STATE ROUTE 386

AREA STUDY

in

City of Gallatin and Sumner County, Tennessee

PREPARED FOR:

Nashville Area Metropolitan Planning Organization,
Sumner County,
and the City of Gallatin

June 30, 2005

PREPARED BY:

Gresham Smith and Partners
1400 Nashville City Center
511 Union Street
Nashville, TN 37219

GRESHAM
SMITH AND
PARTNERS

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1.0 INTRODUCTION

This report documents the results and process for the State Route (SR) 386 Area Study project in Gallatin, Sumner County, Tennessee, performed for the Nashville Area Metropolitan Planning Organization (MPO), Sumner County, and the City of Gallatin. **Figure 1** shows the general project location.

1.1 Project Description

This project analyzed the impacts of completing the SR 386 extension (sometimes referred to as the Vietnam Veterans Boulevard extension) on the transportation network based on the long range development plan for the study area through which SR 386 is to be extended. The transportation analysis was performed with a multimodal perspective, including personal vehicles, transit, bicycle and pedestrian access.

SR 386 is to be extended from the existing SR 386 interchange with Gallatin Pike to its new terminus at Long Hollow Pike. The SR 386 extension would be an access-controlled facility with interchanges to be built at Big Station Camp Boulevard and Harris Lane.

The City of Gallatin has created a long range land use plan to control and manage the development of the area surrounding the SR 386 corridor. The land use plan contains a wide variety of uses including residential, commercial and business space, as well as public facilities and open space.

These planned improvements and developments are expected to increase existing traffic demand on the area's transportation network, thereby resulting in capacity and safety deficiencies. A refined version of the MPO travel demand model was created in order to predict where and to what extent these deficiencies may occur.

1.2 Study Area

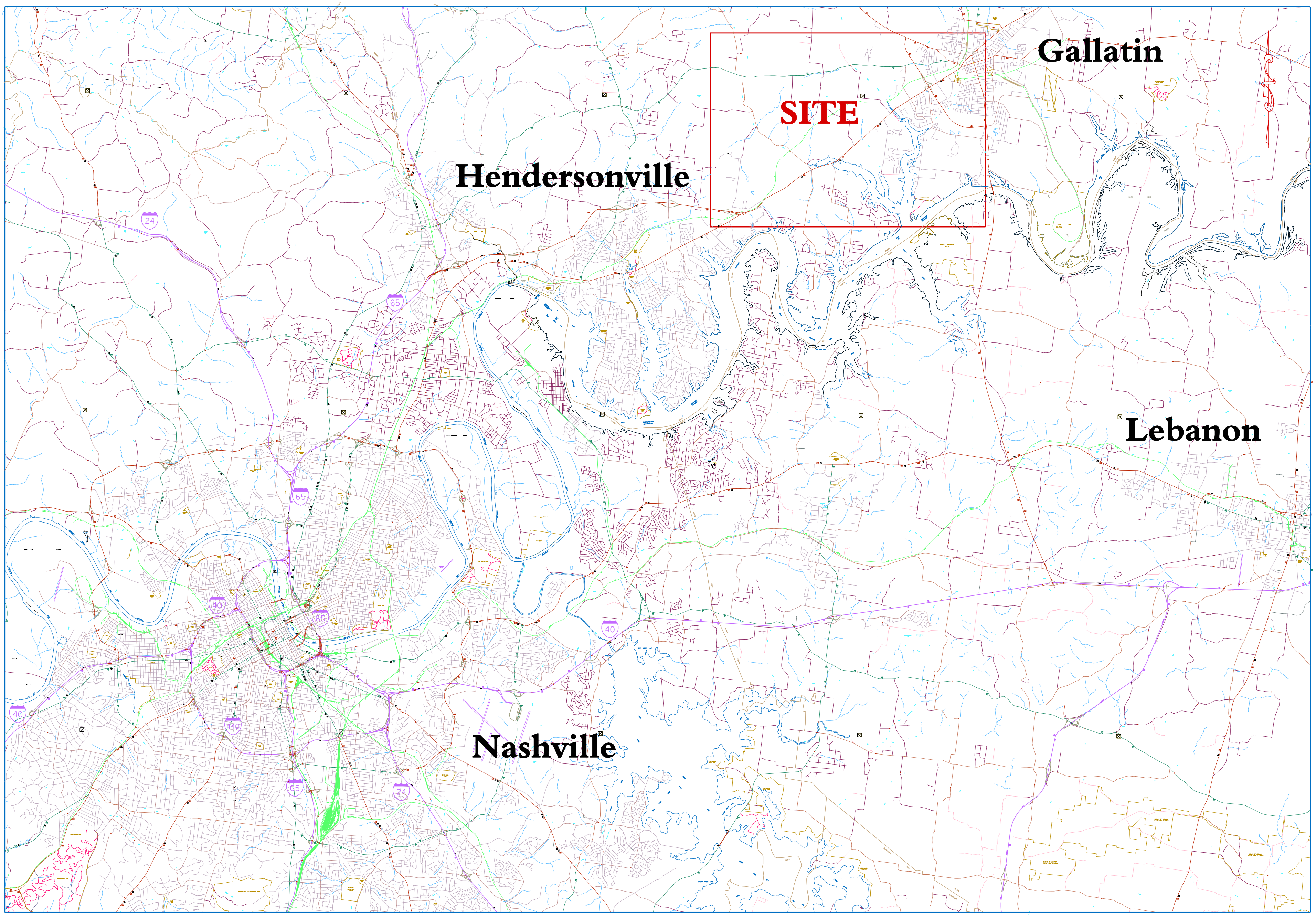
The study area is bounded generally by Long Hollow Pike to the north, Big Station Camp Boulevard to the west, Nashville Pike to the south, and downtown Gallatin to the east. In order to ensure proper transportation analysis in the refined model, the actual study area boundaries were placed beyond these roadways by one quarter of a mile. This buffer allowed for more realistic modeling of the boundary roadways.

A number of future improvements in the study area were included for consideration in the project. These future improvements included the St. Blaise/Harris Lane Connector, the proposed Harris Lane realignment, the new Big Station Camp Boulevard, a realignment of Long Hollow Pike in the City of Gallatin, and all the applicable improvements included in the City of Gallatin Major Thoroughfare Plan.

1.3 Resource References

Besides the above mentioned City of Gallatin Major Thoroughfare Plan and SR 386 Study Area Land Use Plan, several other resources were consulted. A partial list of references includes:

- City of Gallatin Major Thoroughfare Plan,
- SR 386 Study Area Land Use Plan,
- Proposed SR 174 Relocation from SR 109 to US 31E Main Street Advanced Planning Report (APR)
- City of Gallatin Bicycle and Pedestrian Master Plan,
- Sumner County Bicycle and Pedestrian Master Plan,
- Nashville Area MPO Transportation Improvement Program, and
- Several traffic impact studies for approved projects within the study area.



STATE ROUTE 386
AREA STUDY
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SUMNER COUNTY, TN

FIGURE 1
PROJECT VICINITY

2.0 STUDY AREA DESCRIPTION

The study area is bounded generally by Long Hollow Pike to the north, Station Camp Creek Boulevard to the west, Nashville Pike to the south, and downtown Gallatin to the east. Most of this area is in unincorporated Sumner County, though some portions lie within the City of Gallatin. In order to ensure proper transportation analysis in the refined model, the actual study area boundaries were placed beyond these roadways. The study area is shown in **Figure 2.**

The majority of the land within the study area is currently made up of low-density land uses, such as pasture and farm land. Strips of commercial development exist along parts of Nashville Pike and the downtown area. Its environs exhibit typical land uses for such an area, such as closely-spaced offices, shops, and restaurants with small setbacks and direct access to the roadway.

A limited review was performed to identify any potential unusual environmental obstacles to development of the study area. No obvious, uncommon environmental obstacles to roadway improvements were identified. This is not to say that environmental reviews need not be performed or that specific locations, such as waterways, will not need attention during any review process. Any design studies should include a detailed review of the area to determine potential environmental impacts.

The Long Range Land Use Plan for the SR 386 study area includes fifty-eight separate development areas of varied size and land use. The land use plan is summarized in **Table 1** and shown graphically in **Figure 3**. Some of these areas are already developed, as in the case of the downtown area. The entire land use plan covers an area of 8,818 acres. A total of 2,875 acres (32.6 percent) are planned for commercial development, 4,824 acres (54.7 percent) are planned for residential development, 674 acres (7.6 percent) are planned for mixed-use development, and 445 acres (5.0 percent) are planned for public space (including schools and green space).

The SR 386 Land Use Plan was used as the basis for determining the future development makeup of the area and the amount of trips into and out of the study area that might occur. Attention was paid to the individual land uses to determine when specific transportation infrastructure was required. The existing utility placements and inventory were not considered when developing the transportation infrastructure, because the majority of the study area is currently undeveloped.

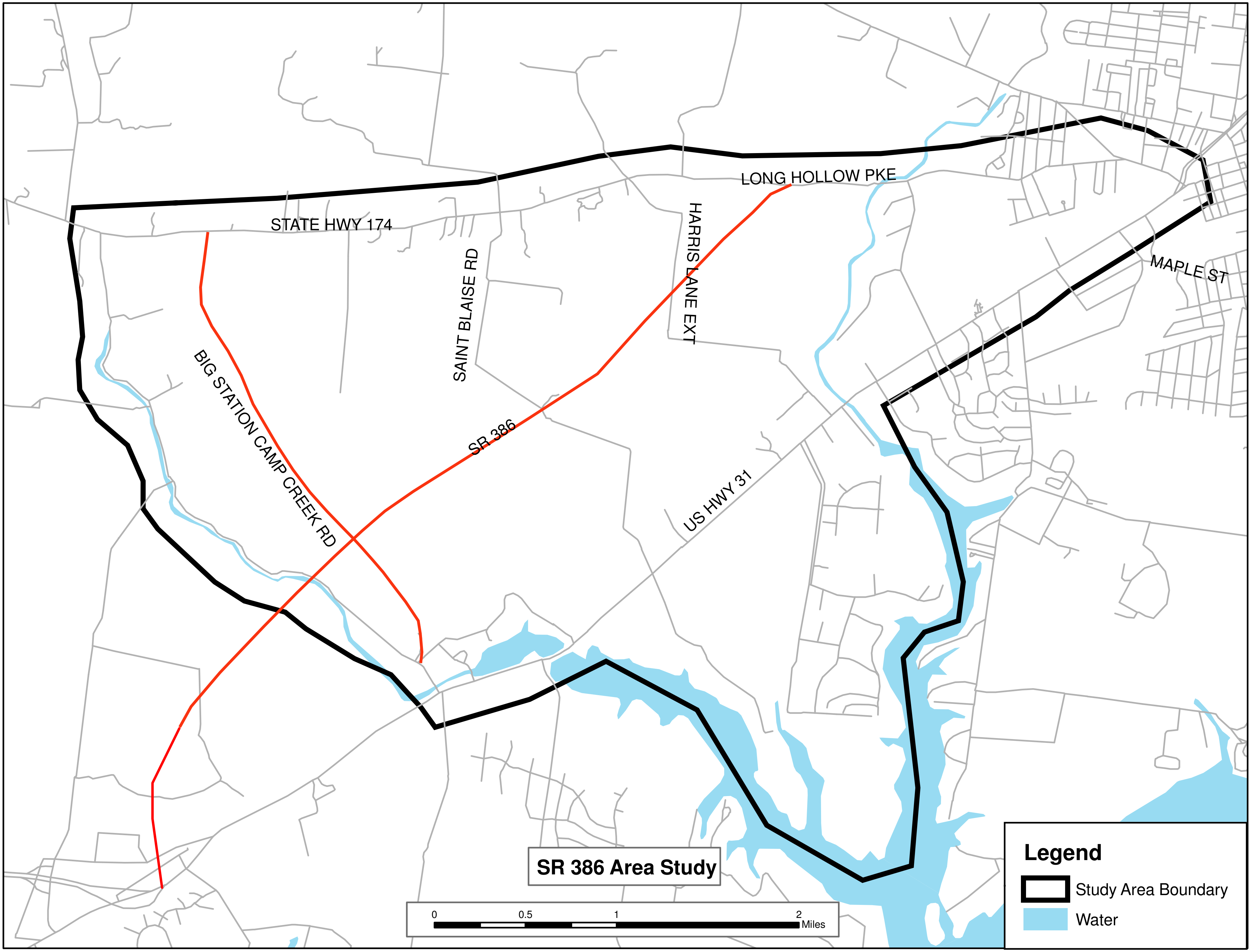
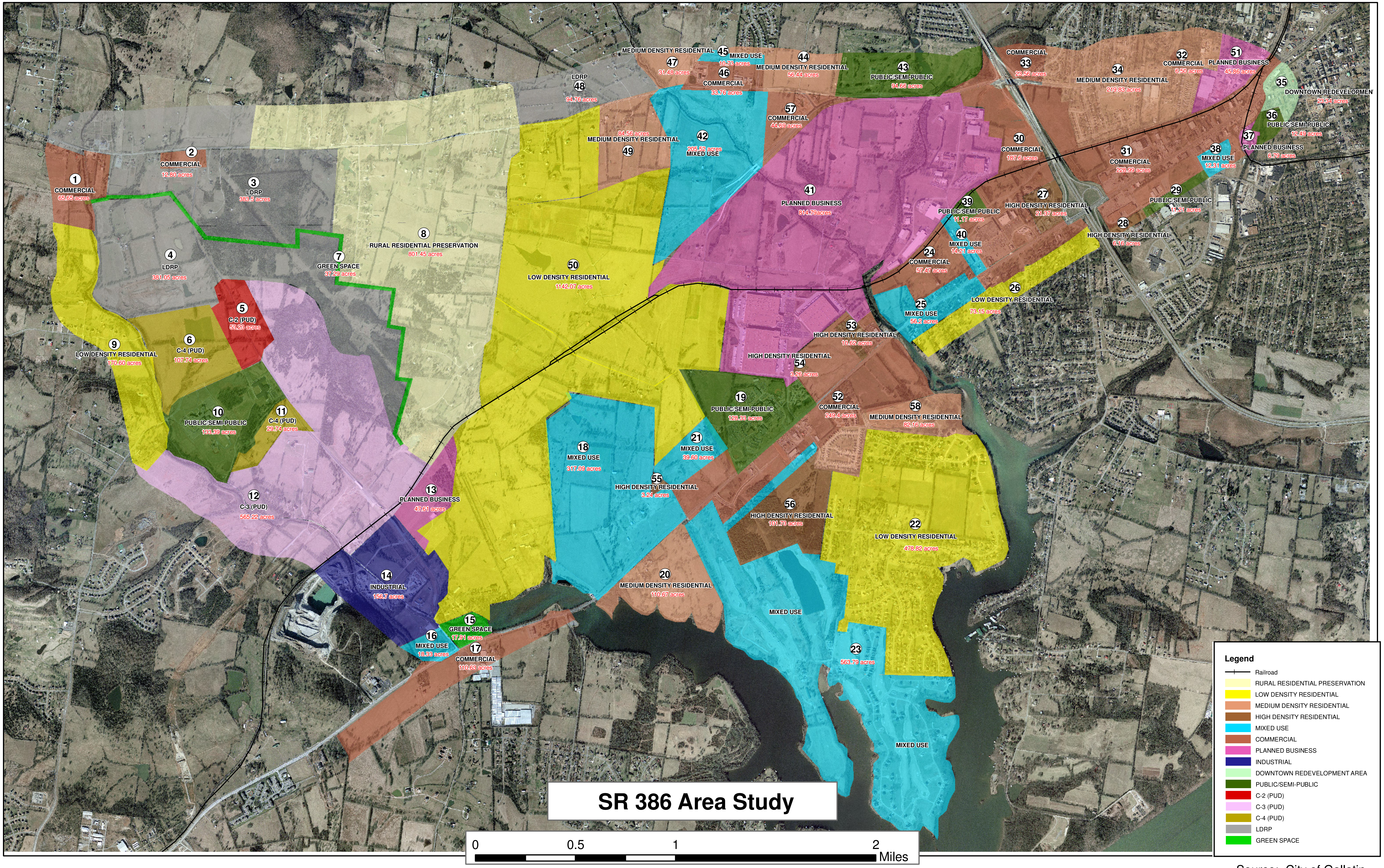


Figure 2: Study Area

Table 1 – Land Use Plan Summary

Land Use Area	Land Use Description	Density	Acres
1	Commercial	Max FAR 1.0	66
2	Commercial	Max FAR 1.0	13
3	LDRP	2.2 Units/Acre	384
4	LDR	2.2 Units/Acre	381
5	C-2 PUD	Max FAR 1.0	53
6	C-4 PUD	Max FAR 1.0	108
7	Greenspace		37
8	Estate A	2 acres per lot	801
9	Low Density Residential	2.2 Units/Acre	171
10	Public(School)	Lower, middle and high school	133
11	C-4 PUD	Max FAR 1.0	30
12	C-3 PUD	15 units per acre	565
13	Planned Business	Max FAR 1.0	48
14	Industrial	Max FAR 1.0	157
15	Greenspace		18
16	Mixed Use	15 units per acre and FAR 0.4	18
17	Commercial	Max FAR 1.0	111
18	Mixed Use	15 units per acre and FAR 0.4	317
19	Public/comm college	Existing	128
20	Medium Density Residential	7.5 units/acre	111
21	Mixed Use	15 units per acre and FAR 0.4	40
22	MDR	7.5 units/acre	479
23	Mixed Use	15 units/acre	564
24	Commercial	Max FAR 1.0	57
25	Mixed Use	15 units per acre and FAR 0.4	56
26	LDR	2.2 Units/Acre	73
27	High Density Residential	15 units per acre	24
28	High Density Residential	15 units per acre	6
29	Public		11
30	Commercial	Max FAR 1.0	188
31	Commercial	Max FAR 1.0	229
32	Commercial	Max FAR 1.0	7
33	Commercial	Max FAR 1.0	24
34	MDR	7.5 units/acre	220
35	Downtown	Max FAR 1.0	23
36	Public		12
37	Planned Business	Max FAR 1.0	7
38	Mixed Use	15 units per acre and FAR 0.4	12
39	Public		11
40	Mixed Use	15 units per acre and FAR 0.4	14
41	Planned Business	Max FAR 1.0	815
42	Mixed Use	15 units per acre and FAR 0.4	206
43	Public		95
44	MDR	7.5 units/acre	56
45	Mixed Use	15 units per acre and FAR 0.4	11
46	Commercial	Max FAR 1.0	34
47	MDR	7.5 units/acre	31
48	LDRP	2.2 units/Acre	95
49	Medium Density Residential	7.5 units/acre	85
50	LDR	3.5 units/acre	1142
51	Planned Business	Max FAR 1.0	46
52	Commercial	Max FAR 1.0	249
53	High Density Residential	15 units per acre	11
54	High Density Residential	15 units per acre	3
55	High Density Residential	15 units per acre	3
56	High Density Residential	15 units per acre	102
57	Commercial	Max FAR 1.0	45
58	Medium Density Residential	7.5 units/acre	82
		TOTAL	**8,818**



Source: City of Gallatin

Figure 3: Land Use Plan

3.0 TRANSPORTATION NETWORK

The existing primary routes for travel within the study area are Nashville Pike (SR 6) and Long Hollow Pike (SR 174), with a small number of roads connecting these two roadways (the number increasing with proximity to the downtown area). SR 109 also transits the study area, though this roadway is used primarily to travel through the study area and not within the study area.

During a visual field review of the existing study roadways, several safety deficiencies were identified. Many of the roadways reflected their existing rural character, with little or no shoulders. The following deficiencies were noted:

- Belvedere Drive – only gravel shoulders
- Harris Lane – no shoulders, portions that narrow to 22 feet of pavement, significant horizontal curves
- St. Blaise Road – unmaintained, 20 feet of pavement, no shoulders, no striping, significant horizontal curves, road narrows to one lane for railroad underpass (10' 9" height limit)
- Red River Road – portions that narrow to 22 feet of pavement, utilities very close to roadway, close on-street parking, acute vertical curve at railroad crossing

A number of existing, local roads that were not part of the MPO regional model were added to the refined model: Harris Lane, St. Blaise Road, St. Blaise Court, Browns Lane, and Bay Point Drive. All other local roads added to the refined model are addressed below.

There is no existing, scheduled mass transit service within the study area. The existing pedestrian/bicycle facilities in the study area are limited to sidewalks in the downtown area (City of Gallatin Bicycle and Pedestrian Master Plan).

3.1 Roadway Cross Section Terminology

A roadway's cross section refers to the profile of the roadway perpendicular to the centerline. The cross section shows not only the width of the roadway, but also the particular portions of the road that make up its total width: median, travel lanes, shoulders, sidewalks, etc.

Throughout this report the roadway widths are referred to in terms of lanes, a four-lane roadway or a five-lane section, for example. The following roadway widths are explained below:

- 2 lane road – one travel lane in each direction
- 3 lane road – one travel lane in each direction with a two-way left turn lane as the median
- 4 lane road – two travel lanes in each direction (a median may or may not be present)

- 5 lane road – two travel lanes in each direction with a two-way left turn lane as the median
- 6 lane road – three travel lanes in each direction with a raised median and turn bays at intersections

3.2 System Improvements

A number of future improvements in the study area were included for consideration in the project and in the refined model. These future improvements are gathered from a variety of sources, but can be grouped into three main categories: Planned Improvements, Approved Improvements, and Proposed Improvements. The Planned Improvements are those improvements that are already planned by the area governing bodies (Major Thoroughfare Plan). Approved Improvements are associated with development projects that have been approved by local governments. Proposed Improvements are the recommendations of this study, which would augment the Planned and Approved Improvements. The composite transportation network, combining the Planned, Approved, and Proposed Improvements, used for the refined travel demand model is shown in **Figure 4**. The following provides a discussion regarding the development of the composite transportation network.

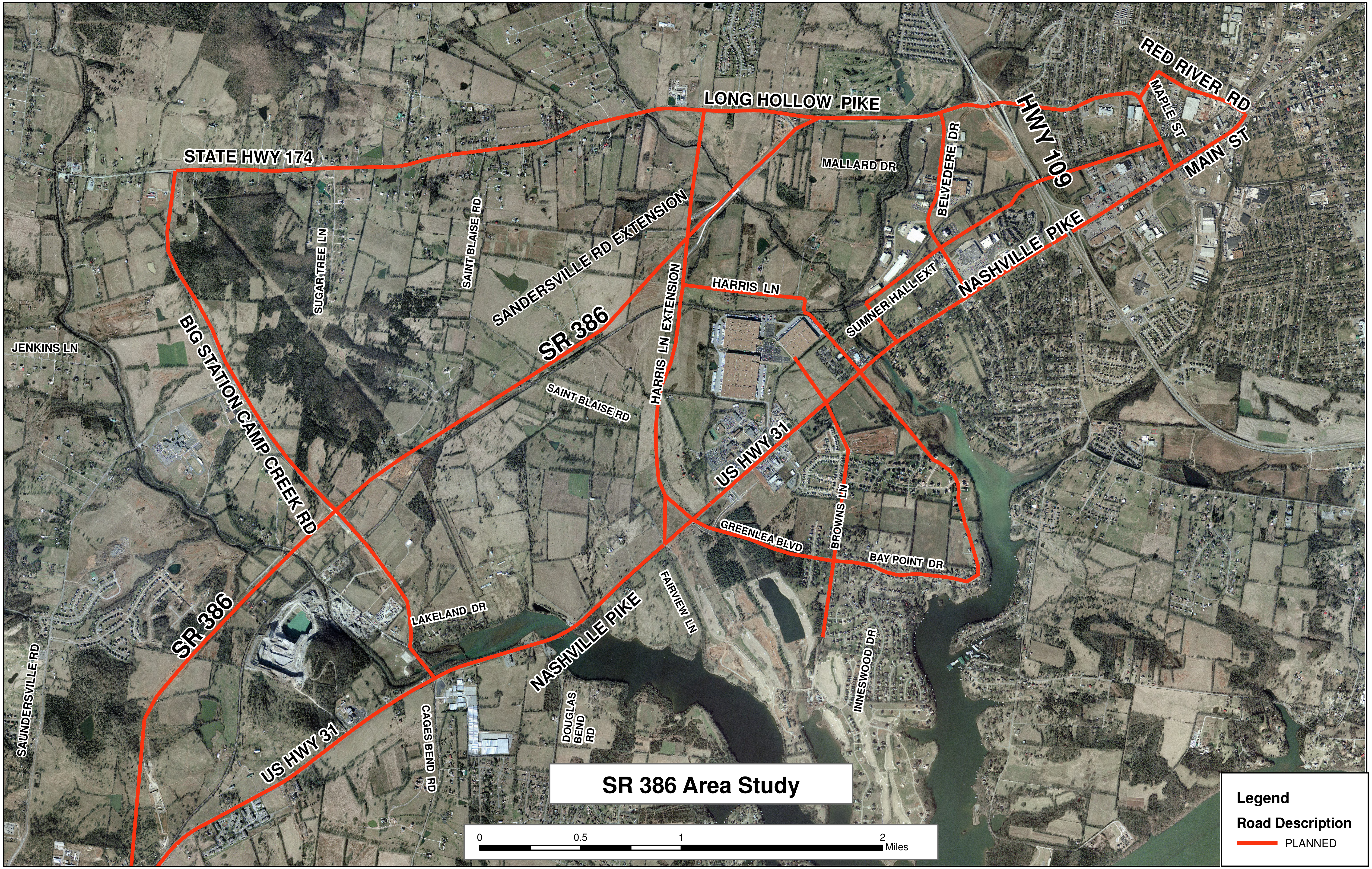
3.2.1 Planned Improvements

The Planned Improvements are transportation network modifications that have been planned by the area governing bodies. The improvements found in the City of Gallatin Major Thoroughfare Plan, for instance, are considered Planned Improvements. These improvements were considered to be in place for the purposes of the long-range model and were not subject to revision, except when additional capacity was required as suggested by the refined model. The Planned Improvements are shown in **Figure 5**.

Roadways

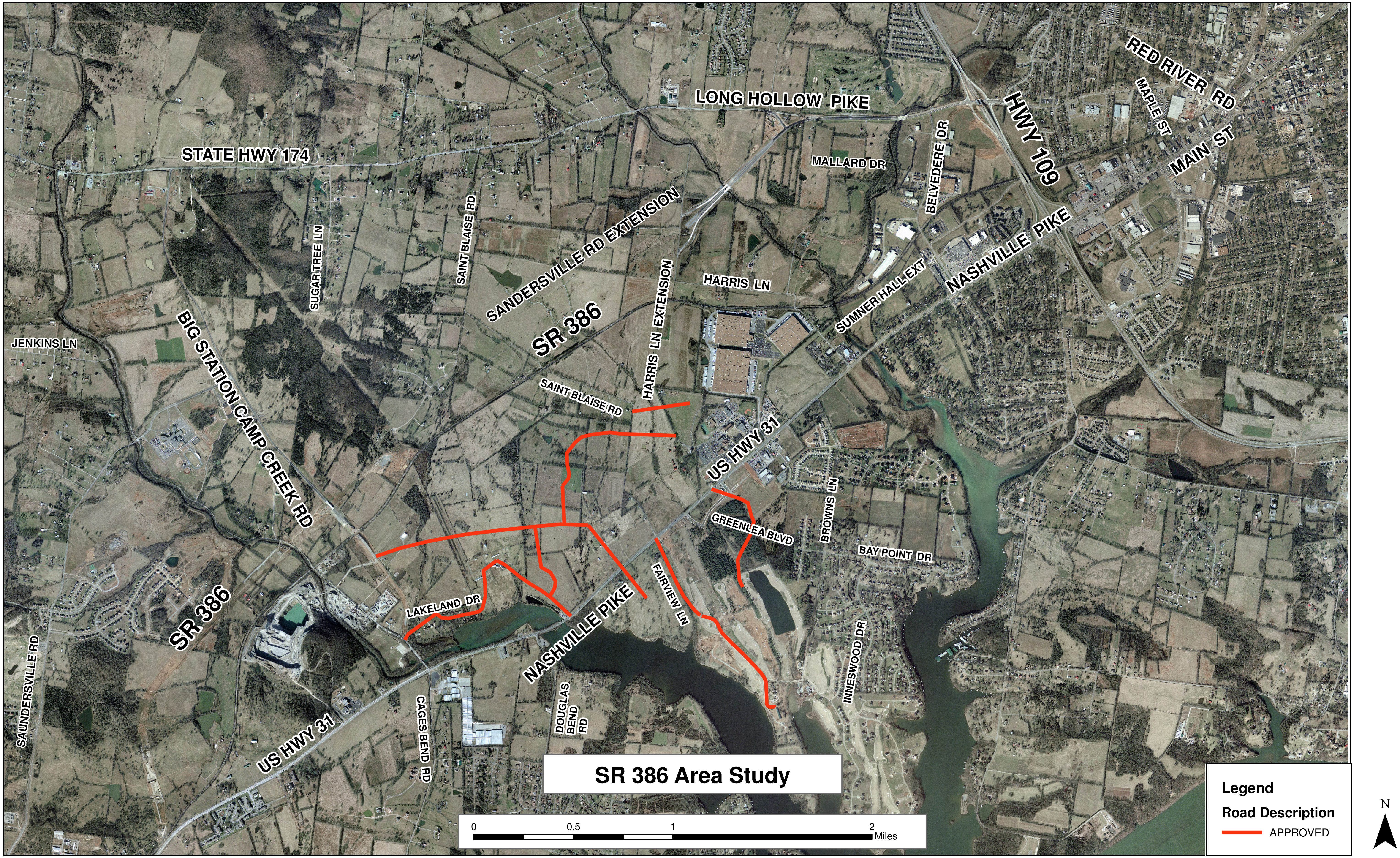
The Roadway Planned Improvements came largely from the City of Gallatin Major Thoroughfare Plan. The following roadway improvements were considered Planned Improvements:

- SR 174 APR, which includes a realignment of Long Hollow Pike (with four lanes) to connect to the Maple Street Extension, the elimination of the existing alignment of Long Hollow Pike between Red River Road and Maple Street, and a new, 2-lane connection between the Maple Street Extension and Red River Road
- Harris Lane Improvements – extension of Harris Lane to provide a continuous, 5-lane connection between Nashville Pike and Long Hollow Pike, with an interchange at SR 386
- Maple Street Extension – a 4-lane extension of Maple Street from the Maple Street/Main Street intersection to the SR 174 realignment
- Belvedere Drive Improvements – expansion of the existing 2-lane facility to a 3-lane section between Nashville Pike and Long Hollow Pike
- Browns Lane Extension – a ¼ mile extension of the existing Browns Lane north of the Browns Lane/Nashville Pike intersection



Source: City of Gallatin

Figure 4: Planned Roadways



Source: City of Gallatin

Figure 5: Approved Roadways

- Sumner-Hall Extension – construction of a new roadway, parallel to Nashville Pike, from the Maple Street Extension to Liberty Branch Creek. The Sumner-Hall Extension would be a 3-lane facility. This project also includes a new collector roadway connection between the Sumner-Hall Extension and Nashville Pike near the Nashville Pike/Lakeshore Drive intersection
- Big Station Camp Boulevard Improvements – improve the existing route to a 3-lane facility from Nashville Pike to the future interchange with SR 386. North of SR 386 the 3-lane facility would continue on a new alignment to Long Hollow Pike
- Greenlea Blvd Extension – extension west of the existing Greenlea Boulevard to connect to the intersection of Nashville Pike and the Harris Lane Extension
- Bay Point Drive Extension – extension north of the existing Bay Point Drive to connect to the intersection of Nashville Pike and Harris Lane

Multimodal Facilities

A high performance transit corridor is currently being considered between the study area and downtown Nashville. The terminus of this high performance transit corridor could be in the general location of the Harris Lane Extension south of SR 386 where current land uses would support transit.

The Planned Improvements in the study area found in the City of Gallatin Bicycle and Pedestrian Master Plan include multi-use paths, bike lanes, and bike routes. Bike lanes are planned for the following locations in the study area:

- Long Hollow Pike (SR 174),
- Nashville Pike (US Highway 31) (except the segment between Belvedere Drive and Sumner-Hall Drive),
- Harris Lane Extension,
- Sumner-Hall Drive,
- portions of the Sumner-Hall Extension,
- Maple Street Extension, and
- behind Volunteer State Community College.

The following locations in the study area are planned for multi-use paths:

- East Camp Creek between Nashville Pike and Long Hollow Pike,
- East Camp Creek Branch between the CSX railroad and Long Hollow Pike,
- Between Station Camp Creek boat ramp and City Park (at Nashville Pike), and
- Station Camp Creek between Nashville Pike and the trail head.

The only bike route planned in the study area is to be located on Belvedere Drive between the Sumner-Hall Extension and Nashville Pike (though the route will continue on Peninsula Drive to Lock Four Road).

3.2.2 Approved Improvements

The Approved Improvements are transportation network modifications that have been designed for specific projects that have been approved for construction by the City of Gallatin. These improvements are typically smaller in scope as compared to the Planned Improvements, as they have been developed for individual sites and not the region as a whole. The Approved Improvements were also considered to be in place for the purposes of the long-range model and, like the Planned Improvements, were not subject to revision, except when additional capacity was required as suggested by the refined model. The Approved Improvements are shown in **Figure 6**.

Roadways

Several collector roadways are included in the Approved Improvements list. All these roadways are part of developments along Nashville Pike. The information for these approved projects comes from traffic impact studies submitted as part of the projects' approval. Below is a list of projects in the study area and their associated roadways that were included in the group of Approved Improvements:

KENNESAW FARMS

The Kennesaw Farms project is a mixed-use development consisting of retail, office, and residential uses located north of Nashville Pike and west of St. Blaise Road. The Kennesaw Farms project includes two collector roads that would connect Nashville Pike to Big Station Camp Boulevard, as well as a road connecting these two collectors. A collector road would also connect the northern end of Kennesaw Farms to St. Blaise Road to the east.

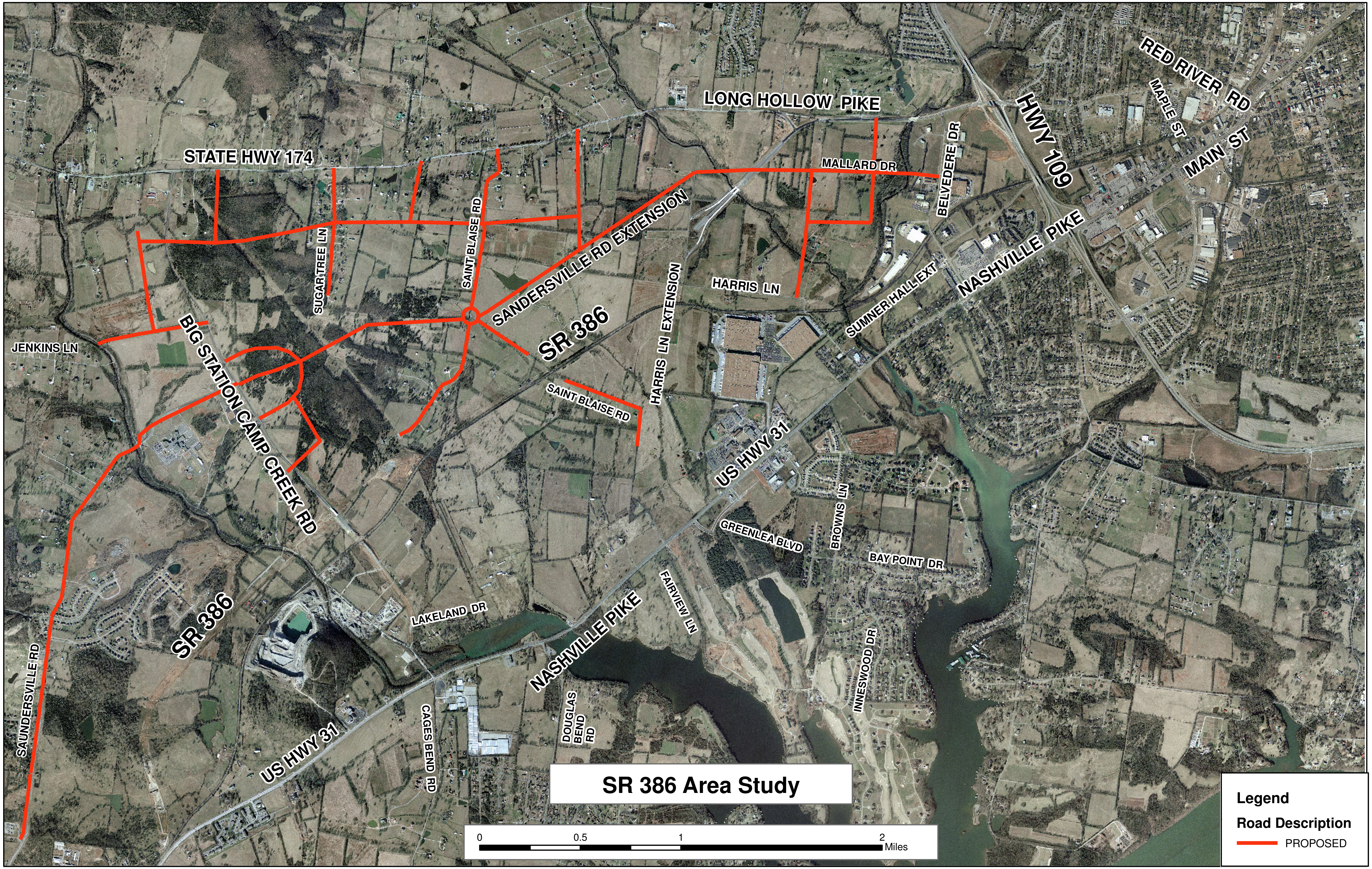
THE FAIRVUE PLANTATION

The Fairvue Plantation project is a large residential development with a golf course south of Nashville Pike and St. Blaise Road. The Fairvue Plantation would include a collector street that would connect to Nashville Pike at its intersection with St. Blaise Road.

GREENSBORO VILLAGE

The Greensboro Village project is a large mixed-use development consisting of commercial, office, and residential uses located north and south of Nashville Pike around the Harris Lane Extension area. The Greensboro Village project includes several collector roads to provide access to its developed areas:

- Two roads would provide access to the development west of the Harris Lane Extension
- Two roads would provide access from the Harris Lane Extension to St. Blaise Road. One of these roadways would be a continuation of one of the roads referenced above to provide access west of the Harris Lane Extension
- Another access road would connect to Nashville Pike east of the Harris Lane Extension and continue south, intersecting with the Greenlea Blvd Extension



Source: Gresham, Smith & Partners

Figure 6: Proposed Roadways

Multimodal Facilities

There are no multimodal facilities that are a part of the Approved Improvements group.

3.2.3 Proposed Improvements

The Proposed Improvements are transportation network modifications that have been proposed as a part of this study. The Proposed Improvements address capacity and access concerns given the City of Gallatin Land Use Plan and the SR 386 Extension. The Proposed Improvements were considered to be fluid suggestions of where improvements would be needed and were subject to revision based on a number of factors such as capacity, necessity, and constructability. The Proposed Improvements are shown in **Figure 7**.

Roadways

The proposed roadways were developed and placed with access management principles in mind, including physical characteristics and spacing. Special attention was paid to intense generators of trips, such as the high-intensity retail area on Big Station Camp Boulevard. Along major corridors, parallel routes were proposed when not included in the Major Thoroughfare Plan or by approved projects. The proposed collector roads were generally spaced ½ mile apart from each other, with allowances made for physical characteristics and the presence of smaller existing roads that could be built into the system. The following roadways were proposed to be added or modified as part of the SR 386 Area Study.

- Saundersville Road, from Nashville Pike to Station Camp Creek, is proposed to be widened from two to four lanes.
- Saundersville Road is proposed to be extended from Lower Station Camp Creek Road to the Harris Lane Extension. This would be a 4-lane roadway.
- St. Blaise Road is proposed to be widened from two to four lanes between Long Hollow Pike and the Saundersville Road extension.
- A roundabout is proposed for the five-legged intersection of St. Blaise Road, St. Blaise Court, and the Saundersville Road extension.
- A 4-lane circulator road is proposed for the east side Big Station Camp Boulevard and intersecting with the Saundersville Road extension. This circulator road would surround a high-intensity retail area.
- A collector road is proposed to be added south of the circulator roadway (see above) which would also intersect with Big Station Camp Boulevard and continue westward.
- A small-scale collector grid is proposed for the study area south of Long Hollow Pike and west of Big Station Camp Boulevard and east of Big Station Camp Boulevard before stopping short of the Harris Lane Extension. The grid would provide access to mostly residential areas and would use existing roadways when appropriate.
- St. Blaise Road is proposed be closed to traffic at the existing tunnel under the CSX railroad. The tunnel would have to be widened to handle the expected amount of future traffic, but widening the tunnel is cost prohibitive. The St. Blaise Road tunnel would remain open for pedestrians and bicyclists.

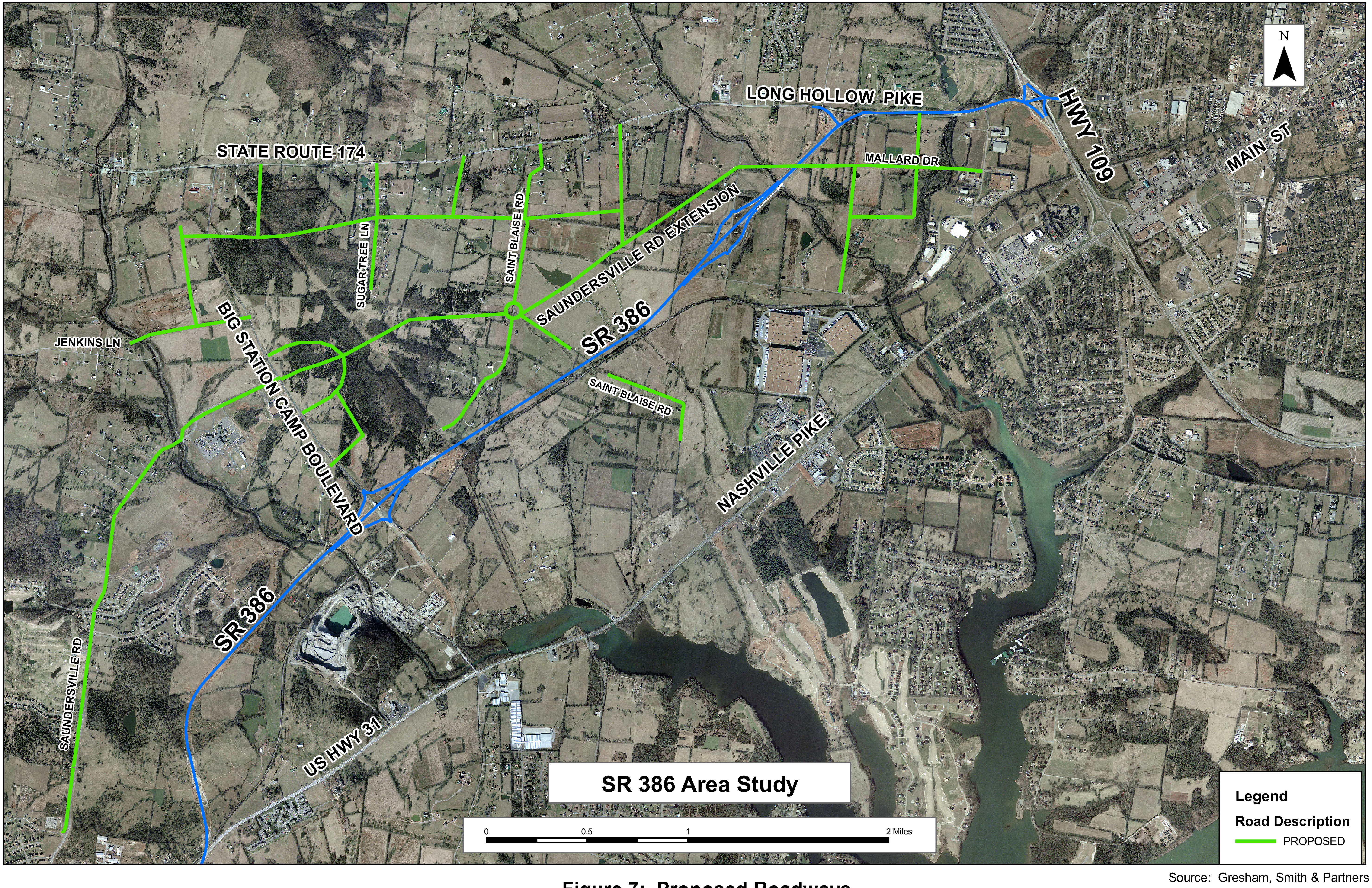


Figure 7: Proposed Roadways

- Mallard Drive is proposed to be extended west as a collector between the Harris Lane Extension and Belvedere Drive and would be a parallel route to Long Hollow Pike.
- A collector is proposed between Harris Lane and the Mallard Drive extension.
- A collector is proposed to connect to Long Hollow Pike between SR 386 and Belvedere Drive, which would be south of Long Hollow Pike and continue south of the Mallard Drive extension before turning west and connecting to the above connector.

The study area is fed by several existing roadways, from major arterials to collector streets. Most of the assumed future changes to the existing roadway structure in the study area are included in the City of Gallatin Major Thoroughfare Plan. The only other assumed change outside of the study area is for Saundersville Road. It is proposed that the existing section of Saundersville Road, from Nashville Pike to Station Camp Creek, will be widened from two lanes to four lanes.

Multimodal Facilities

The proposed multimodal facility consists of transit service and bike and pedestrian facilities. The proposed transit service includes four circulator service areas (see Chapter 7) that all overlap at the multi modal transit station, considered at the Harris Lane Extension. One circulator service area includes the study area between the Harris Lane Extension and SR 109. Another circulator service area includes Volunteer State Community College. The remaining two circulator service areas cover the parts of the study area west of the Harris Lane Extension that are north and south of SR 386. An express bus service is included as part of the proposed transit service that would travel along the SR 386 extension.

The following bike and pedestrian facilities are also proposed for the study area:

- Bike lanes on Long Hollow Pike from the western boundary of the study area to the Maple Street extension.
- Bike lanes on the Saundersville Road extension.
- Bike lanes on St. Blaise Road from Long Hollow Pike to the Saundersville Road extension.
- Bike lanes on the Harris Lane extension.
- Bike lanes on Nashville Pike from the western boundary of the study area to the Maple Street extension.
- A bike route along Big Station Camp Boulevard.
- A bike route along St. Blaise Road south of the SR 386 extension to the Harris Lane extension.
- A bike route along the collector road to the north of Volunteer State Community College.
- A bike route along the Sumner-Hall extension.
- A bike route along Belvedere Drive between the Sumner-Hall extension and Nashville Pike.

4.0 STUDY AREA ACCESS MANAGEMENT

Capacity preservation measures have been identified for the major boundary roads and interchange connectors of the study area based on the transportation network needs analysis. The transportation needs (in roadways and capacity) were assessed using the refined travel demand model in accordance with the Study Area Land Use Plan, as detailed in the previous chapters. Capacity preservation through access management principles will help ensure that the recommended roadways' capacity will be maximized throughout the development of the study area.

A detailed discussion of Access Management and Interchange Area Management recommended guidelines is contained in **Appendix A**.

4.1 Boundary Roadways

There are four main boundary roadways in the study area: Nashville Pike, Long Hollow Pike, Big Station Camp Boulevard, and a small portion of Red River Road. The boundary roadways will have the responsibility of providing access to and from the study area. Developments within the study area will be funneled to these roadways and will also provide the main entry into the study area for those traveling from other locations. In addition, the boundary roadways will be responsible for efficiently moving traffic through the study area so the interior study area roadways are not adversely affected by traffic traveling from one point outside of the study area to another point outside the study area.

Nashville Pike

Nashville Pike (SR 6, US 31E) is a major east west arterial that serves the southern part of the study area. From Big Station Camp Boulevard to Maple Street, Nashville Pike is a four lane divided highway with a two-way-left-turn lane (five lane section). From Big Station Camp Boulevard to Harris Lane Extension, development is suburban with limited access points. From Harris Lane Extension to Maple Street, Nashville Pike is urban with traditional urban development. The recommendations of this study are to plan for further widening to a six-lane cross section from the Harris Lane Extension to Maple Street. Development along Nashville Pike is expected to be fairly dense given its existing capacity and location.

With all these factors taken into consideration, Nashville Pike can be considered a major urban arterial for access management purposes. From Harris Lane Extension to Maple Street, access management should include full intersections spaced at least 1,320 feet apart. Signalized intersection spacing should also be at a minimum of 1,320 feet with turn lanes as appropriate. Unsignalized driveways connecting onto the roadway and/or median openings should be spaced at least 330 feet apart.

From Big Station Camp Boulevard to Harris Lane Extension, Nashville Pike is suburban with moderate development. Access management should include full intersection spaced at ½ mile intervals with directional median openings at ¼ mile intervals. Intersection and major driveway spacing should be a 440 feet (Appendix A, page 16).

A raised median is recommended for the six-lane section of Nashville Pike. The minimum median width is 16 feet, however a width of either 22 feet or 34 feet is recommended, depending on access decisions and ROW restrictions. A 22 foot median is recommended for single left turns, and 34 feet is recommended for dual lefts to accommodate left turn movements at signalized intersections. Left turns out of driveways across the median should be restricted by the raised median. A consistent median width should be maintained throughout the six-lane section.

Long Hollow Pike

Long Hollow Pike (SR 174) is a major two-lane rural arterial, which widens to a four-lane section east of the SR 386 intersection. The City of Gallatin MTP contains plans to maintain the two-lane section but to widen the four-lane section to five lanes. The recommendations of this study are to plan for further widening to a six-lane cross section from SR 386 to SR 109. Long Hollow Pike can be considered a major rural arterial west of SR 386 and a major urban arterial east of SR 386.

Access management for a major urban arterial would include full intersections spaced at least 1,320 feet apart. Signalized intersection spacing should also be at a minimum of 1,320 feet with turn lanes as appropriate. Unsignalized driveways connecting onto the roadway and/or median openings should be spaced at least 330 feet apart.

Access management for a major rural arterial would include minimum spacing of 2,640 feet for major intersections and minimum spacing of 1,320 feet for direct openings. Left turn lanes should be in place at all intersections with major public roads. Driveway openings should be spaced at a minimum 440 feet apart (Appendix A, page 16).

The median for the five-lane section would be a two-way left turn lane, preferably with a width of at least fourteen feet.

A raised median is recommended for the six-lane section of Nashville Pike. The minimum median width is 16 feet, however a width of either 22 feet wide or 34 feet wide is recommended, depending on access decisions and ROW restrictions. A 22 foot median is recommended for single left turns, and 34 feet is recommended for dual lefts to accommodate left turn movements at signalized intersections. Left turns out of driveways across the median should be restricted by the raised median. A consistent median width should be maintained throughout the six-lane section.

Big Station Camp Boulevard

Big Station Camp Boulevard is a minor two-lane rural arterial that connects Nashville Pike and Long Hollow Pike. In the future an interchange with SR 386 is planned to be placed on Big Station Camp Boulevard. The City of Gallatin MTP contains plans to widen the road to a three-lane section. The recommendation of this study is to plan for further widening to a five-lane cross section along its length. Big Station Camp Boulevard can be considered a major rural arterial under future conditions. However, more intense commercial development is expected in the section between Jenkins Lane and the SR 386 interchange, characterizing this stretch as a major urban arterial in the future.

Access management for a major urban arterial would include full intersections spaced at least 1,320 feet apart. Signalized intersection spacing should also be at a minimum of 1,320 feet with turn lanes as appropriate. Unsignalized driveways connecting onto the roadway should be spaced at least 330 feet apart.

Access management for a major rural arterial would include minimum spacing of 2,640 feet for major intersections and minimum spacing of 1,320 feet for direct openings. Left turn lanes should be in place at all intersections with major public roads. Driveways openings should be spaced a minimum 440 feet apart.

The median of the five-lane section (SR 109 to Maple Street) would be a two-way left turn lane, preferably with a width of at least fourteen feet.

Red River Road and the Maple Street-Red River Road Connector

The SR 174 Advanced Planning Report includes a new connection between the Maple Street extension and the existing Red River Road. This new connector and a short segment of Red River Road forms a small section of the study area boundary that is approximately ¾ of a mile in length. This short length does not readily lend itself to access management principles, and the area is also already heavily developed with several existing connections.

The new connector roadway, however, can be designed and constructed with capacity preservation in mind and should be considered a major urban arterial for access management purposes. Access management for a major urban arterial would include full intersections spaced at least 1,320 feet apart. Signalized intersection spacing should also be at a minimum of 1,320 feet with turn lanes as appropriate. Unsignalized driveways connecting onto the roadway should be spaced at least 330 feet apart. The connector's total length would be approximately 1,320 feet, however, with major intersections already planned at the Maple Street extension and at Red River Road. Therefore, no other full intersections should be planned for the connector.

Red River Road can also be considered a major urban arterial. However, access management along Red River Road should be considered with redevelopment of existing land uses. Redevelopment brings opportunities to consolidate driveways for better spacing along the roadway.

4.2 Interchange Connectors

There are two proposed SR 386 interchanges with study area roadways: at Big Station Camp Boulevard and at the Harris Lane Extension. A large amount of traffic is often seen at interchanges as drivers make use of high-capacity corridors. A large amount of commercial development is often seen around interchanges because of the high level of activity and the access to major traffic corridors (and vice-versa). These factors make access management important around interchanges because of the intensity of traffic that gathers in these spots and the number of destinations in the surrounding area.

Both interchanges in the study area would be built in a suburban environment. The following general access spacing guidelines apply to the roadways with interchange ramps:

- First access (driveway) from off-ramp – 990 feet
- First median opening – 1,320 feet
- First access (driveway) before on-ramp – 1,320 feet
- First major signalized intersection – 2,640 feet

4.3 General Guidelines

Several guidelines should be kept in mind as the study area is developed in order to preserve capacity on boundary roadways and create efficient access plans.

- Redevelopment opportunities should be looked for to create proper driveway and/or intersection spacing in areas that have already been developed. This is usually the best way to apply access management principles to already developed areas.
- Caution should be exercised against the subdivision of property (especially large lots) before an overall access plan is created. Piece-meal development often leads to tightly spaced driveways, too many intersections, and a large number of vehicle conflict points that lower the effective capacity of a roadway.
- Driveways should be designed with adequate curb return radii and throat widths and lengths to minimize the interference between through traffic and traffic entering the driveway. The curb return radius should be large enough (a radius of 50 feet is a good rule-of-thumb for most streets) to allow vehicles to enter and exit driveway cuts quickly. A throat width that is wider than normal will also aid in producing quick transitions. A two-way driveway should have a width of at least 24 feet but no more than 36 feet. The throat length should be sufficient to handle any queuing that may occur after vehicles enter the driveway in order to prevent queues from affecting entering traffic.

5.0 TRAVEL DEMAND MODEL RESULTS

A refined travel demand model was created to predict the future traffic volumes in the study area. The refined model was based on the existing Nashville Area MPO regional travel demand model, thus it includes the travel analysis zone (TAZ) structure and transportation network that was approved and included in the regional model. However, the transportation network of the study area was not sufficiently represented in the regional model to produce satisfactory data for this project. Therefore, the refined model was created.

In a refined model, the area in question (the study area) is given greater detail in the model, while the area outside the area of focus remains the same. In the case of this project, the SR 386 study area needed more detail. The transportation network in the SR 386 study area was expanded based on the existing facilities and assumed improvements discussed in the last chapter. It should be noted that the travel demand model does not examine the individual turning movements of vehicles. Therefore, additional turn lanes at intersections are not input into the model, nor are continuous turn lanes included. So, for example, a 5-lane facility (four travel lanes and a continuous turn lane in the median), appears as a roadway with only four lanes in the model.

The existing model TAZs were also broken up into smaller divisions to allow for a more refined trip generation and trip distribution based on the City of Gallatin Land Use Plan. By dividing big TAZs into a large group of small TAZs, a greater number of trip loading points can be established and a more realistic distribution of trips can be realized.

The refined travel demand model was run twice. The first run was made using the transportation network assumptions discussed in the preceding chapter. However, those assumptions were not meant to be unalterable. The first model run indicated if the assumed network requirements were correct and which areas of the network would need more attention. For the second run, modifications to the network were made to address deficiencies that were revealed by the first run and approved changes to the existing City of Gallatin Major Thoroughfare Plan.

5.1 Trip Generation

Trip generation is a process which estimates the number of trips generated by a proposed development. The generated trips include trips into and out of a development. The trips are generated by relating the number of trips entering and exiting the site to the type of land use and size of the proposed development. The trip generation rates are based on traffic counts and surveys at similar existing land uses.

The trip generation analysis was performed using the City of Gallatin Land Use Plan. A summary of the trip generation for the proposed project is contained in **Table 2**. A daily trip generation analysis was necessary as input into the refined travel demand model. The trip generation rates were based on rates published in the Institute of Transportation Engineers (ITE), *Trip Generation*, 7th Edition, 2003. The trip rates were based on the linear rates for the available data.

Table 2 – Land Use Plan Trip Generation

Land Use Area	ITE Code	Land Use Description	Density	Acres	Assumed % of Max Build-out	Size/Units		Trip Rate	Daily Trips	Pass-by Reduction	Internal Capture Reduction	Net Daily Trips
1	820	Commercial	Max FAR 1.0	66	20%	575	ksf	42.94	24,690	20%	20%	14,814
2	820	Commercial	Max FAR 1.0	13	20%	113	ksf	42.94	4,863	20%	20%	2,918
3	210	LDRP	2.2 Units/Acre	384	35%	296	units	9.57	2,830		5%	2,688
4	210	LDR	2.2 Units/Acre	381	35%	293	units	9.57	2,808		5%	2,667
5	820	C-2 PUD	Max FAR 1.0	53	20%	462	ksf	42.94	19,827	20%	20%	11,896
6	820	C-4 PUD	Max FAR 1.0	108	20%	941	ksf	42.94	40,402	20%	20%	24,241
7		Greenspace		37	n/a	0	n/a	n/a	0			0
8	210	Estate A	2 acres per lot	801	35%	140	Lots	9.57	1,341		5%	1,274
9	210	Low Density Residential	2.2 Units/Acre	171	35%	132	units	9.57	1,260		5%	1,197
10	520/522/530	Public(School)	Lower, middle and high school	133	n/a	1500	students	1.54	2,310		5%	2,195
11	820	C-4 PUD	Max FAR 1.0	30	20%	261	ksf	42.94	11,223	20%	20%	6,734
12	230	C-3 PUD	15 units per acre	565	20%	1695	units	5.86	9,933		5%	9,436
13	750	Planned Business	Max FAR 1.0	48	35%	n/a	ac	195.11	3,278	20%	20%	1,967
14	130	Industrial	Max FAR 1.0	157	35%	n/a	ac	63.11	3,468	20%	20%	2,081
15		Greenspace		18	n/a	0	n/a	n/a	0			0
16	230	Mixed Use	15 units per acre and FAR 0.4	18	35%	94.5	units	5.86	554	20%	35%	249
17	820	Commercial	Max FAR 1.0	111	20%	967	ksf	42.94	41,524	20%	20%	24,915
18	230	Mixed Use	15 units per acre and FAR 0.4	317	35%	1664	units	5.86	9,753	20%	35%	4,389
19	540	Public/comm college	Existing	128	20%	1115	ksf	27.49	30,655		5%	29,122
20	230	Medium Density Residential	7.5 units/acre	111	35%	291	units	5.86	1,707		5%	1,622
21	230	Mixed Use	15 units per acre and FAR 0.4	40	35%	210	units	5.86	1,231	20%	35%	554
22	210	MDR	7.5 units/acre	479	35%	587	units	9.57	5,615		5%	5,335
23	230	Mixed Use	15 units/acre	564	35%	1481	units	5.86	8,676		5%	8,242
24	820	Commercial	Max FAR 1.0	57	20%	497	ksf	42.94	21,323	20%	20%	12,794
25	230	Mixed Use	15 units per acre and FAR 0.4	56	35%	294	units	5.86	1,723	20%	35%	775
26	210	LDR	2.2 Units/Acre	73	35%	56	units	9.57	538		5%	511
27	230	High Density Residential	15 units per acre	24	35%	126	units	5.86	738		5%	701
28	230	High Density Residential	15 units per acre	6	35%	32	units	5.86	185		5%	175
29		Public		11	n/a	0	n/a	n/a	0			0
30	820	Commercial	Max FAR 1.0	188	20%	1638	ksf	42.94	70,330	20%	20%	42,198
31	820	Commercial	Max FAR 1.0	229	20%	1995	ksf	42.94	85,667	20%	20%	51,400
32	820	Commercial	Max FAR 1.0	7	20%	61	ksf	42.94	2,619	20%	20%	1,571
33	820	Commercial	Max FAR 1.0	24	20%	209	ksf	42.94	8,978	20%	20%	5,387
34	230	MDR	7.5 units/acre	220	35%	578	units	5.86	3,384		5%	3,215
35	750	Downtown	Max FAR 1.0	23	35%	n/a	acres	195.11	1,571	20%	20%	942
36		Public		12	n/a	0	n/a	n/a	0			0
37	750	Planned Business	Max FAR 1.0	7	35%	n/a	acres	195.11	478	20%	20%	287
38	230	Mixed Use	15 units per acre and FAR 0.4	12	35%	63	units	5.86	369	20%	35%	166
39		Public		11	n/a	0	n/a	n/a	0			0
40	230	Mixed Use	15 units per acre and FAR 0.4	14	35%	73.5	units	5.86	431	20%	35%	194
41	750	Planned Business	Max FAR 1.0	815	35%	n/a	ac	195.11	55,655	20%	20%	33,393
42	230	Mixed Use	15 units per acre and FAR 0.4	206	35%	1082	units	5.86	6,338	20%	35%	2,852
43		Public		95	n/a	0	n/a	n/a	0			0
44	230	MDR	7.5 units/acre	56	35%	147	units	5.86	861		5%	818
45	230	Mixed Use	15 units per acre and FAR 0.4	11	35%	57.75	units	5.86	338	20%	35%	152
46	820	Commercial	Max FAR 1.0	34	20%	296	ksf	42.94	12,719	20%	20%	7,632
47	230	MDR	7.5 units/acre	31	35%	81	units	5.86	477		5%	453
48	210	LDRP	2.2 units/Acre	95	35%	73	units	9.57	700		5%	665
49	230	Medium Density Residential	7.5 units/acre	85	35%	223	units	5.86	1,308		5%	1,242
50	210	LDR	3.5 units/acre	1142	35%	1399	units	9.57	13,388		5%	12,719
51	750	Planned Business	Max FAR 1.0	46	35%	n/a	acres	195.11	3,141	20%	20%	1,885
52	820	Commercial	Max FAR 1.0	249	20%	2169	ksf	42.94	93,149	20%	20%	55,890
53	230	High Density Residential	15 units per acre	11	35%	58	units	5.86	338		5%	321
54	230	High Density Residential	15 units per acre	3	35%	16	units	5.86	92		5%	88
55	230	High Density Residential	15 units per acre	3	35%	16	units	5.86	92		5%	88
56	230	High Density Residential	15 units per acre	102	35%	536	units	5.86	3,138		5%	2,981
57	820	Commercial	Max FAR 1.0	45	20%	392	ksf	42.94	16,834	20%	20%	10,101
58	230	Medium Density Residential	7.5 units/acre	82	35%	215	units	5.86	1,261		5%	1,198
			TOTAL	8,818					636,112			411,330

The Land Use Plan sets out the maximum amount of development for each area in the plan. It is unlikely, however, that any area would reach its maximum allowable development. In the future some areas would be closer to the maximum than others, but, in consultation with MPO and City of Gallatin staff, it was decided that each residential and mixed use area would reach 35 percent of its maximum allowable development and most commercial areas would reach 20 percent of their maximum allowable development. The commercial areas that were designated as Planned Business, Industrial, and Downtown were assumed to reach 35 percent of their maximum allowable development. In general, the development threshold for any land use area is around 40 percent.

A significant portion of traffic to and from commercial facilities is not new to the street system. Commercial facilities tend to attract drivers from nearby streets who decide to stop at the site as they are driving by. These trips are called pass-by trips and represent traffic that would be on the street system whether the proposed project was built or not. A pass-by trip reduction of 20 percent was assumed for each commercial and mixed-use area within the Land Use Plan. No pass-by trips were assumed for the residential areas.

A certain number of trips generated from each development would not leave the TAZ from which it originated, and, therefore, would not travel on the network roadways to get to another TAZ. These trips are referred to as internal capture trips. Examples of internal capture trips would be a person leaving a shopping center and going to a restaurant within the same area. Commercial areas naturally have higher rates of internal capture than residential areas. It was assumed that each commercial area would have an internal capture rate of 20 percent, each residential area would have an internal capture rate of 5 percent, and each mixed use area (which combines commercial and residential uses within the same area) would have an internal capture rate of 35 percent.

5.2 First Run Results and Network Modifications

A number of modifications were made to the model transportation network based on the identified operational deficiencies, as well as a review of the network by MPO and City of Gallatin staff. The modifications made in the refined model based on the first run results are summarized below in **Table 3**.

Table 3 – Roadway Deficiency Corrections after First Model Run

Roadway	Location	Deficiency	Network Modification
Big Station Camp Creek Road	Nashville Pike to Long Hollow Pike	Insufficient capacity	Widen roadway to 4 lanes
Long Hollow Pike	SR 386 to SR 109	Insufficient capacity	Widen segment to 6 lanes
Maple Street	south of Nashville Pike	Insufficient capacity	Widen segment to 4 lanes
Nashville Pike	Harris Lane Extension to Maple Street	Insufficient capacity	Widen segment to 6 lanes
Southern Collector Parallell to Long Hollow Pike	East Camp Creek crossing	Infeasible construction	Remove segment

5.3 Second Run Results

The daily volumes as predicted by the refined model, the corresponding level of service (LOS) for the study area roadways, and the proportion of traffic on each link that is contributed by the study area are shown in fold-out plots in **Appendix B**. The LOS is a measure of driving conditions and delay and has been determined by the volume to capacity (v/c) ratio. Levels of service range from LOS A (free-flow conditions, no delay) to LOS F (severe congestion and delay). The LOS is determined by comparing the number of vehicles on a roadway to the capacity of that roadway. LOS F indicates facilities operating above volume capacity, resulting in severe delays. A roadway's capacity is determined by several factors including the number of lanes and facility type. An expressway can carry more vehicles than a local collector, for example, because the expressway operates at higher speeds and has fewer access points where in-coming vehicles can slow down the traffic stream.

Discussion of the travel demand model in greater depth is presented in **Appendix B**. A detailed summary of the refined travel demand model results on a roadway-by-roadway basis is also included in **Appendix B**.

6.0 ROADWAY NETWORK RECOMMENDATIONS

The final recommendations for the study are based on the refined travel demand model analysis, multimodal needs, and previously approved and planned improvements.

6.1 Roadway Network

The recommended roadway network is shown in **Figure 8**, along with the number of lanes for each roadway.

The travel demand model results reveal several areas for future consideration, which are summarized in **Table 4**. The volume and corresponding LOS are shown for the worst-case area of the segment listed.

Table 4 – Roadway Network Areas for Future Consideration

Roadway	Location	Highest Daily Volume	Travel Lanes	Max Capacity	V/C	LOS
Maple-Red River Connector	Maple Street to Red River Road	23,150	2	18,000	1.29	E
Long Hollow Pike	SR 386 to SR 109	80,368	6	54,000	1.49	F
Main Street	east of downtown	29,716	2	18,000	1.65	>F

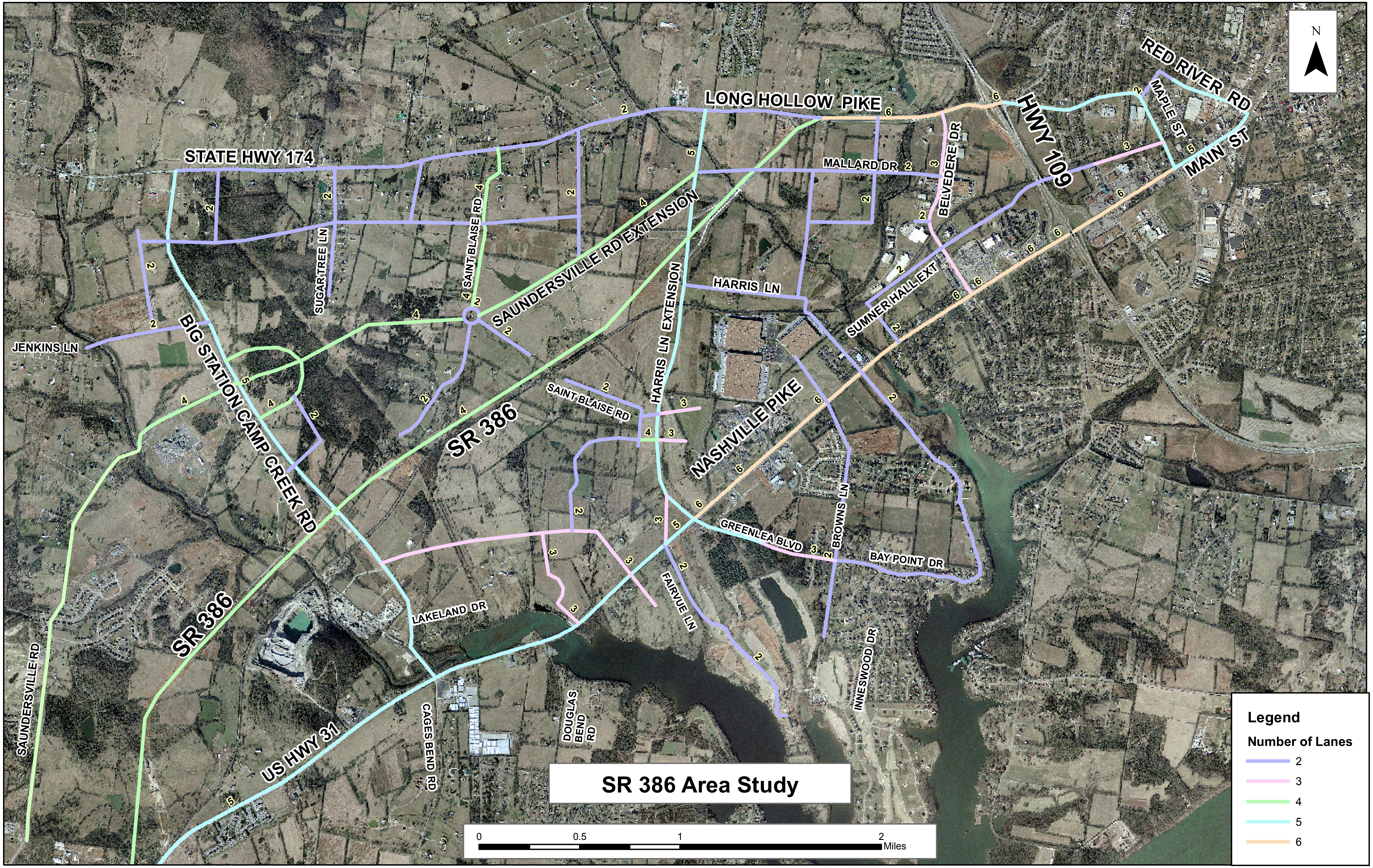
The Maple Street-Red River Road connector is expected to operate at LOS E. This roadway should be a candidate for future widening.

The segment of Long Hollow Pike between SR 386 and SR 109 continues to operate at a poor LOS, despite a six-lane section. Further widening (to an eight-lane section) would not be recommended. The travel demand model results indicate that the possibility should be explored of extending SR 386 north of Long Hollow Pike to connect to SR 109. It is beyond the scope of this study to determine the placement, ROW constraints, or feasibility of construction of such an extension, but the model indicates a large number of vehicles using Long Hollow Pike to travel between SR 386 and SR 109. As an alternative, the possibility of extending the proposed parallel collector road to intersect with the Sumner-Hall Extension could be explored to give drivers the option of bypassing the congested areas of Long Hollow Pike.

Main Street east of downtown is expected to exhibit poor LOS in the future. Mitigation measures are limited because the area is highly developed. The City of Gallatin is aware of the future congestion level on this roadway and is preparing a development plan for the downtown area that would address these issues.

6.2 Typical Cross Sections

A number of typical cross sections were included in the adopted City of Gallatin Major Thoroughfare Plan. These include cross sections for two-, three-, four-, and five-lane sections, both with and without curb and gutter and sidewalks. These cross sections do



Source: Gresham, Smith & Partners

Figure 8: Roadway Network with Lanes

not include any six-lane sections or bike lane considerations, both of which are recommended by this study. A series of typical cross sections is included in **Appendix C** to address the recommendations that are included in this study which are not otherwise addressed by the Major Thoroughfare Plan cross sections. The cross sections in **Appendix C** have been adopted by Nashville Metro Public Works.

6.3 Improvement Priority List

The proposed and planned improvements were given a priority hierarchy to aid in the planning of future roadway improvements (see **Table 5**). Three priority levels were used in classifying the recommended improvements.

Table 5 – Roadway Improvement Priority

Roadway Segment	Priority	Existing Lanes	MTP Recommended Lanes	Study Recommended Lanes
Long Hollow Pike - SR 386 to SR 109	1	2	5	6
Long Hollow Pike - SR 109 to Maple St	1	2	5	5
Nashville Pike - Harris Lane Ext to Maple Ext	1	5	5	6
Big Station Camp Creek Road	1	3	3	5
Harris Lane Extension	1	n/a	5	5
Maple Street Extension	2	n/a	5	5
Maple-Red River Connector	2	n/a	2	2
Saundersville Road - Nashville Pike to Station Camp Creek	2	2	n/a	4
Saundersville Road Extension	2	n/a	n/a	4
Belvedere Drive	2	2	3	3
Sumner-Hall Extension - Liberty Branch to SR 109	2	n/a	2	2
Sumner-Hall Extension - SR 109 to Maple St Ext	2	n/a	3	3
St. Blaise Road (south)	3	2	0	0
St. Blaise Road (north) - Long Hollow Pk to Saundersville Rd Ext	3	2	n/a	4
St. Blaise RR tunnel closure	3	1	n/a	0
Mallard Drive Extension	3	n/a	n/a	2
Greenlea Blvd Extension	3	n/a	2	2/4
Bay Point Dr Extension	3	n/a	2	2
Collector Roadways	4	0/2	n/a	2/4
Approved Roadways	4	0/2	n/a	2/3/5

MTP = City of Gallatin Major Thoroughfare Plan

A Priority 1 level was assigned to major arterial connections, high volume corridors, and boundary roadways in the study area. These roadways will see the most demand in the study area and will do the most to channel outside traffic away from the interior of the study area.

The roadway improvements grouped in the Priority 2 level occur on minor arterials, secondary high volume roadways, urban areas, and new parallel routes to major arterials. The new routes that would parallel major arterials not only provide access to land areas within the study area but also provide some relief to traffic conditions on the major arterials. The new parallel routes also provide connectivity within the study area for vehicles that do not necessarily need to travel on the boundary roadways in order to reach desired destinations.

The Priority 3 level roadway improvements are for minor arterials, roads that would offer further increased connectivity within the study area, access to particular sections of the study area, and secondary parallel routes.

A Priority 4 level was assigned to the collector roadway network and other roads that would be a part of approved projects. These roads are not as important to the transportation system as a whole but instead would be contingent on proposed developments. The Priority 4 roadways should be built as opportunities arise.

The above priority list was created with an overall study area perspective in mind. The suggested priorities are subject to change as the demands of specific developments occur.

6.4 Estimated Costs

The estimated costs associated with the recommended roadway network improvements are summarized below in **Table 6**. Several improvements have been discussed in the existing City of Gallatin Major Thoroughfare Plan and the SR 174 APR, which include estimated costs. These estimated costs are shown below without adjustment.

Table 6 – Recommended Improvement Estimated Costs

Roadway Segment	Priority	App. Length (mi)	Existing Lanes	Recom-mended Lanes	Estimated Cost	Source	MPO Time Line/Imple-mentation	Comment
Long Hollow Pike - SR 386 to SR 109	1	0.90	2	6	$4.0 M	SR 386 Area Study	2025	
Long Hollow Pike - SR 109 to Maple St	1	0.55	2	5	$2.8 M	SR 174 APR	2016	Cost does not include bike lanes
Nashville Pike - Harris Lane Ext to Maple Ext	1	3.10	5	6	$8.0 M	SR 386 Area Study	2016	
Big Station Camp Creek Road	1	2.80	3	5	$7.0 M	SR 386 Area Study	2016	MTP estimated $4.2 M for 3 lane section
Harris Lane Extension	1	2.25	n/a	5	$5.3 M	MTP	2016	Cost does not include bike lanes
Maple Street Extension	2	0.57	n/a	5	$6.1 M	SR 174 APR	2025	Cost does not include bike lanes
Maple-Red River Connector	2	0.18	n/a	2	$1.0 M	SR 174 APR	2025	
Saundersville Road - Nashville Pike to Station Camp Creek	2	2.45	2	4	$8.9 M	SR 386 Area Study	2016	
Saundersville Road Extension	2	3.24	n/a	4	$11.8 M	SR 386 Area Study	2025	
Belvedere Drive	2	0.95	2	3	$0.9 M	MTP	2025	
Sumner-Hall Extension - Liberty Branch to SR 109	2	1.10	n/a	2	$2.0 M	SR 386 Area Study	2025	MTP estimated $5.4 M for 3.15 miles of 3 lane section
Sumner-Hall Extension - SR 109 to Maple St Ext	2	0.67	n/a	3	$1.6 M	SR 386 Area Study	2025	
St. Blaise Road (south)	3	0.57	2	0			2030	
St. Blaise Road (north) - Long Hollow Pk to Saundersville Rd	3	0.93	2	4	$2.6 M	SR 386 Area Study	2030	
St. Blaise RR tunnel closure	3		1	0			2030	
Mallard Drive Extension	3	1.26	n/a	2	$2.1 M	SR 386 Area Study	2030	
Browns Lane Extension	3	0.25	n/a	2	$1.0 M	MTP	2030	
Greenlea Blvd Extension	3	0.90	n/a	3/5	$1.5 M	MTP	2030	
Bay Point Dr Extension	3	0.57	n/a	2	$1.3 M	SR 386 Area Study	2030	
Collector Roadways	4		0/2	2/4			2016	
Approved Roadways	4		0/2	2/3/5			2030	

MTP = City of Gallatin Major Thoroughfare Plan

The approximate estimated costs for the remaining improvements are based on general assumptions for design, construction, materials, right-of-way (ROW) acquisition, and utility relocation. Any design planning undertaken for these improvements should include a more refined cost estimation.

No estimated costs were included for the recommended collector system roadways or the approved project roadways. The ultimate alignment and design of these roadways will depend on the developments that they serve and will be heavily influenced by the type of development, development density, sequence in relation to other developments, land features, and other factors. The costs for these roadways will be estimated at the time that development is proposed.

6.5 Inter-Regional Issues

The results from this study suggest that future study efforts should focus on travel corridors that connect areas outside of the immediate study area, particularly the corridors of SR 109 and US 31E.

As is noted above, a heavy volume of traffic is expected to travel between SR 386 and SR 109 on Long Hollow Pike, contributing to a poor level of service on that stretch of Long Hollow Pike. The future needs of the SR 109 corridor should be assessed from an inter-regional perspective, especially as it relates to the SR 386 corridor.

Likewise, the US 31E corridor should also be assessed from an inter-regional perspective. US 31E (Nashville Pike in the study area) serves the study area and connects to Hendersonville and Nashville to the south. Nashville, north Davidson County, and Hendersonville all have the potential for rapid growth which can contribute to the travel demand in the US 31E corridor.

7.0 MULTIMODAL CONSIDERATIONS

In order to accommodate the growing population and employment anticipated for the Gallatin/Sumner county area surrounding SR 386, a multimodal approach to transportation should be adopted. The following sections are presented to describe potential improvements and additional services that could be implemented to promote multimodal use in the Gallatin/Sumner County area. More specifically, this study considers high performance transit corridor planning and transit oriented development, transit service, bicycle service and pedestrian access options.

7.1 High Performance Transit Corridor Planning

The City of Gallatin in cooperation with the Nashville Area MPO is currently preparing to conduct a transit oriented study for the purpose of identifying multi modal needs for the study area. This study will evaluate alterative modes of transportation that will meet the needs of the community. One mode of transportation to be incorporated into this study will be the evaluation of a commuter rail service from Downtown Nashville to downtown Gallatin. The location of a transit oriented station provides community leaders an opportunity to incorporate transit oriented development in their long range planning for the community. A generalized location of a potential transit oriented station within the study area is shown on the figures contained in this section of the report.

Transit oriented development (TOD) describes the variety and density of development surrounding a transit hub. TOD patterns influence the effectiveness of transit in two ways; first, concentrations of trip origins and destinations are conducive to higher levels of transit ridership; second, pedestrian and bicycle accessibility throughout the development allow for greater transit ridership linkages. According to the Nashville Area Transit Development Plan, prepared in 2003 for the MPO, every transit rider is a pedestrian at some point during their trip, making it imperative that the pedestrian environment be promoted.

The Transit Capacity and Quality of Service Manual suggests the minimum density for an area to be considered transit supportive is approximately 3 households per acre. Most often this is represented as a neighborhood of single-family homes on quarter acre lots. This pattern matches much of the current development thinking in the Sumner County area. In order to maximize transit use through land use planning, denser residential developments should be encouraged.

Density is not the only consideration for transit oriented development. A variety of land uses within a relatively small area is also a positive characteristic of a TOD. Mixed use developments that include retail, services, housing and employment, all arranged with pedestrians in mind, allow transit users to most effectively utilize their time and resources. It also discourages the use of single occupant vehicles.

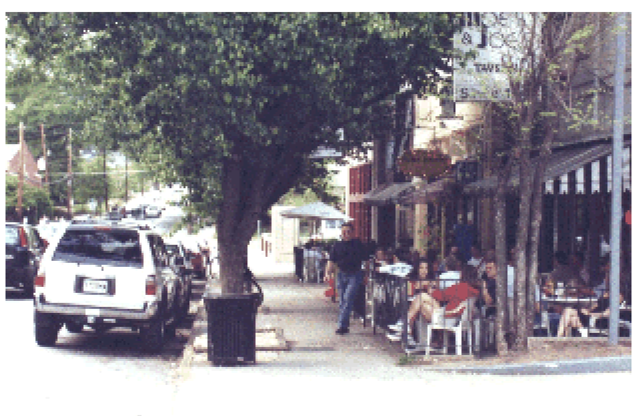
Beyond density and mixed use, the layout of the development is significant. As shown in **Figure 9**, poorly orientated parking lots in front of retail establishments and places of employment can make the transit riders' walk to their final destinations less appealing.

Figure 9 – Undesirable Parking Locations for Multimodal Access

The Transit Capacity and Quality of Service Manual considers employment density of 4 jobs per acre as the minimum acceptable for transit service. Multiple transit passengers heading for a common destination result in more effective transit service.

Figure 10 shows some examples of transit friendly development. It is helpful to notice the variety of services located near each other and the orientation of the walkways and parking lots. Inclusion of signage and other pedestrian friendly services also results in more effective transit service.

Figure 10 – Transit Friendly Development



7.2 Transit Service Characteristics

Key factors for successful multimodal transit options include a variety of characteristics. They consider availability, comfort, convenience, reliability, travel time savings, and safety and security.

In general, availability can be summarized as providing sufficient trip access points, sufficient capacity, travel times coordinated to rider needs and user friendly information (e.g. signs, schedules). Also, comfort and convenience address ridership issues such as system reliability, passenger crowding, transfer requirements, door to door travel times, and appearance. Passenger safety and security are final key components.

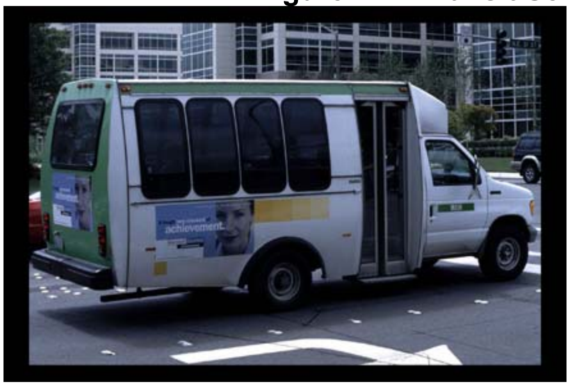
The unique characteristics of the SR 386 development plan incorporate commuter trips to and from Nashville, a future transit connection, and circulation within Gallatin. In addition, there are areas of high density mixed land use and low density residential development. Large area employers, the university, and anticipated retail centers are also important characteristics to be considered when evaluating transit service options.

There are a broad range of available service options in a multimodal system. To be successful, the multimodal system should consider the broadest range feasible for the development area. Anticipated transit service will serve as a focal point. To maximize the ridership experience and potentially minimize cost, other service options should be developed to support each other. These options could include a fixed route bus service, shuttle service, demand response service, Dial-a-Ride service, and special event service. The photos in **Figure 11** show examples of these services.

Figure 11 – Transit Service Options

Fixed Route Bus or Express Bus Vehicle

Figure 11 – Transit Service Options (con't.)



Shuttle Van Vehicle

Commuter Rail Vehicle

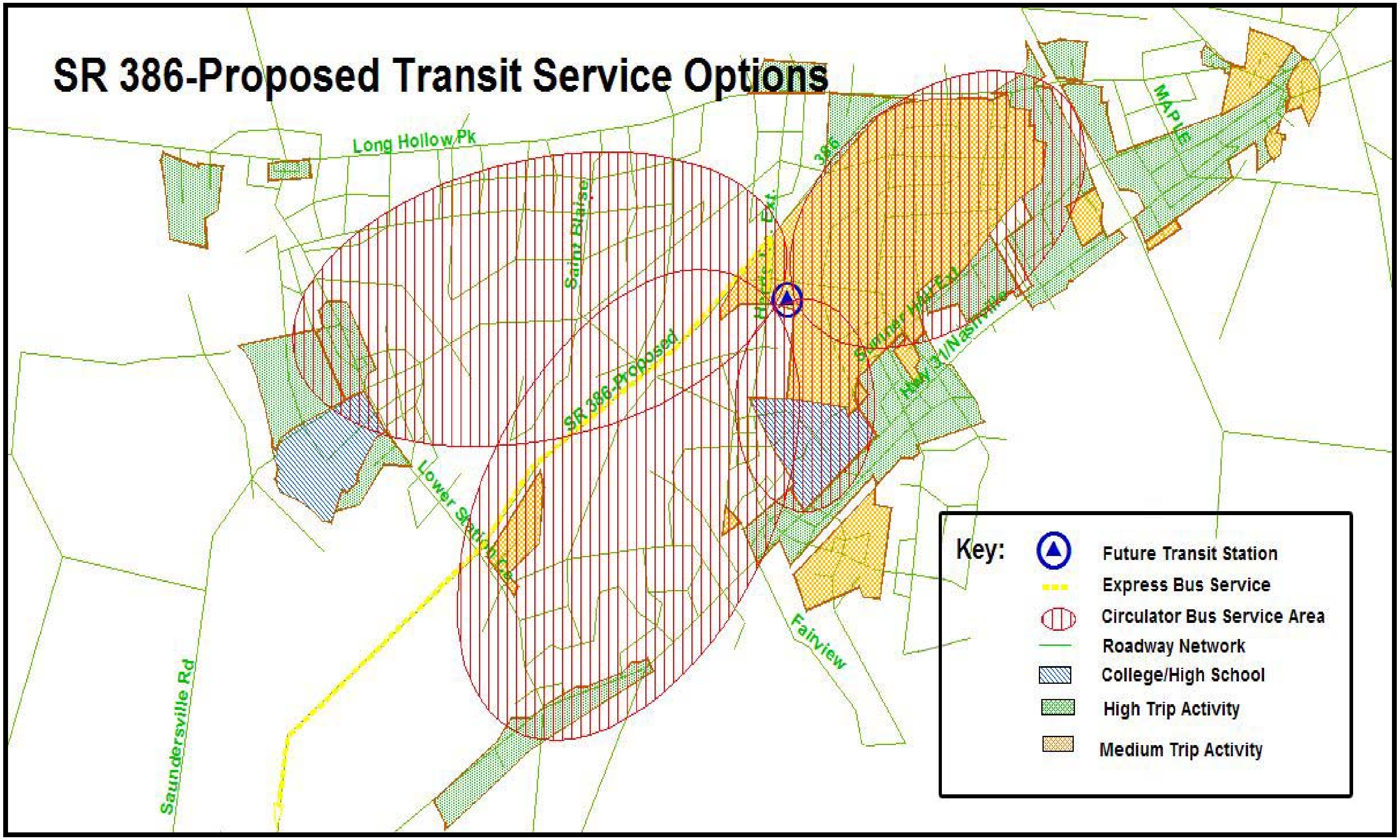
Fixed Route Bus Vehicle

Given the existing level of transit service and the development planned in the SR 386 area, the following transit service options should be considered for the SR 386 Area Transportation Study.

A park-n-ride lot should be developed at the future transit location. Given its central location in the SR 386 area, a park-n-ride lot could serve as a transit hub even before transit service is established. The implementation of express bus service to the Nashville Metropolitan area from this hub would serve an interim role in meeting the needs of the Gallatin to Nashville commuter.

In order to facilitate transit passenger access, egress, and general distribution around Gallatin and the SR 386 area, it is suggested that circulator/demand response services be implemented. This type of service utilizes small bus or van vehicles with routes that vary by user choice or need and can be used to feed future bus or rail service. They generally operate during peak times or special events such as the county fair or holiday shopping periods. This service represents a low cost transit implementation. **Figure 12** shows a possible set of service areas for circulator/demand response service within Gallatin.

Figure 12 – Transit Service Areas



7.3 Pedestrian Access

As mentioned, every transit rider is a pedestrian first. Therefore, considering pedestrian needs in a multimodal design is an important element. Easy access to all transit options by pedestrians is a critical component of a successful TOD.

Sensitivity to pedestrian use is assumed in the design and development of the multimodal transit options discussed in this report. For example, all bike paths are multi-use. In addition, a pedestrian sensitive design is assumed in the development of sidewalks, parking lots and a future rail station. Finally land use ordinances should consider the needs of the pedestrian.

Pedestrian friendly streetscapes include easy access to transit options, sidewalks wide enough to accommodate multiple users, and parking lots that are located to the rear of a development. To the contrary, unfriendly pedestrian designs rarely contain sidewalks, have poor signage, and do not support mixed use developments. The photographs shown in **Figure 13** contain examples of these unfriendly streetscapes.

Figure 13 – Unfriendly Pedestrian Streetscapes

Figure 13 – Unfriendly Pedestrian Streetscapes (con't.)

7.4 Bicycle Access

The American Association of State, Highway and Transportation Officials (AASHTO) standards for bicycle facilities include three classes:

- Bike Path-Class I Shared-Use Path
- Bike Lane-Class II Bicycles Only
- Bike Route-Class III Shared Roadway

Bike Path-Class I assumes the path is physically separated from motorized vehicular traffic, paved 12-14 feet wide and shares use with pedestrians and other non-motorized traffic. These are often installed along natural physical boundaries such as streams or rivers.

Bike Lane-Class II exists within a portion of roadway right of way designated by striping, signing, pavement markings and typically requires additional pavement provided on the roadway shoulder (4-6 feet).

Bike Route-Class III is not separated from vehicular traffic, is designated by signs and informational markings and located on low traffic volume roadways. They are often located on roads with wider than normal lane widths.

In addition to these standards, other criteria considered in the bicycle access recommendations include:

- access to activity centers (areas generating high daily trips per acre),
- connectivity to other bike facilities through the creation of systems of lanes/routes,
- ease of implementation (through proposed new roadway construction), and
- linkage to future transit network.

The City of Gallatin, in their Bicycle and Pedestrian Master Plan (September 2000), presents a variety of bicycle development factors and plans. Building on this base, considering the land use proposed for the SR 386 area, the corresponding road improvements, and the future commuter rail station location, a series of recommendations is presented.

Figure 14 contains bike paths that meet the qualification of Class I facilities. These recommendations were contained in the Bicycle and Pedestrian Master Plan (September 2000) and remain relevant in the context of the SR 386 area land use proposed for the SR 386 Area Study.

Figure 15 contains bike lanes and routes that meet the qualifications of Classes II and III. These bike lanes and routes were formulated for the SR 386 Area Study. They are based on roadway improvements resulting from the land use proposal and recommendations included in the City of Gallatin Bicycle and Pedestrian Master Plan (September 2000).

Figure 14 – SR 386 Area Bike Paths

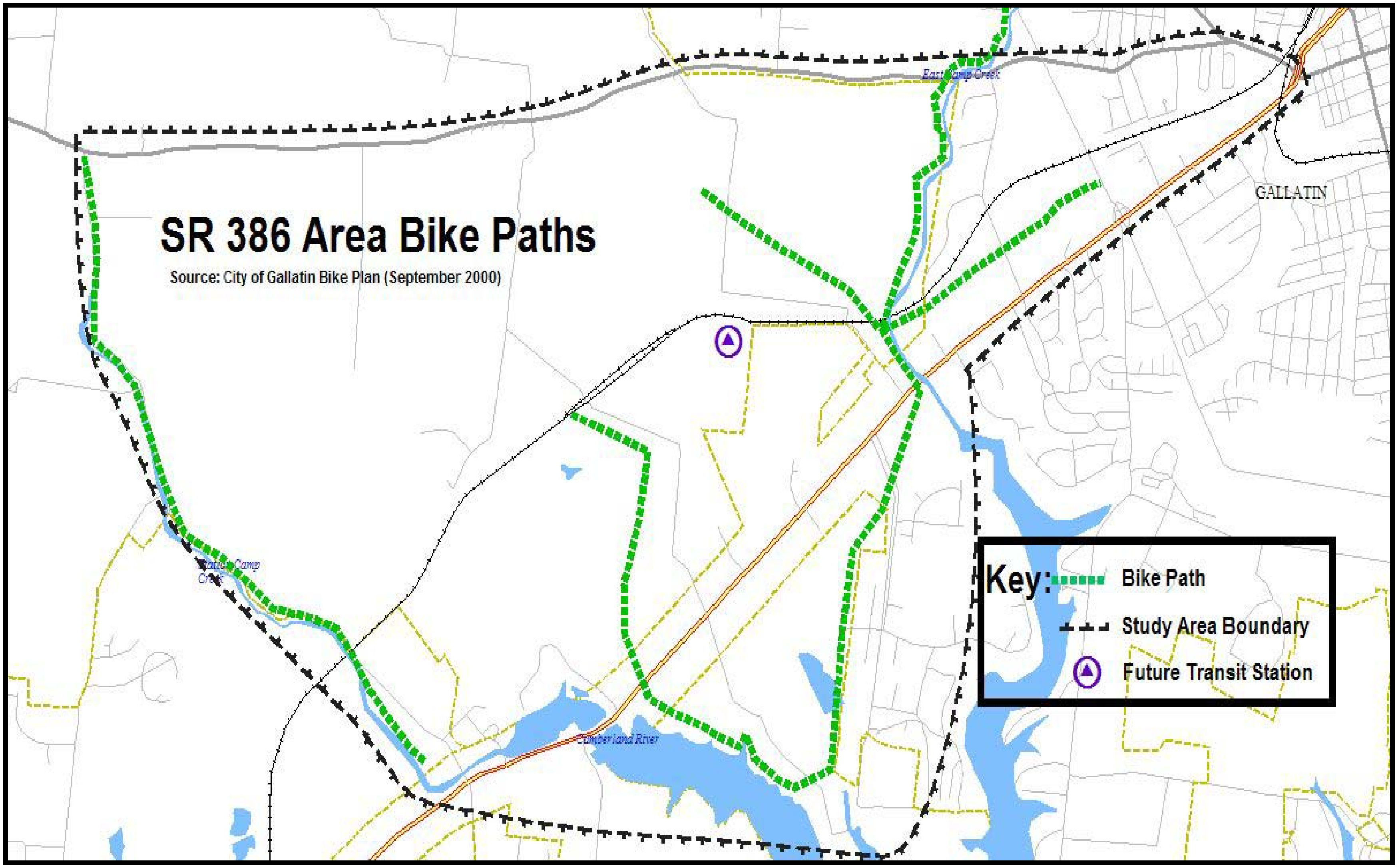
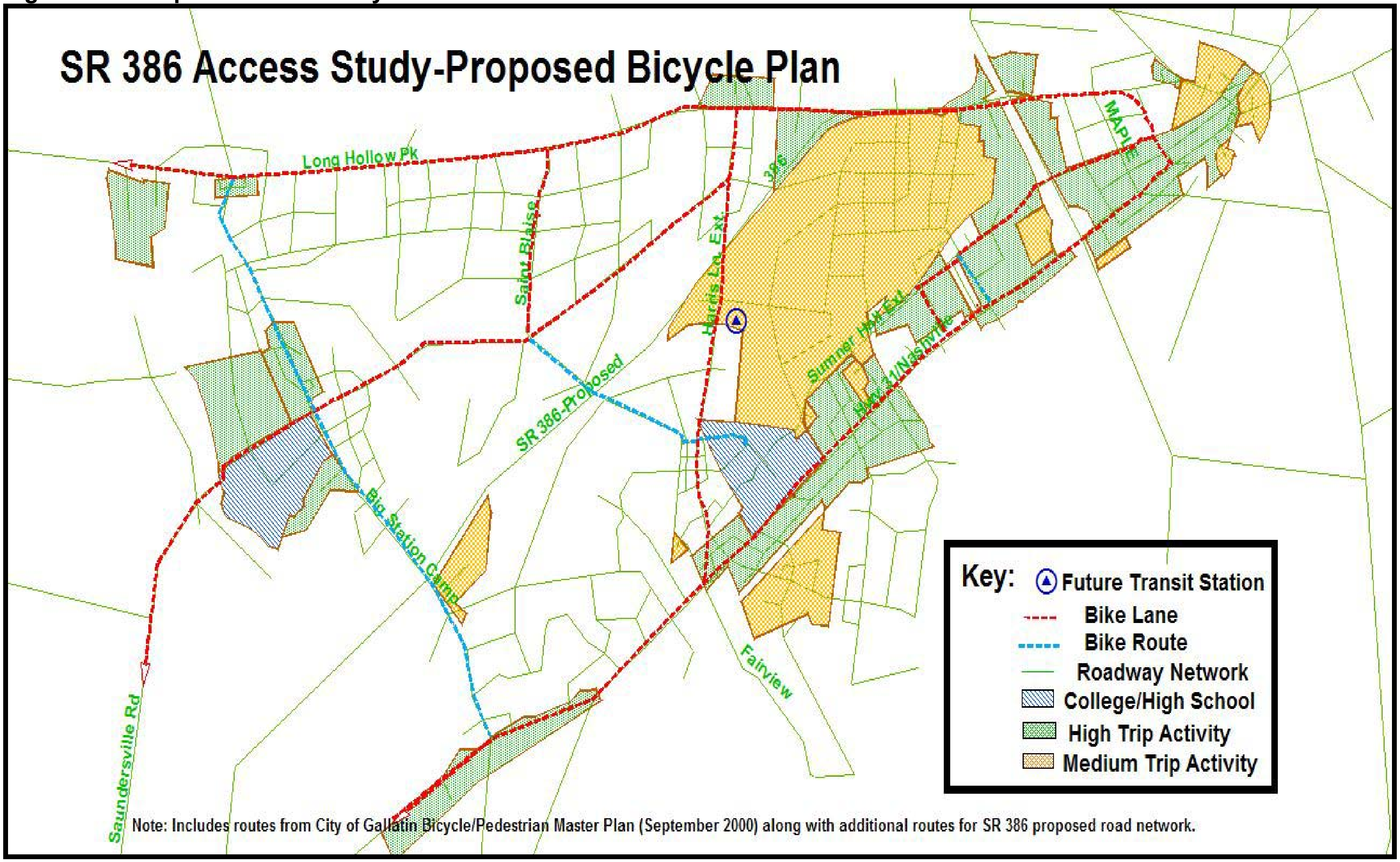


Figure 15 – Proposed SR 386 Bicycle Plan



APPENDIX A

GUIDELINES FOR INTERCHANGE AREA MANAGEMENT AND ACCESS MANAGEMENT

SR 386 AREA STUDY

PREPARED FOR:

Nashville Metropolitan Planning Organization,
Sumner County,
and the City of Gallatin

June 30, 2005

PREPARED BY:

Gresham Smith and Partners
1400 Nashville City Center
511 Union Street
Nashville, TN 37219

GRESHAM
SMITH AND
PARTNERS

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A-1.0 INTERCHANGE AREAS

The Center for Urban Transportation Research (CUTR) of the University of South Florida has developed a document Land Development and Access Management Strategies for Florida Interchange Areas. This document is the basis for the recommendations for the SR 386 interchange areas.

A-1.1 Definition of Freeways and the Importance of Interchange Areas

Freeways are heavily traveled thoroughfares that allow us to quickly get from here to there. Freeway interchange areas have become important points for providing necessities and conveniences that aid in travel comfort and frequently serve as gateways to communities. Advanced planning and access management can reduce traffic conflicts and create a balance between access and mobility needs.

If an interchange area does not function smoothly, it can damage the economic vitality of nearby communities. From a transportation perspective, interchanges are a vital link in the system. They provide access from surface streets to freeways and may be required to handle very high traffic volumes during peak travel periods. They are also a critical interface between the freeway and the surface street system, providing a transition from high speed travel to lower speeds.

A-1.2 Issues in Current Practice

Land use changes can be rapid and intensive near interchange areas. By providing for development in interchange areas without the necessary plans or regulations to manage access outcomes, the result is a proliferation of driveways near interchange ramps. In addition, major street intersections are often located too close to the ramp termini. Some problems resulting from this development include: heavy weaving traffic, complex traffic signal operations, accidents, congestion and traffic backing up the ramps on to the main line. Curb cuts and median openings near the ramp termini further compound these problems.

Because interchanges invite development and traffic, it is essential to have regulations in place that address issues of compatibility and function. Access management plans and regulations help to preserve the safety and efficiency of interchange areas as development occurs. Although the need for improved access management is clear, the separation of state and local jurisdiction has made it difficult to accomplish. Effective interchange area management requires a combination of techniques involving land use planning, zoning, subdivision regulation, signage, access management and intergovernmental coordination.

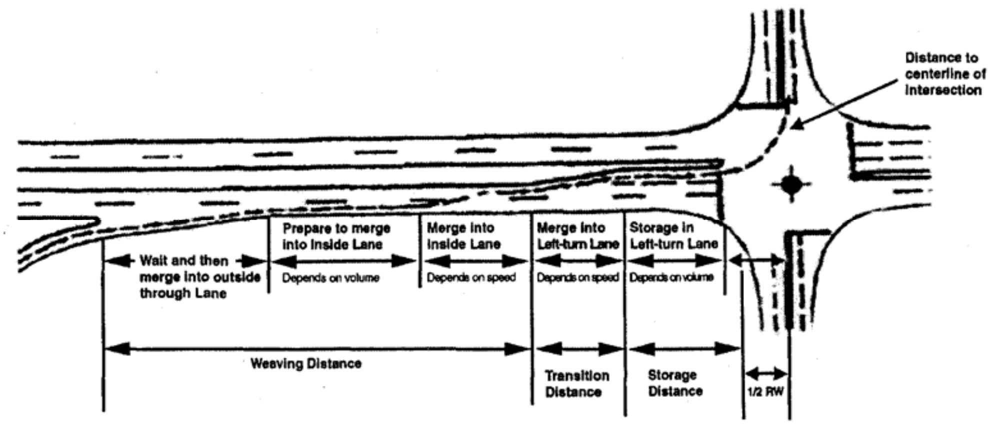
A concern that often arises at the local level is that access controls could impede economic development. It is understandable that local governments are interested in increasing their tax base through development. What is often not understood is that not managing access can have long-term adverse impacts on both the transportation function and economic development potential of interchanges. For example, shared access roads open up more land for development on the interior of interchange areas, thereby increasing their development potential and allowing more efficient use of land. Access management plans and requirements can also help to discourage the division of roadway frontage into small lots with constrained development potential, and help to preserve larger parcels for higher quality development with good internal circulation and access design.

NCHRP 420: Impacts of Access Management Techniques concludes that the separation distances used by state agencies are often far less than the spacing needed to ensure good traffic signal progression and adequate weaving and storage for left turns. From this research it was concluded that separation distances from exit ramps should include those set forth below in **Table A-1** and illustrated in **Figure A-1**.

Table A-1 – Separation Distances from Interchange Exit Ramps

Roadway Segment	Distance Recommendation
Weaving – moving across through lanes	800 feet on two lane arterials 1200 feet on four lane arterials 1600 feet on six lane arterials
Transition – moving into turn lane(s)	150 – 200 feet
Perception-reaction distance	100 – 150 feet
Storage	Adequate for volume without overflow into through lane (typical 200 – 300 feet depending on demand).
Distance to centerline of intersection	40 – 50 feet

Figure A-1 – Components of Access Separation Distances



Based on the analysis, **Table A-2** shows the suggested minimum access spacing standards for four lane cross routes at interchanges.

Table A-2 – Four Lane Cross Routes

Access Type	Area Type Fully Developed Urban (45 mph)	Suburban (45 mph)	Rural (55 mph)
First Access From Off Ramp	750 feet	990 feet	1320 feet
First Median	990 feet	1320 feet	1320 feet
First Access Before On Ramp	990 feet	1320 feet	1320 feet
First Major Signalized Intersection	2630 feet	2640 feet	2640 feet

A-1.3 Land Development and Access Management Strategies

Access management in interchange areas can be accomplished through advance planning and a range of regulatory and non-regulatory techniques. It also requires cooperation with property owners, developers, and local governments. Regulatory methods require certain actions, while non-regulatory methods encourage or drive desired actions. Non-regulatory techniques are often in the form of agreements or incentives. Below is an overview of the many techniques that may be applied to advance access management objectives.

Access Management Plans

Planning for interchange areas is similar to corridor development planning – it targets a specialized area and takes a comprehensive approach. An interchange area plan is linked to the roadways and should concentrate on the interrelationship of land use and access. An interchange area access management plan gives clear direction for development, provides organizational structure, and is the basis for achieving a positive, welcome perception of the community. A good plan will also prevent situations from occurring that will limit economic benefits to the community.

The first step in interchange area access management planning is determining the interchange area boundaries. The recommended boundary is ½ mile from the taper along cross street, or to the first major signalized intersection. Elements that need to be evaluated to assure future access management include, but are not limited to:

- Site plans (encourage unified development such as shared signage, driveway and parking);
- Signage (control of billboards and advertisements)
- Highway and traffic (road function, access to adjacent land, evaluation of traffic generation versus benefits such as employment generation)
- Access control (minimizes conflicts)
- Street system (internal, frontage, backage, local and crossroads)
- Setbacks (safety, future construction, aesthetics)
- Corner clearance
- Loading on premises (for pick-up, delivery, service and emergency vehicles)
- Consolidated signage
- Pedestrian circulation

It will also be necessary to assess existing conditions, such as:

- Property ownership and land division characteristics
- Lot frontage
- Access points
- Transportation characteristics

It is important to determine what types of development will be allowed, where development should be located and, perhaps the most important, planning a system of local roads to serve development. When developing a plan, some areas of caution to consider are:

- Incompatible land uses (especially in rural areas)
- Strip development
- Unattractive and cluttered buildout, including signage (causes confusion)
- Insufficient building setbacks (obscures vision and increases cost for road widening)
- Excessive number of access points
- Land uses that generate excessive traffic
- Inadequate off-street parking, loading space and delivery area

Land Development Regulations

No single land use control is enough to fulfill planning for interchange development and protection. It requires a combination of land use/zoning, subdivision and site plan regulations. Each control serves a separate function in the process, and incorporating several controls ensures the intended outcome of the plan. Types of regulations used will vary depending on location and environment – urban or rural, developed or undeveloped. Below are some useful regulatory techniques for managing interchange area development.

Subdivision Regulations

Subdivision regulations are critical with regard to interchange areas. They can require dedication of land for road improvements, ensure proper street layout in relation to existing or planned roadways, require internal property access for residential development and establish design principles and standards for lots, blocks, streets, public places, pedestrian ways, and utilities.

The subdivision review process should address a variety of issues, including:

- Proper placement of access in relation to the interchange ramp, sight distance requirements, and related considerations
- Fronting units on residential access streets rather than major roadways; and
- Linking the pedestrian path system to buildings with parking areas, entrances to the development, open space and other community facilities.

Zoning Regulations

Zoning regulations are important as they establish the allowable use of land, building setbacks, and lot dimensional requirements. Minimum lot frontage standards should be higher on thoroughfares and near interchanges to allow for greater spacing between access points and interchange ramps. Smaller lot frontages are appropriate where properties have frontage on internal subdivision roads or where there are other alternatives to direct, individual highway access. Wider and deeper parcels also increase flexibility of site and circulation design and provide a wider range of development opportunities than small or irregularly shaped lots.

Zoning regulations can also be applied in a variety of ways to advance interchange area access and development objectives. These include:

- Interchange Overly District – Interchange zoning controls are added to the standard zoning requirements of the underlying district (commercial, residential, etc.) The property and any improvements thereon are subject to both the standard zoning regulations and the overlay restrictions. Overlay requirements may address any issues of concern, such as driveway spacing or consolidated access roads, and are often used to implement an access management plan.
- Interchange Zoning District – A separate zoning district specifically for those areas within the designated interchange area, having its own set for subdivision and development regulations.
- Planned Unit Development for Interchange Areas – Larger tracts are planned and developed as a functional unit, as opposed to standard zoning, which

regulates development on a lot-by-lot basis. A PUD process is oriented toward accomplishing site design that is more sensitive to the characteristics of an area. For interchange areas, they could be oriented toward accomplishing consolidated access and circulation systems. PUD controls are more flexible and are subject to a thorough investigation and review before approval is granted. Conditions for approval are specified prior to development.

- Special or Conditional Use Permits – Certain conditions must be found to exist prior to granting approval, and development must be compatible with the surrounding areas.

Access Management Measures

Access management measures can be regulatory and non-regulatory. For example, separation distances on state roads in Florida are regulatory, while using raised medians rather than nonrestrictive medians is part of roadway design. Medians are an effective way to reduce traffic conflicts and encourage driveway consolidation. Medians are especially useful for retrofitting problem areas, as they can control left turns and reduce traffic conflicts in already developed areas.
Access management measures in interchange areas include:

- Alternate Access Roads
- Access Separation Distances (Spacing Standards)
- Medians
- Joint and Cross Access Requirements
- Improved Driveway Design
- Acquisition of Access Rights

The most effective technique that can be used to preserve the function of interchange areas over the long term involves the provision of alternate access to the interchange area crossroad. Purchasing access rights or building an alternate access road may achieve this.

Alternate (frontage, backage or reverse frontage, or local) road systems provide additional property access, decrease access on arterial roads, and allow traffic from multiple parcels to be channeled through a single access point. A poorly located access road can harm the flow on the arterial road it was intended to protect. It is essential to consider how the alternate road will interface with the arterial road and to assure adequate corner clearance from any nearby intersection.

Alternate access roads can be implemented through public and private contributions in a variety of ways. For example, developers could be required to set aside right-of-way needed for the alternate access road as a condition of development approval, and the local government could construct and maintain the road. In some cases, developers may construct a portion of the road. In other cases, a local government may opt to complete undeveloped segments of the road as an incentive for private participation.
To promote the development of alternate access roads, state or local agencies can purchase access rights a certain distance from the interchange ramp. In some states,

the DOTs contribute to local road improvements where this would improve safety and reduce operational problems on a state highway.

Medians help to reduce conflicts in interchange areas by restricting left turn and crossing movements. Median construction or reconstruction to close median openings can be used as an effective retrofit strategy in areas where driveway access and left turn movements is a problem. Additional measures can also help. NCHRP 420 suggests the following:

- Frontage roads along freeways can be better integrated with ramps at interchanges
- Interchanges can be configured and modified to provide better accessibility to major developments or activity centers and thereby avoid "double loading" arterials.

Driveway Design is important for the safety and efficiency of the roadway as well. Driveways may have adequate spacing, but if not designed correctly, can still cause back-up on the roadway. A driveway should have adequate right turn lanes, channelization and a minimum throat length to accommodate on-site storage of queued vehicles without interfering with street traffic.

Redevelopment and Nonconforming Situations will also need to be addressed. Although most techniques are best when implemented prior to development, some can also be used for retrofit projects and/or redevelopment. Even if an area is not identified as a redevelopment area, a change in land use usually triggers a site plan review, at which time the adopted regulations will have an effect.

Prior to drafting regulations and policies, it will be necessary to decide how to deal with existing elements on a site that do not conform to the new standards. These situations may never meet minimum interchange management standards, but new regulations should specify opportunities for bringing those elements into conformance. Existing elements are allowed to remain, while measures are being taken to avoid further deterioration. Retrofit strategies include:

- Selectively reconstructing existing substandard driveways
- Negotiating driveway closure, reconstruction or relocation during roadway resurfacing or improvement
- Requiring improvement of access during redevelopment or expansion of an existing land use.
- Providing for joint and cross access with abutting properties
- Issuing temporary access until adjoining properties are developed.

It will be necessary to review local policies that relate to the interchange management area to determine if they require any regulatory or policy changes. This may include plan amendments, updating policies and procedures, revising design standards, securing intergovernmental agreements and so on.

It is much more difficult to retrofit or change an area that is already developed. Therefore, the critical time for instituting access management regulations for interchange areas is prior to building the interchange. Because the time period between programming dollars for purchase of right-of-way and completion of the construction is so long, there is adequate opportunity for development of regulations for the interchange area.

Agreements and Resolutions

Development Agreements legally record the trade-offs between public benefits and development incentives. Agreements ensure that all parties follow the terms for development. Development agreements usually run with the use of the land; however, they can also run with the land, binding each successive owner.
Joint Development Agreements specify how public and private developers will each contribute to the development of strategic projects, and hinge on the public and private sectors each performing on schedule. These agreements are particularly important with regard to redevelopment efforts. Joint efforts are a good way for government agencies to demonstrate their commitment to access management and their willingness to assist in retrofitting for the benefit of the community.

Intergovernmental Agreements are binding contracts creating legal rights and obligations between parties. They convey the consent and mutual obligation to untie in a common purpose. This is the preferred method for intergovernmental coordination, as it is both legally binding and specific in its terms of the desired course of action. Intergovernmental agreements work best when responsibilities, financial obligations and procedures for review and management are detailed.

Memoranda of Understanding (MOU) are an effective way to clearly document the role of each agency in helping to implement a plan. A MOU sets forth goals, objectives, actions, deadlines and funding responsibility.

A Resolution is the formal expression of an opinion or the will of an official body. A resolution publicly declares the unilateral position of a governing body on a given policy matter at a point in time. Resolutions are not legally binding and are subject to change, particularly if the members of the elected body change.

Coordination

State agencies lack authority over the land development process, and local governments lack authority over access permitting decisions on state highways. Together, these factors make coordination difficult, but essential. State transportation agencies and local governments must coordinate closely and consider the effects of their decisions on the entire interchange area, if it is to work efficiently. Too often state and local agencies act independently, leading to problems that actually undermine the functional integrity of the interchange. Because each agency has authority over a different part of the process, state and local governments can achieve far more through mutual cooperation than either agency could achieve alone.

Coordination is accomplished when parties responsible for interchange management decisions act in harmony. The goal is to make decisions that are consistent with each agency's standards. Ideally, coordination leads to compatible standards and procedures within and across government agencies. This makes it beneficial not only to the agencies involved, but also to the public and the developer or property owner whose financial investment is at stake.

Coordination between government agencies requires each agency to verify their level of commitment and agree upon their respective roles and responsibilities. This can be formally accomplished through Resolutions, MOUs or Intergovernmental Agreements.

Interchange management plans are another way to facilitate intergovernmental coordination and consistent decision-making within interchange areas. These plans are developed and implemented through a cooperative effort between the state and local governments. As individual developments occur, permits can be issued that conform to the plan, or permits outlining conditions can be issued so that the development will ultimately be in conformance.

Another effective action is the development of a coordinated review process. This would help minimize inconsistencies between state and local permitting decisions. This could be achieved by structuring a tiered review. For larger projects, the first stage could consist of an informal meeting or telephone conference in which state transportation officials and local regulatory staff can discuss the proposed development concept. A pre-application meeting could then be scheduled where representatives of both agencies could be in attendance to advise the developer or property owner what is required to receive development approval. For smaller projects, early state and local communication might be sufficient.

After a preliminary site plan is drafted, it would be reviewed by both the state and local government to determine if additional changes or conditions are needed. When the plan meets both state and local approval, the applicant would submit a final site plan for the permit approvals.

Other Techniques

Incentives provide a benefit to an investor that is greater than the cost of receiving it. For example, in exchange for a site design that furthers access management, developers may be allowed to relax other requirements. Local governments may:

- Allow increased density or greater floor area ratio
- Lower impact fees
- Reduce setbacks
- Reduce taxes
- Provide greater flexibility in mitigation

Infrastructure Improvements

Public facilities (roads and utilities) may be located in a way that directs development to desired areas. Developers should share in the cost of providing the infrastructure to accommodate additional traffic generated by their establishments.

A-2.0 INTRODUCTION TO ACCESS MANAGEMENT

A-2.1 What is Access Management?

Access management is controlling the access and roadway geometrics for connections to the local transportation network. Various techniques are used including restrictive driveways, medians, deceleration and acceleration lanes and connectivity. The use of these features has proven to increase safety and efficiency on the roadways and extend the functionality of the transportation network.

What is FHWA's Role in Access Management?

According to the FHWA's Office of Operation's website, their role in Access Management is to:

- Encourage and advance the development of state and local access management policies, guidelines, and procedures for the management of facilities; and integrate these into established planning, policy and design processes.
- Increase awareness and understanding of the linkage between land use, transportation planning, corridor preservation, and management.
- Increase awareness of access management techniques by state DOTs, cities and counties.
- Increase use of access management techniques by state DOTs, cities, towns, and counties.
- Promote use of TRB Access Management Manual and other useful resources.
- Advance state of the practice through training courses and workshops that present up-to-date information and real world examples.
- Advance state of the practice in access management through research.
- Share expertise and experience at national and regional conferences.
- Work with business organizations and public entities to align and advance economic development opportunities with access management strategies.

A-2.2 Goals of Access Management

The primary goals of Access Management are to improve roadway safety, improve traffic operations, protect taxpayer's investments in roads and create better conditions for pedestrians. Some secondary goals include opportunities to beautify areas and to reduce cut through traffic on residential roads.

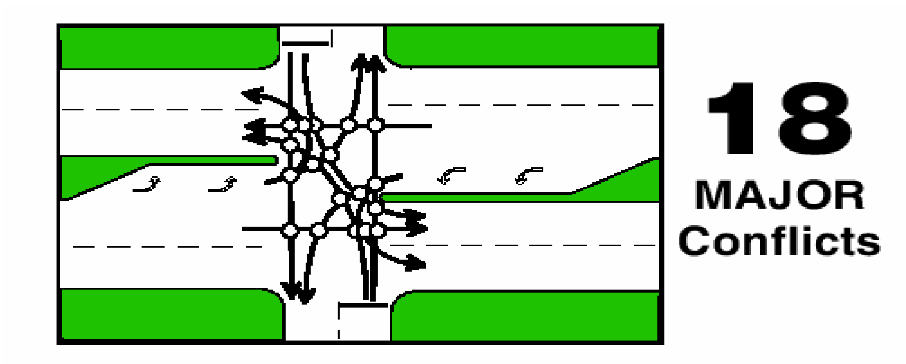
A-2.3 Benefits of Access Management

Access Management has been shown to increase safety and efficiency on roads. The following information is geared toward the higher volume roadways; however, the same principals should be considered for local roads.

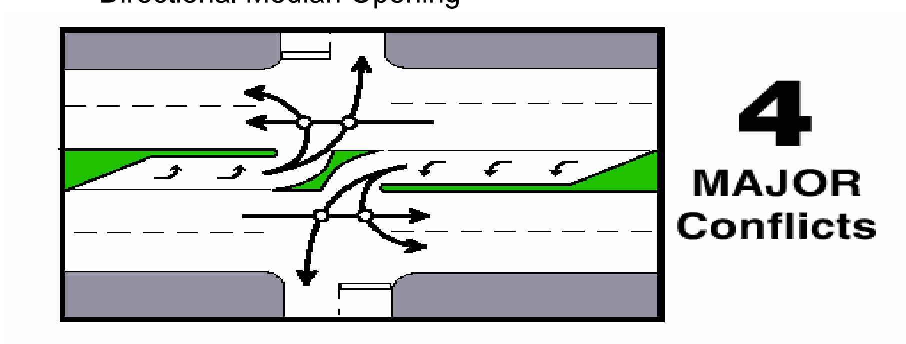
One of the most noticeable improvements associated with controlled access is the reduction in conflict points, which increase safety and efficiency. **Figure A-2** shows the conflict points associated with each type of median opening.

Figure A-2 – Conflict Points

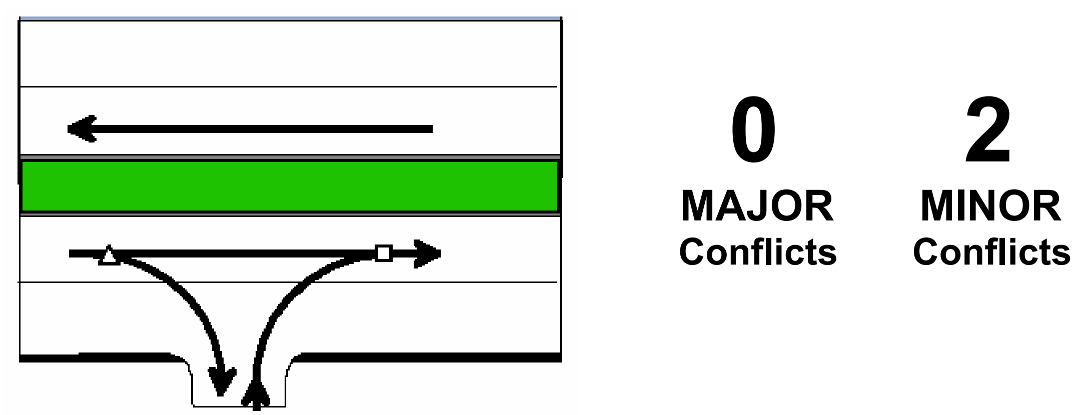
Full Median -



Directional Median Opening –



3 Way Intersection/Closed Median –



The more controlled the median opening is, the lesser probability there is for severe crashes. For example, with a full median opening, there are 18 major crashes that could occur because drivers are allowed to maneuver their cars freely. With a closed median, conflict points are reduced to 2 per driveway and these crashes would generally be minor rear end or sideswipe. Access management allows drivers sufficient sight distance and reaction time to recognize and react to potential hazards. This helps create a safer environment for pedestrians and drivers.

Efficiency of through traffic is greatly increased when access is controlled. There are less conflict points and therefore less stop-and-go traffic. Because vehicles at some drives do not have sufficient gaps to cross high volume roads, channelizing traffic to signals reduces the delay at the side streets and driveways. The greater efficiency creates increased and preserved capacity of the road. This in turn preserves the investment of the roadway system by delaying the need to add more lanes.

Raised medians and better-spaced driveways can improve the aesthetics of a community. Landscaping can be included in raised medians and buffer areas. However, if it is improperly designed or maintained, the vegetation may become a safety hazard as sight distance is diminished. The regulated spacing of driveways also reduces the visual clutter of a road, i.e., consolidation of commercial signs and driveways.

All of these factors, plus the comfort level felt by the drivers and pedestrian increase the appeal of the community. Everyone benefits by cooperative effort to provide good access design. The public safety and investment in the roadways is protected by the application of access management techniques. Property values remain stable or may increase along roadways, which carry significant traffic volumes so long as the traffic can flow smoothly with a minimum of congestion and conflicting movement. Each driver is rewarded with lower vehicle operating costs due to the smoother operations and less delay and with greater safety and comfort due to fewer conflicting traffic movements.

Often access management is thought of just median openings; however, access management extends much further to include driveways, land planning and transportation facility planning.

A-2.4 The Local Municipality's Role

The local municipalities in the SR 386 area should use the concept of access management to help alleviate traffic concerns and ensure a viable future roadway network within their jurisdictions.

A-2.5 A Typical Statement of a City's Authority

In order to promote safe and reasonable access between public roadways and adjacent land; improve the convenience and ease of movement of travelers on public roads; and permit reasonable speeds and economy of travel while maintaining the capacity of the roadway, the location and design of access points shall be in accordance with the access management regulations within this document. These regulations shall apply to all existing, planned, or proposed roadways within the jurisdiction of the City. New or proposed roadways within the City not identified on the adopted Street Classification Map shall interconnect with the existing roadway network in a uniform and efficient manner.

The following indemnifies the City and gives them the authority to enforce these access management regulations and guidelines.

- The applicant shall hold harmless the City, its officials, appointed agents and employees against any action for personal injury or property damage sustained by reason of the exercise of a permit issued hereunder.
- The City may install barriers across or cause the removal of any driveway providing direct access to a City street, which is constructed without a driveway permit after the effective date of this article. The property owner listed on the City's most recent tax rolls shall be sent written notice of the City's action within ten (10) days thereafter. When practical, the City will notify the property owner and/or illegal access user of pending action.
- It shall be unlawful for any person to drive a vehicle onto or from any City street at a point other than a permitted driveway.
- When a permitted driveway is constructed or used in violation of this article, permit terms and conditions, the City may obtain a court order enjoining the continued violation of this article, permit terms and /or conditions. The City may revoke driveway permits if at any time the permitted driveway and its use fail to meet the requirements of this article or the terms and conditions of the permit.

Any access points along routes maintained or controlled by the State Department of Transportation should follow the following procedure. A copy of the plans for all access points to be constructed along a state maintained or controlled route shall also be submitted to the State for review and approval during the same time as plans are submitted to the City. Permission for the construction of access points along state maintained roadways is subject to the approval of plans by both the local and state agencies.
The City Engineer or his/her designee may, at its discretion, reasonably waive or modify the requirements of this statement; if it is determined that such action is warranted given the nature of the individual project.

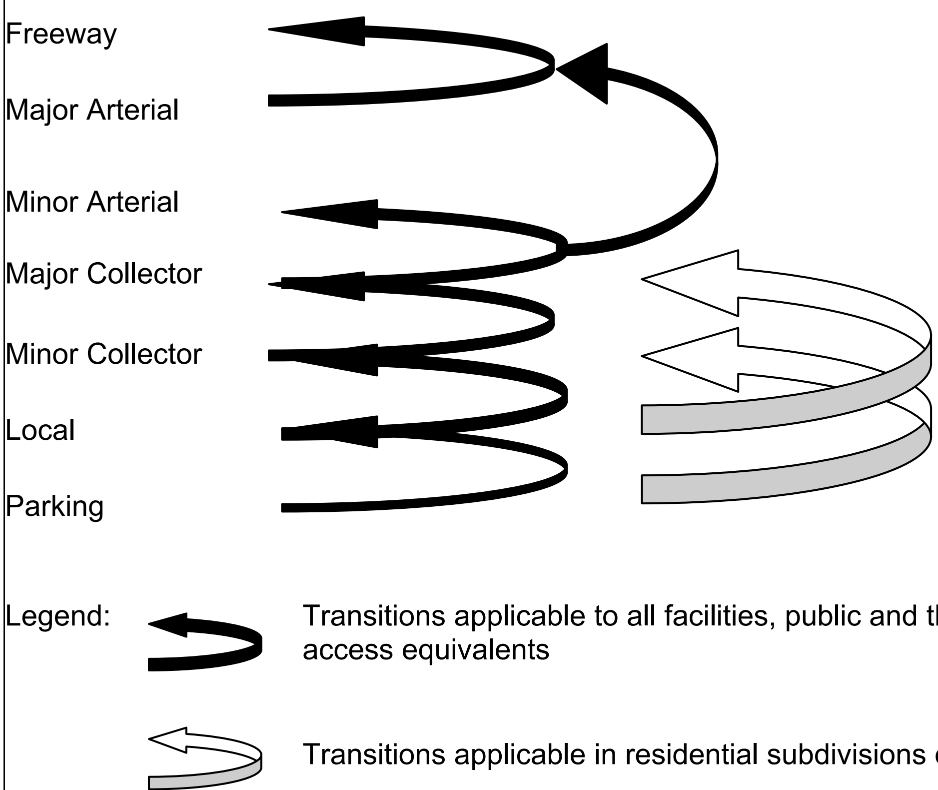
A-2.6 Roadway Classification

It is important to classify the roadways within the SR 386 area to effectively manage the traffic on those roads. Within any community there are different types of streets, which are planned and constructed to serve different purposes. On one end of the scale, the multi-lane freeway, i.e. SR 386, is designed to carry high volumes of traffic at high speeds over relatively long distances. Virtually no direct access between these freeways and the land, which abuts them, is allowed. On the other end of the scale is the local road, whose function is to provide access to and from the property abutting it and to provide the first link between that property and the entire roadway network. The bulk of the streets in a community, however, do no fit neatly into either of these two categories. Most streets provide, in varying degrees, for both the through movement of traffic and access to the property abutting those streets but, unfortunately, these two functions often conflict with one another. New developments need adequate access to the property in order to be viable but each additional access point lessens the capacity of the roadway to carry traffic volumes. This compromise can be accomplished through the application of a comprehensive policy based on the principles of access management. **Figure A-3** shows correlation between access and functional class.

Figure A-3 – Functional Hierarchy

As shown, local/residential roads can function with the highest number of access connections. However, a freeway should have the greatest control of access, limiting the connections to major crossroads. The actual roadway structure is also important in the success of a roadway network. Local roads should feed to collectors, which should feed into arterials, etc. This is shown in **Figure A-4** below.

Figure A-4 – Functional Hierarchy of Intersections



Reference: V.G. Stover, Medians Short Course, Center for Urban Transportation, University of South Florida for the Florida Department of Transportation, October 1995.

A-2.7 Typical Roadway Classification Guidelines

Table A-3 includes typical roadway classification Guidelines.

Table A-3 – Example Roadway Classification Guidelines

Design Criteria	Freeway	Arterial	Collectors Major	Collectors Minor	Local Residential	Local Frontage
Volume range (vehicle trips/day)	?	> 10,000	4,500 to 10,000	1,000 to 4,500	< 1,000	n/a
Right-of-way width (min. feet)	240	100*	80*	60	50	40
Number of lanes (minimum)	4	5**	3**	2	2	2
Design speed (mph)	55+	50	40	30	30	n/a
Interchange spacing (miles)	1.0*** 2.0**** 3.0*****	n/a	n/a	n/a	n/a	n/a
Intersection spacing, > 45 mph (min. feet)	n/a	660	440	440	125	125
Intersection spacing, < 45 mph (min. feet)	n/a	440	245	245	125	125
Median spacing, directional (min. feet)	n/a	1,320	660	660	n/a	n/a
Median spacing, full (min. feet)	n/a	2,640	2,640	1,320	n/a	n/a
Signal spacing (min. feet)	n/a	2,640	2,640	1,320	1,000	1,000

Notes:

* Medians and /or Shoulders and Ditches may increase needed Right-Of-Way Width.

** Two Way Left Turn Lanes may be replaced with Medians and Dedicated Turn Lanes.

*** CBD or CBD Fringe in Cities in Urbanized Area

**** Existing Urbanized Areas Other Than CBD or CBD Fringe

***** Transitioning Urbanized Areas and Urban Areas Other than CBD, CBD Fringe or Existing Urbanized Areas

The local municipalities shall assign to each roadway, or portion thereof, within their jurisdiction of the City a functional classification based on a consideration of existing and projected traffic volumes, adopted local transportation plans and needs, the existing and/or projected character of lands adjoining the roadway, adopted local land use plans and zoning, and the availability of reasonable access to those lands. These functional classifications are defined as follows:

1. Arterial: These roadways are capable of providing medium to high speeds and traffic volumes over medium to long distances. Direct access to abutting land is subordinate to providing service to through traffic.
2. Collector: These roads are capable of providing moderate travel speeds and traffic volumes and generally provide the linkage between Arterial and Local roadways. There is a reasonable balance between access and mobility needs within this classification.
3. Local: These streets allow for low to medium travel speeds and traffic volumes and are linked to the roadway network through intersections with Arterial or Collector roadways and other Local roadways. Access needs take

priority over through traffic movement without compromising the public health, welfare, and safety.

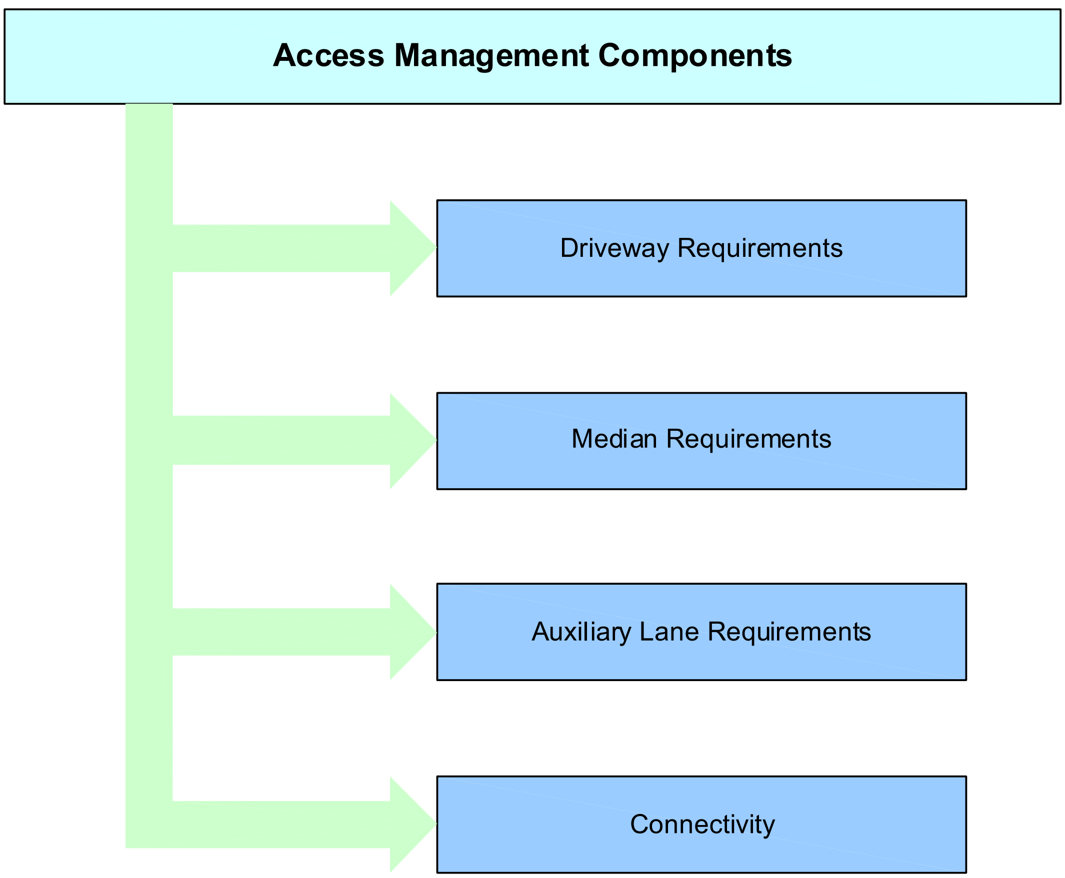
Frontage Roads are considered access drives and should be considered Local.

Any change to an Access Classification should include public involvement with an opportunity for public comment.

A-2.8 Access Management Components

The primary components of Access Management include: driveways, medians, auxiliary lanes and connectivity. See **Figure A-5** below

Figure A-5 – Access Management Components



Driveways allow for ingress and egress from a roadway to abutting properties. The control of the spacing and design of driveways help to create a smooth flow of traffic and have been proven to reduce crash rates.

Medians physically separate different directions of traffic flow. The management of median openings facilitates a smoother flow of traffic, a separation of opposing traffic and channelizes traffic-to-traffic signals. Properly designed and spaced medians have also been proven to reduce crash rates, especially the more serious head on and angle crashes.

Auxiliary lanes are incorporated into access management designs to facilitate the flow of traffic near and at driveways and median openings. Auxiliary lanes, including left and right deceleration lanes, allow traffic exiting the through lanes an area to decelerate and be safely stored with minimal effects to the through traffic. Acceleration lanes allow traffic entering the through traffic to merge with minimal disruption to the through traffic.

Connectivity allows traffic to progress from local roads up the functional class hierarchy to arterials and freeway roads. This progression reduces the “cut through” traffic on local roads and provides the proper balance of access. Connectivity between abutting properties reduces the trips on the through road thus eliminating additional conflict points and congestion.

A-2.9 Helpful Access Management Websites

For more information on Access Management, the following websites provide guidance:

- www.cutr.eng.usf.edu/index2.htm (Access Management)
- www.myflorida.com/myflorida/transportation/learn/planning/systems management/index.html
- www.odot.state.or.us/tdb/planning/access_mgt/

A-2.10 FAQ’s

Some frequently asked questions regarding Access Management include questions about emergency vehicle access, the safety of u-turns, and economic impacts.

Q1. Will emergency vehicles be able to access a site once raised median and other control devices are in place?

A1. Yes, these medians and other controlling features should be designed with mountable curbs for emergency vehicles. Also, representatives for all affected public services should be contacted during the design of the projects.

Q2. Are U-Turns safe and do they add extra driving time?

A2. If properly designed, yes U-Turns are a safe maneuver. They divide the maneuvers, i.e., a right turn, merge into median, u-turn, so drivers concentrate on less conflict points at one time. Also, the left turn lane provides safe storage until the driver can see the traffic ahead of them is clear. In most instances, u-turns do not add a significant time increase to a trip. This is because there is less delay at the side street/driveway to turn right than to wait for all of the lanes of traffic to clear to turn left. Usually the increased safety of U-Turns outweighs the few extra seconds of driving time.

Q3. Does Access Management keep customers away?

A3. Studies have found that “destination” businesses (doctors, specialty retail stores, service oriented businesses) are not affected by access management modifications. Interviews with both customers and business owners have shown that most people have no problem making a slightly longer trip, including U-turns to access destination businesses. Although pass-by businesses (convenience stores, gas stations, fast food restaurants) may be impacted more by access management modifications, studies show that even pass by businesses are not negatively impacted as long as reasonable access is provided. As traffic flow is made more efficient, the roadway can handle more traffic and congestion levels decrease. This results in more motorists being exposed to your business.

A-3.0 PERMITTING

A-3.1 Permitting Guidelines

For each proposed permit, the approval should be based on the following considerations for access management:

- How many connections will be allowed?
- Where will they be located?
- What is the throat length?
- Other design concerns?
- How will this traffic affect the adjacent road(s)?
- How will this traffic circulate on the site?
- Are there any impacts to third parties? Adjacent properties? Deliveries?
- Is a Traffic Impact Study Required?

With any type of review, a field investigation of the site should be conducted. This ensures there are no additional concerns with the site and that all of the considerations listed above have been reviewed.

A-3.2 Contact and Permitting Information

The flow charts depicted in **Figures A-6 and A-7** show the information needed and the process for a permit review.

Figure A-6 – Access Permitting

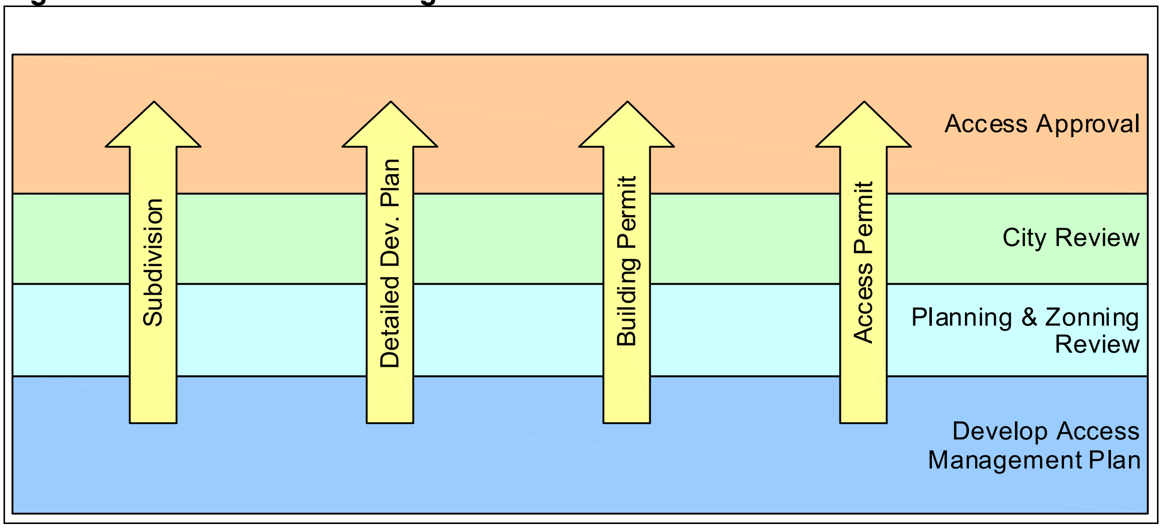
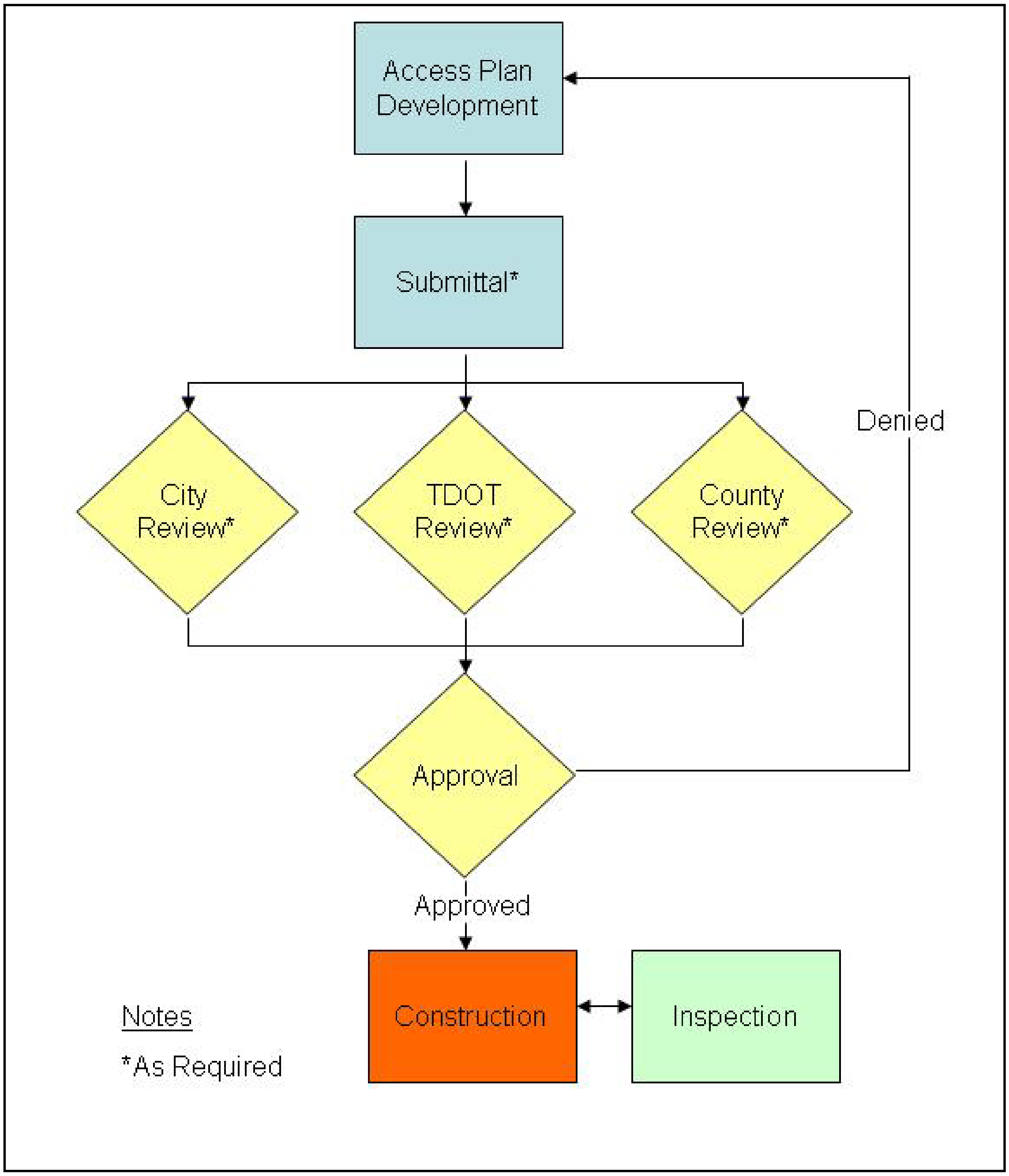


Figure A-7 – Access Plan Review Process



A-3.3 Recommended Permitting Regulations

a. If a development includes a change in the property use that will increase the trip generation by 20% the developer will need to get the site plan approved through the City's permit process. If the trip generation is less than 20% of the original use and the Developer is not proposing changes within the right of way then the developer should submit the plans for development to the City for their information. The latest edition of the ITE Trip Generation Handbook should be used to calculate the future number of trips.

b. When a vacant parcel is to be developed the developers will need to go through the permit approval process as outlined in the above flow charts. The size and type of development will determine the depth of the City's review.

   If a parcel has been improved, but these improvements have been vacated for over a year, the parcel should go through the permit approval process again. However, if the property is in an area targeted for revitalization the City may decide to reduce some of their standards.

c. A safety upgrade is defined as no change to the existing property use but the private/public entity wants to improve conditions for ingress/egress to the development. Current standards can be modified as long as the applicant can show a marked improvement to current conditions

d. The developer should be aware some properties are under multiple jurisdictions. All affected agencies should be contacted for approval before any construction begins. If any jurisdiction recommendations contradict another's, the stricter of the two should be adhered to or a meeting should be scheduled to resolve the differences.

e. No person shall construct, reconstruct, relocate or in any way alter the design or operation of any driveway providing direct vehicular movement to or from any public street from or to property adjoining a public street without an access permit. No work shall be undertaken on a driveway until the applicant has received the executed permit.

f. In no event shall a driveway be allowed or permitted if it is determined by the City Engineer to be detrimental to the public health, welfare and safety.

g. If the proposed development requires a Traffic Impact Study, final approval of the access to the property is pending final approval of the TIS. Traffic studies shall be submitted in accordance with the Metro Davidson County's Traffic Impact Study Procedures.

h. A joint private access easement may be required between adjacent lots fronting on arterial and major collector streets in order to minimize the total number of access points along those streets and to facilitate traffic flow between lots. The owner or developer of property required to use shared driveways shall be responsible for obtaining easements on adjacent property as necessary.

A-4.0 DRIVEWAYS

A-4.1 Recommended Driveway Guidelines

a. Driveway design, location and spacing are fundamental to the success of access management. While regulating driveway spacing and design may restrict direct access to certain businesses, the benefits allow for safer and more efficient use of the roadways and access to private developments. Driveways and turning lanes must be designed so that they are capable of handling the amount of traffic expected to use them. If a driveway is not designed properly, traffic on the through road may have to slow considerably, stop, or swerve into another lane to avoid a car turning. This greatly reduces capacity and causes safety concerns.

b. The primary information needed to begin review of a new driveway connection is the development type, the type of road the driveway is connecting to, the trip generation, the type of vehicles entering and the adjacent property use. Each driveway needs careful consideration to ensure the roadways and drivers are not adversely affected.

c. There are two major types of driveways, residential and commercial. Residential driveways serve low volume single family, duplex and small apartment complex properties, less than 8 units. Commercial driveways can be subdivided into three categories, major commercial, minor commercial and industrial. Typical major commercial drives serve large shopping malls, big box stores, strip shopping centers, restaurants, etc. Minor commercial driveways typically serve real estate offices, small medical offices, hair salons, "mom and pop" type operations and smaller apartment buildings. Industrial driveways should be reviewed as a commercial drive with emphasis on the heavy truck traffic associated with the site. Larger radii, lane width, throat length and storage queues may be necessary.

d. Joint Use/Cross Access Driveways should be encouraged where feasible. If cross access is not feasible under existing conditions, a stub out should be included in permits for possible future cross access agreements. Some adjacent land uses do not promote the use of joint use drives. One example is a school driveway sharing with an industrial driveway. Success of joint use/cross access driveways partially depends upon sufficient throat depth for drivers to access their choice of destination after entering the drive and site plans should be laid out to encourage these drives. Sometimes grade differences and site characteristics, i.e., creek, wetlands or historical significant areas prohibit the use of joint/cross access. Such elements of site design can be determined through a thorough traffic impact study.

e. Many new developments request to have divided drives for the inclusion of signs and/or landscaping to beautify their property. These features should be designed with care not to promote wrong way movements, hinder sight distance or divert attention away from driving.

f. Safety upgrades of driveways may include relocating, eliminating, consolidating, and/or redesigning driveways. Owners may realize after a project is built that the safety and efficiency of their site may not function as anticipated. If this occurs, the local municipality should work with the owners to improve the condition of their site and bring conditions as near current standards as possible.

A-4.2 Recommended Driveway Regulations

a. The City may require that upon completion of a development all traffic requiring access to and from the development shall operate in such a manner as to not adversely affect the capacity of the roadway. Provisions for the present or future construction of a frontage road, restriction or channelization of turning movements, or other improvements may be required, as a condition of approval, in order to maintain the capacity of any adjacent roadway. Sometimes in the course of public street reconstruction by the City it becomes necessary to revise or eliminate an existing driveway, it is recommended the property owner be notified in writing of the required changes, the changes should be implemented at the cost of the appropriate public agency, and it should not result in denial of reasonable access from the property to the general street system.

b. Each existing tract of land is entitled to one direct or indirect access point to the public roadway network provided that its location and design fulfill, as a minimum, the requirements of minimum corner clearance, and minimum sight distance and alternative cross access agreements could not be coordinated.

c. Major access points on opposite sides of arterial and collector roadways shall be located opposite each other. If not, turning movement restrictions should be imposed as determined necessary by the City Engineer or his/her designee. In addition, in order to maximize the efficient utilization of access points, access drives shall be designed, located, and constructed in a manner to provide and make possible the coordination of access with and between adjacent properties developed (present or future) for similar or compatible uses.

d. Whenever the use of a parcel of land changes, or two or more parcels of land are assembled under one purpose, plan or entity, or usage, the existing driveway permits shall become void and the new permit shall be based upon the owner/developer’s plans to use some existing driveways and/or close or relocate other driveways. Any such new or reauthorized access point must meet any updated standards or regulations.

e. Unless contained on the building permit site plan, a site plan showing all existing right of way easements, curbs, storms drain inlets, flumes, underground and overhead utilities, trees and sidewalks shall be required for each non-residential driveway permit applications. If the subject property is along a road with a raised median and there is no median opening servicing the property, i.e., within 150 feet of the property lines, the driveways and roadway characteristics on the opposite side of the median shall not be required to be shown on the permit request.

A-5.0 MEDIAN TREATMENTS

A-5.1 Typical Median Treatment Guidelines

a. Medians should be included or planned to be included on all arterial roads, where there is enough right of way to be obtained. On major collector roads, medians should be seriously considered for inclusion for future projects. For minor collector and local roads, medians should be included where their benefits are greater than their costs or for aesthetic purposes.

b. Some typical design flaws of medians include multiple median openings very closely spaced, narrow medians where cars cannot safely store within them; no left turn lanes; median openings that are too wide; etc. These medians can often reduce the safety and efficiency of a road.

A-5.2 Median Treatment Design Elements

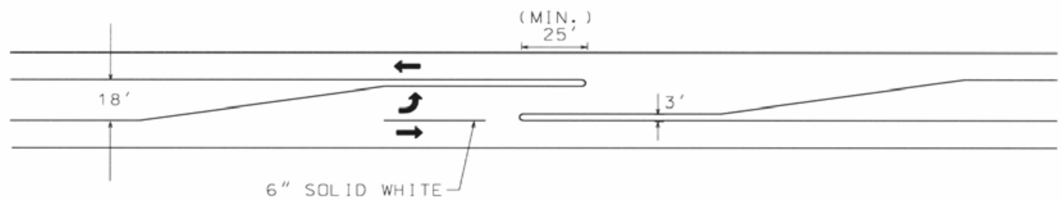
a. The proper design of medians and median openings is needed to ensure the safety and efficiency benefits. If possible and warranted, all median openings should be designed with <u>left turn deceleration lanes</u>. If an adequate deceleration lane cannot be included, these openings may be signed with a "No Left Turn" or a "No U-Turn" sign.

b. <u>Raised medians</u> incorporate an actual barrier between the two flows of traffic on a road. Raised medians are generally designed with mountable curb and at least 14 – 40 feet wide (<u>median width</u>). The median openings are a traffic control device. Many times these medians restrict direct access to properties from one side of the road; however, access is maintained by allowing vehicles to make u-turns or through connectivity between sites.

c. <u>Painted medians</u> include pavement markings on the road, which give motorists direction on how to use the road. Many times these medians are disregarded since motorists do not have any physical obstacles to prevent them from making the movement they desire and if the pavement markings get worn it is hard for motorists to see the markings.

Raised or painted median openings may be designed at a signalized intersection, a full unsignalized opening or a directional median opening. With a <u>signalized intersection</u> a traffic signal permits movements and most movements are controlled by the signal indicators. <u>Unsignalized full median openings</u> permit left turns to and from the main road and the intersecting road or driveway. Generally, the traffic on the main road has the right of way while traffic on the secondary road or driveway connection is regulated by stop or yield signs. <u>Directional median openings</u> allow for left turns from the major road but preclude left turns from the intersecting road or driveway. Other directional median openings allow for left turns into an intersecting road or driveway and/or out from the driveway. **Figure A-8** depicts an example of a directional median opening.

Figure A-8 – Design of Directional Median Opening



d. A Two Way Left Turn Lane (TWLTL) is defined as a center lane of a road which is striped to allow left turns from virtually any place along the road. This effectively creates a situation with a high number of conflict points, since every driveway functions as a full median opening. However, the design of TWLTLs are encouraged on low volume roads with a high proportion of left turning vehicles (>20%) and a low density of driveways (<12 driveways per traffic direction per mile) in commercial areas. The traffic volumes should be below 28,000 ADT for a five lane typical section and below 17,500 ADT for a three lane typical section. TWLTLs should not be incorporated into 6 lane roadways. Where there are high pedestrian volumes, pedestrian refuge islands should be considered. These create a visual and concrete area for a pedestrian to wait if they cannot cross the entire street at one time. However, care should be taken if these islands are landscaped that the landscaping does not hide the pedestrians.

e. Median spacing helps preserve the efficiency of the traffic and the future capacity of the road. The priority of full median openings should be at existing or future signal locations. Typically, full median opening spacing should not be less than ¼ mile (1320 feet). This ensures optimal efficiency for signals. From the existing/future signal locations, corridors should be reviewed for the inclusion of other full or directional median openings. Generally, municipalities grant full median openings at public streets or the highest trip generator. Some exceptions to this philosophy are at locations of high heavy truck volumes and high schools due to their specialized needs including truck turning radius and available area to do u-turns and high school peak hour traffic and inexperienced drivers. The median opening locations should also be reviewed to ensure an adequate left turn deceleration lane could be incorporated with the median opening. If there is nothing to generate left turns from one side of a median opening, it may be reviewed to omit a left turn lane for that direction. Some factors to consider are the number of u-turns that will be using that location and including the proper sign design to prohibit turns. Due to safety considerations, full median openings with little opportunity to become signalized should not be included on six lane roadways. Vehicles tend to become trapped in the median opening with difficulty seeing the three approaching lanes.

f. Wide median opening widths should be avoided to help control traffic within median openings. The median width is measured from the opposing median noses. This width should vary between 65 feet and 100 feet with an average of 75 feet. The wider the side road or driveway, the wider the median opening width will need to be. If side roads or driveways are offset, they should be reviewed for median opening widths and conflicting turning movements.

g. Access management corridor plans are beneficial by planning development along a corridor so that all parties know what the access will be, signal spacing can be controlled and future construction costs can be offset by the donation of right of way and/or developers including part of the ultimate typical section in their plans.

h. Sight Distance should be reviewed at each median opening. Some of the different types of sight distance associated with median openings are intersection sight distance, U-turn sight distance and sight distances for left and right turns.

A-6.0 AUXILIARY LANES

A-6.1 Auxiliary Lane Guidelines

Auxiliary lanes are any separate lanes used for left and right turning vehicles decelerating or accelerating. Left turn deceleration and storage lanes should be provided at all median openings that allow left and/or u-turns. Right turn deceleration lanes should be included when a right turning vehicle will cause the through traffic to slow or create congestion in the outside lane.
Acceleration lanes allow drivers entering the roadway to accelerate and then merge laterally into the through traffic lane. Acceleration lanes are desirable where high speeds and a lack of gaps in traffic make it difficult for vehicles to enter the roadway.

At those access points where vehicles turning to and from the roadway will affect the capacity of the roadway or create an unacceptable accident risk, the developer shall dedicate sufficient right of way and construct deceleration/acceleration lanes as necessary to maintain the capacity of the roadway and minimize the potential accident risk. If this is unfeasible due to lot limitations, right of way shall be donated for future construction.

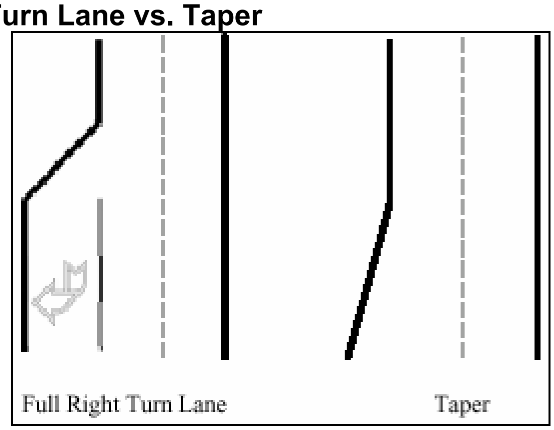
A-6.2 Deceleration Lane Regulations

Deceleration lanes allow drivers to exit the through lane before beginning to slow. This allows for minimal disruption to the through movement and provides a safe area to wait to turn.

Left turn lanes should be long enough to include a taper, a safe deceleration area, and queuing of cars.

Some multi-lane highways with adequate capacity may not need right turn lanes if the outside lane can function as a continuous right turn lane and vehicles can safely maneuver around the turning vehicle without slowing considerably. Some alternatives to a full right turn lane are a right turn taper or use of a larger ingress radius. These offer the motorists a small area to begin exiting the through lane prior to the ingress lanes of the driveway.

Figure A-9 – Right Turn Lane vs. Taper



A-6.3 Acceleration Lane Regulations

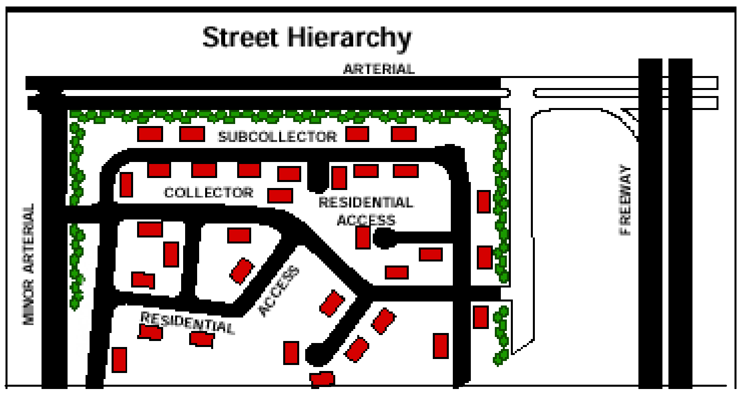
An important factor for the design of acceleration lanes is that they must be long enough to allow the accelerating vehicle to reach the desirable merging speed. The desirable merging speed should be the average running speed of the through traffic (NHI).

A-7.0 CONNECTIVITY

A-7.1 Functional Class

Connectivity is an integral component of access management. Connectivity can be achieved by having the correct progression from a local feeder road to a connector road and then from there to an arterial road. Functional class connectivity is shown in **Figure A-10**.

Figure A-10 – Street Hierarchy



A-7.2 Parcel Level

Connectivity can also be thought of as having more than one access to a side road for a large development, having cross access, i.e., connecting more than one driveway by a frontage road or connecting more than one development to one driveway. Connectivity allows trips to be distributed between the internal systems and the hierarchy of the roadway structure. A variety of street types should be included in development plans to help interconnectivity and reduce volumes on major roadways. A common access management tool used to promote connectivity within developments is the use of frontage roads. These roads allow the traffic that would utilize the main road to access business to use an alternate parallel road, the frontage road, to make their turns. Connectivity also allows for pedestrian routes, which encourage walking between destinations, and removes internal trips from the adjacent road network.

A-8.0 DEFINITIONS (NHI DOCUMENT)

1. **Acceleration Lane –** An auxiliary lane, including taper, for the purpose of enabling a vehicle entering a roadway to increase its speed to a rate at which it can safely merge with through traffic.
2. **Access –** The ability to enter or leave a public street or highway from an abutting private property or another public street.
3. **Access – Control of –** The condition where the right of vehicular traffic movement to abutting property to the highway is fully or partially controlled by public authority.
4. **Access – Right of –** The right of an abutting property owner to vehicular movement to and from the highway and the owner's property.
5. **Access Control Plan –** A roadway design plan which designates access locations and their designs for the purpose of bringing those portions of roadway included in the access control plan into conformance with their access category to the extent feasible.
6. **Access Point –** The connection of a driveway at the right-of–way line to the highway.
7. **ADT –** The annual average two-way daily traffic volume. It represents the total annual traffic for the year, divided by 365.
8. **Arterial Highway –** A highway primarily for through traffic, usually on a continuous route.
9. **Auxiliary Lane –** A separate lane for the purpose of enabling a vehicle entering or leaving a roadway to increase or decrease its speed to a rate at which it can more safely merge or diverge with through traffic.
10. **Buffer Area –** The area between the outside edge of shoulder or curb and the right-of-way line.
11. **Conflict –** A traffic even that causes evasive action by a driver to avoid collision with another vehicle, usually designated by a light application or evasive lane change.
12. **Conflict Point –** An area where intersecting traffic either merges, diverges or crosses.
13. **Corner Clearance –** The minimum dimension parallel to a highway between the curb, pavement, or shoulder lines of an intersecting highway and the nearest edge of a driveway.
14. **Deceleration Lane –** An auxiliary lane, including taper, for the purpose of enabling a vehicle to leave the through traffic lane at a speed equal to or slightly less than the speed of traffic in the through lane and to decelerate to a stop or to execute a slow speed turn.
15. **Directional Island –** An area within the roadway not for vehicular movement; designed to control and direct specific movements of traffic to definite channels. The island may be defined by paint, raised concrete or other devices.
16. **Divided Highway -** A two-way road on which traffic traveling in opposite directions is physically separated by a median.
17. **Downstream –** The direction along the roadway toward which the vehicle flow under consideration is moving.

18. **Driveway –** The physical connection between a public street or highway and an abutting private tract of land.
19. **Egress –** The exit of vehicular traffic from abutting properties to a highway.
20. **Frontage Road –** A local street or road located parallel to an arterial highway for service to abutting properties for the purpose of controlling access to the arterial highway.
21. **Grade –** The rate or percent of change in slope, either ascending or descending, form or along the highway. It is to be measured along the centerline of the roadway or access.
22. **Guideline –** A recommended value which reflects good engineering practice and which should be followed in most situations.
23. **Highway –** The entire width between the boundary lines of every publicly maintained way when any part thereof is open to the public use for purposes of vehicular travel.
24. **Ingress –** The entrance of vehicular traffic to abutting properties from a highway.
25. **Interchange –** A facility that grade separates intersecting roadways and provides directional ramps for access movements between the roadways. The structure and the ramps are considered part of the interchange.
26. **Lane –** The portion of a roadway for the movement of a single line of vehicles and does not include the gutter or shoulder of the roadway.
27. **Level-of-Service –** A qualitative measure of the effect of a number of factors including speed and travel time, traffic interruptions, freedom to maneuver, safety, driving comfort and convenience, and operating costs.
28. **Local Road –** A county road or city street for which the primary function is to provide access to adjacent properties.
29. **Median –** The physical portion of a highway separating the traveled ways for opposing traffic flows.
30. **Median Opening –** A gap in a median provided for crossing and turning traffic.
31. **Merging –** The process by which two separate traffic streams moving in the same general direction combine or unite to form a single stream.
32. **MUTCD –** The Manual of Uniform Traffic Control Devices
33. **Right-of-Way –** The land within legally defined property boundaries vested in the governing body and designated for highway purposes.
34. **Roadway –** That portion of a highway improved, designed or ordinarily used for vehicular travel exclusive of the berm or shoulder. In the even a highway includes two or more separate roadways, “roadway” refers to any such roadway separately but not to all such roadways collectively.
35. **Rural –** Any area not included in a business, industrial, or residential zone of moderate or high density, whether or not it is within the boundaries of a municipality.
36. **Sight Distance –** The distance visible to the driver of a passenger vehicle measured along the normal travel path of a roadway to a specified height above the roadway when the view is unobstructed to traffic.
37. **Stopping Sight Distance –** The distance required by a driver of a vehicle, traveling at a given speed, to bring the vehicle to a stop after an object on the roadway becomes visible. It includes the distance traveled during driver perception and reaction times and the vehicle braking distance.
38. **Storage Length –** Additional lane footage added to a deceleration lane to store the maximum number of vehicles likely to accumulate during a peak period so as not to interfere with the through travel lanes.

39. **Traffic Control Device –** Any sign, signal, marking or device placed or erected for the purpose of regulating, warning, or guiding vehicular traffic and/or pedestrians.
40. **Traffic Gap –** The clearance interval in time or distance between individual vehicles.
41. **Turning Radius –** The radius of an arc, which approximates the turning path of a vehicle.
42. **Undivided Highway –** A road that has no directional separator, wither natural or structural, separating traffic moving in opposite directions.
43. **Urban –** Any territory within an incorporated area or with frontage on a highway, which is at least 50%, built up with structures devoted to business, industry, or dwelling houses for a distance of a quarter of a mile or more.
44. **Warrant –** A requirement based on a legal precedent, or officially adopted policy-mandated for use within the jurisdiction of the adopting governmental unit.
45. **Weaving Maneuvers –** The crossing of traffic streams moving in the same general direction accomplished by merging and diverging.

APPENDIX B

TRAVEL MODEL SUMMARY

SR 386 AREA STUDY

PREPARED FOR:

Nashville Metropolitan Planning Organization, Sumner County, and the City of Gallatin

May 5, 2005

PREPARED BY:

Bernardin ! Lochmueller & Associates, Inc.
6200 Vogel Road
Evansville, IN 47715

Memo

TO: Lane W. Swauger, P.E.

FROM: Jonathan Avner

RE: TN 386 Area Study
BLA Project No: 104-0092
Task 3.3.3 – Delivery of Modeled Daily Traffic Volumes

DATE: January 4, 2005

Purpose of this Memorandum is to document the development of the forecast volumes for the SR 386 Study Area. The information is organized by Task Number from our original Scope of Services dated July 8, 2004.

Task 2
Once all information was received on the Tennessee SR 386 Study Area project, BLA was able to move quickly onto the development of the refined travel demand model for the study area.

The roadways included in your Roadway Plan were added to the MPO network to create the Refined Model Network. The numbers of lanes provided were used in all cases. Facility type was assigned based on connectivy and consistency with other roadways in the network. In most cases, the number of lanes and facility type of facilities in the MPO network were not altered. Exceptions include:

- MPO Network had SR 386 north east of Nashville Pike coded as Major Arterial with a speed of 45mph. This was changed to make it consistent with the other segments of SR 386 to the west, resulting in a higher capacity and speed.
- SR 174 between SR 386 and SR 109 was coded as 2 lanes in the MPO network. To be consistent with the Roadway Plan provided, this was changed to four lanes.

Maps of the refined Traffic Analysis Zones (Task 2.1.2), and refined model network (Task 2.1.4) were sent to your staff on December 27, 2004 (Task 2.1.3). Comments were received and discussed with Chris and Lee and the necessary changes were made to the files (Task 2.1.5). The final refined model network and TAZ system are shown in the following figures.

Figure 1. Refined Model Network - SR 386 Study Area

Figure 2. Refined TAZ Structure - SR 386 Study Area

Following is a table that summarizes the roadway characteristics for each Facility Type:

Table 1. Speed and Capacity by Facility Type

Facility Type	Speed	Daily Per Lane Capacity
1 – Interstate	65	20350
2 – Freeway	55	17500
3 – Major Arterial	45	15000
4 – Minor Arterial	40	8850
5 – Collector	35	6650

Task 3 – Travel Demand Modeling

Task 3.1 – Trip Generation

The final trip generation numbers were received from GS&P (Task 3.1.1). As previously discussed the study area land uses were disaggregated based on the following requirements (Task 3.1.3):

- Land uses were split to prevent roadways from crossing through a zone; and
- The MPO TAZ boundaries were to be preserved, such that trips could be aggregated to the MPO TAZ or the study area land use.

Once the refined TAZs were defined, trips were allocated based on the percentage of area in the refined zone as a proportion of the total study area zone. Using this method, all trips were maintained and an equal development density was assumed. Thus, the total area of the refined zones making up one Study Area Zone are equal.

The following table provides the number of trips entering and leaving each refined traffic analysis zone. The final column, TAZ Label matches what is provided on the attached map of the study area.

Table 2. Trip Generation Results

Study Area	Model TAZ ID	Weight	Prod	Attr	TAZ Label
1	272010	70%	5,184.90	5,184.90	1.A
1	569010	30%	2,222.10	2,222.10	1.B
2	569020	50%	729.25	729.25	2.A
2	569021	50%	729.25	729.25	2.B
3	569034	20%	264.39	264.39	3.E
3	569030	13%	176.26	176.26	3.A
3	569031	25%	330.49	330.49	3.B
3	569032	20%	264.39	264.39	3.C
3	569035	10%	132.20	132.20	3.F
3	569033	13%	176.26	176.26	3.D
4	569040	41%	545.52	545.52	4.A
4	569041	15%	202.05	202.05	4.B
4	569042	12%	161.64	161.64	4.C
4	569043	32%	424.30	424.30	4.D
5	569050	13%	743.50	743.50	5.A
5	569051	38%	2,230.50	2,230.50	5.B
5	569052	50%	2,974.00	2,974.00	5.C
6	569060	100%	12,120.50	12,120.50	6.A
8	569080	23%	148.98	148.98	8.A
8	569082	10%	66.78	66.78	8.C
8	569083	30%	190.07	190.07	8.D
8	569084	24%	154.11	154.11	8.E
8	569081	10%	61.65	61.65	8.B
8	569085	2%	15.41	15.41	8.F
9	272090	50%	299.25	299.25	9.A
9	273090	38%	224.44	224.44	9.B
9	274090	13%	74.81	74.81	9.C

Study Area	Model TAZ ID	Weight	Prod	Attr	TAZ Label
10	569100	100%	1,097.00	1,097.00	10.A
11	569110	100%	3,366.50	3,366.50	11.A
12	274120	20%	943.60	943.60	12.A
12	569120	4%	166.52	166.52	12.B
12	569121	7%	333.04	333.04	12.C
12	569122	6%	277.53	277.53	12.D
12	569123	27%	1,276.64	1,276.64	12.E
12	569124	32%	1,498.66	1,498.66	12.F
12	569125	5%	222.02	222.02	12.G
13	554130	100%	983.00	983.00	13.A
14	554140	100%	1,040.00	1,040.00	14.A
15	554150	100%	-	-	15.A
16	554160	100%	124.50	124.50	16.A
17	281170	100%	12,457.00	12,457.00	17.A
18	554180	35%	761.18	761.18	18.A
18	554181	29%	626.86	626.86	18.A
18	554182	37%	805.96	805.96	18.A
19	554190	50%	7,280.50	7,280.50	19.A
19	554191	50%	7,280.50	7,280.50	19.A
20	551200	100%	811.00	811.00	20.A
21	554210	50%	138.25	138.25	21.A
21	554211	50%	138.25	138.25	21.B
22	551221	4%	115.96	115.96	22.B
22	551220	72%	1,913.28	1,913.28	22.A
22	551222	21%	550.79	550.79	22.C
22	551223	3%	86.97	86.97	22.D
23	551230	100%	4,120.50	4,120.50	23.A
24	550240	100%	6,396.50	6,396.50	24.A
25	550250	33%	129.17	129.17	25.A
25	550251	67%	258.33	258.33	25.B
26	550260	100%	255.50	255.50	26.A
27	550270	100%	350.50	350.50	27.A
28	404280	100%	87.50	87.50	28.A
29	404290	100%	-	-	29.A
30	399301	32%	6,825.99	6,825.99	30.A
30	399302	6%	1,241.09	1,241.09	30.B
30	550300	9%	1,861.63	1,861.63	30.C
30	550301	12%	2,482.18	2,482.18	30.D
30	550302	41%	8,687.62	8,687.62	30.E
31	404310	21%	5,317.24	5,317.24	31.A
31	404311	14%	3,544.83	3,544.83	31.B
31	550310	31%	7,975.86	7,975.86	31.C
31	550311	34%	8,862.07	8,862.07	31.D
31	559310	0%	-	-	31.E
32	399320	100%	785.50	785.50	32.A
33	399330	100%	2,693.00	2,693.00	33.A
34	399340	37%	587.93	587.93	34.A
34	399341	37%	587.93	587.93	34.B
34	399342	27%	431.15	431.15	34.C
35	406350	50%	235.50	235.50	35.A
35	406351	0%	-	-	35.B
35	559350	50%	235.50	235.50	35.C
36	559360	100%	-	-	36.A
37	559370	100%	143.00	143.00	37.A
38	404380	100%	83.00	83.00	38.A
39	550390	100%	-	-	39.A
40	550400	100%	96.50	96.50	40.A
41	399410	4%	647.15	647.15	41.A
41	399411	5%	906.01	906.01	41.B
41	399412	4%	647.15	647.15	41.C
41	399413	6%	1,035.44	1,035.44	41.D
41	554410	12%	2,070.88	2,070.88	41.E
41	554411	4%	647.15	647.15	41.F
41	554413	3%	517.72	517.72	41.H
41	554412	17%	2,847.47	2,847.47	41.G

Study Area	Model TAZ ID	Weight	Prod	Attr	TAZ Label
41	554417	10%	1,682.59	1,682.59	41.L
41	554415	26%	4,271.20	4,271.20	41,J
41	554416	7%	1,164.87	1,164.87	41.K
41	554414	2%	258.86	258.86	41.I
42	554420	26%	377.34	377.34	42.A
42	554421	35%	503.12	503.12	42.B
42	554422	26%	377.34	377.34	42.C
42	554423	12%	167.71	167.71	42.D
43	553430	100%	-	-	43.A
44	553440	100%	409.00	409.00	44.A
45	553450	100%	76.00	76.00	45.A
46	553460	100%	3,815.50	3,815.50	46.A
47	553470	100%	226.50	226.50	47.A
48	569480	100%	332.50	332.50	48.A
49	554490	100%	621.00	621.00	49.A
50	5545000	17%	1,101.28	1,101.28	50.B
50	5545003	24%	1,527.58	1,527.58	50.E
50	5545006	1%	71.05	71.05	50.H
50	5545001	12%	781.55	781.55	50.C
50	5545002	9%	568.40	568.40	50.D
50	5545007	10%	639.45	639.45	50.I
50	5545004	9%	603.93	603.93	50.F
50	5545005	3%	213.15	213.15	50.G
50	5545009	1%	35.53	35.53	50.K
50	5545008	1%	35.53	35.53	50.J
50	5545011	1%	71.05	71.05	50.M
50	5545010	4%	248.68	248.68	50.L
50	569500	7%	461.83	461.83	50.A
51	399510	44%	418.67	418.67	51.A
51	399511	22%	209.33	209.33	51.B
51	399512	33%	314.00	314.00	51.C
52	551520	5%	1,330.69	1,330.69	52.A
52	551521	24%	6,653.45	6,653.45	52.B
52	551522	14%	3,992.07	3,992.07	52.C
52	551523	10%	2,661.38	2,661.38	52.D
52	551524	7%	1,996.04	1,996.04	52.E
52	554521	14%	3,992.07	3,992.07	52.G
52	554522	12%	3,326.73	3,326.73	52.H
52	554520	7%	1,996.04	1,996.04	52.F
52	554523	7%	1,996.04	1,996.04	52.I
53	554533	100%	160.50	160.50	53.A
54	554540	100%	43.50	43.50	54.A
55	554550	100%	43.50	43.50	55.A
56	551560	24%	350.71	350.71	56.A
56	551561	6%	87.68	87.68	56.B
56	551563	29%	438.38	438.38	56.D
56	551562	41%	613.74	613.74	56.C
57	554570	100%	5,050.00	5,050.00	57.A
58	551580	38%	224.63	224.63	58.A
58	551581	31%	187.19	187.19	58.B
58	551582	31%	187.19	187.19	58.C
Total			205,653.00	205,653.00	

Task 3.2 – Trip Table Factoring

Using standard modeling methods, the Nashville MPO Long Range Forecast (2025) daily trip table was expanded to include the new Traffic Analysis Zones created for the SR 386 Study Area. For consistency with the MPO model, the distribution of trips from the original MPO TAZ was assigned to each refined TAZ within the original TAZ borders. Thus the percentage of trips in the MPO model going from the TAZ to the CBD for example is consistent in each of the refined TAZs.

The productions (exits) and attractions (entries) were then factored to the trip generation volumes presented in Table 2. No intrazonal trips were assumed (no trips stayed within the refined TAZ). This assumption is consistent with your adjustments made to the trip generation for internal capture and pass by.

Task 3.3 – Traffic Assignment

Utilizing the same traffic assignment methods utilized by the Nashville MPO in their forecast, the SR 386 Study Area trips were assigned to the network (Task 3.3.1). The results of the traffic assignments are shown in the attached plots of the SR 386 Study Area (Task 3.3.3).

In order to asses the results, BLA has provided a Level of Service on each link in the study area. These LOS values were assigned based on a calculation of the Volume to Capacity Ratio on each link. Based on the observed capacities that are approximately Level of Service C, the following ranges were used for each LOS:

Table 3. V/C Ranges by LOS Category – LOS C Capacities

Level of Service	Low V/C	High V/C
C or Better	0	< 1.0
D	1.0	< 1.2
E	1.2	<1.4
F	1.4	<1.6
Greater than F	1.6	

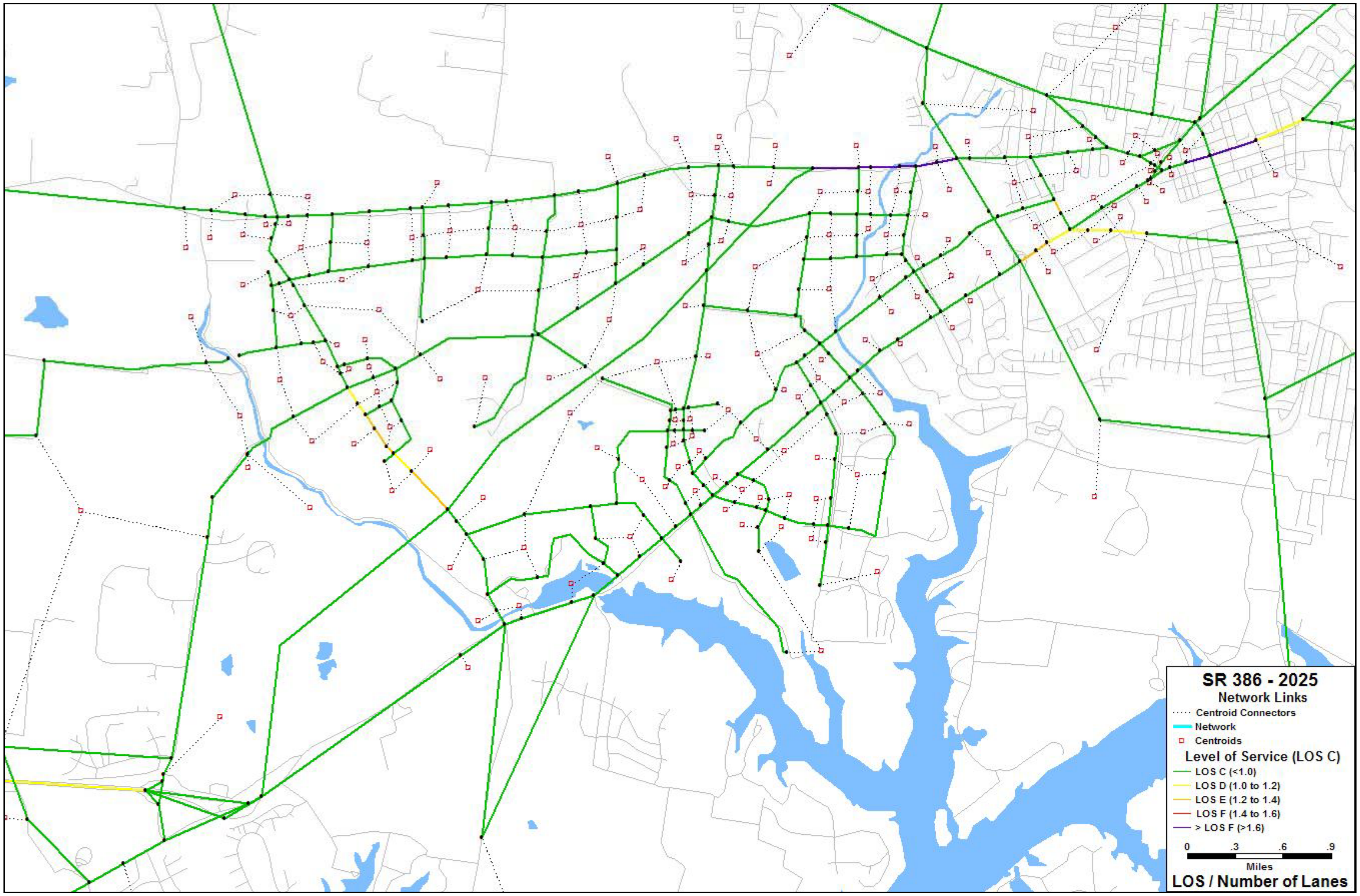


Figure 3. LOS - SR 386 Study Area

As part of the traffic assignment process, modeled forecast turning volumes were collected at all interchanges in the study area. Following are two examples showing the daily forecast volumes along SR 386. The first is at Lower Station Camp, and the second is Harris Lane. If desired, we can report the turning volumes for only study area generated traffic rather than total volume.

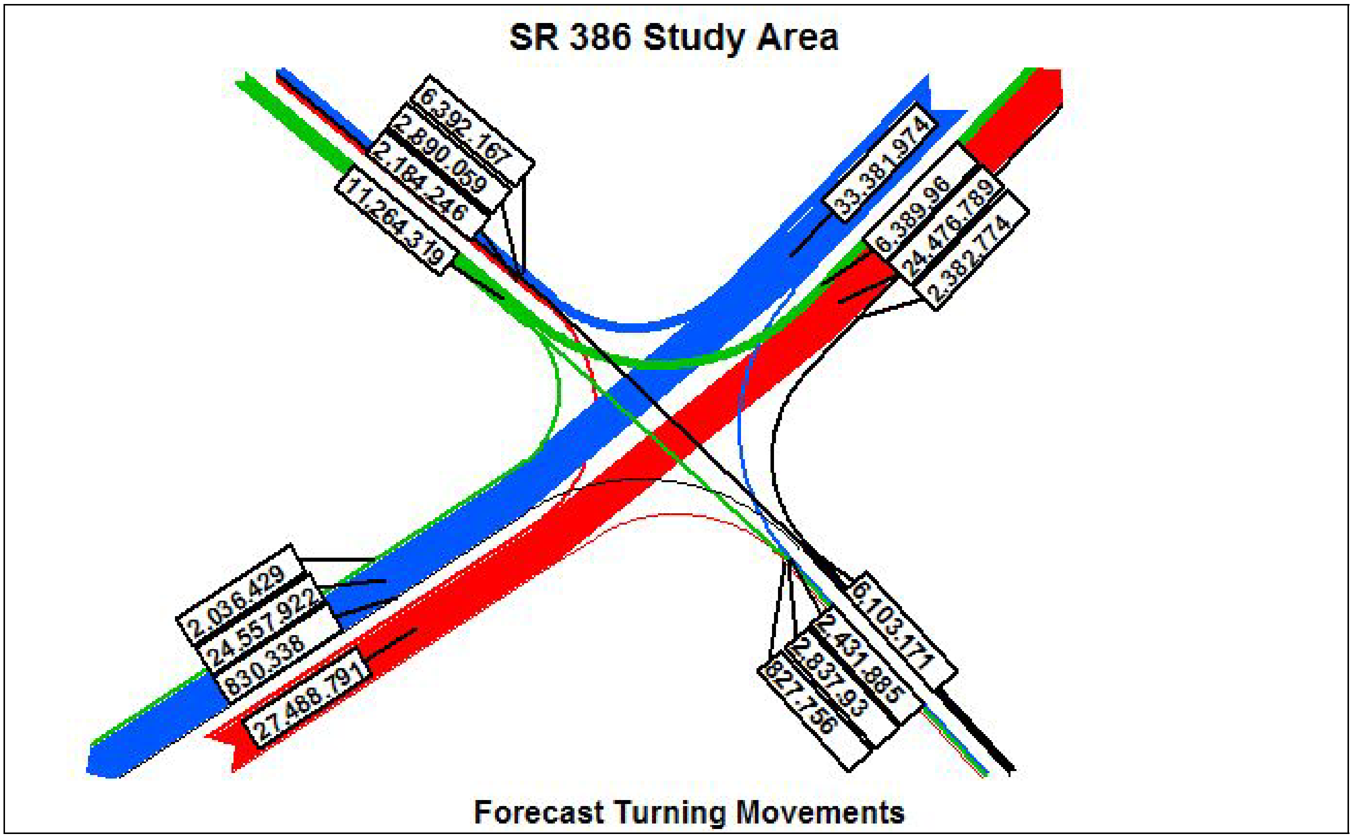


Figure 4. Forecast Turning Movements at SR 386 and Lower Station Camp

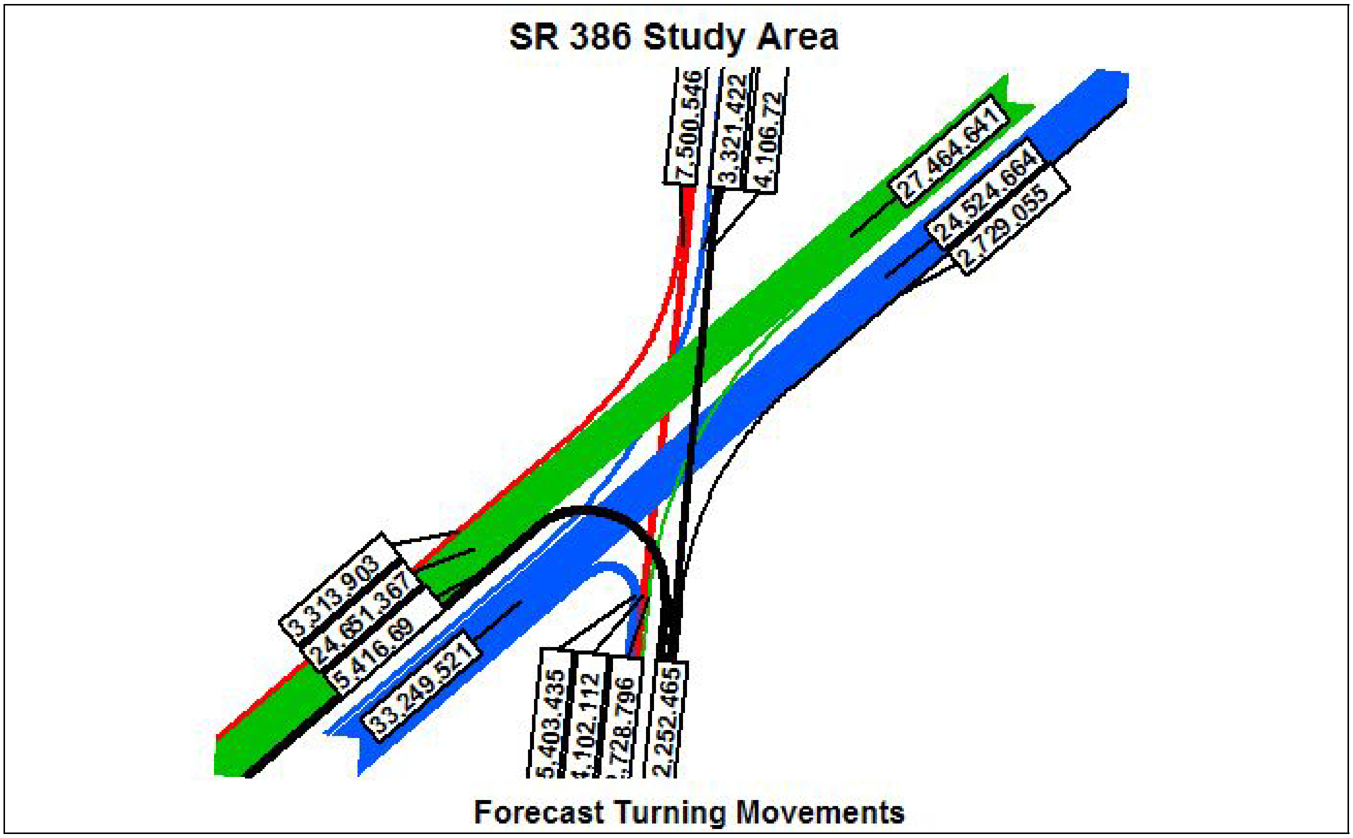


Figure 5. Forecast Turning Movements at SR 386 and Harris Lane

If this type of information is useful, please provide a map of locations that you desire turning movements at. We can either provide figures like those above, or the results in tabular format (Task 3.3.2).

Task 3.4 – Critical Link Analysis

When the scope was originally written, significantly fewer zones were envisioned for the study area than over 140 were ultimately created. Because of this, doing a Critical Link Analysis on each and ever zone is not a feasible scenario. As an interim tool, we have prepared a plot showing the percentage of traffic on each link that is generated (produced or attracted) by the study area versus the background, or non-study area traffic. We can discuss at a later time alternative methods that may generate the necessary information for your analysis.

Task 3.5 – Alternative Analysis

As discussed, a second alternative for the SR 386 Study Area can be run and similar results will be prepared. Please let us know if you would like this second alternative done before the scheduled public meeting at the end of this month, or if it will come out of that meeting.

Results

Attached, BLA has provided the following Plots for your use:

- Study Area Land Use Areas and Refined Traffic Analysis Zones
- Model Network – Percent of Daily Forecast Traffic Generated from Study Area
- MPO Long Range Plan Forecast Volumes
- Daily Level of Service (LOS C Capacities) Based on Modeled Volume Capacity Ratio
- Model Network – Daily Forecast Volumes
- Model Network and Refined Traffic Analysis Zones

We expect that you will want to use some of this material as part of the presentation at the public meeting later this month. Please let us know how we can help. If you have any questions, please do not hesitate to contact either myself or David Ripple who is familiar with the project as well.

Attachments

CC: Dr. David Ripple, AICP, P.E.
Vince Bernardin, AICP
Teressa Estes, P.E.
Chris Cown, P.E.
Julie Dunbar, P.E.

BERNARDIN ! LOCHMUELLER & ASSOCIATES, INC.
6200 VOGEL ROAD • EVANSVILLE, INDIANA 47715-4006
PHONE 812.479.6200 • TOLL FREE 800.423.7411 • FAX 812.479.6262
WEB SITE www.blainc.com

May 2, 2005

Mr. Lane Swauger, P.E.
Associate
Greshram, Smith & Partners
511 Union Street, Suite 1400
Nashville, TN 37219

RE: Alternative 2 SR 386 Study Area Model Results (Memorandum #2 Update)
BLA Project No: 104-0092
Task 3.5

Dear Mr. Swauger:

Purpose of this Memorandum is to document the development of the second forecast roadway alternative volumes for the SR 386 Study Area. Memorandum Number 2, dated January 4, 2005 provides information on the development of the refined model for the SR 386 Study Area, as well as results from the initial alternative.

Development of Alternative 2

In January of 2005, BLA provided to GS&P the forecast 2025 daily traffic volumes for Alternative 1. The roadway plan used as part of Alternative 1 was to be refined based on those results and feedback from the public. The network changes were received from GS&P by Fax on March 25, 2005. The changes that were to be made to the network are provided in the following table:

Table 1. Alternative 2 Network Changes

Change No.	Description	Basis for Change
1	Widen Big Station Camp Creek Road to 4 lanes from Nashville Pike to Long Hollow Pike	Initial Capacity Insufficient
2	Widen Long Hollow Pike from 6 lanes from SR 386 to SR 109.	Initial Capacity Insufficient
3	Remove Maple Street Extension between Nashville Pike and Long Hollow Pike	Gallatin Major Thoroughfare Plan
4	Realign Maple Street south of Nashville Pike to reflect roadway	Network Observation
5	Widen Maple Street to 4 lanes from Nashville Pike to third centroid connector loading point	Initial Capacity Insufficient
6	Realign Long Hollow Pike to reflect SR 174 APR plan – curve to connect to Maple / Nashville intersection (4 lanes), mane new connection between Long Hollow Pike and Red River Road (2 lanes), remove existing portion of Long Hollow Pike between Red River Road and new alignment	SR 174 APR
7	Widen Nashville Pike to 6 lanes from SR 109 to new alignment of Maple Street	Initial Capacity Insufficient
8	Remove 2nd collector connection across waterway	
9	The Sumner-Hall Extension will be removed between Harris Lane Extension and just east of the waterway (realign centroids connectors)	Gallatin Major Thoroughfare Plan
10	The Sumner – Hall Extension will be extended to the new Long Hollow Pike alignment	Gallatin Major Thoroughfare Plan
11	A new connection will be made between Nashville Pike and the Sumner-Hall Extension just east of the waterway	Gallatin Major Thoroughfare Plan

Change No.	Description	Basis for Change
12	Widen Nashville Pike to 6 lanes from Harris Lane Extension to SR 109	Removal of Parallel Collector
13	St. Blaise will be removed between Nashville Pike and the first roadway to the north (realign centroid connectors)	Gallatin Major Thoroughfare Plan
14	A new connection will be made between Nashville Pike and the Harris Ln Extension – it will start at the current Nashville / St. Blaise intersection and connect the current Haris / Sumner-Hall intersection (realign centroid connectors)	Gallatin Major Thoroughfare Plan

Alternative Two Network is shown in the following figure.

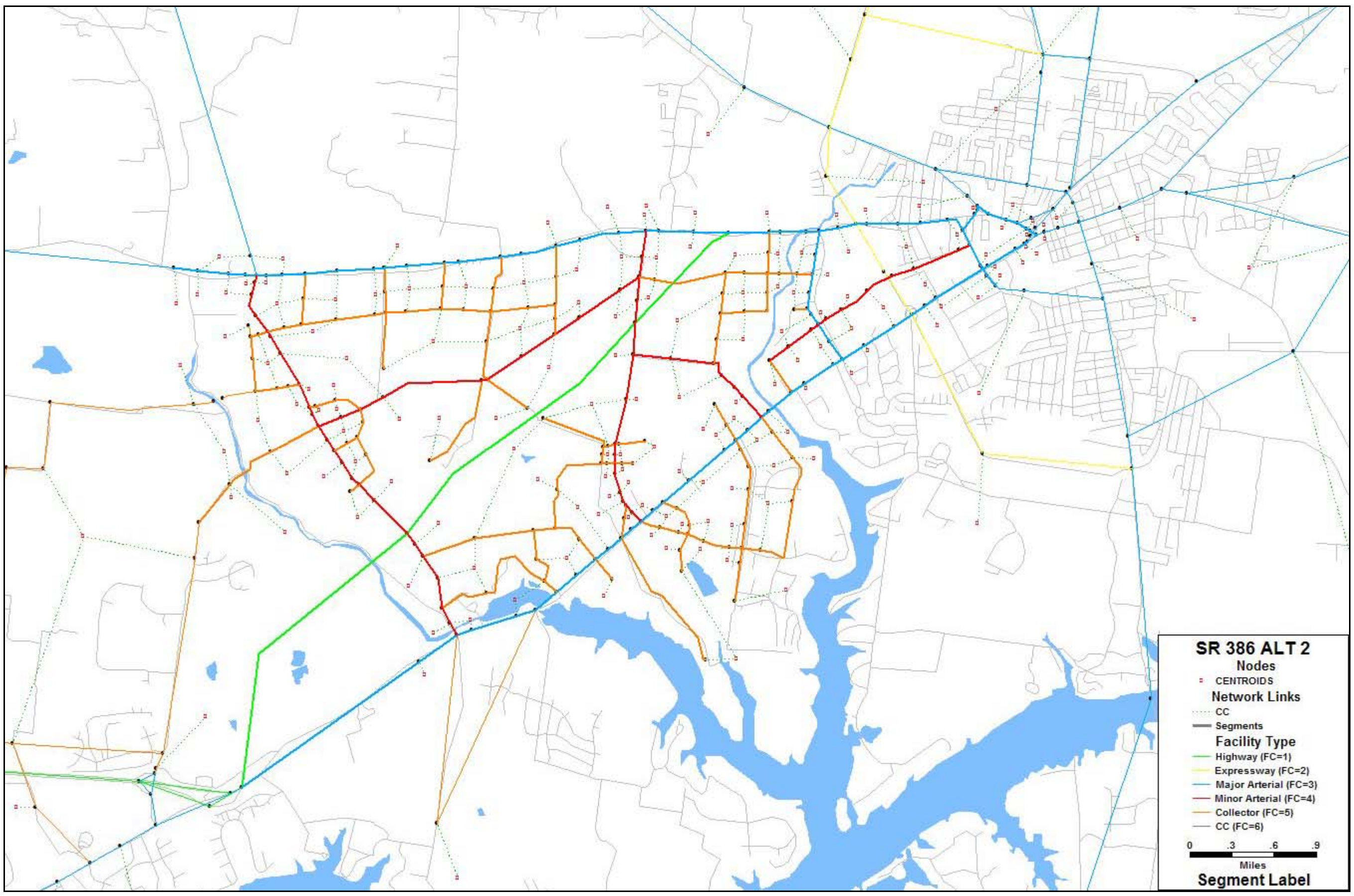


Figure 1. Alternative 2 Network Map

Roadway Segmentation

GS&P has developed a system where each roadway in the network has been assigned a unique identifier. For each roadway, segments have been defined between each cross street. The list of roadways used is provided in Table 2.

Table 2. Roadways in SR 386 Study Area

Roadway Identifier	Road Name
N	Approved Road #1
O	Approved Road #2
P	Approved Road #3
Q	Approved Road #4
S	Approved Road #5
T	Approved Road #6
W	Approved Road #7

Roadway Identifier	Road Name
MM	Approved Road #8
KK	Bay Point Drive
DD	Belvedere Drive
D	Big Station Camp Creek Road
LL	Browns Lane
Z	Browns Lane Extension
EE	Calvert Drive
NN	Fairview Lane
Y	Harris Lane
U	Harris Lane Extension
B	Jenkins Lane
QQ	Long Hollow Pk
X	Mallard Drive Extension
RR	Maple Street
HH	Maple Street Extension
II	Maple-Red River Connector
PP	Nashville Pike
TT	Nashville Pike-Approved Road #6 Connector
V	Nashville Pike-Harris Lane Connector
FF	Nashville Pike-Sumner-Hall Connector
L	Proposed Circulator
C	Proposed Collector #1
E	Proposed Collector #2
G	Proposed Collector #3
H	Proposed Collector #4
J	Proposed Collector #5
M	Proposed Collector #6
AA	Proposed Collector #7
BB	Proposed Collector #8
CC	Proposed Collector #9
JJ	Red River Road
A	Saundersville Road Extension
OO	SR 386
K	St. Blaise Court
I	St. Blaise Road North
R	St. Blaise Road South
F	Sugartree Lane
GG	Sumner-Hall Extension
SS	Sumner-Hall Extension (West)

Figure 2 shows the study area and the roadways identified in the previous table color coded.

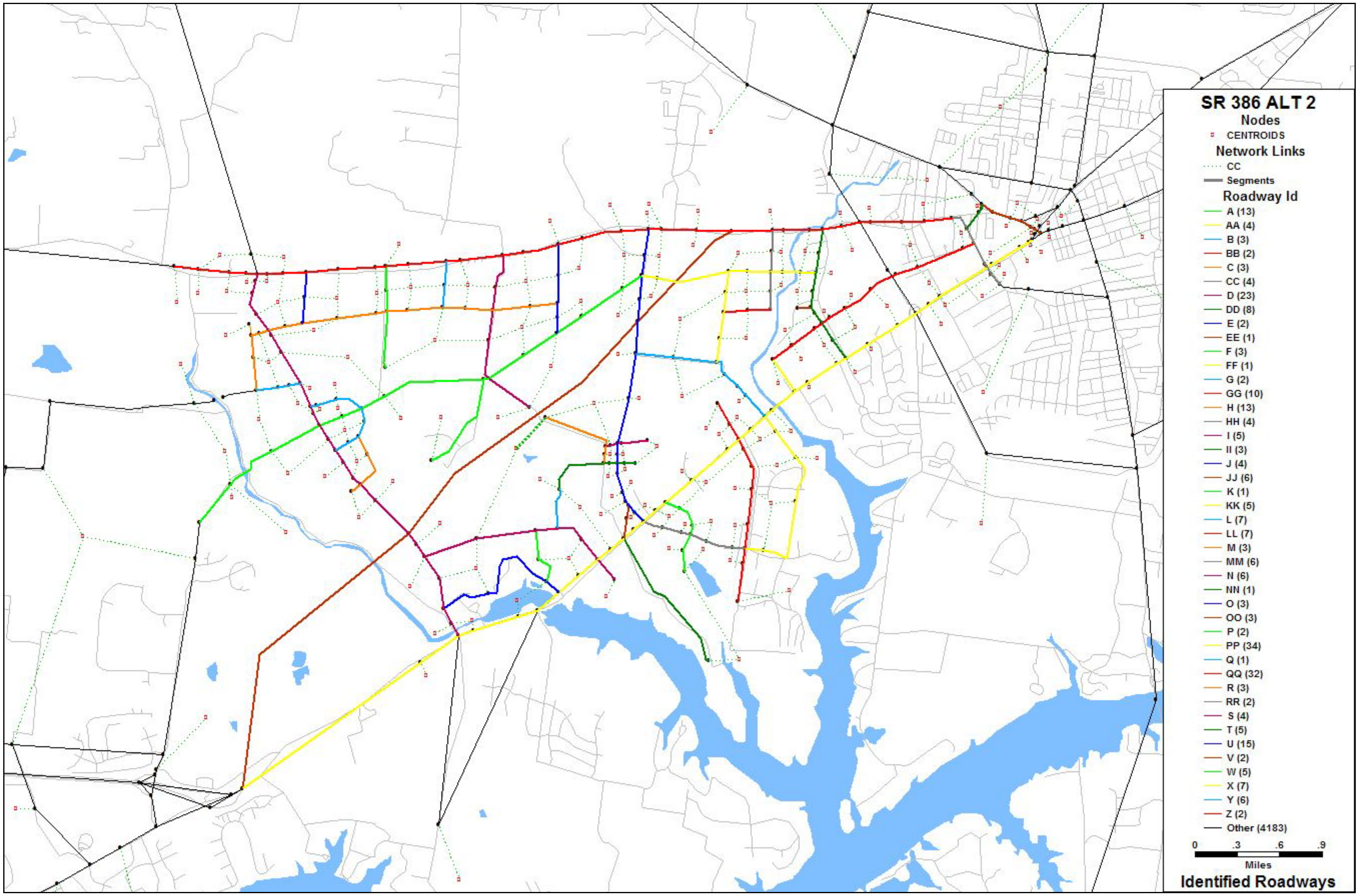


Figure 2. Roadway System Map

Alternative 2 Results

As with Alternative 1, the results of the SR 386 Refined Model can be assessed using Level of Service (Task 3.3). For purposes of this analysis, the volume to capacity ratio was used to define the level of service on each roadway segment.

In order to asses the results, BLA has provided a Level of Service on each link in the study area. These LOS values were assigned based on a calculation of the Volume to Capacity Ratio on each link. Based on the observed capacities that are approximately Level of Service C, the following ranges were used for each LOS:

Table 3. V/C Ranges by LOS Category – LOS C Capacities

Level of Service	Low V/C	High V/C
C or Better	0	< 1.0
D	1.0	< 1.2
E	1.2	<1.4
F	1.4	<1.6
Greater than F	1.6	

A map of the study area is provided in the following figure where each link has been color coded by Level of Service. This can be compared to Figure 3 in the January 4, 2005 Memorandum.

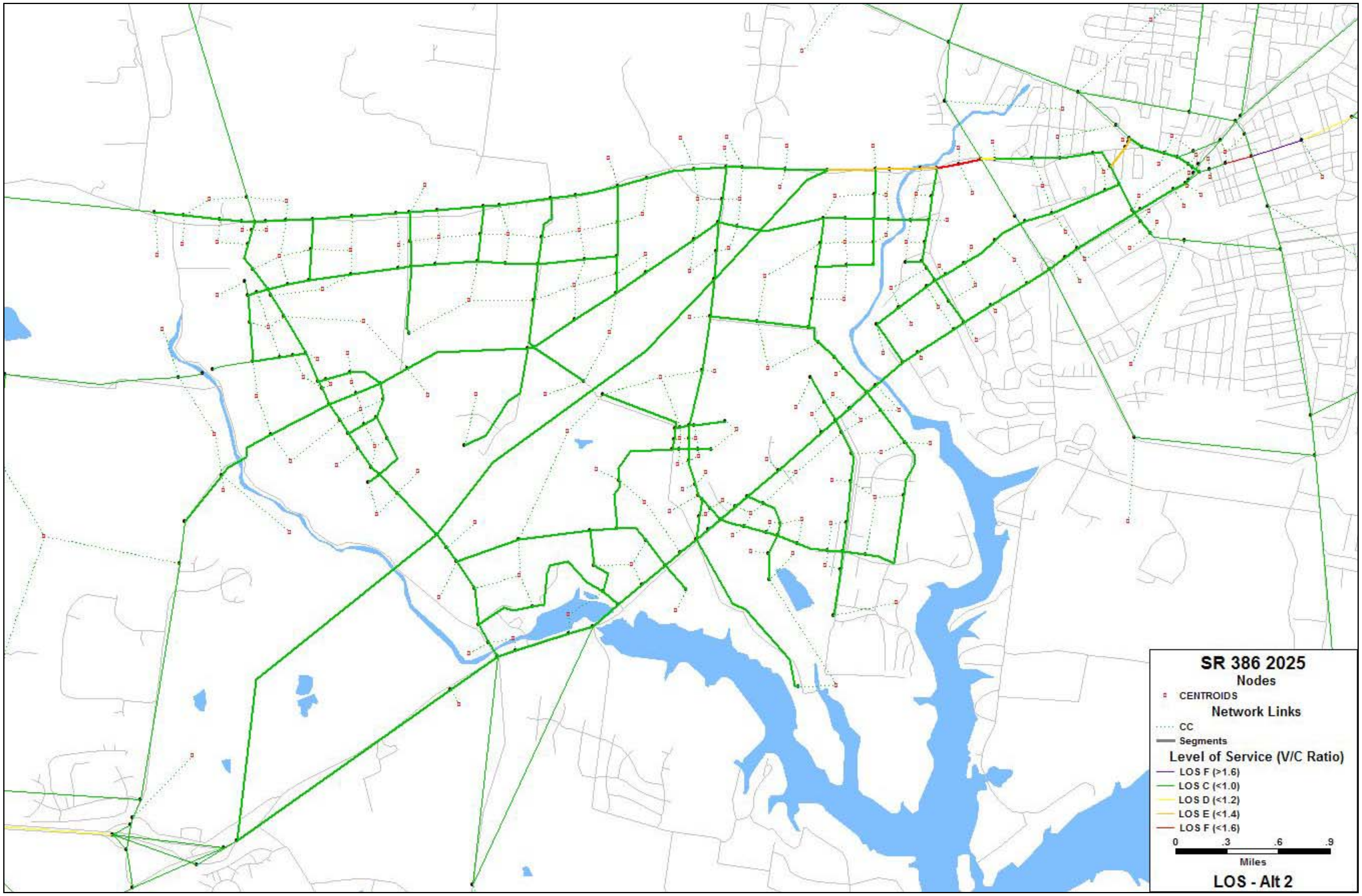


Figure 3. Alternative 2 Level of Service

Comparison of Alternative 1 and 2

Alternative 2 network was created to eliminate congestion problems witnessed under the first alternative. Examples included Big Station Camp Creek Road and Long Hollow Pike between SR 386 and SR 109. The improvement to the overall study area can be seen in the following table. The total vehicle miles traveled (VMT) on roadways of LOS C, D, E, F, and G were summed for both alternatives. Roadways with LOS D or worse were reduced.

LOS	ALT1		ALT2	
	VMT	Percent	VMT	Percent
LOS C	866,019	90%	908,086	92%
LOS D	18,969	2%	3,070	0%
LOS E	25,348	3%	51,327	5%
LOS F	-	0%	20,834	2%
LOS G	57,132	6%	-	0%
Total	967,468		983,317	

Overall, Alternative 2 performs better with a reduction in the percentage of VMT on facilities with higher LOS. Alternative 2 does create more VMT in the study area which is attributed to a reduction in total roadway mileage in the network (Alternative 1 = 54.66 miles, Alternative 2 = 53.28 miles). Trips are forced to use longer routes, thus creating additional VMT.

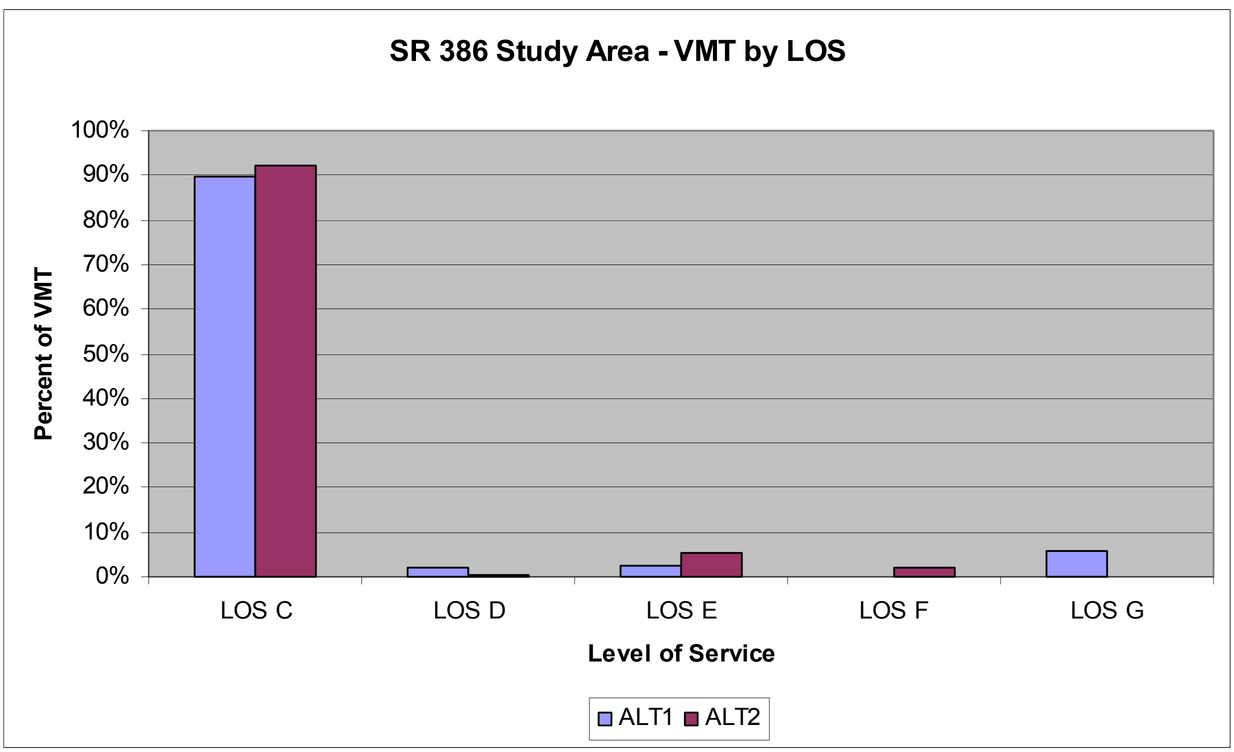


Figure 4. Comparison of VMT by LOS

A detailed comparison of each roadway segment has defined previously is included in the following table. Because a roadway segment includes multiple model links, the maximum assigned volume and capacity are reported in the table. For each segment, the Level of Service is calculated using the same V/C ratio.

Table 4. Alternative 1 and 2 Segment Comparison

								ALTERNATIVE 2					ALTERNATIVE 1				
Roadway	From		To		REF_LAB	SEG_LAB	LAB	Daily Vol	Total Lanes	Max Capacity	V/C	LOS	Daily Vol	Total Lanes	Max Capacity	V/C	LOS
SR 386	Nashville Pk		Big Station Camp Creek Road	D	OO	1	OO-1	55,459	4	81,400	0.68	C	54,913	4	81,400	0.67	C
	Big Station Camp Creek Road	D	Harris Lane Extension	U	OO	2	OO-2	68,881	4	81,400	0.85	C	66,631	4	81,400	0.82	C
	Harris Lane Extension	U	Long Hollow Pk	QQ	OO	3	OO-3	65,841	4	81,400	0.81	C	54,803	4	81,400	0.67	C
Nashville Pk	SR 386	OO	Big Station Camp Creek Road	D	PP	1	PP-1	45,764	4	60,000	0.76	C	45,645	4	60,000	0.76	C
	Big Station Camp Creek Road	D	Douglas Bend Rd		PP	2	PP-2	31,934	4	60,000	0.53	C	31,908	4	60,000	0.53	C
	Douglas Bend Rd		Approved Road #2	O	PP	3	PP-3	37,614	4	60,000	0.63	C	37,158	4	60,000	0.62	C
	Approved Road #2	O	Approved Road #1	N	PP	4	PP-4	38,467	4	60,000	0.64	C	38,001	4	60,000	0.63	C
	Approved Road #1	N	Nashville Pike-Harris Lane Connector	V	PP	5	PP-5	44,397	4	60,000	0.74	C	42,924	4	60,000	0.72	C
	Nashville Pike-Harris Lane Connector	V	Harris Lane Extension	U	PP	6	PP-6	42,822	4	60,000	0.71	C	45,927	4	60,000	0.77	C
	Harris Lane Extension	U	Approved Road #7	W	PP	7	PP-7	53,002	6	90,000	0.59	C	43,725	4	60,000	0.73	C
	Approved Road #7	W	Browns Lane Extension	Z	PP	8	PP-8	55,466	6	90,000	0.62	C	47,428	4	60,000	0.79	C
	Browns Lane Extension	Z	Harris Lane	Y	PP	9	PP-9	58,672	6	90,000	0.65	C	47,165	4	60,000	0.79	C
	Harris Lane	Y	Nashville Pike-Sumner-Hall Connector	FF	PP	10	PP-10	54,866	6	90,000	0.61	C	48,919	4	60,000	0.82	C
	Nashville Pike-Sumner-Hall Connector	FF	Belvedere Drive	DD	PP	11	PP-11	51,179	6	90,000	0.57	C	49,283	4	60,000	0.82	C
	Belvedere Drive	DD	SR 109		PP	12	PP-12	55,418	6	90,000	0.62	C	56,849	4	60,000	0.95	C
	SR 109		Maple Street	RR	PP	13	PP-13	46,385	6	54,000	0.86	C	44,923	4	36,000	1.25	E
	Maple Street	RR	Main St		PP	14	PP-14	32,767	4	36,000	0.91	C	33,492	4	36,000	0.93	C
Long Hollow Pk	west of Big Station Camp Creek Rd		Big Station Camp Creek Road	D	QQ	1	QQ-1	14,526	2	30,000	0.48	C	14,594	2	30,000	0.49	C
	Big Station Camp Creek Road	D	Proposed Collector #2	E	QQ	2	QQ-2	9,246	2	30,000	0.31	C	10,044	2	30,000	0.33	C
	Proposed Collector #2	E	Sugartree Lane	F	QQ	3	QQ-3	9,800	2	30,000	0.33	C	10,585	2	30,000	0.35	C
	Sugartree Lane	F	Proposed Collector #3	G	QQ	4	QQ-4	9,852	2	30,000	0.33	C	10,594	2	30,000	0.35	C
	Proposed Collector #3	G	St. Blaise Road North	I	QQ	5	QQ-5	9,894	2	30,000	0.33	C	10,589	2	30,000	0.35	C
	St. Blaise Road North	I	Proposed Collector #5	J	QQ	6	QQ-6	10,148	2	30,000	0.34	C	10,810	2	30,000	0.36	C
	Proposed Collector #5	J	Harris Lane Extension	U	QQ	7	QQ-7	11,702	2	30,000	0.39	C	12,334	2	30,000	0.41	C
	Harris Lane Extension	U	SR 386	OO	QQ	8	QQ-8	22,064	2	30,000	0.74	C	20,188	2	30,000	0.67	C
	SR 386	OO	Proposed Collector #9	CC	QQ	9	QQ-9	75,300	6	54,000	1.39	E	62,357	4	36,000	1.73	>F
	Proposed Collector #9	CC	Belvedere Drive	DD	QQ	10	QQ-10	73,376	6	54,000	1.36	E	60,906	4	36,000	1.69	>F
	Belvedere Drive	DD	SR 109		QQ	11	QQ-11	80,368	6	54,000	1.49	F	70,959	4	36,000	1.97	>F
	SR 109		Maple Street Extension	HH	QQ	12	QQ-12	38,381	4	36,000	1.07	D	34,316	4	36,000	0.95	C
Red River Road	Maple-Red River Connector	II	Main Street		JJ	1	JJ-1	16,682	3.67	36,000	0.46	C	20,722	4	36,000	0.58	C
Belvedere Drive	Long Hollow Pk	QQ	Mallard Drive Extension	X	DD	1	DD-1	10,018	2	30,000	0.33	C	16,725	2	30,000	0.56	C
	Mallard Drive Extension	X	Calvert Drive	EE	DD	2	DD-2	10,298	2	30,000	0.34	C	15,895	2	30,000	0.53	C
	Calvert Drive	EE	Sumner-Hall Extension		DD	3	DD-3	10,298	2	30,000	0.34	C	16,887	2	30,000	0.56	C
	Sumner-Hall Extension		Nashville Pike	PP	DD	4	DD-4	17,861	2	30,000	0.60	C	16,207	2	30,000	0.54	C
Maple Street Extension	Long Hollow Pk	QQ	Maple-Red River Connector	II	HH	1	HH-1	34,029	4	36,000	0.95	C					
	Maple-Red River Connector	II	Sumner-Hall Extension		HH	2	HH-2	22,488	4	36,000	0.62	C	14,253	2	18,000	0.79	C
	Sumner-Hall Extension		Nashville Pike	PP	HH	3	HH-3	30,938	4	36,000	0.86	C	21,806	2	18,000	1.21	E
Maple Street	Nashville Pike	PP	first turn east		RR	1	RR-1	25,100	4	36,000	0.70	C	21,163	2	18,000	1.18	D
Big Station Camp Creek Road	Long Hollow Pk	QQ	Proposed Collector #4	H	D	1	D-1	16,766	4	35,400	0.47	C	16,378	2	17,700	0.93	C
	Proposed Collector #4	H	Jenkins Lane	B	D	2	D-2	11,087	4	35,400	0.31	C	10,547	2	17,700	0.60	C
	Jenkins Lane	B	Proposed Circulator	L	D	3	D-3	11,221	4	35,400	0.32	C	10,573	2	17,700	0.60	C
	Proposed Circulator	L	Saundersville Road Extension	A	D	4	D-4	14,038	4	35,400	0.40	C	12,759	2	17,700	0.72	C
	Saundersville Road Extension	A	Proposed Circulator	L	D	5	D-5	25,484	4	35,400	0.72	C	21,198	2	17,700	1.20	D
	Proposed Circulator	L	Proposed Collector #6	M	D	6	D-6	26,515	4	35,400	0.75	C	21,605	2	17,700	1.22	E
	Proposed Collector #6	M	SR 386	OO	D	7	D-7	27,317	4	35,400	0.77	C	22,731	2	17,700	1.28	E
	SR 386	OO	Approved Road #1	N	D	8	D-8	12,960	4	35,400	0.37	C	12,201	2	17,700	0.69	C
	Approved Road #1	N	Approved Road #2	O	D	9	D-9	5,922	4	35,400	0.17	C	6,131	2	17,700	0.35	C
	Approved Road #2	O	Nashville Pike	PP	D	10	D-10	5,182	4	35,400	0.15	C	5,433	2	17,700	0.31	C
Saundersville Road Extension	west of Big Station Camp Creek Rd		Big Station Camp Creek Road	D	A	1	A-1	15,015	4	26,000	0.58	C	15,454	4	26,000	0.59	C
	Big Station Camp Creek Road	D	Proposed Circulator	L	A	2	A-2	2,473	4	35,400	0.07	C	4,761	4	35,400	0.13	C
	Proposed Circulator	L	St. Blaise Road North	I	A	3	A-3	3,758	4	35,400	0.11	C	6,346	4	35,400	0.18	C
	St. Blaise Road North	I	Proposed Collector #5	J	A	4	A-4	3,288	4	35,400	0.09	C	5,885	4	35,400	0.17	C
	Proposed Collector #5	J	Harris Lane Extension	U	A	5	A-5	6,512	4	35,400	0.18	C	9,238	4	35,400	0.26	C
Harris Lane Extension	Long Hollow Pk	QQ	Saundersville Road Extension	A	U	1	U-1	8,790	4	35,400	0.25	C	11,672	4	35,400	0.33	C
	Saundersville Road Extension	A	SR 386	OO	U	2	U-2	11,316	4	35,400	0.32	C	15,013	4	35,400	0.42	C
	SR 386	OO	Harris Lane	Y	U	3	U-3	20,134	4	35,400	0.57	C	24,487	4	35,400	0.69	C
	Harris Lane	Y	Approved Road #5	S	U	4	U-4	13,403	4	35,400	0.38	C	11,161	4	35,400	0.32	C
	Approved Road #5	S	Approved Road #6	T	U	5	U-5	5,874	4	35,400	0.17	C	3,606	4	35,400	0.10	C
	Approved Road #6	T	Nashville Pike-Harris Lane Connector	V	U	6	U-6	14,155	4	35,400	0.40	C	4,049	4	35,400	0.11	C
	Nashville Pike-Harris Lane Connector	V	Nashville Pike	PP	U	7	U-7	11,145	4	35,400	0.31	C	8,392	4	35,400	0.24	C
Harris Lane	Harris Lane Extension	U	Proposed Collector #7	AA	Y	1	Y-1	13,459	2	17,700	0.76	C	17,424	2	17,700	0.98	C

								ALTERNATIVE 2					ALTERNATIVE 1				
Roadway	From		To		REF_LAB	SEG_LAB	LAB	Daily Vol	Total Lanes	Max Capacity	V/C	LOS	Daily Vol	Total Lanes	Max Capacity	V/C	LOS
	Proposed Collector #7	AA	Nashville Pike	PP	Y	2	Y-2	11,727	2	17,700	0.66	C	14,531	2	17,700	0.82	C
Sumner-Hall Extension	Nashville Pike-Sumner-Hall Connector	FF	Belvedere Drive	DD	GG	1	GG-1	10,070	2	17,700	0.57	C					
	Belvedere Drive	DD	SR 109		GG	2	GG-2	9,062	2	17,700	0.51	C	16,940	2	17,700	0.96	C
	SR 109		Maple Street Extension	HH	GG	3	GG-3	8,941	2	17,700	0.51	C	16,380	2	17,700	0.93	C
Jenkins Lane	Proposed Collector #1	C	Big Station Camp Creek Road	D	B	1	B-1	2,791	2	13,000	0.21	C	2,846	2	13,000	0.22	C
Proposed Collector #1					C	1	C-1	7,304	2	13,000	0.56	C	7,384	2	13,000	0.57	C
Proposed Collector #2					E	1	E-1	573	2	13,000	0.04	C	563	2	13,000	0.04	C
Sugartree Lane	Long Hollow Pk	QQ	Proposed Collector #4	H	F	1	F-1	97	2	13,000	0.01	C	81	2	13,000	0.01	C
	Proposed Collector #4	H	south of Proposed Collector #4		F	2	F-2	0	2	13,000	0.00	C	0	2	13,000	0.00	C
Proposed Collector #3					G	1	G-1	270	2	13,000	0.02	C	247	2	13,000	0.02	C
Proposed Collector #4	Proposed Collector #1	C	Big Station Camp Creek Road	D	H	1	H-1	7,933	2	13,000	0.61	C	7,969	2	13,000	0.61	C
	Big Station Camp Creek Road	D	Proposed Collector #2	E	H	2	H-2	1,343	2	13,000	0.10	C	1,321	2	13,000	0.10	C
	Proposed Collector #2	E	Sugartree Lane	F	H	3	H-3	511	2	13,000	0.04	C	503	2	13,000	0.04	C
	Sugartree Lane	F	Proposed Collector #3	G	H	4	H-4	206	2	13,000	0.02	C	215	2	13,000	0.02	C
	Proposed Collector #3	G	St. Blaise Road North	I	H	5	H-5	148	2	13,000	0.01	C	202	2	13,000	0.02	C
	St. Blaise Road North	I	Proposed Collector #5	J	H	6	H-6	988	2	13,000	0.08	C	1,051	2	13,000	0.08	C
St. Blaise Road North	Long Hollow Pk	QQ	Proposed Collector #4	H	I	1	I-1	39	4	26,000	0.00	C	32	4	26,000	0.00	C
	Proposed Collector #4	H	Saundersville Road Extension	A	I	2	I-2	175	4	26,000	0.01	C	177	4	26,000	0.01	C
	Saundersville Road Extension	A	south of Saundersville Road Extension		I	3	I-3	922	2	13,000	0.07	C	923	2	13,000	0.07	C
Proposed Collector #5	Long Hollow Pk	QQ	Proposed Collector #4	H	J	1	J-1	579	2	13,000	0.04	C	563	2	13,000	0.04	C
	Proposed Collector #4	H	Saundersville Road Extension	A	J	2	J-2	1,597	2	13,000	0.12	C	1,725	2	13,000	0.13	C
St. Blaise Court					K	1	K-1	308	2	13,000	0.02	C	308	2	13,000	0.02	C
Proposed Circulator	Big Station Camp Creek Road	D	Saundersville Road Extension	A	L	1	L-1	1,646	4	26,000	0.06	C	1,977	4	26,000	0.08	C
	Saundersville Road Extension	A	Proposed Collector #6	M	L	2	L-2	880	4	26,000	0.03	C	1,352	4	26,000	0.05	C
	Proposed Collector #6	M	Big Station Camp Creek Road	D	L	3	L-3	634	4	26,000	0.02	C	695	4	26,000	0.03	C
Proposed Collector #6	Proposed Circulator	L	Big Station Camp Creek Road	D	M	1	M-1	706	2	13,000	0.05	C	1,091	2	13,000	0.08	C
	Big Station Camp Creek Road	D	west of Big Station Camp Creek Road		M	2	M-2	1,444	0	13,000	0.11	C	1,465	0	13,000	0.11	C
Approved Road #1	Big Station Camp Creek Road	D	Approved Road #3	P	N	1	N-1	5,901	2	13,000	0.45	C	4,791	2	13,000	0.37	C
	Approved Road #3	P	Approved Road #4	Q	N	2	N-2	5,674	2	13,000	0.44	C	4,621	2	13,000	0.36	C
	Approved Road #4	Q	Nashville Pike	PP	N	3	N-3	4,586	2	13,000	0.35	C	3,561	2	13,000	0.27	C
	Nashville Pike	PP	south of Nashville Pike		N	4	N-4	1,621	2	13,000	0.12	C	1,622	2	13,000	0.12	C
Approved Road #2	Big Station Camp Creek Road	D	Approved Road #3	P	O	1	O-1	0	2	13,000	0.00	C	0	2	13,000	0.00	C
	Approved Road #3	P	Nashville Pike	PP	O	2	O-2	0	2	13,000	0.00	C	10	2	13,000	0.00	C
Approved Road #3					P	1	P-1	174	2	13,000	0.01	C	175	2	13,000	0.01	C
Approved Road #4					Q	1	Q-1	1,163	2	13,000	0.09	C	1,115	2	13,000	0.09	C
St. Blaise Road South	south of SR 386		Approved Road #5	S	R	1	R-1	2,228	2	13,000	0.17	C	2,235	2	13,000	0.17	C
	Approved Road #5	S	Approved Road #6	T	R	2	R-2	1,444	2	13,000	0.11	C	1,474	2	13,000	0.11	C
Approved Road #5	St. Blaise Road South	R	Harris Lane Extension	U	S	1	S-1	3,877	2	13,000	0.30	C	3,877	2	13,000	0.30	C
	Harris Lane Extension	U	east of Harris Lane Extension		S	2	S-2	6,874	2	13,000	0.53	C	7,075	2	13,000	0.54	C
Approved Road #6	Approved Road #4	Q	St. Blaise Road South	R	T	1	T-1	1,895	2	13,000	0.15	C	1,902	2	13,000	0.15	C
	St. Blaise Road South	R	Harris Lane Extension	U	T	2	T-2	455	4	26,000	0.02	C	475	4	26,000	0.02	C
	Harris Lane Extension	U	east of Harris Lane Extension		T	3	T-3	7,707	2	13,000	0.59	C	37	2	13,000	0.00	C
Nashville Pike-Harris Lane Connector	east of Harris Lane Extension				V	1	V-1	4,717	2	13,000	0.36	C					
Mallard Drive Extension	Harris Lane Extension	U	Proposed Collector #7	AA	X	1	X-1	4,264	2	13,000	0.33	C	10,020	2	13,000	0.77	C
	Proposed Collector #7	AA	Proposed Collector #9	CC	X	2	X-2	3,728	2	13,000	0.29	C	9,630	2	13,000	0.74	C
	Proposed Collector #9	CC	Belvedere Drive	DD	X	3	X-3	6,120	2	13,000	0.47	C	10,144	2	13,000	0.78	C
Browns Lane Extension					Z	1	Z-1	3,504	2	13,000	0.27	C	4,490	2	13,000	0.35	C
Proposed Collector #7	Mallard Drive Extension	X	Proposed Collector #8	BB	AA	1	AA-1	2,440	2	13,000	0.19	C	3,809	2	13,000	0.29	C
	Proposed Collector #8	BB	Harris Lane	Y	AA	2	AA-2	4,792	2	13,000	0.37	C	3,570	2	13,000	0.27	C
Proposed Collector #8					BB	1	BB-1	945	2	13,000	0.07	C	3,360	2	13,000	0.26	C
Proposed Collector #9	Long Hollow Pk	QQ	Mallard Drive Extension	X	CC	1	CC-1	3,461	2	13,000	0.27	C	2,844	2	13,000	0.22	C
	Mallard Drive Extension	X	Proposed Collector #8	BB	CC	2	CC-2	945	2	13,000	0.07	C	2,878	2	13,000	0.22	C
Nashville Pike-Sumner-Hall Connector					FF	1	FF-1	4,237	2	13,000	0.33	C					
Bay Point Drive	Nashville Pike	PP	first turn south		KK	1	KK-1	3,434	2	13,000	0.26	C	3,540	2	13,000	0.27	C
	first turn south		right angle turn		KK	2	KK-2	48	2	13,000	0.00	C	51	2	13,000	0.00	C
	right angle turn		Browns Lane	LL	KK	3	KK-3	12	2	13,000	0.00	C	16	2	13,000	0.00	C
Browns Lane	Nashville Pike	PP	Bay Point Drive	KK	LL	1	LL-1	3,527	2	13,000	0.27	C	3,520	2	13,000	0.27	C
	Bay Point Drive	KK	sough of Bay Point Drive		LL	2	LL-2	3,825	2	13,000	0.29	C	3,826	2	13,000	0.29	C
Approved Road #7	Nashville Pike	PP	Approved Road #8	MM	W	1	W-1	2,121	4	26,000	0.08	C	2,119	4	26,000	0.08	C
	Approved Road #8	MM	south of Approved Road #8		W	2	W-2	2,050	2	13,000	0.16	C	2,102	2	13,000	0.16	C
Approved Road #8	Nashville Pike	PP	Approved Road #7	W	MM	1	MM-1	4,475	4	26,000	0.17	C	4,477	4	26,000	0.17	C

Roadway	From		To		REF_LAB	SEG_LAB	LAB	ALTERNATIVE 2					ALTERNATIVE 1				
								Daily Vol	Total Lanes	Max Capacity	V/C	LOS	Daily Vol	Total Lanes	Max Capacity	V/C	LOS
	Approved Road #7	W	Browns Lane	LL	MM	2	MM-2	2,214	2	13,000	0.17	C	2,221	2	13,000	0.17	C
Fairview Lane					NN	1	NN-1	7,612	2	13,000	0.59	C	7,560	2	13,000	0.58	C
Calvert Drive					EE	1	EE-1	0	2	13,000	0.00	C	2,849	2	13,000	0.22	C
Red River Road	Maple-Red River Connector	II	Nashville Pike	PP	JJ	1	JJ-1	16,682	3.67	36,000	0.46	C	20,722	4	36,000	0.58	C
Maple-Red River Connector	Maple Street Extension	HH	Red River Road	JJ	II	1	II-1	23,150	2.00	18,000	1.29	E					
Sumner-Hall Extension (West)	Harris Lane Extension	U	Browns Lane Extension	Z	SS	1	SS-1						10056	2	17700	0.568136	C
	Browns Lane Extension	Z	Harris Lane	Y	SS	2	SS-2						12511	2	17700	0.706836	C
	Harris Lane	Y	Belvedere Drive	DD	SS	3	SS-3						15873	2	17700	0.89678	C
Nashville Pike-Approved Road #6 Connector	Nashville Pike	PP	Approved Road #6	T	TT	1	TT-1						153	4	26000	0.005885	C

Detailed plots of the Alternative 2 network were transmitted to Lee Klieman on April 8, 2005. Plots were provided showing:

- 2025 Daily Forecast Traffic Volumes and Functional Class
- 2025 Daily Level of Service and Number of Lanes
- Percent of Daily Traffic Generated by Study Area

If you have any questions, please do not hesitate to contact either myself or David Ripple who is familiar with the project as well.

Regards,

BERNARDIN, LOCHMUELLER & ASSOCIATES, INC.

Jonathan Avner
Transportation Planner II

cc: Teressa Estes, P.E. (GS&P)
Lee Klieman (GS&P)
Dr. David Ripple, AICP, P.E.
Vince Bernardin, Sr., AICP

BERNARDIN, LOCHMUELLER & ASSOCIATES, INC.

SR 386 Area Study - Travel Demand Model

Model Network - Daily Forecast Volumes

Year 2025 - Alternative 2 (Jenkins Lane)

SR 386 - 2025
Network Links
Centroid Connector
Network
Centroid
Facility Type
Highway (FC=1)
Expressway (FC=2)
Major Arterial (FC=3)
Minor Arterial (FC=4)
Collector (FC=5)
0 .1 .2 .3
Miles
FC / Daily Volume

Date: June 23, 2005

SR 386 Area Study - Travel Demand Model

Daily Level of Service (LOS C Capacities) Based on Modeled Volume Capacity Ratio and Number of Lanes

Year 2025 - Alternative 2 (Jenkins Lane)

BERNARDIN, LOCHMUELLER & ASSOCIATES, INC.

Date: June 23, 2005

SR 386 - 2025
Network Links
Centroid Connector
Network
Centroid
Level of Service (LOS C)
LOS C (<1.0)
LOS D (1.0 to 1.2)
LOS E (1.2 to 1.4)
LOS F (1.4 to 1.6)
> LOS F (>1.6)
0 .1 .2 .3
Miles
LOS / Number of Lanes

SR 386 Area Study - Travel Demand Model

Model Network - Percent of Daily Forecast Traffic Generated from Study Area

Year 2025 - Alternative 2 (Jenkins Lane)

BERNARDIN, LOCHMUELLER & ASSOCIATES, INC.

Date: June 23, 2005

SR 386 - 2025

Network Links

- Centroid Connector
- Network
- Centroid

Facility Type

- Highway (FC=1)
- Expressway (FC=2)
- Major Arterial (FC=3)
- Minor Arteiral (FC=4)
- Collector (FC=5)

0 .1 .2 .3

Miles

FC / % STUDY TRAFFIC

APPENDIX C

TYPICAL ROADWAY CROSS SECTIONS

SR 386 AREA STUDY

PREPARED FOR:

Nashville Metropolitan Planning Organization,
Sumner County,
and the City of Gallatin

June 30, 2005

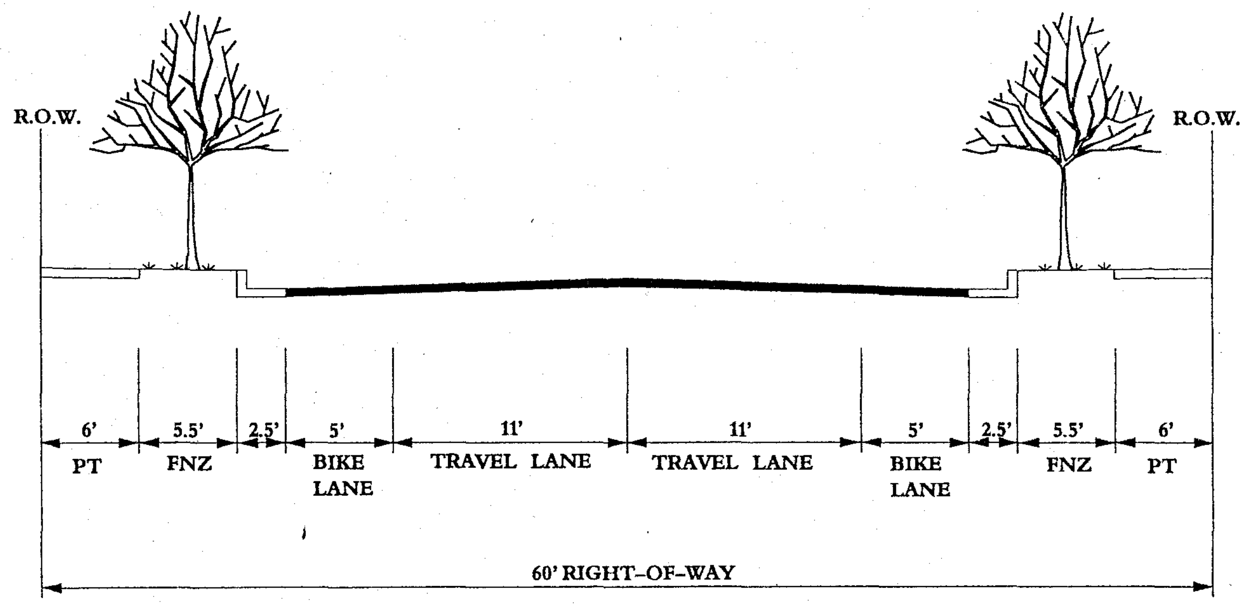
PREPARED BY:

Gresham Smith and Partners
1400 Nashville City Center
511 Union Street
Nashville, TN 37219

G S & P

GRESHAM
SMITH AND
PARTNERS

COLLECTOR STREET
(2 LANES)
NEIGHBORHOOD GENERAL W/O PARKING
(60' R.O.W.)



NOTES :
1) ALL UTILITIES LOCATED OUTSIDE ROW IF FEASIBLE
2) PT = PEDESTRIAN TRAVELWAY
3) FNZ = FURNISHINGS ZONE

TYPICAL CROSS SECTIONS
MAJOR AND COLLECTOR STREET PLAN
NASHVILLE - DAVIDSON COUNTY

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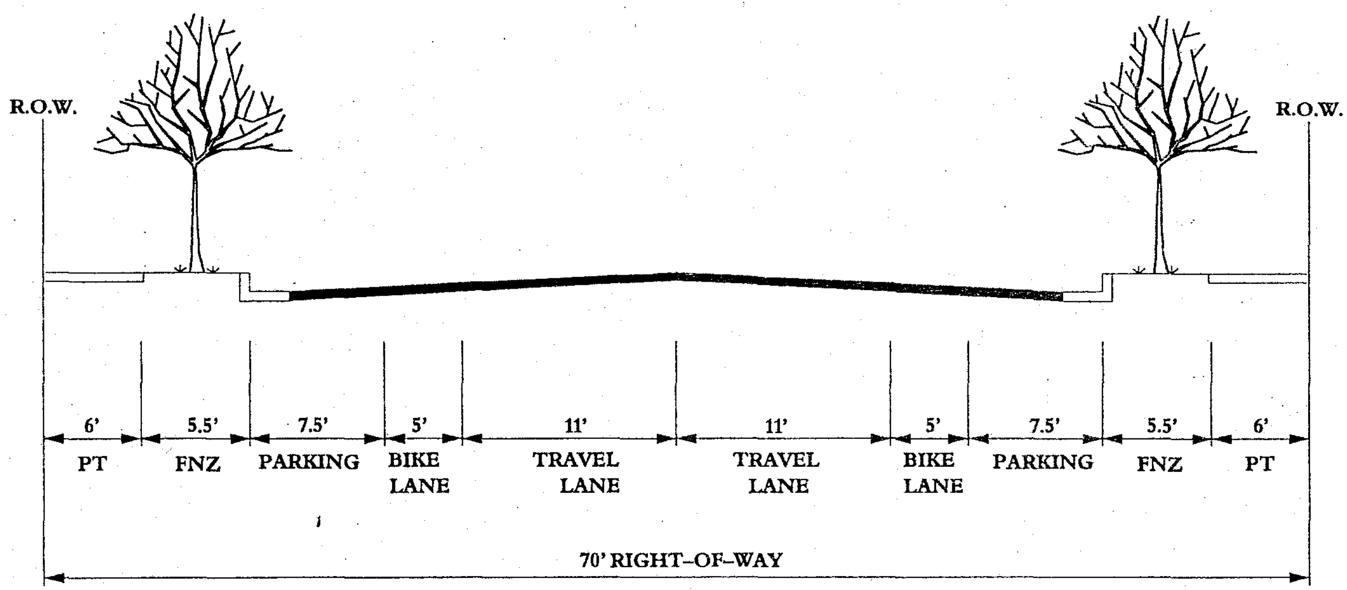
COLLECTOR STREET
(2 LANES)
NEIGHBORHOOD GENERAL WITH PARKING
(70' R.O.W.)



NOTES :
1) ALL UTILITIES LOCATED OUTSIDE ROW IF FEASIBLE
2) FURNISHINGS ZONE MAY BE USED FOR WIDER PEDESTRIAN TRAVELWAY AS APPROPRIATE
3) PT = PEDESTRIAN TRAVELWAY
4) FNZ = FURNISHINGS ZONE

TYPICAL CROSS SECTIONS
MAJOR AND COLLECTOR STREET PLAN
NASHVILLE - DAVIDSON COUNTY

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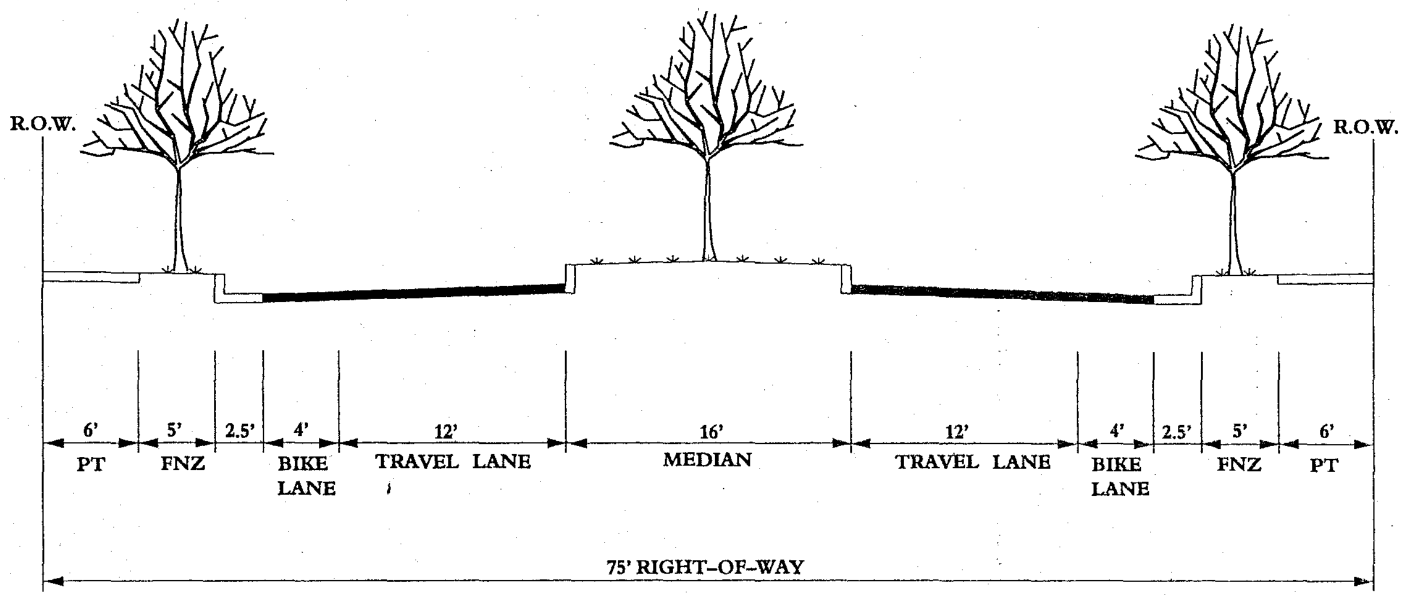
COLLECTOR BOULEVARD
(2 LANES WITH MEDIAN)
RESIDENTIAL W / O PARKING
(75' R.O.W.)



NOTES :
1) ALL UTILITIES LOCATED OUTSIDE ROW IF FEASIBLE
2) FURNISHING ZONE MAY BE USED FOR WIDER PEDESTRIAN TRAVEL WAY AS APPROPRIATE
3) PT = PEDESTRIAN TRAVELWAY
4) FNZ = FURNISHINGS ZONE

TYPICAL CROSS SECTIONS
MAJOR AND COLLECTOR STREET PLAN
NASHVILLE - DAVIDSON COUNTY

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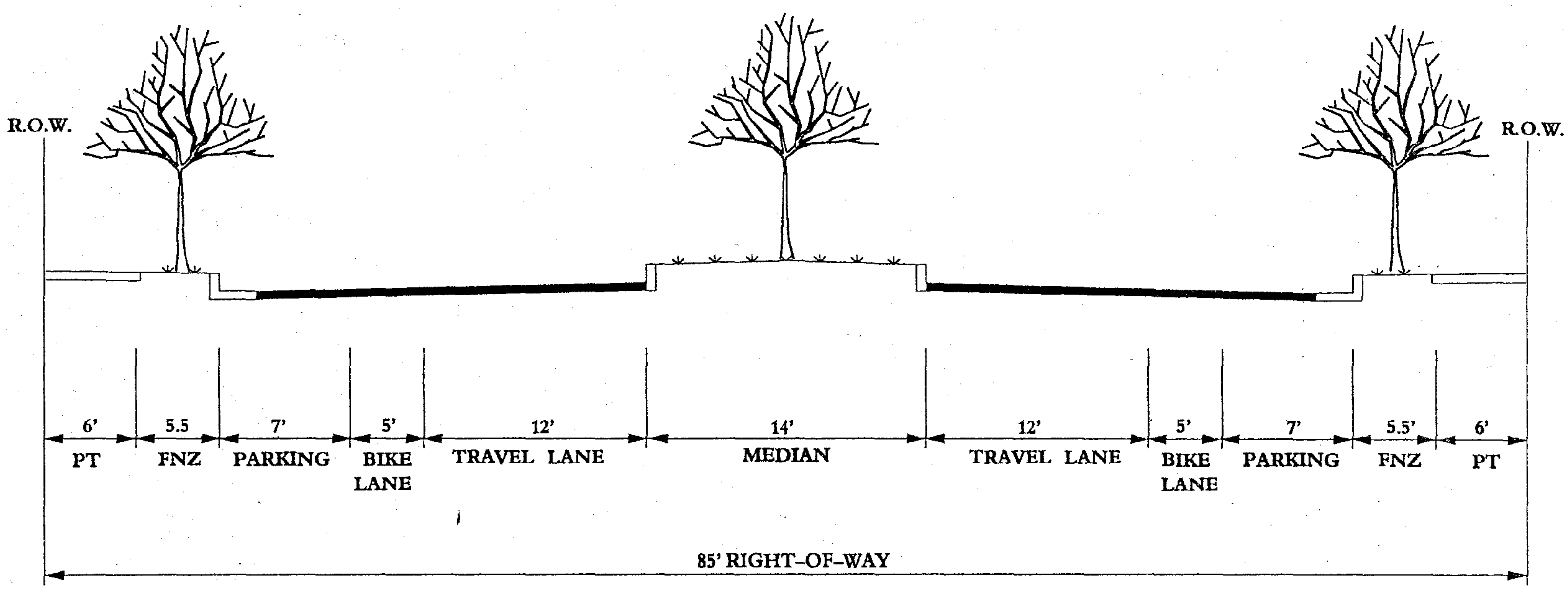
COLLECTOR BOULEVARD
(2 LANES WITH MEDIAN)
RESIDENTIAL WITH PARKING
(85' R.O.W.)



NOTES :
1) ALL UTILITIES LOCATED OUTSIDE ROW IF FEASIBLE
2) FURNISHING ZONE MAY BE USED FOR WIDER PEDESTRIAN TRAVEL WAY AS APPROPRIATE
3) PT = PEDESTRIAN TRAVELWAY
4) FNZ = FURNISHINGS ZONE

TYPICAL CROSS SECTIONS
MAJOR AND COLLECTOR STREET PLAN
NASHVILLE - DAVIDSON COUNTY

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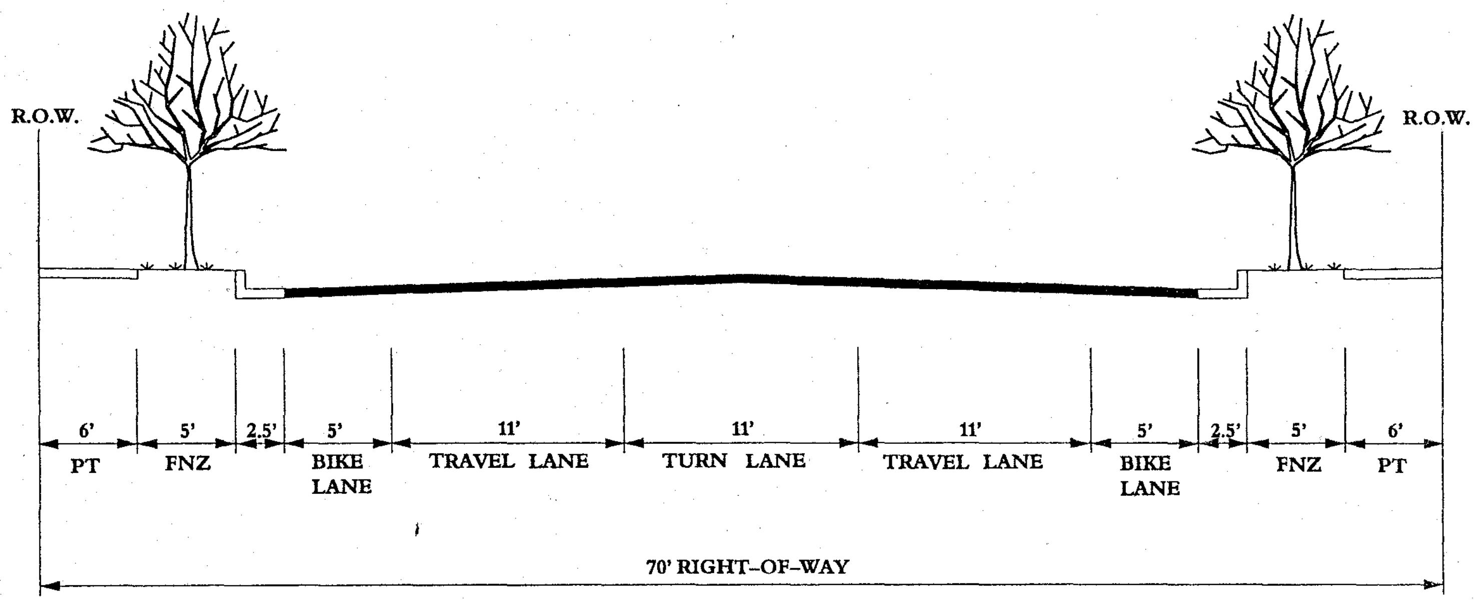
COLLECTOR STREET
(2 LANES WITH CENTER TURN LANE)
NEIGHBORHOOD GENERAL W/O PARKING
(70' R.O.W.)



NOTES :
1) ALL UTILITIES LOCATED OUTSIDE ROW IF FEASIBLE
2) FURNISHING ZONE MAY BE USED FOR WIDER PEDESTRIAN TRAVEL WAY AS APPROPRIATE
3) PT = PEDESTRIAN TRAVELWAY
4) FNZ = FURNISHINGS ZONE

TYPICAL CROSS SECTIONS
MAJOR AND COLLECTOR STREET PLAN
NASHVILLE - DAVIDSON COUNTY

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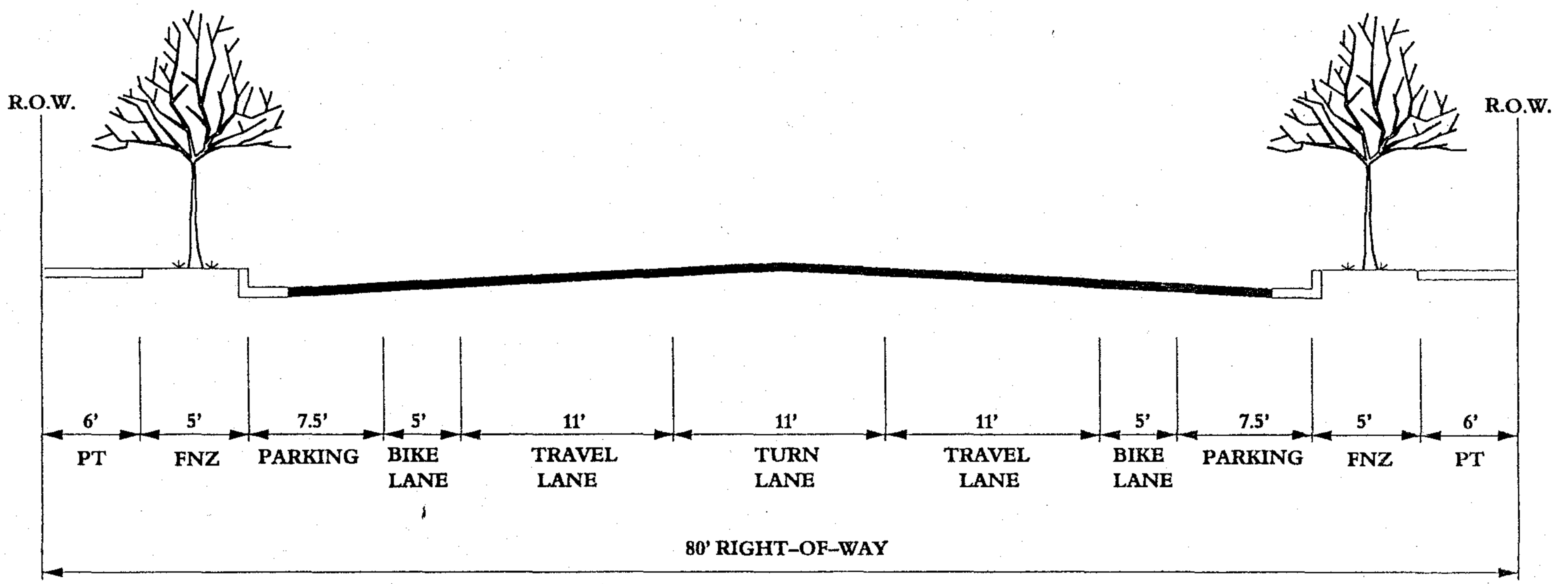
COLLECTOR STREET
(2 LANES WITH CENTER TURN LANE)
NEIGHBORHOOD GENERAL WITH PARKING
(80' R.O.W.)



NOTES :
1) ALL UTILITIES LOCATED OUTSIDE ROW IF FEASIBLE
2) FURNISHINGS ZONE MAY BE USED FOR WIDER PEDESTRIAN TRAVELWAY AS APPROPRIATE
3) PT = PEDESTRIAN TRAVELWAY
4) FNZ = FURNISHINGS ZONE

TYPICAL CROSS SECTIONS
MAJOR AND COLLECTOR STREET PLAN
NASHVILLE - DAVIDSON COUNTY

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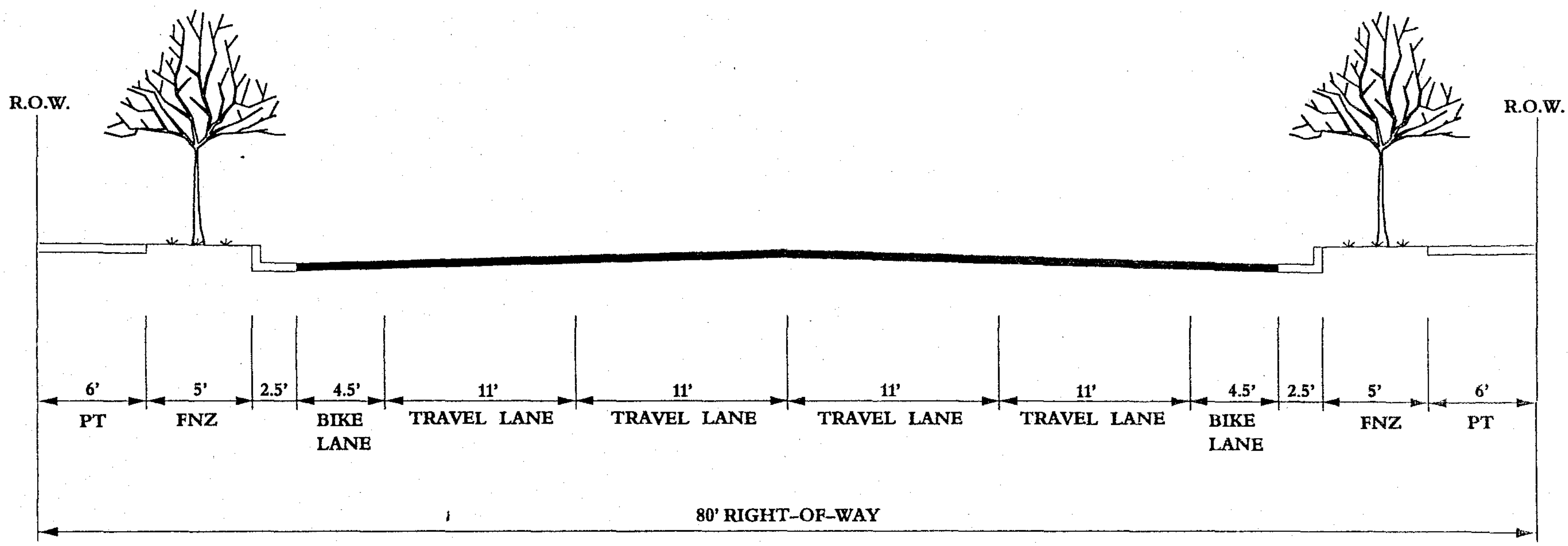
COLLECTOR STREET
(4 LANES)
NON-RESIDENTIAL
(80' R.O.W.)



NOTES :
1) ALL UTILITIES LOCATED OUTSIDE ROW IF FEASIBLE
2) FURNISHINGS ZONE MAY BE USED FOR WIDER PEDESTRIAN TRAVELWAY AS APPROPRIATE
3) PT = PEDESTRIAN TRAVELWAY
4) FNZ = FURNISHINGS ZONE

TYPICAL CROSS SECTIONS
MAJOR AND COLLECTOR STREET PLAN
NASHVILLE - DAVIDSON COUNTY

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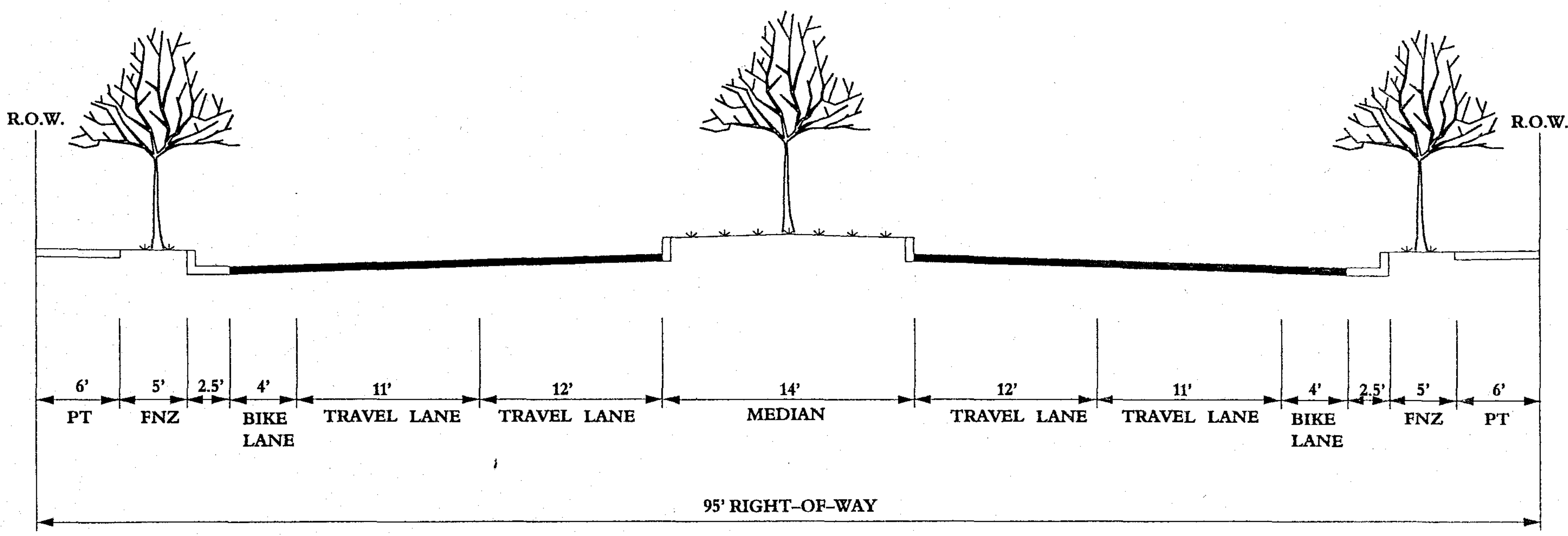
COLLECTOR BOULEVARD
(4 LANES WITH MEDIAN)
NON-RESIDENTIAL
(95' R.O.W.)



NOTES :

1) ALL UTILITIES LOCATED OUTSIDE ROW IF FEASIBLE
2) FURNISHINGS ZONE MAY BE USED FOR WIDER PEDESTRIAN TRAVELWAY AS APPROPRIATE
3) PT = PEDESTRIAN TRAVELWAY
4) FNZ = FURNISHINGS ZONE

TYPICAL CROSS SECTIONS
MAJOR AND COLLECTOR STREET PLAN
NASHVILLE - DAVIDSON COUNTY

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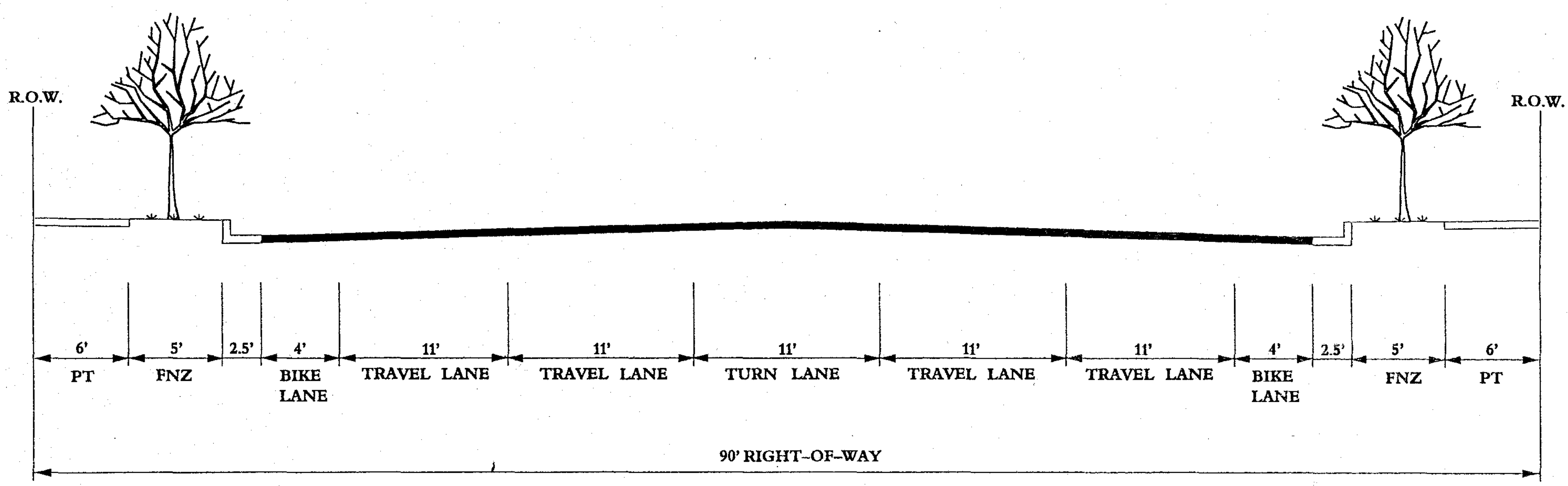
COLLECTOR STREET
(4 LANES WITH CENTER TURN LANE)
NON-RESIDENTIAL
(90' R.O.W.)



NOTES :
1) ALL UTILITIES LOCATED OUTSIDE ROW IF FEASIBLE
2) FURNISHINGS ZONE MAY BE USED FOR WIDER PEDESTRIAN TRAVELWAY AS APPROPRIATE
3) PT = PEDESTRIAN TRAVELWAY
4) FNZ = FURNISHINGS ZONE

TYPICAL CROSS SECTIONS
MAJOR AND COLLECTOR STREET PLAN
NASHVILLE - DAVIDSON COUNTY

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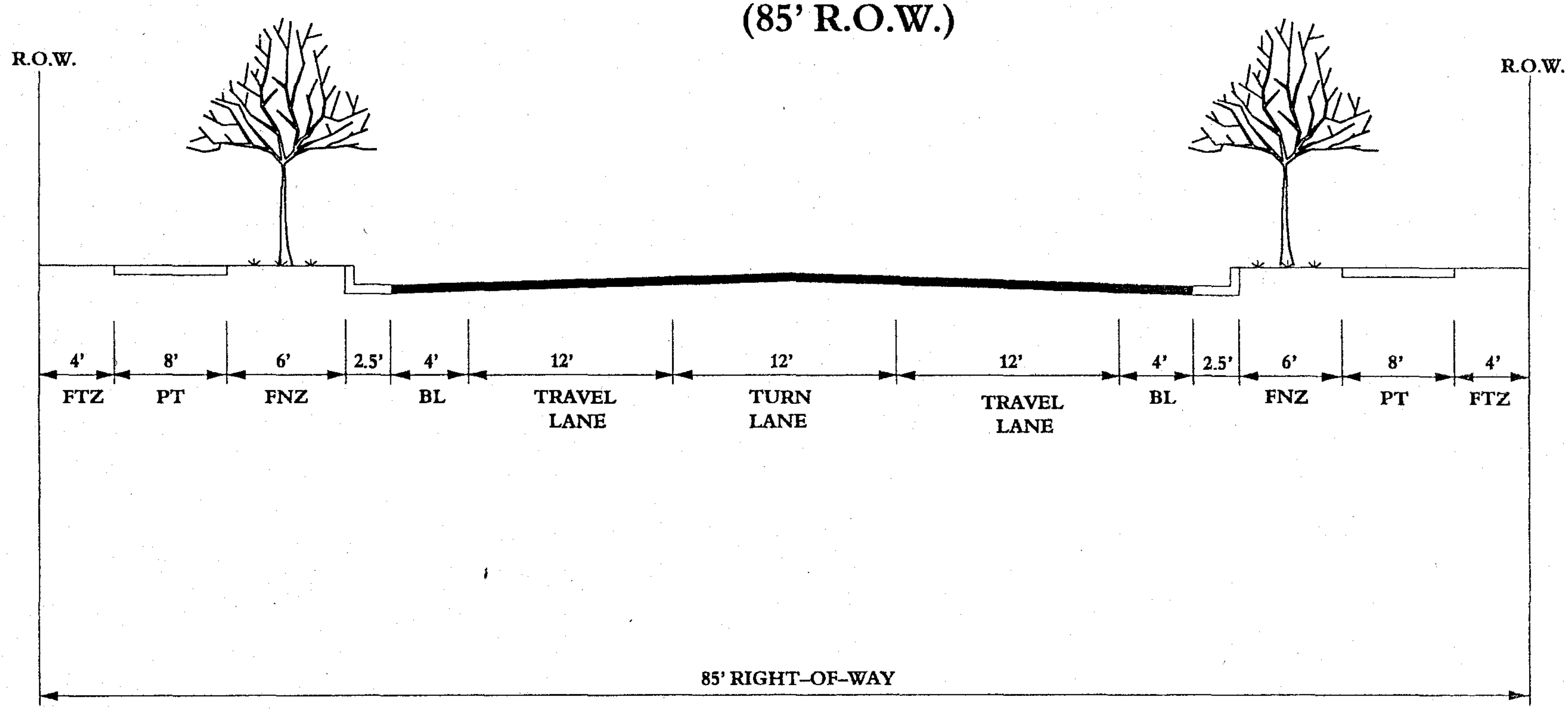
U2 – URBAN ARTERIAL
(2 LANES WITH CENTER TURN LANE)
(85' R.O.W.)



NOTES : 1) ALL UTILITIES LOCATED OUTSIDE ROW IF FEASIBLE
2) PT = PEDESTRIAN TRAVELWAY
3) FNZ = FURNISHINGS ZONE
4) FTZ = FRONTAGE ZONE
5) BL = BIKE LANE

TYPICAL CROSS SECTIONS
MAJOR AND COLLECTOR STREET PLAN
NASHVILLE – DAVIDSON COUNTY

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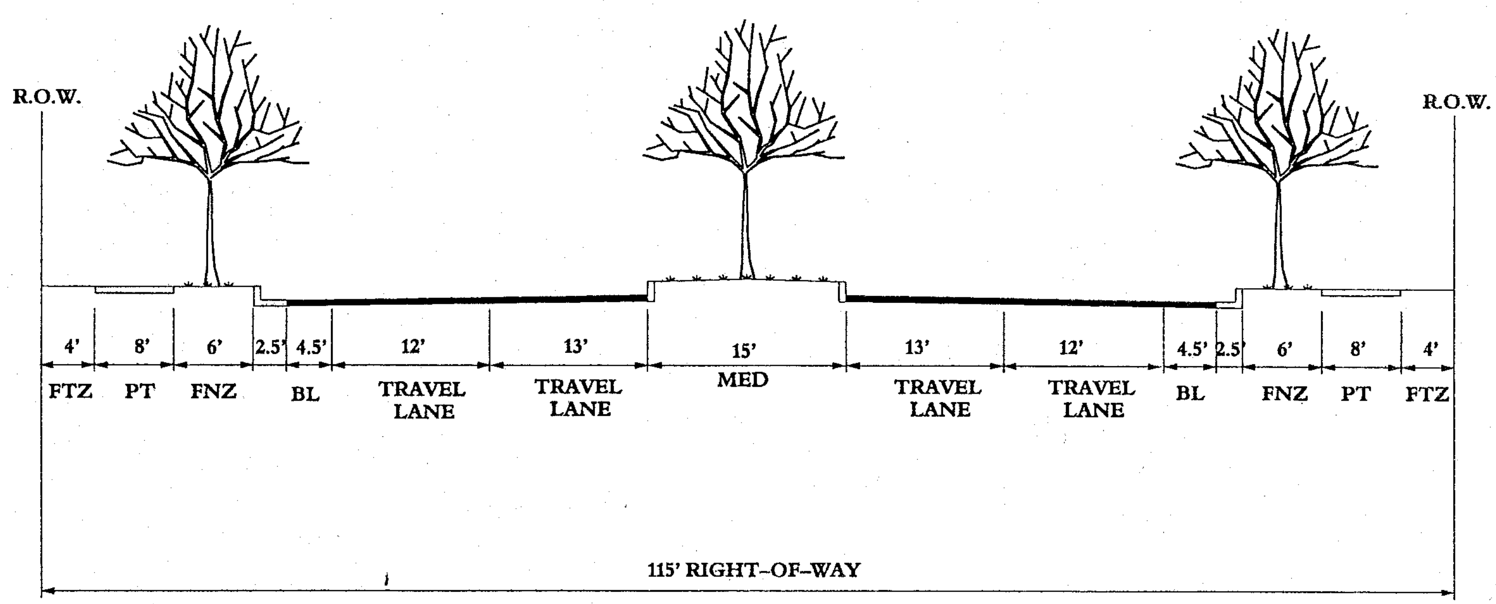
U4B - ARTERIAL BOULEVARD
(4 LANES WITH MEDIAN)
(115' R.O.W.)



NOTES : 1) ALL UTILITIES LOCATED OUTSIDE ROW IF FEASIBLE
2) PT = PEDESTRIAN TRAVELWAY
3) FNZ = FURNISHINGS ZONE
4) FTZ = FRONTAGE ZONE
5) BL = BIKE LANE

TYPICAL CROSS SECTIONS
MAJOR AND COLLECTOR STREET PLAN
NASHVILLE - DAVIDSON COUNTY

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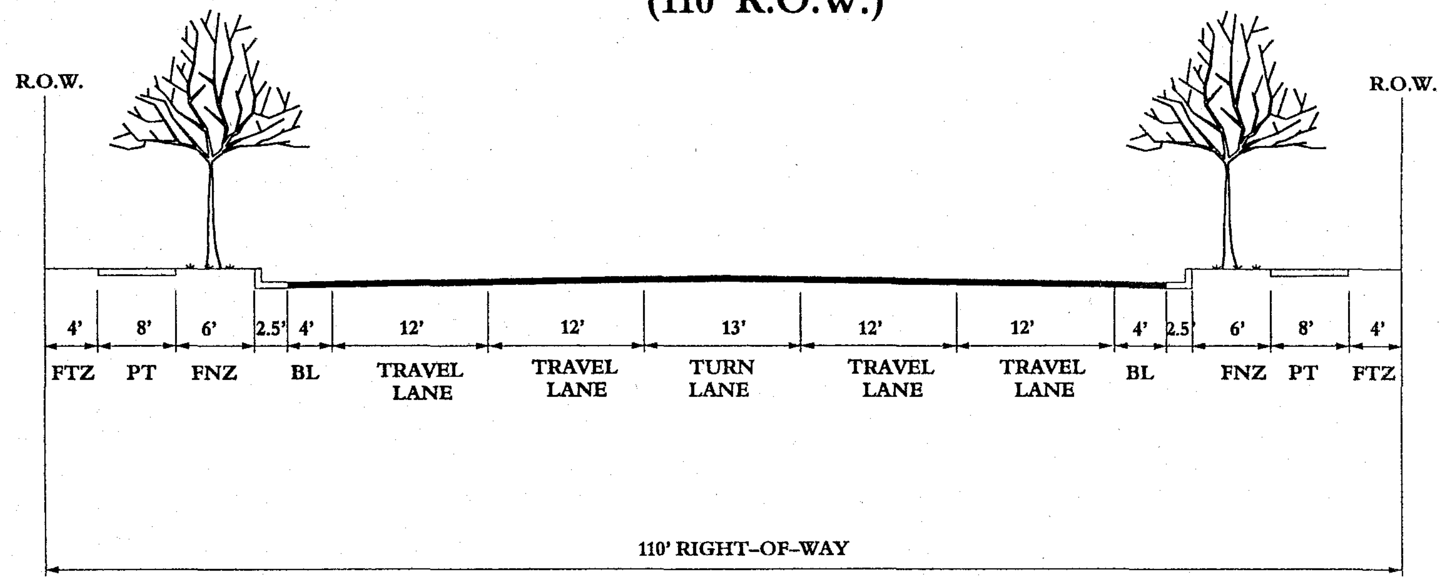
U4 - URBAN ARTERIAL
(4 LANES WITH CENTER TURN LANE)
(110' R.O.W.)



NOTES :
1) ALL UTILITIES LOCATED OUTSIDE ROW IF FEASIBLE
2) PT = PEDESTRIAN TRAVELWAY
3) FNZ = FURNISHINGS ZONE
4) FTZ = FRONTAGE ZONE
5) BL = BIKE LANE

TYPICAL CROSS SECTIONS
MAJOR AND COLLECTOR STREET PLAN
NASHVILLE - DAVIDSON COUNTY

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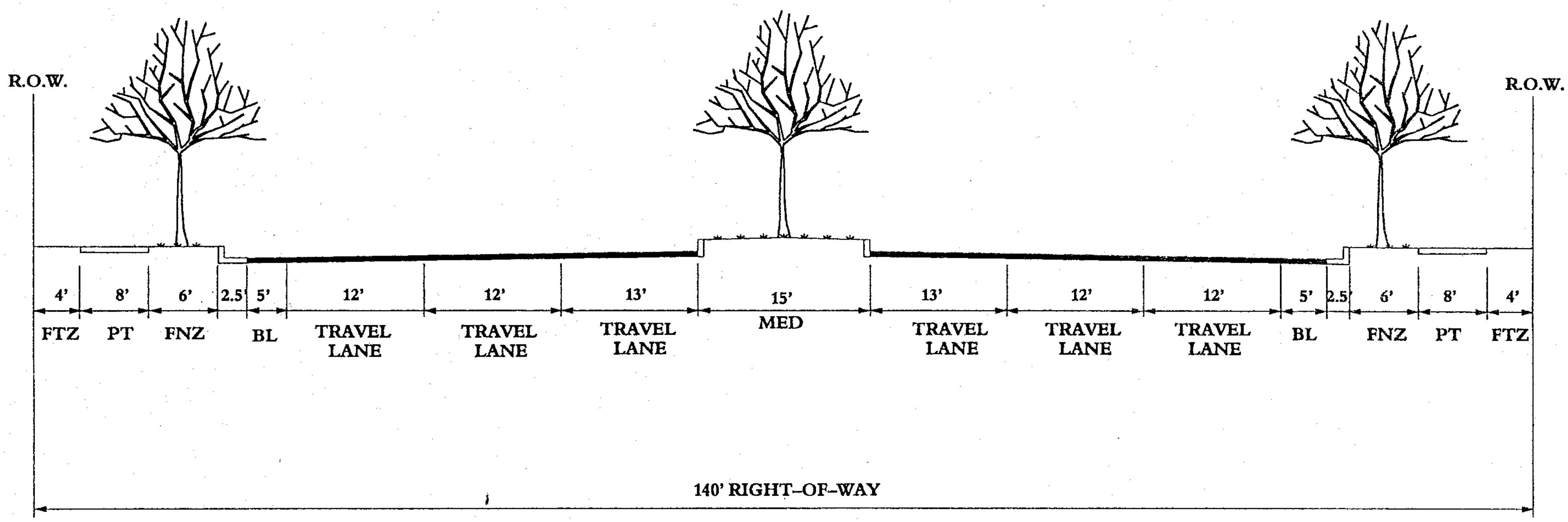
U6B – ARTERIAL BOULEVARD
(6 LANES WITH MEDIAN)
(140' R.O.W.)



NOTES : 1) ALL UTILITIES LOCATED OUTSIDE ROW IF FEASIBLE
2) PT = PEDESTRIAN TRAVELWAY
3) FNZ = FURNISHINGS ZONE
4) FTZ = FRONTAGE ZONE
5) BL = BIKE LANE

TYPICAL CROSS SECTIONS
MAJOR AND COLLECTOR STREET PLAN
NASHVILLE – DAVIDSON COUNTY

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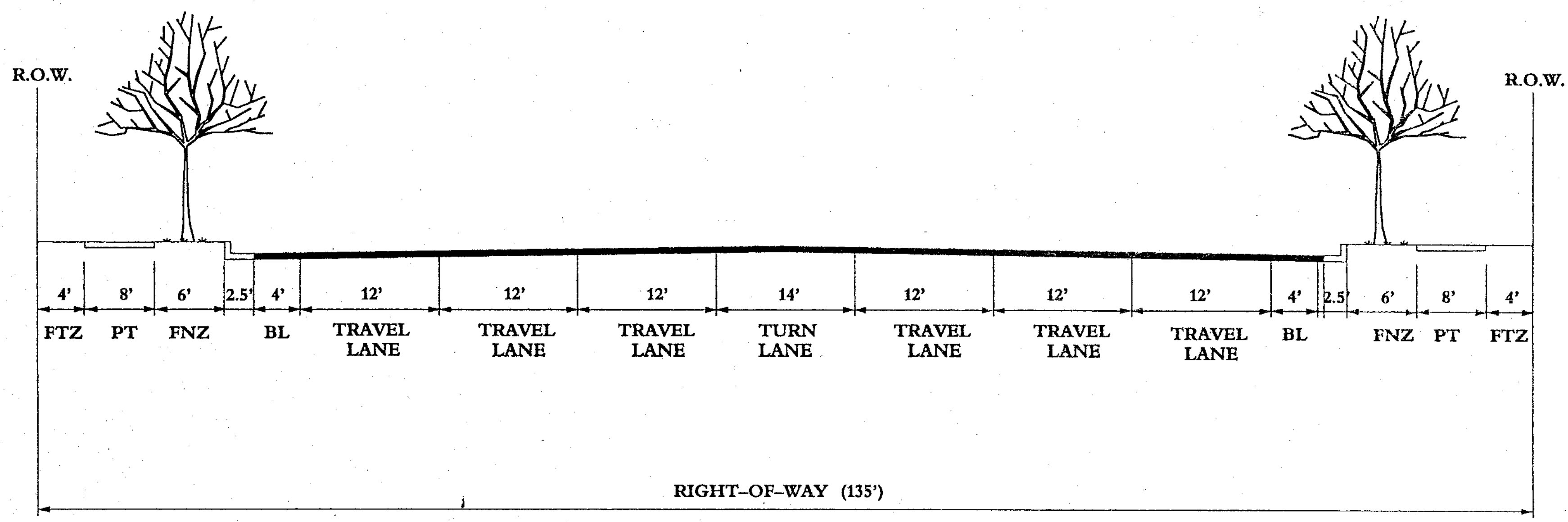
U6 – URBAN ARTERIAL
(6 LANES WITH CENTER TURN LANE)
(135' R.O.W.)



NOTES :
1) ALL UTILITIES LOCATED OUTSIDE ROW IF FEASIBLE
2) PT = PEDESTRIAN TRAVELWAY
3) FNZ = FURNISHINGS ZONE
4) FTZ = FRONTAGE ZONE
5) BL = BIKE LANE

TYPICAL CROSS SECTIONS
MAJOR AND COLLECTOR STREET PLAN
NASHVILLE – DAVIDSON COUNTY

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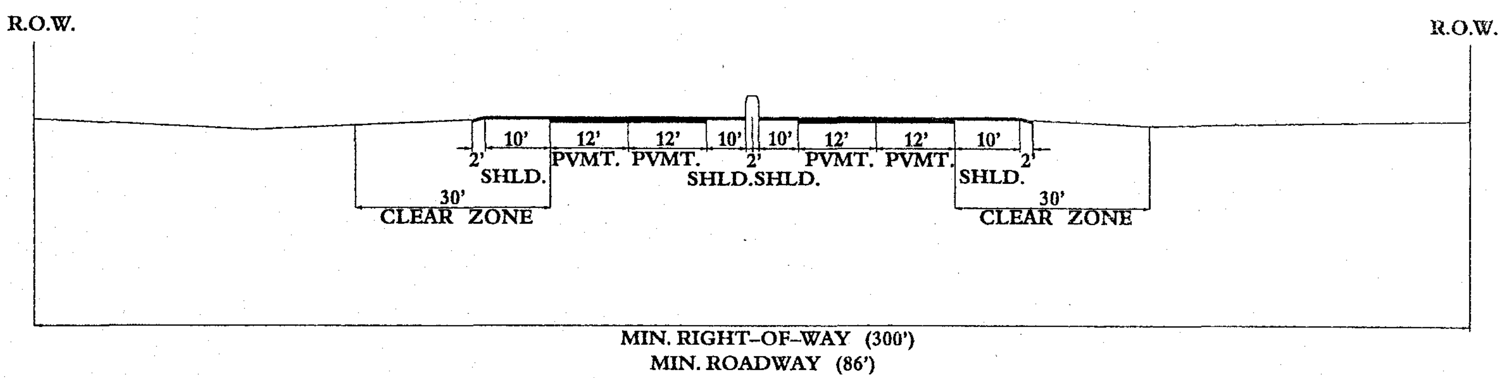
F4 – FREEWAY (4 LANES)
(300' R.O.W.)



NOTES:

1. MINIMUM R.O.W. IS THAT REQUIRED TO ACCOMODATE SLOPES (15 TO 20 FEET OUTSIDE THE SLOPE LIMIT IS DESIRABLE).
2. A MEDIAN OF 14' MINIMUM IF 22' NOT ACHIEVABLE.
3. OUTSIDE SHOULDERS OF 12' (10' PAVED, 2' FOR GUARDRAIL OFFSET) PER SHOULDER. INSIDE PAVED SHOULDERS OF 6' PER SHOULDER; 10' PER SHOULDER FOR 6 LANES OR MORE.
4. FULL CONTROL OF ACCESS.

TYPICAL CROSS SECTIONS
MAJOR AND COLLECTOR STREET PLAN
NASHVILLE - DAVIDSON COUNTY

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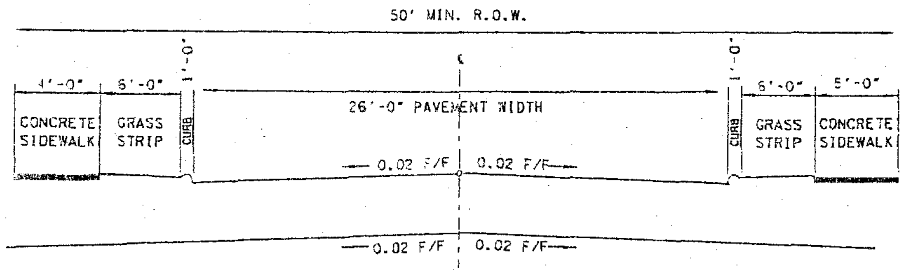
TABLE 6.1

DESIGN ELEMENTS OF RECOMMENDED ROADWAY CLASSIFICATIONS
GALLATIN MAJOR THOROUGHFARE PLAN

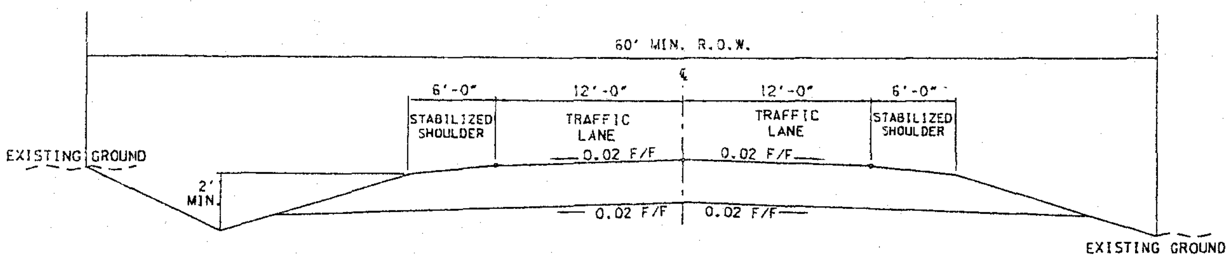
ELEMENTS	MAJOR ARTERIAL			MINOR ARTERIAL				COLLECTOR		LOCAL
Number of Lanes	2	4	5	2	3	4	5	2	3	N/A
Minimum Right-of-Way	60'	64' - 90'	84' - 118'	60'	60'	64' - 70'	84' - 88'	50' - 60'	60'	50'
Median Width	N/A	Variable (0'-20')	12' (Center Turn Lane)	N/A	12' (Center Turn Lane)	Variable (0'-20')	12' (Center Turn Lane)	N/A	12' (Center Turn Lane)	N/A
Shoulder Width	6' - 10'	Variable (0'-10')	Variable (0'-10')	6' - 10'	Variable (0'-10')	Variable (0'-10')	Variable (0'-10')	Variable (0'-10')	Variable (0'-10')	N/A
Sidewalk Width	5' - 8'	5' - 8'	5' - 8'	5' - 8'	5' - 8'	5' - 8'	5' - 8'	5' - 8'	5' - 8'	4' (6' Grass Strip)
Lane Width	12'	12'	12'	12'	12'	12'	12'	12'	12'	26' Pavement

* Utility easement outside R.O.W may be necessary.

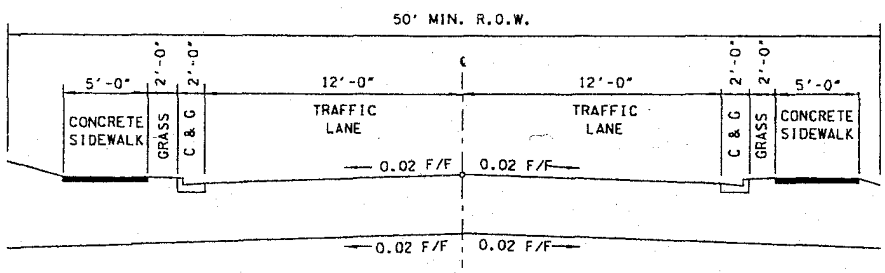
** Please refer to the Gallatin Bicycle and Pedestrian Plan (IDE & Associates, 1999) for specific information on those routes that would require provisions for bike lanes.



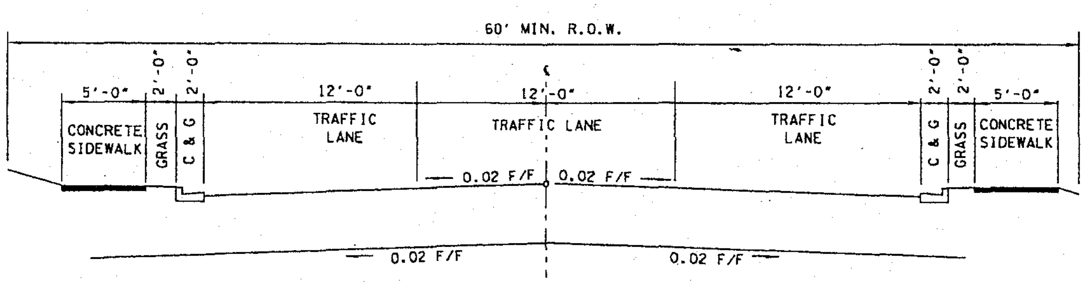
TYPICAL TANGENT SECTION - LOCAL STREET



TYPICAL TANGENT SECTION - 2 LANE COLLECTOR, SWALE

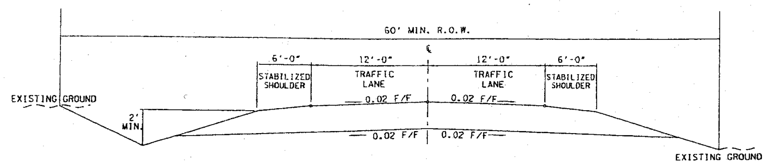


TYPICAL TANGENT SECTION - 2 LANE COLLECTOR, CURB & GUTTER

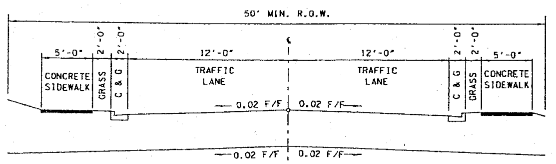


TYPICAL TANGENT SECTION - 3 LANE COLLECTOR, CURB & GUTTER

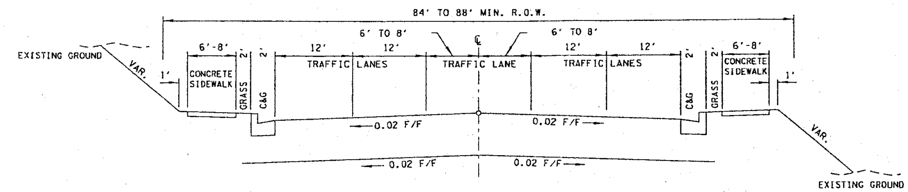
GALLATIN MAJOR THOROUGHFARE PLAN NEEL-SCHAFFER, INC. ENGINEERS • PLANNERS	TYPICAL ROADWAY SECTIONS FOR LOCAL AND COLLECTOR ROUTES	FIGURE 6.1 A



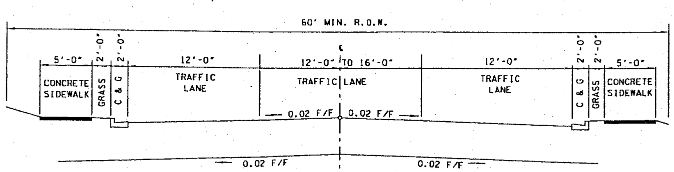
TYPICAL TANGENT SECTION - 2 LANE MINOR ARTERIAL, SWALE



TYPICAL TANGENT SECTION - 2 LANE MINOR ARTERIAL, CURB & GUTTER

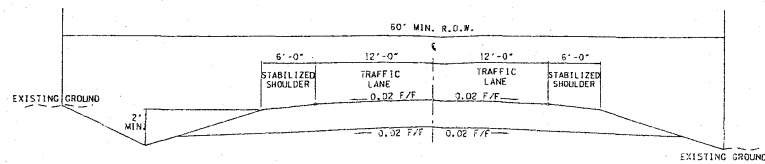


TYPICAL TANGENT SECTION - 5 LANE MINOR ARTERIAL, CURB & GUTTER

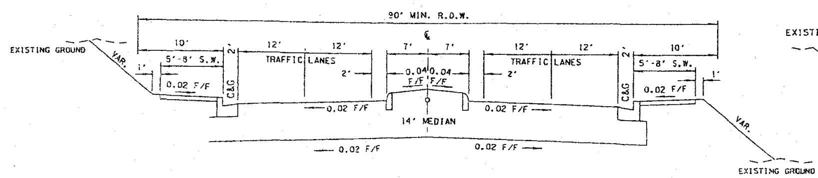


TYPICAL TANGENT SECTION - 3 LANE MINOR ARTERIAL, CURB & GUTTER

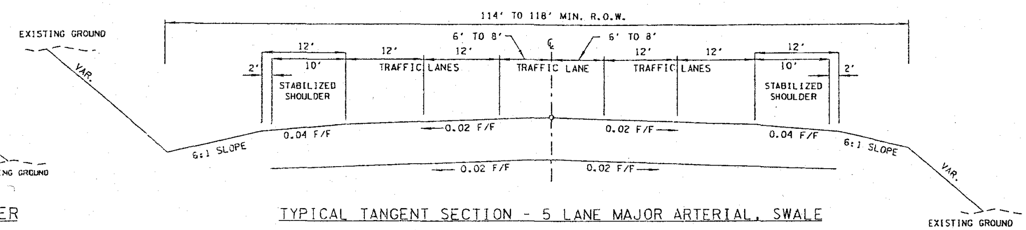
GALLATIN MAJOR THOROUGHFARE PLAN NEEL-SCHAFFER, INC. ENGINEERS • PLANNERS NASHVILLE, TENNESSEE	TYPICAL ROADWAY SECTIONS FOR MINOR ARTERIAL ROUTES	FIGURE 6.1 B



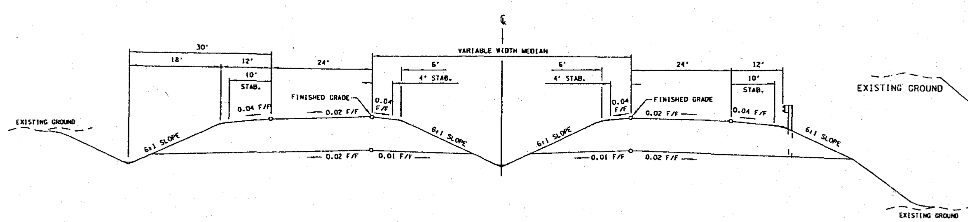
TYPICAL TANGENT SECTION - 2 LANE MAJOR ARTERIAL, SWALE



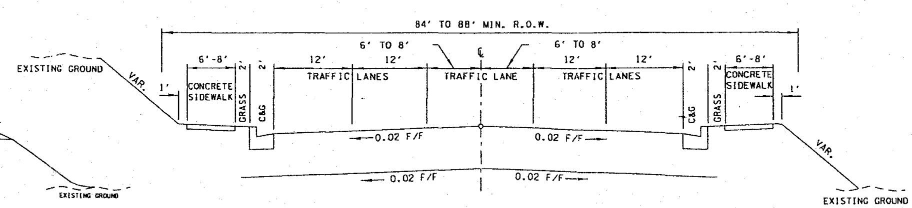
TYPICAL TANGENT SECTION - 4 LANE MAJOR ARTERIAL, CURB & GUTTER



TYPICAL TANGENT SECTION - 5 LANE MAJOR ARTERIAL, SWALE



TYPICAL TANGENT SECTION - 4 LANE DIVIDED PRINCIPAL ARTERIAL, SWALE



TYPICAL TANGENT SECTION - 5 LANE MAJOR ARTERIAL, CURB & GUTTER

GALLATIN MAJOR THOROUGHFARE PLAN NEEL-SCHAFFER, INC. ENGINEERS • PLANNERS NASHVILLE, TENNESSEE	TYPICAL ROADWAY SECTIONS FOR MAJOR ARTERIAL ROUTES 48	FIGURE 6.1 C