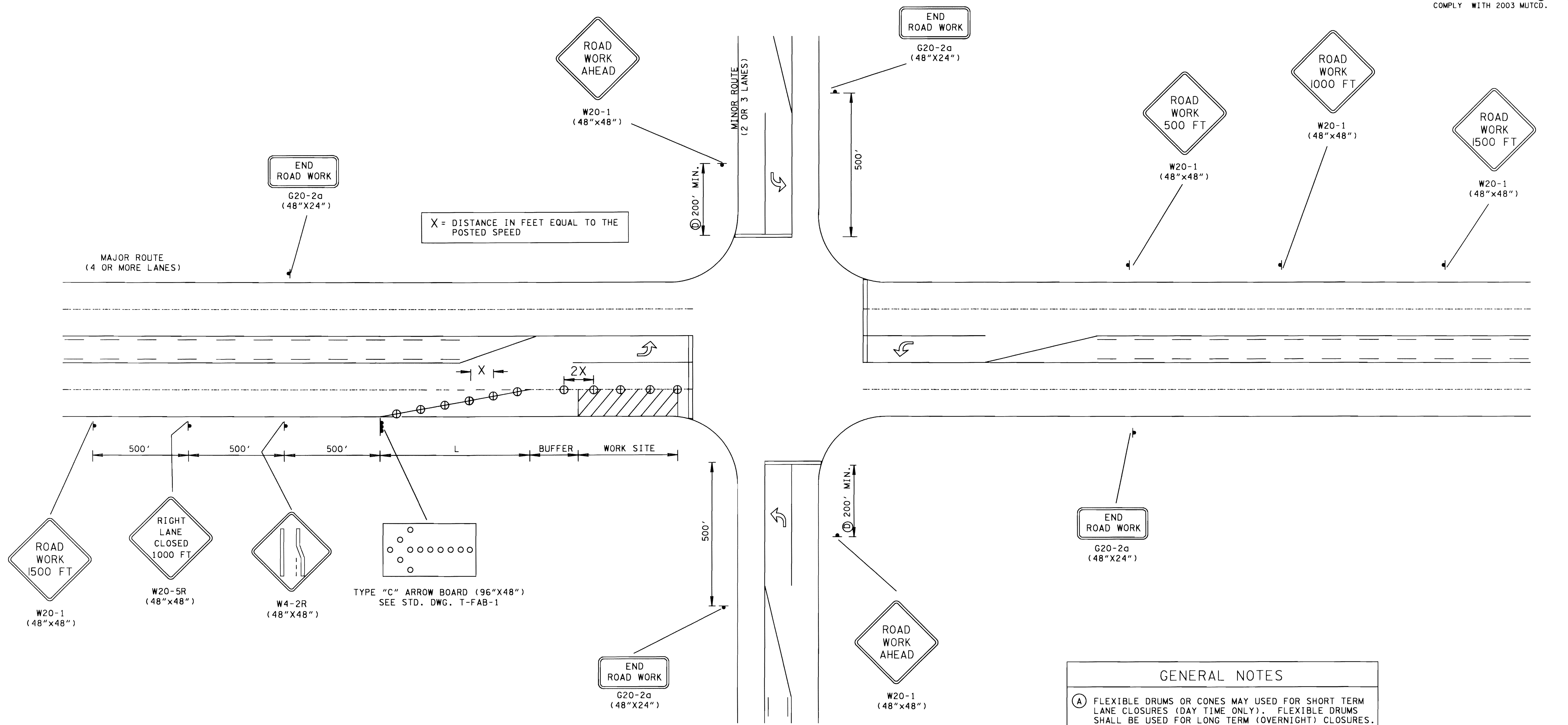
RIGHT LANE CLOSURES AT NEAR SIDE OF INTERSECTIONS

- REV. 9-1-05: REMOVED TYPE "C" WARNING LIGHTS FROM FLEXIBLE DRUMS IN TAPER. REMOVED TYPE "C" WARNING LIGHT NOTE FROM GENERAL NOTES.
- REV. 4-15-99: ADDED GENERAL NOTE Ⓔ.
- REV. 12-18-99: MODIFIED HEADING DESCRIPTION AND ELIMINATED OLD GENERAL NOTE Ⓐ.
- REV. 4-15-04: CHANGED W4-2 SIGN. CHANGED GENERAL NOTES Ⓑ AND Ⓒ TO COMPLY WITH 2003 MUTCD.



CHANNELIZATION DEVICE LEGEND

⦶	FLEXIBLE DRUMS
▸	SIGN SUPPORT
▨	WORK SITE
arrow board symbol	FLASHING YELLOW ARROW BOARD (SEE STD. DWG. NO. T-FAB-1,FOR DETAILS AND SPECIFICATIONS)

COMPUTATION FOR DISTANCE L

$L = W \times S$ (FOR POSTED SPEEDS OF 45 MPH OR GREATER)

$L = \frac{W \times S^2}{60}$ (FOR POSTED SPEEDS OF 40 MPH OR LESS)

L = TAPER LENGTH IN FEET
W = WIDTH OF OFFSET IN FEET
S = POSTED SPEED

GENERAL NOTES

Ⓐ FLEXIBLE DRUMS OR CONES MAY USED FOR SHORT TERM LANE CLOSURES (DAY TIME ONLY). FLEXIBLE DRUMS SHALL BE USED FOR LONG TERM (OVERNIGHT) CLOSURES.

Ⓑ SEE TABLE 6C-2 OF PART VI OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) FOR RECOMMENDED LENGTHS OF BUFFER SPACE WHICH ARE BASED ON STOPPING SIGHT DISTANCE AS A FUNCTION OF SPEED.

Ⓒ SEE TABLE 6C-1 OF PART VI OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) FOR GUIDELINES FOR ADVANCE WARNING SIGN SPACING TO BE USED TO DETERMINE DISTANCE FOR "ROAD WORK AHEAD" SIGN TO BE PLACED PRIOR TO INTERSECTION.

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

RIGHT LANE CLOSURES AT NEAR SIDE OF INTERSECTIONS

5-27-98 | T-WZ-40

10/21/2005
$$$$DGNSPEC$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

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* DETAIL TAKEN FROM LIST OF TDOT STANDARD DRAWINGS

GREGORY D. JUDY
STATE OF TENNESSEE

TRAFFIC SIGNAL COORDINATION PROJECT
MAIN STREET (U.S. 31, SR-6)
CITY OF SPRING HILL, TENNESSEE

NEEL-SCHAFFER
Solutions you can build upon

SHEET NO. 10

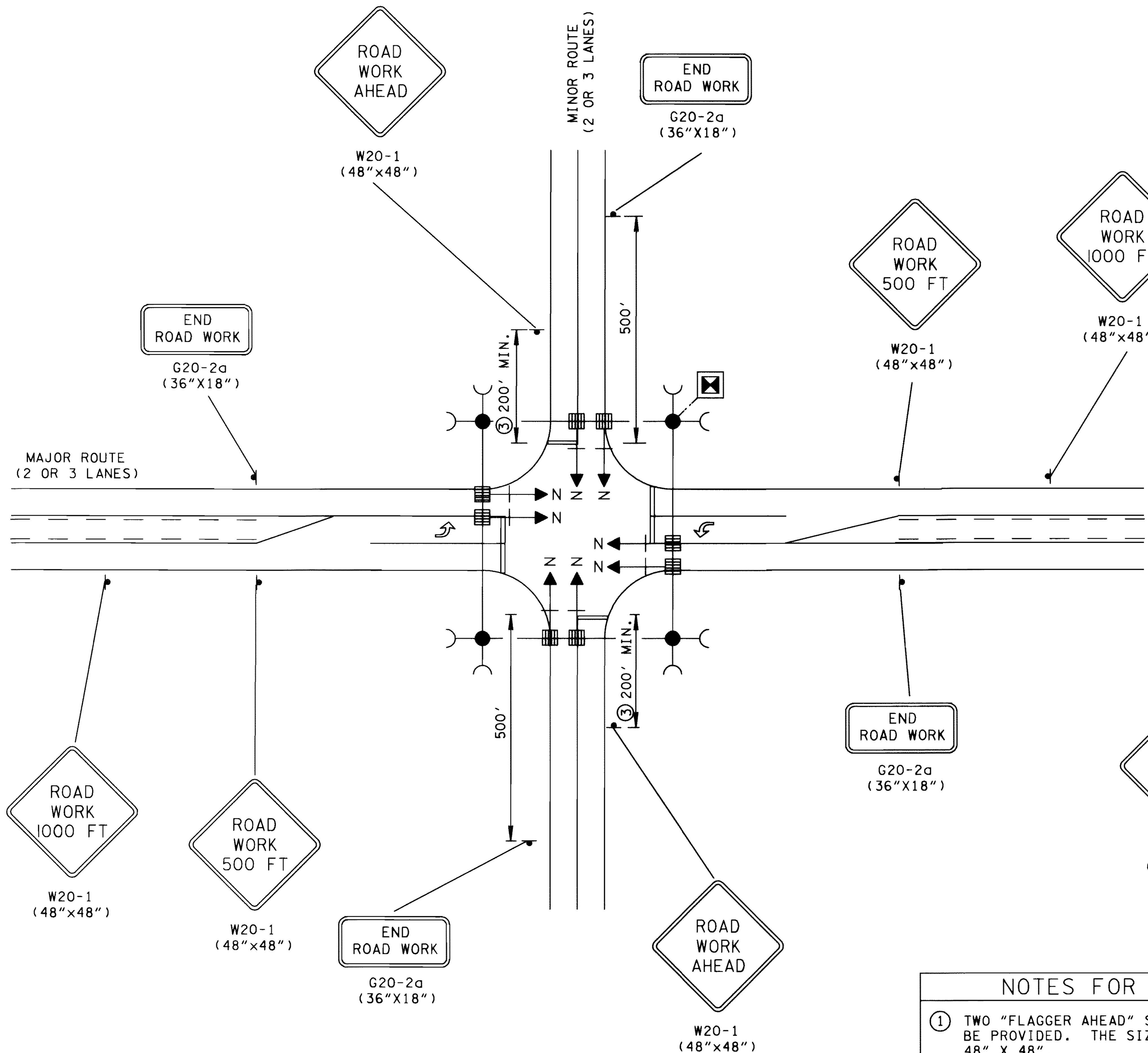
REV. 10-26-98: CHANGED CONSTRUCTION SIGN QUANTITIES.

⊡ REV. 12-18-99: IN NOTES FOR ABOVE LAYOUT BLOCK DELETED OLD NOTE NO. ②.

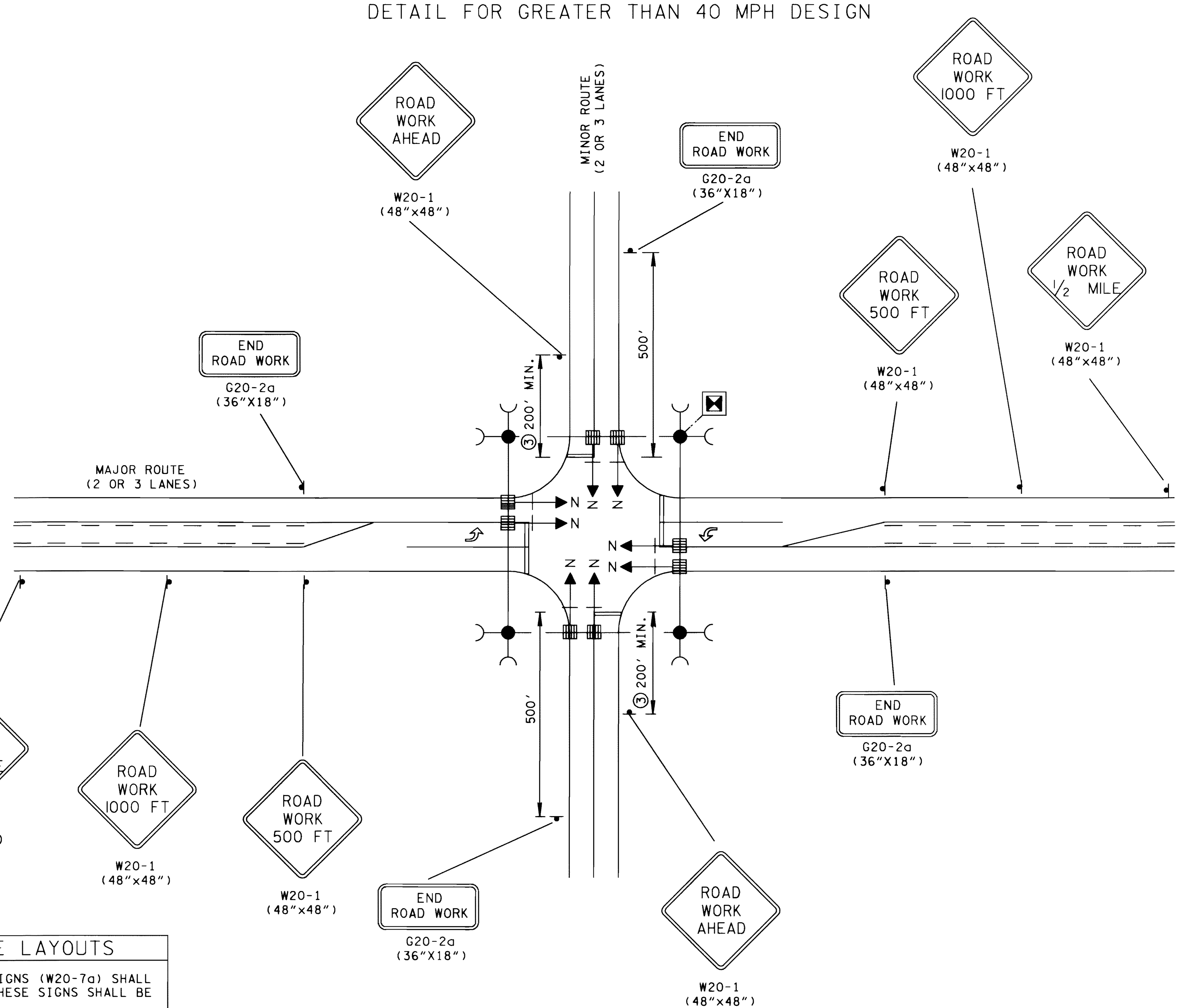
⊡ REV. 7-29-03: CHANGED SIZE OF END ROAD WORK CONSTRUCTION SIGN FROM 48"X24" TO 36"X18".

TRAFFIC CONTROL FOR SIGNAL ONLY PROJECTS WITH 2 OR 3 LANES ENTERING FROM ALL DIRECTIONS

DETAIL FOR 40 MPH DESIGN OR LESS



DETAIL FOR GREATER THAN 40 MPH DESIGN



NOTES FOR ABOVE LAYOUTS

① TWO "FLAGGER AHEAD" SYMBOL SIGNS (W20-7a) SHALL BE PROVIDED. THE SIZES OF THESE SIGNS SHALL BE 48" X 48".

② SEE TABLE VI-3 IN PART VI OF THE MUTCD (CURRENT EDITION).

CONSTRUCTION SIGN QUANTITIES
(ITEM NO. 712-06)

"T" INTERSECTIONS	- 93.5 S.F.
4 - LEGGED INTERSECTIONS	- 114 S.F.

LEGEND

⊠	PAD MOUNTED CONTROLLER
●	WOOD POLE FOR SIGNAL SUPPORT
—(	GUYING DEVICE ANGLE ANCHOR
▤—+—▶ N	SIGNAL HEAD WITH NUMBER AND BACKPLATE

CONSTRUCTION SIGN QUANTITIES
(ITEM NO. 712-06)

"T" INTERSECTIONS	- 125.5 S.F.
4 - LEGGED INTERSECTIONS	- 146 S.F.

⊡ MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

TRAFFIC CONTROL FOR SIGNALS ONLY PROJECTS ON 2 OR 3 LANE MAJOR ROUTES

5-27-98 | T-WZ-50

* DETAIL TAKEN FROM LIST OF TDOT STANDARD DRAWINGS

1/31/2005
$$$$DGNSPEC$$$$$$$$$$$$$$$$$$$$$$$$$$$$

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GREGORY D. JUDY — STATE OF TENNESSEE — 11-20-08

TRAFFIC SIGNAL COORDINATION PROJECT
MAIN STREET (U.S. 31, SR-6)
CITY OF SPRING HILL, TENNESSEE

NEEL-SCHAFFER
Solutions you can build upon

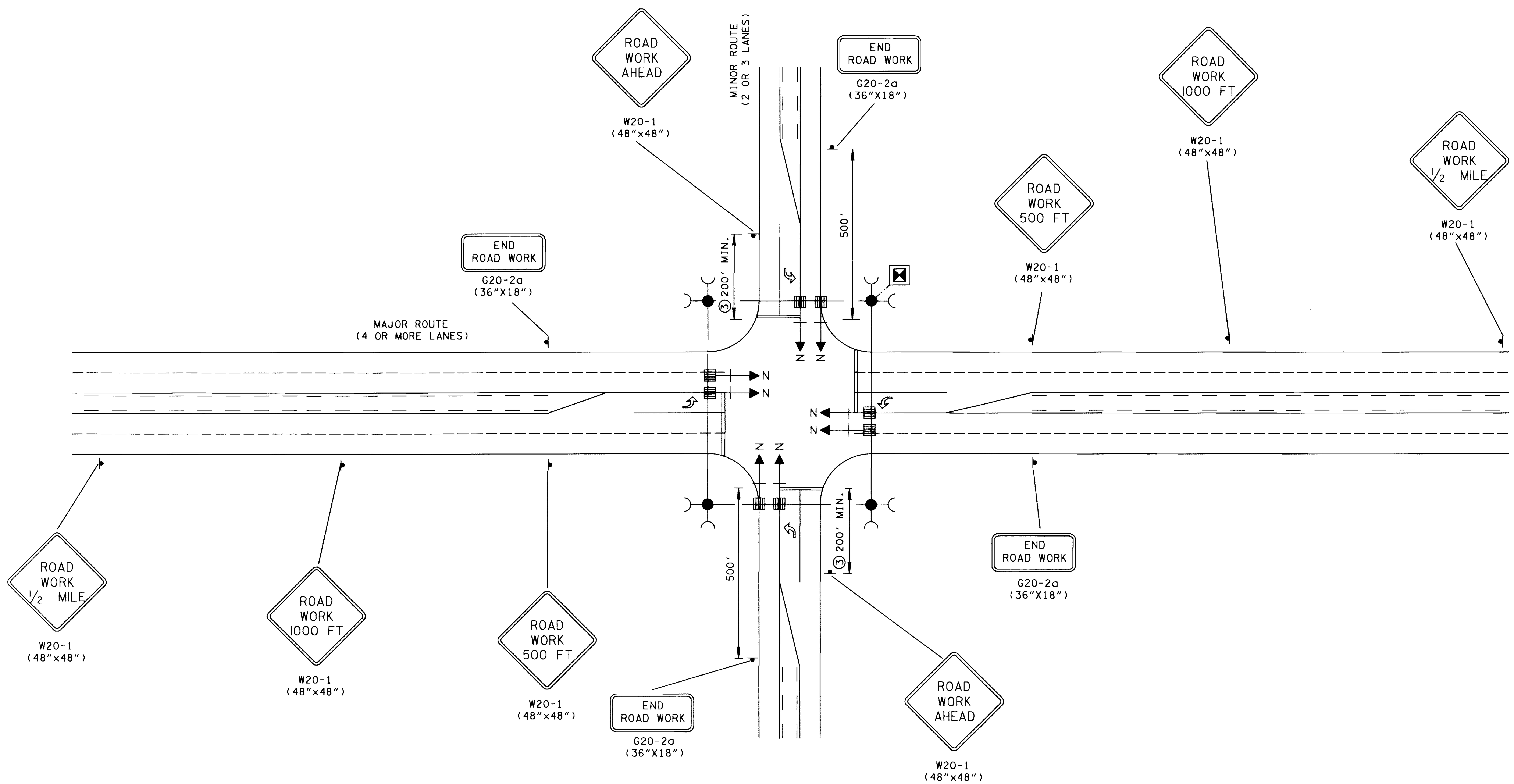
SHEET NO. 10A

REV. 10-26-98: CHANGED CONSTRUCTION SIGN QUANTITIES.

◘ REV. 12-18-99: IN NOTES FOR ABOVE LAYOUT BLOCK DELETED OLD NOTE NO. ②.

◘ REV. 7-29-03: CHANGED SIZE OF END ROAD WORK CONSTRUCTION SIGN FROM 48"X24" TO 36"X18".

TRAFFIC CONTROL FOR SIGNAL ONLY PROJECTS WITH A 4 OR 5 LANE MAJOR ROUTE AND A 2 OR 3 LANE MINOR ROUTE



NOTES FOR ABOVE LAYOUT

① ONE LEFT LANE CLOSED 1000 FT. SIGN (W20-5L), ONE RIGHT LANE CLOSED 1000 FT. SIGN (W20-5R), ONE "LEFT LANE MERGE" SYMBOL SIGN (W4-2L), ONE "RIGHT LANE MERGE" SYMBOL SIGNS (W4-2R), AND TWO "FLAGGER AHEAD" SYMBOL SIGNS (W20-7a) SHALL BE PROVIDED. THE SIZES OF THESE SIGNS SHALL BE 48"X48". SEE STANDARD DRAWING NOS. T-WZ-40 AND T-WZ-41 FOR MORE DETAILS.

② SEE TABLE VI-3 IN PART VI OF THE MUTCD (CURRENT EDITION).

LEGEND

- PAD MOUNTED CONTROLLER
- WOOD POLE FOR SIGNAL SUPPORT
- GUYING DEVICE ANGLE ANCHOR
- SIGNAL HEAD WITH NUMBER AND BACKPLATE

CONSTRUCTION SIGN QUANTITIES
(ITEM NO. 712-06)

"T" INTERSECTIONS	- 125.5 S.F.
4 - LEGGED INTERSECTIONS	- 146 S.F.

◘ MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

STATE OF TENNESSEE DEPARTMENT OF TRANSPORTATION

TRAFFIC CONTROL FOR SIGNALS ONLY PROJECTS ON 4 OR 5 LANE MAJOR ROUTES

5-27-98 | T-WZ-51

* DETAIL TAKEN FROM LIST OF TDOT STANDARD DRAWINGS

1/31/2005
$$$$DGNSPEC$$$$$$$$$$$$$$$$$$$$$$$$$$$$

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TRAFFIC SIGNAL COORDINATION PROJECT
MAIN STREET (U.S. 31, SR-6)
CITY OF SPRING HILL, TENNESSEE

NEEL-SCHAFFER
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SHEET NO. 10B