TRANSPORTATION MASTER PLAN UPDATE

AUGUST 2019

Disclaimer: Financed through TxCDBG - Office of Rural Affairs of the Texas Department of Agriculture. The preparation of this document was financed through provisions of a Texas Community Development Block Grant Program (TxCDBG) Grant from the U.S. Department of Housing and Urban Development. The Texas Department of Agriculture in conjunction with the United States Department of Housing and Urban Development furnished financial support to the activity described in this publication which does not necessarily indicate the agreement of the Texas Department of Agriculture or of the United States Department of Housing and Urban Development with the statements or conclusions contained in this publication.

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Executive Summary

Plan Purpose

The Huntsville Transportation Master Plan (TMP) update is built on the goals and visions developed in the City's 2002 Transportation Master Plan, 2007 Comprehensive Plan, 2007 Economic Development Strategic Plan, 2009 Sidewalk Master Plan, and 2013 Harnessing Huntsville's Potential Report. This plan update seeks to uphold the established precedents of Huntsville, while framing a future transportation network focused on multi-modal mobility, connectivity, and accessibility.

Huntsville is going through a huge transformation with the expansion of Interstate Highway (IH) 45, which is the primary corridor connecting Dallas and Houston. The expansion includes the addition of collector-distributor roads and upgrades of interchanges, thus providing more capacity and opportunity for economic and business development. Other regional projects such as Texas High Speed Train and IH 14 are in the works and would directly impact the City. In addition, the student population is expected to increase from 22,000 to 30,000 as per the information received at the stakeholder meeting on October 12, 2018. A huge demand in student housing and apartments resulted in new housing development projects across the City. This, along with the improved connection of Veterans Memorial Parkway to State Highway (SH) 19 and SH 75 on the south end of the city, are promoting more development on the west side of IH 45 along Veterans Memorial Parkway. All of the new commercial and residential development is challenging the current transportation infrastructure.

In anticipation of this growth, City leaders seek to update the Transportation Master Plan that was created in 2002, so that access to highway facilities can be evaluated, the transportation network analyzed, and the thoroughfare plan updated. The TMP seeks to enhance mobility, connectivity, and accessibility of Huntsville and offers alternate modes of transportation as an ultimate goal.

Source: Facebook @ City of Huntsville, TX

Project Background

Opportunities

The City of Huntsville is home to several large institutions, including Sam Houston State University (SHSU), the Texas Department of Criminal Justice, Huntsville Memorial Hospital, and Huntsville Independent School District (HISD), which are also among the major employers. The city also boasts two (2) large parks—the Sam Houston National Forest and Huntsville State Park.

The 2013 Houston-Galveston Area Council's (H-GAC's) Harnessing Huntsville's Potential Report seeks to transform downtown Huntsville into a "University Village." Similarly, the 2007 Economic Development Strategic Plan identifies an opportunity for Huntsville in downtown redevelopment and strengthening connections to the SHSU campus.

Source: Facebook @ City of Huntsville, TX

Challenges

A large portion of the new housing development in Huntsville is geared towards students, which are a transient population. This exacerbates the difficulty of developing strong and stable neighborhoods that are affordable for a variety of households. In fact, over half of the residents (58.6 percent)[1] in the community are renters.

In addition, out of the seven (7) state prisons located within Walker County, five (5) are located within Huntsville. Although the state and federal operations bring many jobs, the large tracts of land that they occupy are exempt from property taxes and limit the supply of developable land. Over fifty (50) percent of the land within Huntsville is publicly-owned and exempt from property taxes[1].

In view of the above opportunities and challenges, City leaders and staff have been proactive in developing transportation improvements and funding strategies to pay for them. This TMP update will serve as a tool to seek federal funding and partnership with other entities such as TxDOT and Walker County.

1 (2013). "Harnessing Huntsville's Potential Report"

Plan Development Process

To develop recommendations for an update to the TMP, many factors were evaluated and analyzed. City goals and planned projects were reviewed and incorporated. The study area was defined, and major corridors were studied to ensure thoroughness and to address community congestion concerns.

The previous studies and TMP were reviewed, crash data and traffic counts were collected, and field observations were made to collect existing data for analysis of existing conditions. Projected growth rates and recommended improvements were simulated in travel demand models to determine future conditions of the network. Future planning years were established and four scenarios were selected to analyze:

- 2018 Existing Conditions
- 2025 Conditions with IH 45 Improvements
- 2035 Conditions with IH 45 Improvements and Recommended Improvements
- 2045 Conditions with IH 45 Improvements and Recommended Improvements

Public and stakeholder input was received throughout the course of the project through stakeholder meetings, city council meetings, and a public workshop. The plan was revised to address the concerns received and a set of recommendations were made for key corridors. Multi-modal plans including a bicycle network, sidewalk network update, and a public transit framework were developed.

A thoroughfare plan was developed to address congestion and gaps in the network while providing better connectivity. The projects identified in the thoroughfare plan and other recommendations were prioritized into short-, mid-, and long-term lists along with associated costs. Also, the current roadway classification and right-of-way (ROW). requirements of the City were reviewed, and a set of updated street cross-sections and ROW needs were developed for adoption into the City's design standards.

Source: City of Huntsville, TX Website

Corridor Recommendations

The roadway improvements to Huntsville's transportation network are meant to ease congestion, improve safety and mobility for all users, and to provide and plan for future connectivity and accessibility. The recommended improvements include traditional improvements such as roadway widening, intersection improvements, signalization, addition of turn lanes, and new roadway construction. Other types of recommended improvements include creating one-way street couplets, high-capacity transit, travel demand management strategies and multi-modal alternatives. The recommended improvements have been quantified to short-, mid-, and long-term with associated costs, to prioritize these projects to address the City's needs. The prioritized improvements are shown in the Recommendations section of this update.

Recommendations and Strategies

With pro-active planning, active outside agency coordination, and clear goals established through documents such as this one, the City will have a living road map to assist in planning for "the Huntsville of both today and tomorrow."

The improvements made to the transportation network in Huntsville will be built over a long period of time. Recommendations in this plan will be implemented gradually as development occurs and as infrastructure needs increase. This update will serve as a guide to help prioritize projects and to suggest funding strategies as projects are selected to become a part of the built environment.

The recommendations and strategies identified in this Transportation Master Plan Update include but are not limited to:

- Update the Transportation Master Plan every five (5) years
- Deploy ITS technologies and Travel Demand Management techniques
- Redevelop 11th Street and Sam Houston Avenue as a "To Place" rather than a "Through Place"
- Develop and implement Access Management guidelines
- Coordinate actively with outside agencies
- Consider a long range transit framework
- Implement Complete Streets concepts
- Consider context sensitive solutions
- Identify sustainable and innovative transportation funding strategies and
- Implement the Sidewalk and Bicycle Plan developed in this TMP in phases.

1. Introduction

1.1 Overview and Purpose

The City of Huntsville, Texas was the home to Sam Houston, the first President of the Republic of Texas. Today, it is home to the 12th largest university in Texas[2] , numerous correction facilities, and a high potential for continued development. To better understand and prepare for the transportation needs of Huntsville today and tomorrow, the City has developed this update to its 2002 Transportation Master Plan.

The City of Huntsville Transportation Master Plan Update is built on the goals and visions developed in the City's 2002 Transportation Master Plan, 2007 Comprehensive and Thoroughfare Plan, and 2009 Sidewalk Master Plan. This plan update seeks to uphold the established precedents of Huntsville, while framing a future transportation network focused on multi-modal mobility, connectivity and accessibility. Any transportation improvements will be weighed against community impact in order to maintain the cultural identity of the city. Equally important is to create policies that have a level of flexibility in order to adapt to the ever-changing landscape of a growing city.

2 Sam Houston State University. "Katfacts" https://www.shsu.edu/about/facts.html

Source: City of Huntsville, TX

1.2 Background

Huntsville, Texas is the county seat of Walker County, and has direct connections to major cities such as Houston, College Station, and Dallas. According to the 2010 U.S. Census, the population of Huntsville is 38,548. A major land use is single family residential with additional land uses such as commercial, multi-family apartments, student housing, institutional, and correctional facilities.

The center of Huntsville is bordered on the west side by IH 45 and on the east side by SH 19. Sam Houston Avenue is the major north-south corridor that splits the center of Huntsville. The eastern part of the center of Huntsville is mainly composed of Sam Houston State University. Lecture halls, student housing, and commercial development all congregate in and around this institution, thus the university is a vital part of the transportation network. The western part of the center of Huntsville is mainly composed of single-family residence, multi-family apartments, and student housing. The quiet neighborhoods here are an essential part of the cultural identity of the City.

IH 45 forms the western border of the central part of Huntsville and is currently being expanded. Commercial and housing development in the City and specifically, along the interstate will continue to increase as the roadway is completed with the potential to attract more visitors to the region.

Some improvements in the City's 2002 Transportation Master Plan have been implemented, but many others have not been approved yet. This update to the transportation master plan has evaluated previously proposed projects for relevancy for the future years of Huntsville. Funding strategies are being investigated to pay for transportation investments of the future.

Source: City of Huntsville, TX Website

This update expands on the City's current plans by developing a set of recommendations to improve safety and mobility for all roadway users. In addition, the benefit of these recommended improvements is quantified in order to develop the appropriate short-, mid-, and long-term roadway improvements that will improve the quality of life for the City's residents.

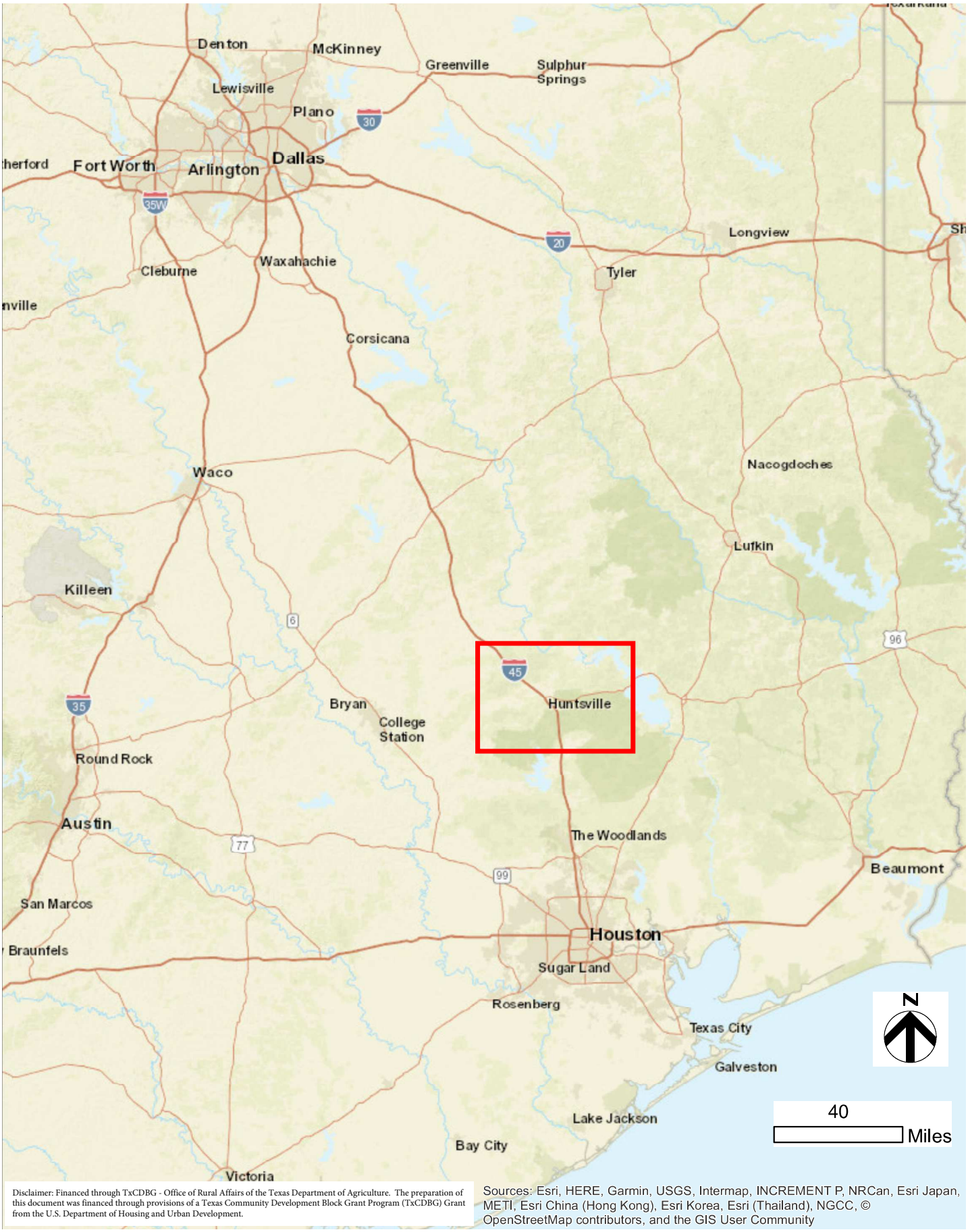


Figure 1-1: Major Cities Around Huntsville

1.3 Previous (2002) Transportation Master Plan

Major ideas from the previous transportation master plan are implemented in the updated master plan. One of these ideas is to use a total system approach by incorporating various modes of transportation based on the analysis of travel demand with consideration to community costs and benefits. Recommended transportation improvements need to come from a holistic view of the entire city's development patterns, right-of-way constraints, and planned improvements already underway. Right-of-way constraints in particular, demonstrate the need for solutions based on transportation system management techniques and access management techniques etc. as a source of relieving congestion. The list of recommended programs from the previous plan and the status of the programs as of April 2019 are shown in Table 1-1 and 1-2 below.

Table 1-1: 2002 TMP Recommended - Long Term Improvement Programs

Improvement	Status
Widen SH 75 from SH 19 to South of Southwood Drive to a 5-lane facility	Not Completed
Widen SH 75 from South of Southwood Drive to Park Road 40 to a 3-lane facility	Not Completed
Widen 16th Street from Bear Kat Boulevard to Avenue R to a 5-lane secondary arterial	Not Completed
Improve US 190 to a Four-lane Facility as per Ongoing Corridor Study	Not Completed
Widen Bowers Boulevard from Sam Houston Avenue to Sycamore Avenue	Not Completed: Bowers Boulevard is discontinuous between Avenue J and Avenue I. From Avenue H to Sycamore Avenue, Bowers Boulevard is a 4-lane facility.
Widen SH 30 from FM 1791 West to Didlake Road to a 5-lane facility	Not Completed: SH 30 is only a 5-lane facility for 0.70 miles west of FM 1791.
Widen Sycamore Avenue from Bowers Boulevard to US 190 to a collector facility	Most of Sycamore Avenue between Bowers Boulevard and US 190 is a 3-lane facility.
Widen FM 980 from FM 247 North to FM 2628 to a 5-lane facility	Not Completed
Widen FM 247 from FM 980 North to FM 2628 to a 5-lane facility	Not Completed

Table 1-2: 2002 TMP Recommended - Short Term Improvement Programs

Improvement	Status
SH 19 Widening to 4-lane Freeway Facility from IH 45 to SH 30	Completed
Convert IH 45 Frontage Roads to One-way operation from SH 75 to Avenue S	Completed
SH 30 Widening to 5-lane facility from Veterans Memorial to FM 1791	Mostly completed: It is a 5-lane facility at crossovers.
Widen FM 1374 (Montgomery Road) from IH 45 to Darrel White Road	Not Completed: FM 1374 is still at two-lane facility.
Access Management and TSM improvements along 11th Street	Not Completed
16th Street Extension from Avenue R to IH 45 Northbound Frontage Road	Not Completed
Pine Shadows (10th Street) Extension from Hickory Drive to IH 45 NB Frontage Road	Not Completed
Widen FM 1791 interchange at IH 45 to 5-lane cross-section	Completed: interchange has been widened.
Construct New Roadway from Avenue S at IH 45 to Sycamore Ave. at Sam Houston	Not Completed
Improve/Extend Powell Road from Sam Houston Ave. to IH 45 NB Frontage Road	Not Completed
Construct Powell Road Overpass at IH 45 and extend to Veterans Memorial	Not Completed
Realign FM 247 and Widen to 5-lane cross section from FM 2821 to 11th Street	Not Completed
Add Continuous two-way left-turn lane to FM 2821 from FM 247 to SH 75	Not Completed
Park and Ride Shuttle System for SHSU Commuter Students along IH 45	Not Completed: Trial run in Fall 2017, but discontinued.
Bicycle and Pedestrian Facility Improvements in Various Locations	Partially Completed

1.4 Current Transportation Issues

The Houston to Dallas connection along IH 45 is a major network link for the entire state thus high traffic volumes pass through the City. Major retailers Walmart and Target and the Huntsville medical center have been built along this segment of IH 45 serving as major attractors for local citizens and out-of-town visitors. Many of the transportation issues center on the lack of alternative routes, which places a strain on existing major corridors:

- **11th Street** is the only major east-west corridor in the City. This roadway connects other major roadways such as IH 45, Sam Houston Avenue, and SH 19, therefore much of the City's congestion begins and ends with 11th Street.

- **Sam Houston Avenue** is another important corridor that runs north-south and connects IH 45, 11th Street, and FM 2821 on the north side of town. In addition, Sam Houston State University is situated along this corridor generating large amounts of vehicular and pedestrian traffic. Improving the pedestrian infrastructure at major crossings along Sam Houston Avenue is important to increase the safety for pedestrians.

Other transportation issues include the need for:

- Multi-modal options
- Signal coordination along 11th St and Sam Houston Avenue
- Improved access management at key intersections
- An updated thoroughfare plan to better influence future development patterns.

1.5 Goals and Objectives

1.5.1 Goals

Develop a transportation plan that utilizes multi-modal, safe, sustainable and environment-friendly solutions to promote efficient transportation and economic development.

Source: HDR, Inc.

1. Provide multimodal options that provide trip-making choices including bicycle, pedestrian, and transit options.
   - Determine what percentage of City roadways requires bike lanes, type of bike lanes, and schedule for implementation.
   - Determine what percentage of City roadways require sidewalks and develop an implementation schedule.
   - Develop a future transit framework.

2. Develop cross-sections and functional classifications to provide context-sensitive and safe street design -- that is consistent with neighborhood and community character and tailored to the roadway's purpose.

3. Plan strategic infrastructure investments to enhance access to areas where growth is projected and improve the public amenities and infrastructure that attracts people and businesses to move to Huntsville and retain university graduates. (eg. walking trails, pedestrian plazas, public art).

4. Promote partnerships and leverage public resources for effective implementation and to catalyze private sector responses.

5. Introduce technology and smart solutions to assist with access management, travel demand management, parking supply, congestion, and emergency response times, and enhance safety throughout the City. (eg. bike share, ride share, smart streets)

6. Improve health outcomes and reduce air/noise/water pollution through active transportation connections to employment, medical, parks, and green spaces.

7. Identify key areas where street connections can reduce congestion (identify gaps), connect neighborhoods to key destinations (connectivity issues), and identify ROW requirements that are consistent with the City's comprehensive and land use plans.

Source: Facebook @ City of Huntsville, TX

2. Conditions Evaluation

2.1 Study Area Overview

See Figure 2-1 below of the project study area, which divides up the City by traffic analysis zones (TAZs). Each TAZ has demographic data such as population, dwelling units, total employment, retail employment, and other forms of employments. This demographic data is a key component to generating the travel demand model, which is described in further detail in Section 2.3 below.

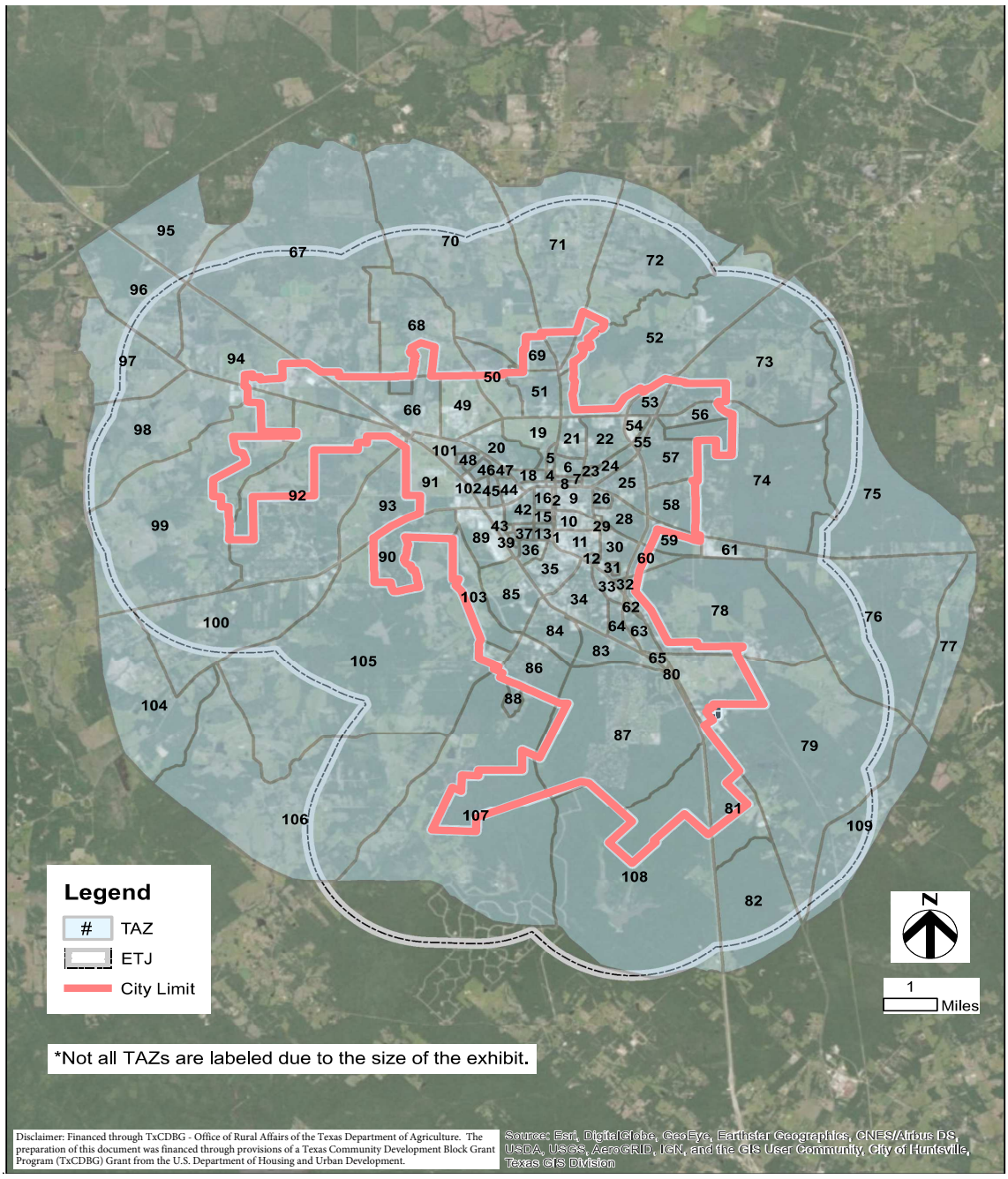


Figure 2-1: Travel Demand Model Project Area

2.2 Data Collection and Observations

2.2.1 Crash Data

As part of the data collection for this Transportation Master Plan update, the crash history of the City was obtained from the Texas Department of Transportation's (TxDOT's) Crash Records Information System (CRIS) database. This includes crashes in Huntsville reported from January 1, 2015 through December 31, 2018.

Of the total 4,765 crashes within the Huntsville city limits, severity information was available for 4,332 of the crashes (90.9%). See Table 2-1 for a summary of the crash data by severity and description of whom or what was hit. As shown below, 926 crashes resulted in some kind of injury, and twelve (12) crashes resulted in fatalities within the four (4) year period. Figure 2-2 shows the density of crashes within the City, and intersections with a high number of crashes during this time period have been circled in red.

Table 2-1: Crash Data Summary

	Crash Severity					Vehicle Crash With				
Year	Unknown	Non-Injury	Injury	Fatality	Total	Pedal Cyclists	Pedestrians	Another Moving Vehicle	Other	Total
2015	91	740	218	1	1050	5	10	737	298	1050
2016	104	910	261	4	1279	6	8	913	352	1279
2017	118	813	223	4	1158	7	13	818	320	1158
2018	120	931	224	3	1278	7	15	841	415	1278
Total	433	3394	926	12	4765	25	46	3309	1385	4765
Total (%)	9.1%	71.2%	19.4%	0.3%		0.5%	1.0%	69.4%	29.1%	

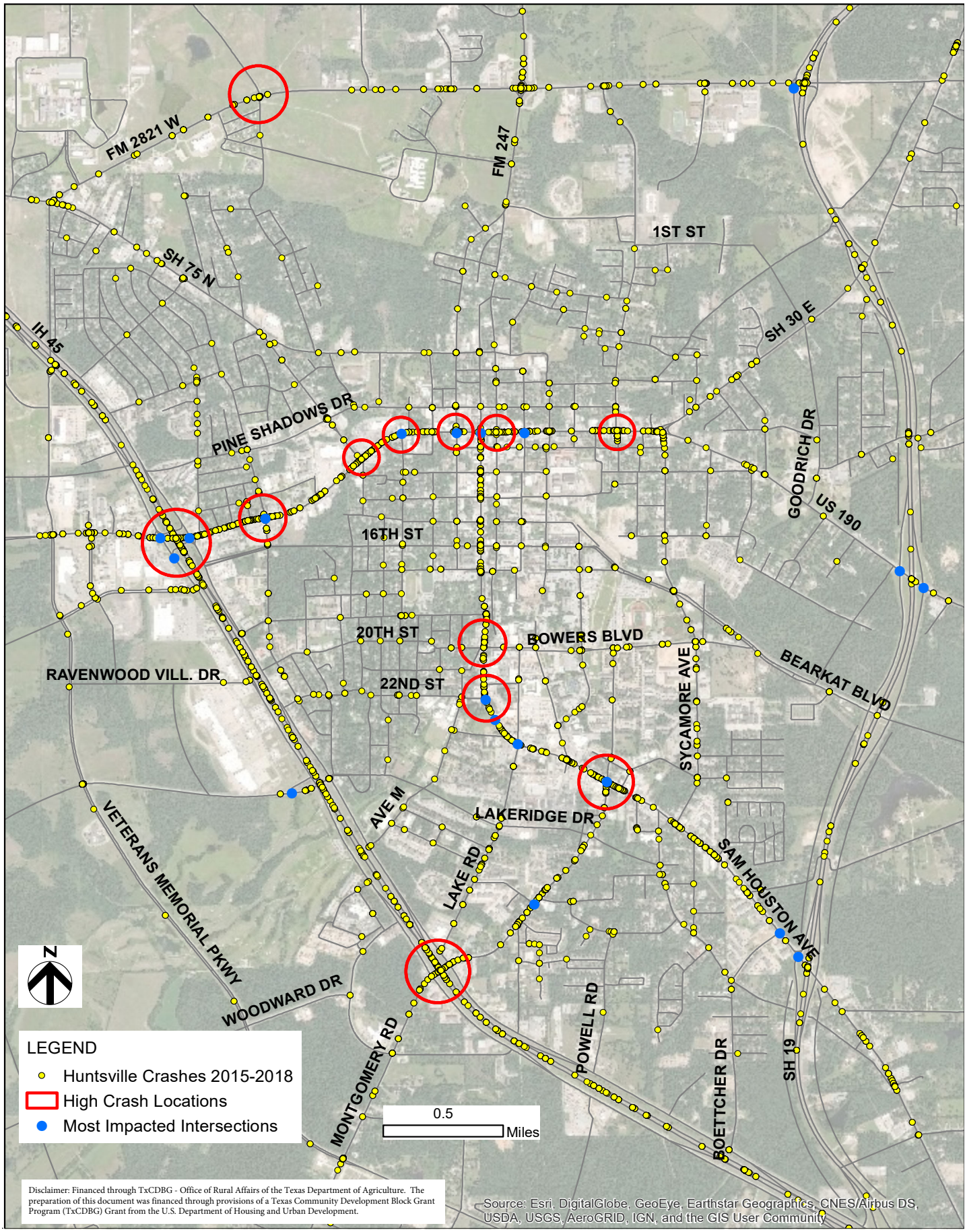


Figure 2-2: Crash Analysis

Manner of Collision

Below are examples of some common types of collisions from TxDOT's CRIS and potential solutions to mitigate them.

1. One Straight-One Left Turn

Potential Solution: Improving access to businesses along high crash corridors along with the addition of left-turn storage lanes at critical intersections can help reduce these types of crashes. Storage lanes offer refuge for vehicles while waiting for a safe gap to complete a left-turn. Restricting left-turns at high crash intersections with turning radii or line of sight issues is another potential solution. Figure 2-3 shows the intersection of 11th Street at University Avenue with no left-turn storage lane where this type of collision can occur.

Figure 2-3: Left-Turn Conflicts

2. *Failure to Control Speed*

Potential Solution: Decreasing the width of travel lanes and/or adding bicycle lanes (where appropriate) will force vehicles to slow down to a speed that will promote overall safe roadway operation.

3. Failure to Yield to Pedestrian

Potential Solution: Increasing the visibility of crosswalks by updating pavement markings or painting wider crosswalks will draw more attention to pedestrians in the crosswalk. Also, implementing protected left-turn only signal operation would allocate a certain amount of time for drivers to safely make left-turns, rather than forcing drivers to be aware of both opposing traffic and pedestrians on the crosswalks during permissive left-turn signal operation. In some special cases, adding a leading pedestrian interval, allowing pedestrians to enter the crosswalk before allowing a green phase for vehicles, can increase their visibility.

Adding signs that point out nearby pedestrian infrastructure will improve safety for pedestrians by increasing the driver's level of awareness. Figure 2-4 below shows an example of providing pedestrian infrastructure with painted crosswalks and warning signs that alert the driver to an active pedestrian zone.

Figure 2-4: Pedestrian Infrastructure at Sam Houston State University

4. Failure to Yield Right-of-Way at Stop Sign

Potential Solution: Improving the stop bar pavement marking and decreasing obstructions to intersecting roadways can promote safer traffic operations at stop-controlled intersections. Further, evaluating signal warrants' applicability for critical intersections can be considered.

2.2.2 Traffic Counts

A key component to updating the travel demand model was to collect traffic counts. Two primary sources of historic traffic data include the annual average daily traffic (AADT) from TxDOT's Statewide Planning Map and traffic counts conducted for previous traffic impact analyses (TIA) and speed studies in Huntsville. In order to supplement this data, traffic counts were also conducted at ten (10) locations in the City (Figure 2-5). These counts are included in Appendix A.

Figure 2-5: Traffic Count Locations

2.2.3 Field Observations

The data collection effort further included visual observations of the city's transportation network. Field observations were made during the peak hours to document traffic operations at key locations around the city including:

- IH 45 and 11th Street interchange
- 11th Street, from IH 45 to SH 19
- Sam Houston Avenue, from 11th Street to SH 19
- Montgomery Road, from Veterans Memorial Parkway to Bowers Boulevard
- Intersection of Smither Drive and IH 45.

Field observations were also made during off-peak hours along the major roadways to make note of roadway elements such as:

- Posted speed limits
- Roadway geometry, including number of lanes
- Median type and shoulder
- Land use
- Major developments
- An inventory of bike and pedestrian infrastructure
- Traffic operational problems (e.g., long vehicle queues).

These roadway elements were used to update the transportation network in the travel demand model, which is discussed in Section 2.3. Some key observations involving signalized intersections and pedestrian walkability include:

Signalized Intersections

- Signals at the interchange of IH 45 and 11th Street need better coordination (Figure 2-6).
- Signals along 11th Street at Avenue M, Sam Houston Avenue, and University Avenue are spaced less than 500 feet apart and lack coordination. This results in vehicles stopping at multiple lights along the corridor.
- Further, the lack of turning lanes causes traffic to back up behind turning vehicles yielding for opposite traffic. This results in unused capacity on the inside lane.
- Figure 2-7 and Figure 2-8 show the signal coordination issues along 11th Street.
- Signals along Sam Houston Avenue at 16th Street, 17th Street, 19th Street, and 20th Street lack proper coordination.
- Signals along Sam Houston Avenue at Lake Road, Avenue I, Montgomery Road, and Sycamore Avenue lack proper coordination.

Figure 2-6: Signalized Intersection at IH 45 and 11th St

Figure 2-7: Signalized Intersection along 11th St

Figure 2-8: Queuing along 11th St at Ave M

Pedestrian Walkability

- High pedestrian activity was noted at the intersection of Sam Houston Avenue and Lake Road. The pedestrian walk time needs reevaluation. Vehicles making a left-turn on the northbound approach were noted to nearly miss colliding with pedestrians crossing the west crosswalk. Improving crosswalk visibility and width, in addition to utilizing protected left-turns, could increase pedestrian safety.
- Avenue I has crosswalks crossing Sam Houston Avenue but no pedestrian push buttons and signals (Figure 2-9).
- Some sidewalks were noted to be non-compliant with ADA requirements and have obstructions in the pedestrian path. An extensive sidewalk inventory may be needed to upgrade sidewalks to ADA standards. Figure 2-10 shows a non-ADA compliant sidewalk with a utility pole in the middle of the curb ramp at the intersection of 11th Street and Avenue M.

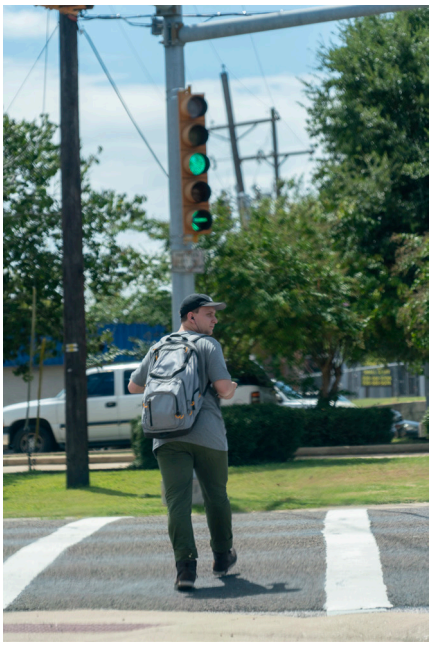


Figure 2-9: Pedestrian Walkability at Sam Houston Ave and Ave I

Figure 2-10: Pedestrian Walkability at 11th St and Ave M

2.3 Travel Demand Model

2.3.1 Overview

A travel demand model is an important tool for transportation planners that involves analyzing the typical sequence of how we travel and the choices made during each trip. The model is a trip-based model that uses a traditional Four-Step Transportation Forecasting process:

1. Trip Generation: Trips are produced as a function of land use.
2. Trip Distribution: Where are trips starting and ending?
3. Mode Choice: What modes are used to make the trip?
4. Trip Assignment: What route choices are made to reach the destination?

This Four-Step process is used to evaluate average traffic volumes based on the population present and employment forecasts and projected highway travel conditions.

The travel demand model from the previous transportation master plan was converted from TransCAD modeling software to CUBE modeling software. The conversion was made mainly to take advantage of advanced network editing features of CUBE. Some of the most important inputs to the model are: population and employment data (both existing and projected) and highway network representation.

The first step in the model application process is to develop a base year model to replicate current travel patterns with reasonable accuracy. Once the base year model is calibrated to existing traffic counts, then it can be applied to future conditions by updating the demographic and land use inputs as well as planned highway infrastructure. During the model conversion process, the population, employment and highway network inputs were updated to ensure the base year model has the most current data.

The demographic data from the American Community Survey was used to update the base year population and household data, and population projections were obtained from the Texas Demographic Center and 2016 Regional Water Plan. The employment projections were updated to be consistent with county level data maintained by the Houston-Galveston Area Council (H-GAC). Population and employment projections were used to develop growth rates for three (3) future scenarios: Year 2025, 2035, and 2045.

For the Base year model, every street coded in the model network was reviewed for accuracy in terms of capacity, posted speed limit, length, number of lanes and functional classification and updated, if necessary. For forecast year scenarios, all the planned infrastructure improvements on IH 45 and frontage roads in the City of Huntsville were incorporated in the model using schematic data that was available from TxDOT.

The various steps involved in model development and application are shown in Figure 2-11. The travel demand model was used as the starting point of discussion for evaluating transportation improvements for the Transportation Master Plan Update. Five (5) different scenarios were analyzed:

- Base Year Scenario: Existing conditions within the network were evaluated to ensure the model is able to replicate current conditions with acceptable accuracy.
- Future Year 2025 Scenario represents an evaluation of the roadway network conditions with TxDOT's IH 45 South Walker County Project completed with projected demographic data.
- Future Year 2035 Scenario represents an evaluation of the roadway network conditions with TxDOT's IH 45 Central Walker County Project completed with projected demographic data.
- Future Year 2045 Scenario represents an evaluation of the roadway network conditions with TxDOT's IH 45 Central Walker County Project completed with projected demographic data.

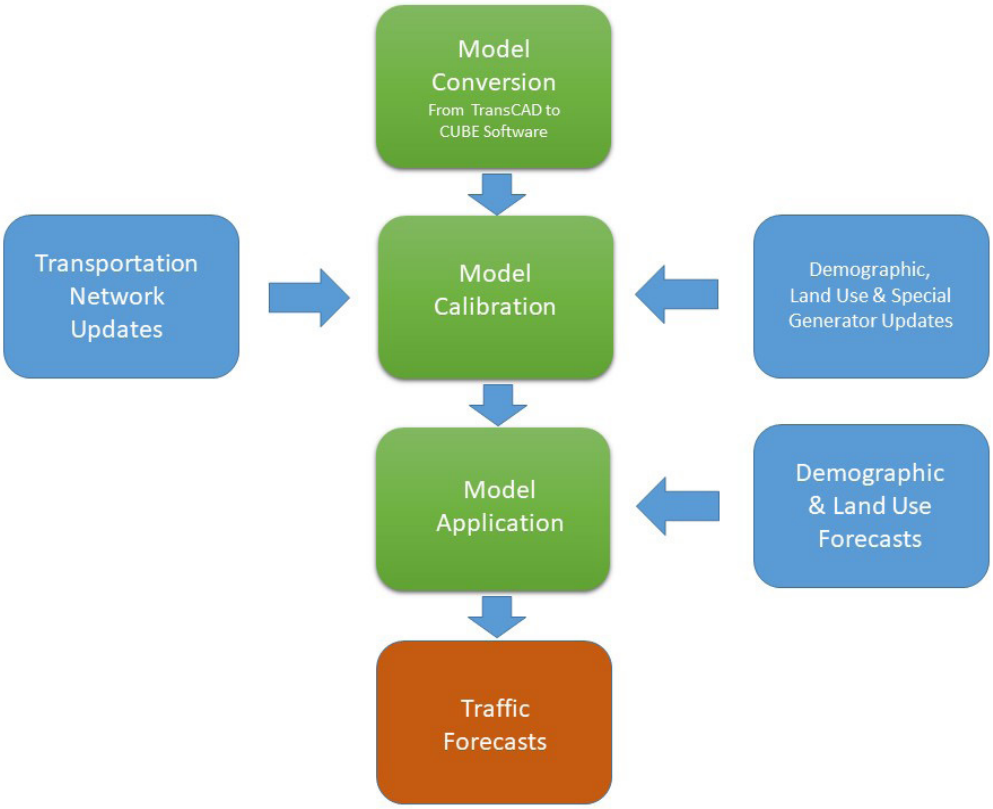


Figure 2-11: Travel Demand Model Development and Application Process

Source: Facebook @ City of Huntsville, TX

2.3.2 Performance Measures

The travel demand model generated two key measures for evaluating the base year and future year transportation network conditions: projected traffic volumes and volume-to-capacity ratio (V/C). V/C is a conventional level-of-service (LOS) measure for roadways, comparing roadway demand (vehicle volumes) with roadway supply (carrying capacity).

This measure can alert transportation planners to areas where traffic mitigation measures should be considered. Each roadway, based on roadway functionality in the model, is assigned with an estimated capacity in terms of maximum number of vehicles it can carry before experiencing operational failure. The model provides a count of the number of cars in the network, and this count is calculated against network capacity, or how many roads and travel lanes are available. In the past, exceeding a V/C ratio of 0.85 was considered a capacity deficiency. Today, a V/C of 1.0 is considered a more appropriate threshold due to a greater awareness of environmental issues, providing for multimodal choices, limited financial resources, and system operations.

2.3.3 Model Results

Across all scenarios, the three (3) arterials with the highest traffic volumes were

- 11th Street, from IH45 to Sam Houston Avenue
- Sam Houston Avenue, from Sycamore Avenue to Old Phelps Road
- 11th Street, from Martin Luther King Jr. Boulevard to Sycamore Avenue

Table 2-2 and Figures 2-12 through 2-15 below describe traffic volumes for key segments in Huntsville for all travel demand model scenarios.

Table 2-2: Travel Demand Model Daily Traffic Estimates

Segment	Daily Traffic Estimates (Vehicles)			
	Base Year 2018	Future Year 2025	Future Year 2035	Future Year 2045
FM 2821 from SH 75 to FM 247	14,000	15,000	16,000	17,000
FM 2821 from FM 247 to SH 19	9,500	11,000	12,000	13,500
SH 75 N from FM 2821 to 11th St	9,500	11,000	11,500	12,500
11th St from IH 45 to SH 75 S	25,000	27,500	30,000	32,000
11th St from SH 75 S to Sycamore Ave	17,000	18,000	23,000	24,000
SH 75 S from 11th St to Montgomery Rd	14,500	18,000	19,000	19,500
SH 75 S from Montgomery Rd to SH 19	21,000	22,000	23,000	25,000
Montgomery Rd from IH 45 to SH 75	15,000	16,000	16,500	17,000
Lake Rd From IH 45 to SH 75 S	11,000	14,500	16,000	17,000
Sycamore Ave from 11th St to SH 75 S	8,000	8,500	9,000	9,500
Bear Kat Blvd from Sycamore Ave to SH 19	3,000	3,100	3,200	3,500
Veterans Memorial Parkway, south of SH 30 to IH 45	9,000	9,500	10,000	10,500

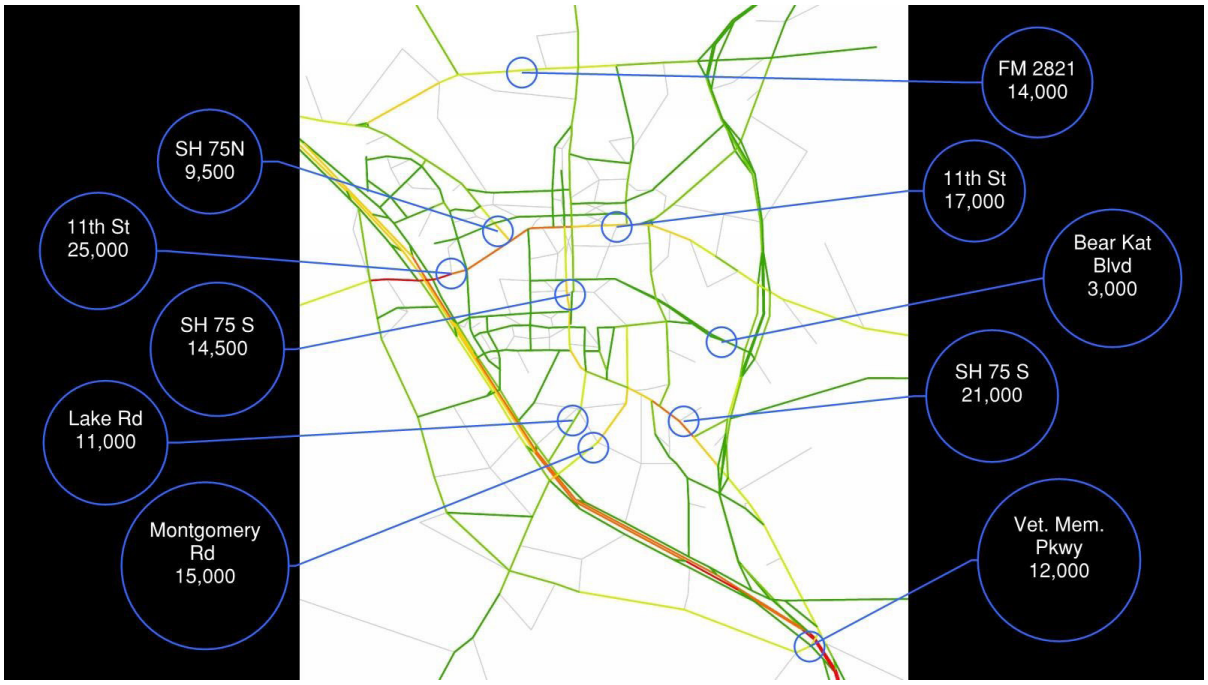


Figure 2-12: TDM - Base Year Daily Traffic Volume

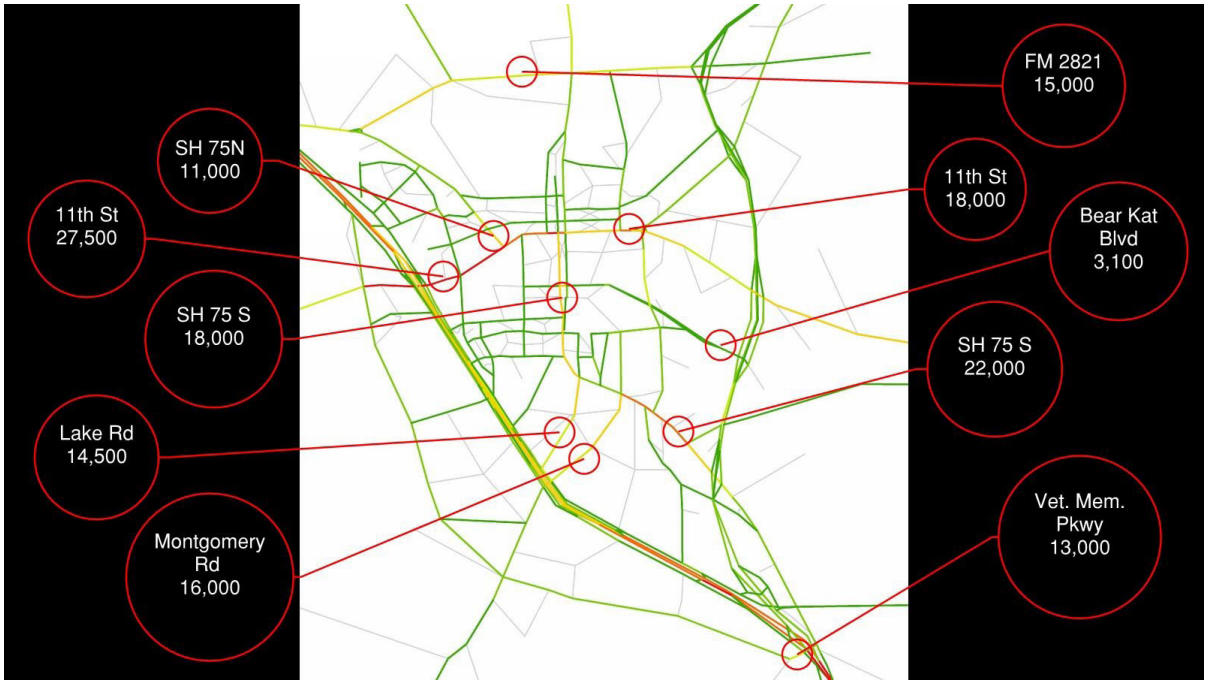


Figure 2-13: TDM - Year 2025 Daily Traffic Volume

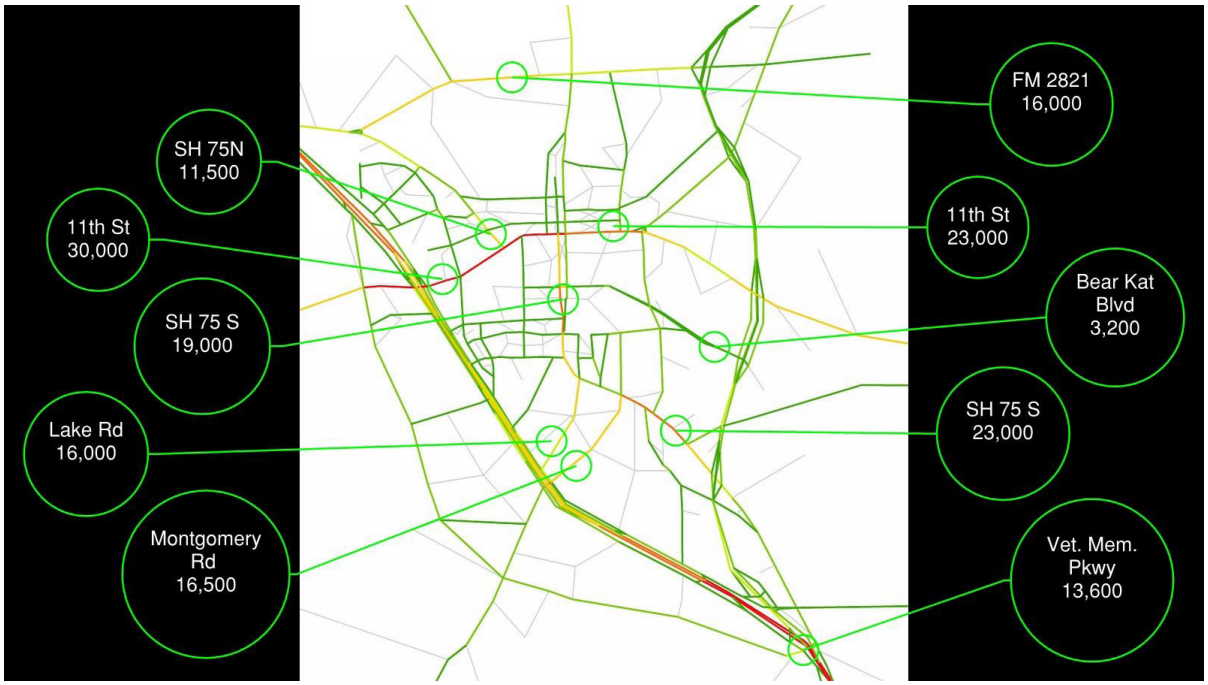


Figure 2-14: TDM - Year 2035 Daily Traffic Volume

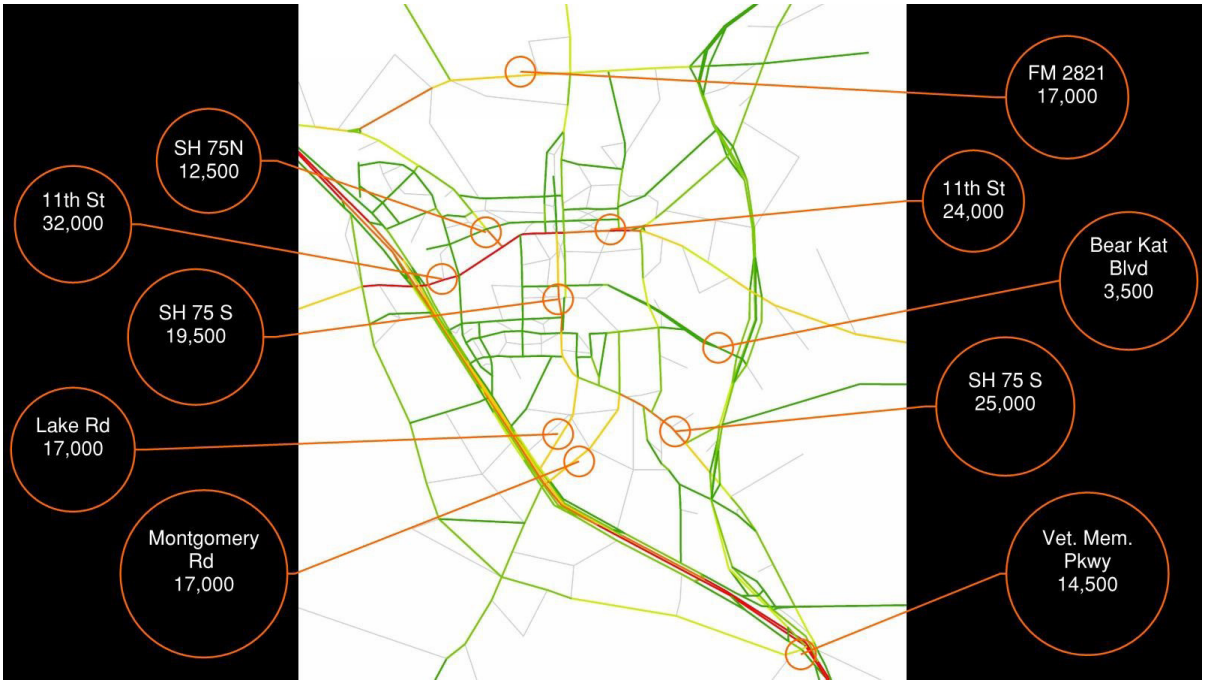


Figure 2-15: TDM - Year 2045 Daily Traffic Volume

3. Recommendations

3.1 Roadway Classification

Roadways are classified for specific uses within the transportation network. Currently the City of Huntsville defines six (6) types of classifications within its roadway system.

3.1.1 Freeways

Intended to move high volumes of automobile traffic at relatively high speeds over long distances, freeways (or highways) also have limited access to help maximize traffic flow and safety. Freeways are generally accessed via on-ramps from frontage roads or direct connectors from other high-speed facilities. Freeways' primary function is to connect local areas to other regions, rather than serve local traffic needs.

Currently, IH 45 provides north-south freeway access to the Huntsville area, and connects to Houston on the south and Dallas on the north.

Figure 3-1: IH 45 at SH 30

3.1.2 Expressways

Expressways are similar to Freeways and designed for high speed traffic, with controlled entrances and exits. They are typically two (2) or more lanes in each direction with physical barrier separating the opposite directions of traffic. Cross-streets are connected through on and off-ramps with a very limited number of at-grade intersections.

SH 19 traveling north-south is the only designated Expressway in the Huntsville area, providing access into the city via six (6) interchanges and an at-grade signalized crossing at Old Colony Road.

Figure 3-2: SH 19 near SH 30

3.1.3 Primary and Secondary Arterials

These are continuous routes whose function is to serve high volume needs of local traffic and regional traffic. Speeds are relatively high on arterial streets, and access is controlled by planning the locations of intersecting streets, left turn lanes, and traffic signals. Arterial roads will function more efficiently when the number and location of median breaks and driveway cuts is managed. Arterial streets provide connectivity across the transportation network, so it is best practice to consider all modes on these streets. Due to the high automobile speeds, protective measures should be established for cyclists and pedestrians along these routes.

Within the City of Huntsville, 11th Street, Sam Houston Avenue, SH 75, University Avenue, Veterans Memorial Parkway and part of Montgomery Road are classified as Primary Arterials. FM 2821, SH 30 east of Sycamore Avenue, Martin Luther King Jr Boulevard, Bear Kat Boulevard, Col Etheridge Boulevard, part of Smither Drive and Montgomery Road are classified as Secondary Arterials.

Figure 3-3: Sam Houston Avenue at Avenue I

3.1.4 Collectors

Designed for medium volumes of vehicles operating at lower speeds (i.e., 30 – 35 mph), collectors provide access and movement within residential, commercial, and industrial areas. Direct access to higher intensity development, such as commercial, daycare, places of worship, schools, and multi-family uses calls for lower speed limits on collectors than arterials due to more turning movements on collectors. Slower speed limits increase safety. Direct access to single-family development is generally not encouraged, with access from local streets being preferred. Lake Road, Normal Park Drive, I-45 Frontage Road, Avenue M are some examples of collectors within the City of Huntsville.

3.1.5 Local Streets

Local streets give access to smaller often destination-oriented areas, such as neighborhoods, subdivisions or local business districts. Pedestrian activity can be expected to be higher on local streets, while traffic volumes are lower, so lower speed limits are appropriate. Because local streets are intended to carry traffic of the main transportation network rather than through it, these streets generally do not travel across districts and usually are more residential in character.

Figure 3-4: 17th St near University Ave

3.1.6 Proposed Roadway Classification Changes

As part of the TMP update, current roadway classification was reevaluated and no change was made. While having six (6) classes of roadway allows flexibility in planning and designing roadways, any new classes of streets are deemed unnecessary at this time. The classification of individual streets was reevaluated and the following three (3) changes are recommended:

- Sycamore Avenue is a key north-south collector roadway providing alternative connection between 11th Street and Sam Houston Avenue. This street currently contains a mix of commercial and residential land uses. It is recommended that Sycamore Avenue is converted into a secondary arterial providing enough ROW for a better cross-section. See more detailed discussion in Section 3.3.4.
- Montgomery Road is a key roadway providing access into the City and SHSU from IH 45. Montgomery Road is designated as a primary arterial to the west of IH 45 and as a secondary arterial to the east of IH 45. It is recommended that the portion east of IH 45 is designated as primary arterial as well, to plan projects addressing the growing traffic demand. See more detailed discussion in Section 3.3.3.
- FM 2821 is a key east-west roadway on the north side of the City and is currently designated as a secondary arterial. It provides connection to IH 45 on the west and SH 19 on the east. It is recommended that this street is converted to a primary arterial to promote development towards the north of the City.

Figure 3-5 below shows the proposed road classification of the city.

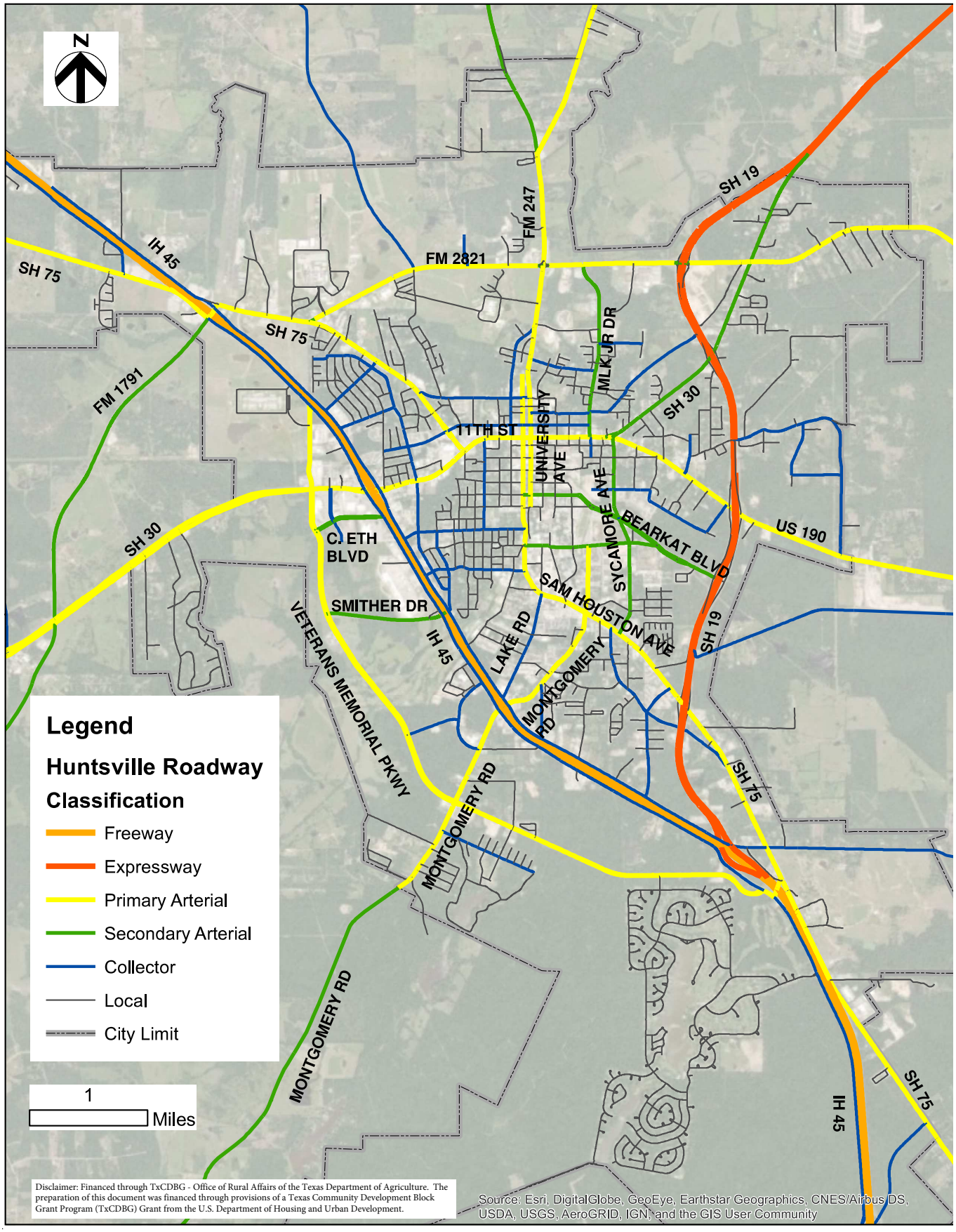


Figure 3-5: Proposed Roadway Classification

3.2 Potential Cross Sections

Several street cross sections are proposed for the three (3) main existing road types (Arterials, Collectors and Local Streets) in Huntsville to balance vehicular travel and storage lanes with active transportation facilities for biking and walking (Appendix B). These cross sections can be considered a resource in the toolbox to consider when evaluating roadway reconstruction, repaving, or remarking projects. The proposed cross sections account for a combination of factors such as the number of vehicle lanes, vehicle speeds, traffic volumes, roadway functional classification and different levels of comfort for pedestrians and bicyclists. As an ideal scenario, the proposed cross sections include center medians with turning lanes at intersections, for improved access management, walkability, and to reduce mode conflicts. Factors such as right-of-way (ROW) constraints, project funding and community preferences shall be taken into considerations while providing median as part of a proposed cross-section.

A comparison of current design guidelines and proposed ROW and typical cross-section requirements for different classes of roadway is provided in Table 3-1 below:

Table 3-1: Current and Proposed Roadway Design Guidelines

Street Classification	Existing Travel Lanes	Existing Parking Lanes	Existing Minimum ROW Width (Feet)	Existing Minimum Pavement Width (Feet)	Proposed Travel Lanes	Proposed Parking Lanes	Proposed Minimum ROW Width (Feet)	Proposed Minimum Pavement Width (Feet)
Arterial								
Primary Arterial	5	2	120	90	4	0	100	84
Secondary Arterial	5	0	90	61	-	-	-	-
Collector								
Standard Collector	2	2	70	41	2	2	72	52
Local								
Standard Local	2	1	50	32	2	0	48	32

3.3 Corridor of Focus

3.3.1 11th St

Profile

11th Street from Veterans Memorial Parkway to Sycamore Avenue is the major east-west corridor of Huntsville with two (2) lanes in each direction and a two way left-turn lane for part of the corridor (Figure 3-6 and Figure 3-7). This roadway connects IH 45 on the west side of the City to SH 30 and US 190 on the east. Traffic generators such as HEB, Town Square, the Huntsville Prison Unit, Walker County Courthouse, and City Hall are established along 11th Street or within a block of this roadway. The speed limit on 11th Street is 45 mph from Veterans Memorial Parkway to Financial Plaza, 40 mph from Financial Plaza to Avenue O, and 35 mph from Avenue O to Sycamore Avenue. This two-mile corridor has thirteen (13) signalized intersections and eleven (11) unsignalized intersections.

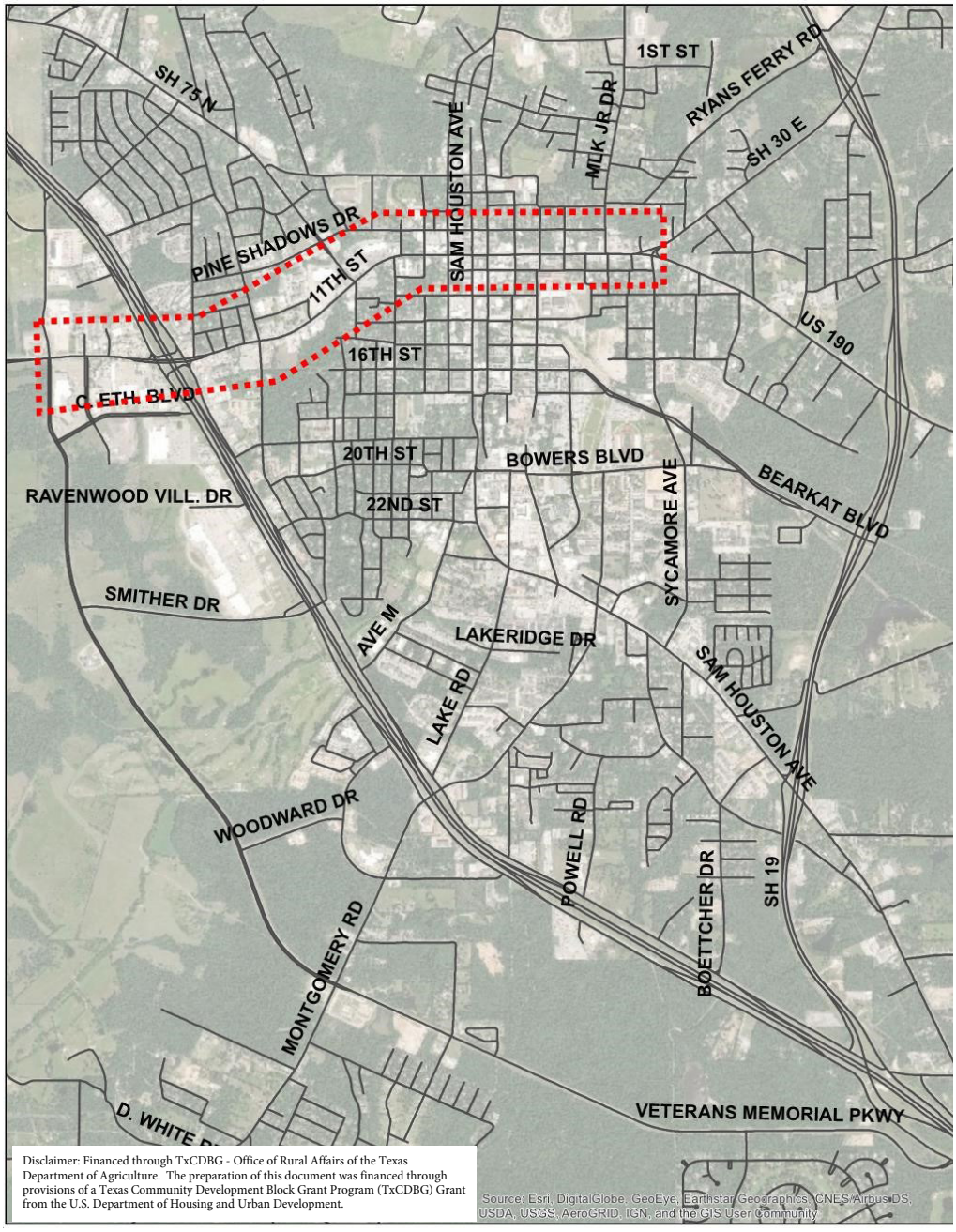


Figure 3-6: 11th St Corridor

Issues

The lack of coordination between signalized intersections, specifically at closely spaced intersections, prevents an efficient flow of traffic along this corridor. This is especially evident between Avenue M and Sam Houston Avenue, which are about 460 feet apart, and between Sam Houston Avenue and University Avenue, which are about 300 feet apart. Another issue is the need for dedicated left-turn lanes at intersections along 11th Street between SH 75 North and Avenue I. Left turning vehicles along this segment of 11th Street cause delay for the through traffic, and hence, under-utilizing the capacity of the inside lane. The sidewalks are narrow, discontinuous, cracked and obstructed by physical objects along this important commercial corridor, thus discouraging any pedestrian activity between businesses.

Figure 3-7: 11th St and Normal Park Drive

Recommended Improvements

Short-Term

Coordination of signalized intersections from Veterans Memorial Parkway to Normal Park Drive and from SH 75 North to Sycamore Avenue will improve the traffic flow along the corridor. For the delay caused by left-turning traffic, adding left-turn storage lanes is a typical solution, but the right-of-way along this corridor is limited, thus a left-turn storage lane cannot be added at every intersection. One solution may be to restrict left-turns at closely spaced intersections. This will improve the flow of through traffic, and left-turning traffic will have to reroute. Another possible solution is to replace through lanes with a left-turn storage lane at only certain intersections while restricting left-turns at other intersections. Overall, coordinating these intersections, adjusting signal timings, and rerouting the left-turn traffic are all vital parts to promoting an efficient flow of traffic.

Long-Term

With the right-of-way restrictions on 11th Street, a more creative solution might be necessary to improve the traffic operation of this corridor. Converting 10th and 11th Street into a one-way couplet is a possibility. As the name implies, each of these streets would only allow traffic in one direction. This change would eliminate opposing traffic conflicts such as the left-turn movement on the east/west approaches and provides both

operational and safety benefits. In addition, this roadway change will also increase the space for turn lanes, additional thru lanes, bike lanes, and wider sidewalks while maintaining street parking. Lowering the speed limit and improving pedestrian walkability can create a downtown atmosphere promoting social and economic benefits. This would also provide an opportunity to develop livable streets along the corridor to convert it into a destination rather than a pass-through. More traffic analysis will be needed to fully determine the impact of converting 10th and 11th Street to one-way streets.

Cross Sections

Designing new cross sections depends on the available ROW and the specific needs of each corridor. Potential cross sections should be considered on a segment by segment basis. One (1) potential cross section for 11th Street is a four-lane roadway with a raised median and sidewalks on both sides (Figure 3-8). The raised median would provide a physical barrier for vehicular traffic, thus decreasing the chance for head-on collisions. The raised median would also provide turning lanes at appropriate intersections and consolidated set of driveways, which promotes safer left-turn movements. Furthermore, adding sidewalks to both sides of the roadway would increase pedestrian access to storefronts along the corridor, which can have potential health, economic, and transportation benefits.

Based on the travel demand modeling, the western portion of this corridor near IH 45 is anticipated to receive about 32,000 vehicles per day in 2045. Hence, a six-lane roadway with raised median and sidewalks on both sides may be considered (Figure 3-9). This type of cross section can have a similar positive impact to the previously described four lane cross section while also increasing the capacity of the roadway.

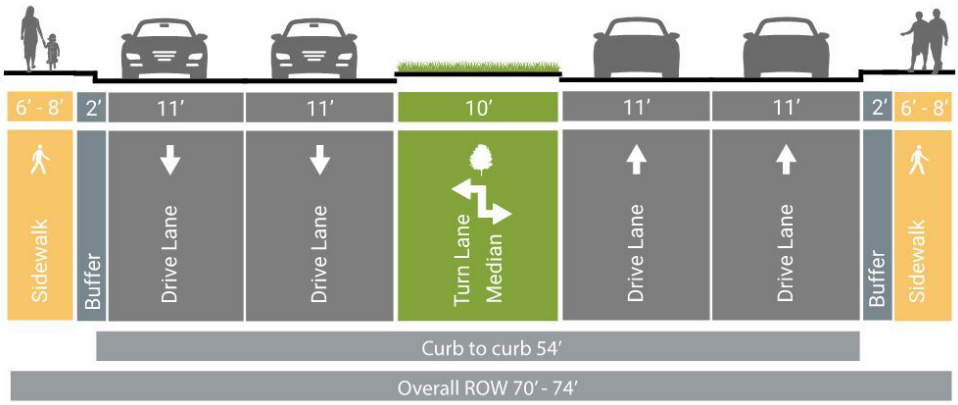


Figure 3-8: Four Lanes with Raised Median and Sidewalks

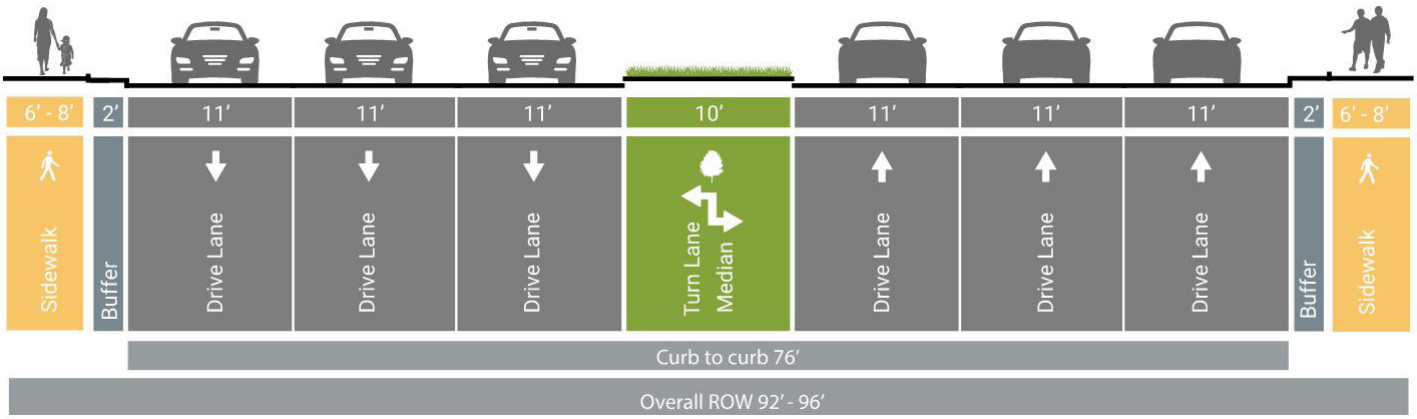


Figure 3-9: Six Lanes with Raised Median and Sidewalks

3.3.2 Sam Houston Avenue South

Profile

Sam Houston Avenue from 11th Street to SH 19 is a major north-south corridor in Huntsville (Figure 3-10 and Figure 3-11). Currently, this corridor has two (2) different cross-sections. The northern portion between 11th Street and Montgomery Road has two (2) lanes in each direction. The southern portion between Montgomery Road and SH 19 also has two (2) lanes in each direction in addition to a two way left-turn lane. The speed limit on Sam Houston Avenue is 30 mph from 11th Street to Lake Road, 35 mph from Lake Road to Sycamore Avenue, and 40 mph from Sycamore Avenue to SH 19.

The land uses along the corridor include residential neighborhoods and multi-family housing to the west and the SHSU campus to the east. In addition to residential and educational land uses, many restaurants and shops are established in this area, which attracts a significant amount of vehicular and pedestrian traffic. Overall, this corridor has eleven (11) signalized intersections and fourteen (14) unsignalized intersections within a three-mile stretch.

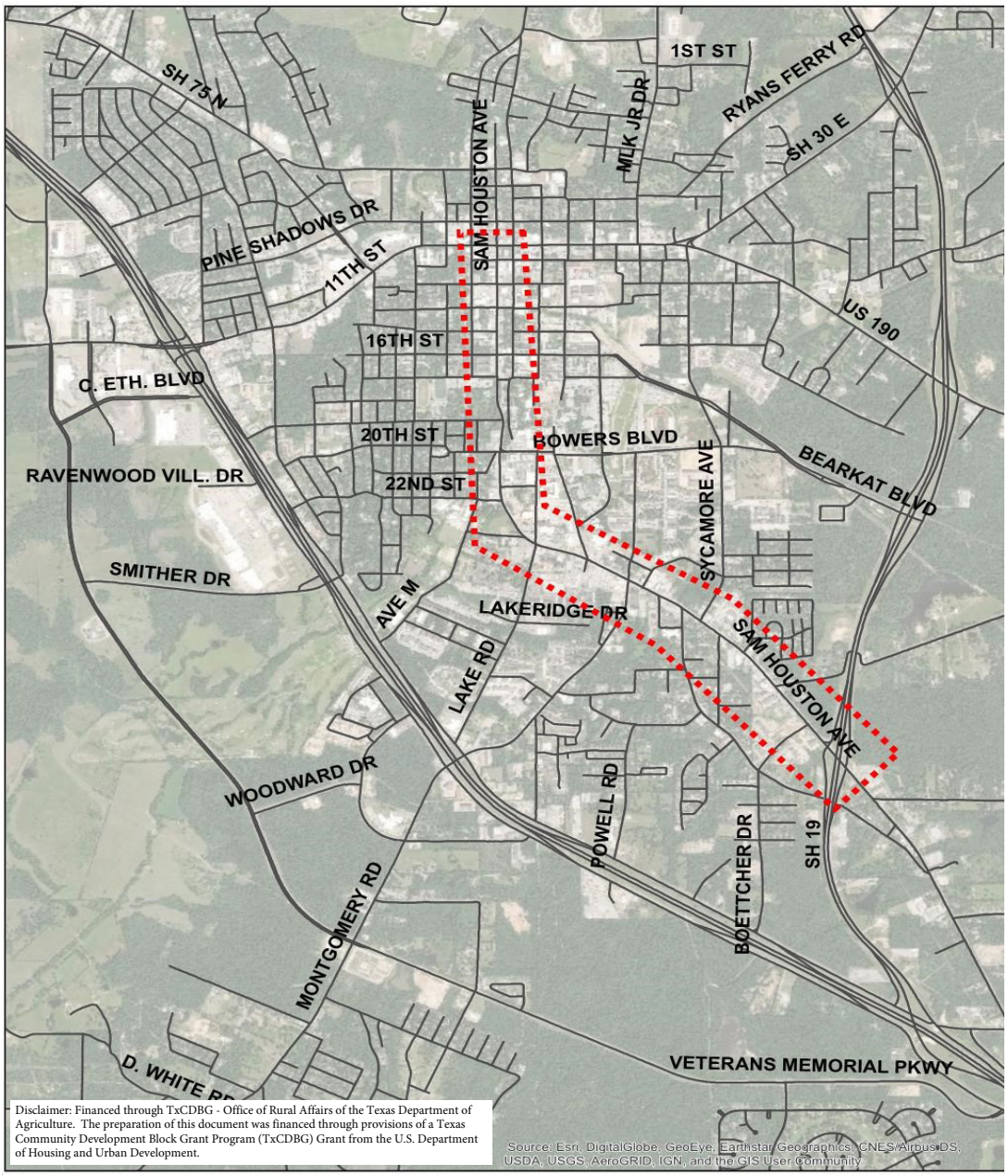


Figure 3-10: Sam Houston Avenue Corridor

Issues

The lack of coordination between signalized intersections, specifically at closely spaced intersections prevents an efficient flow of traffic along this corridor. In addition, the northern portion of this corridor does not have left-turn storage lanes. Left turning vehicles cause delay for the through traffic and hence under-utilizing the capacity of the inside lane.

Pedestrian walkability is another issue at specific intersections. During the field visit, the Lake Road crossing did not appear to give sufficient time for pedestrians to cross Sam Houston Avenue. In addition, vehicles making a left-turn on the northbound approach of Lake Road have a permissive phase in which the vehicle has to yield to pedestrians, but this puts a driver's patience against an active pedestrian walking area. With the completion of the housing development at Lake Road, the foot traffic will increase and the potential for crashes involving pedestrians may increase as well.

Another intersection of concern is at Avenue I. This roadway has crosswalks to cross Sam Houston Avenue, but there are no pedestrian push buttons or pedestrian signal heads to indicate when pedestrians have the right-of-way.

Figure 3-11: Sam Houston Avenue and 13th Street

Recommended Improvements

Short-Term

A traffic study is needed to properly coordinate the traffic signals in this corridor. In addition, monitoring the pedestrian traffic and understanding which intersections have a greater need for improving pedestrian infrastructure and a need for providing adequate walk time is crucial to managing the pedestrian traffic. A possible solution is to improve the pedestrian infrastructure, such as crosswalk markings, curb ramps, pedestrian signals and push buttons. Coordinating the signals and developing an understanding of the pedestrian needs will improve the vehicular and pedestrian traffic flow while maintaining a high level of safety

for pedestrians. Furthermore, signalization may be considered for 22nd Street, pending a traffic signal warrant study.

Long-Term

In the long run, a more creative solution to improving traffic flow for pedestrians and vehicles may be to convert Sam Houston Avenue and University Avenue to a one-way couplet. This change would eliminate opposing traffic conflicts, such as the left-turn movement on the north/south approaches, and provides both operational and safety benefits. In addition, this roadway change would also increase the space for turn lanes, additional through lanes, bike lanes, wider sidewalks, and potential street parking.

Lowering the speed limit and improving pedestrian walkability can create a downtown atmosphere promoting social and economic benefits. This would also provide an opportunity to develop livable streets along the corridor to convert it into a destination rather than a pass-through. More traffic analysis will be needed in order to fully understand the impact of converting Sam Houston Avenue and University Avenue to one-way streets.

Another potential improvement is to widen the roadway to six (6) lanes from Montgomery Road to SH 19. Based on the travel demand modeling, this part of the corridor is anticipated to receive about 25,000 vehicles per day by 2045, hence may warrant six (6) travel lanes. One (1) other potential improvement that came in discussion during the stakeholder outreach is providing a pedestrian bridge across Sam Houston Avenue near Lake Road. This can be considered as a long-term option to address the heavy pedestrian conflicts along Sam Houston Avenue. However, this option might require a detailed analysis to evaluate an appropriate location, the cost-benefit aspect and funding through a public-private partnership with SHSU, TxDOT, and the City of Huntsville as primary partners.

Cross Sections

For the northern segment of this corridor from 11th Street to Montgomery Road, a four (4) lane roadway with a raised median and sidewalks on both sides of the roadway is a potential cross section (Figure 3-8). The raised median would provide a physical barrier for opposing vehicular traffic decreasing the chance for head-on collisions. The raised median would also provide turning lanes at appropriate intersections, which promotes safer left-turn movements. Lastly, some sidewalks are not ADA-compliant in this corridor. Improving the pedestrian accessibility to storefronts along the corridor can have potential health, economic, and transportation benefits.

For the southern segment of this corridor from Montgomery Road to SH 19, a six (6) lane roadway with raised cycle track and sidewalks is a potential cross section (Figure 3-12). In addition to the benefits of a raised median and increasing the capacity of the roadway, the cycletrack would allow the use of bikes as a viable means of alternative transportation to and from the SHSU campus. Refer to the bike network plan in Section 3.4.2.

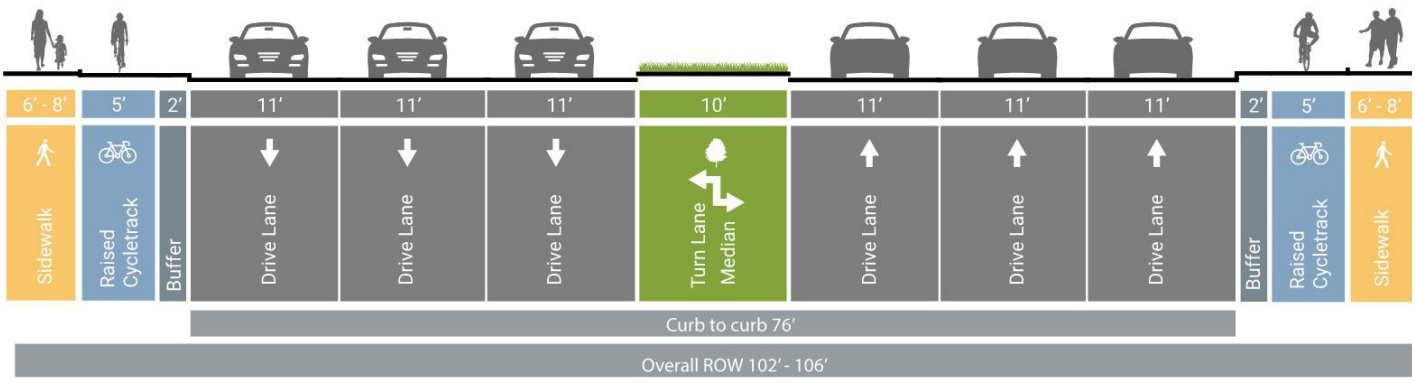


Figure 3-12: Six Lanes with Raised Cycletrack and Sidewalk

3.3.3 Montgomery Road

Profile

Based on the roadway characteristics and cross-sections, Montgomery Road can be divided into three (3) segments: Darrell White Road to IH 45, IH 45 to Sam Houston Avenue, and Sam Houston Avenue to Bowers Boulevard (Figure 3-13 and Figure 3-14). The south segment has one (1) lane in each direction. The middle segment has two (2) lanes in each direction, and the north segment has one (1) lane in each direction with a two way left-turn lane. The speed limit on Montgomery Road is 55 mph from Darrell White Road to IH 45, 45 mph from IH 45 to Sam Houston Avenue, and 30 mph from Sam Houston Avenue to Bowers Boulevard.

In terms of traffic generators, a medical center is located about a quarter mile south of the IH 45 and Montgomery Road interchange. There are multiple housing developments along the middle segment of Montgomery Road. Along the north segment of the corridor that ends at the SHSU campus are many housing developments, including student housing. Overall, this corridor has four (4) signalized intersections and nine (9) unsignalized intersections.

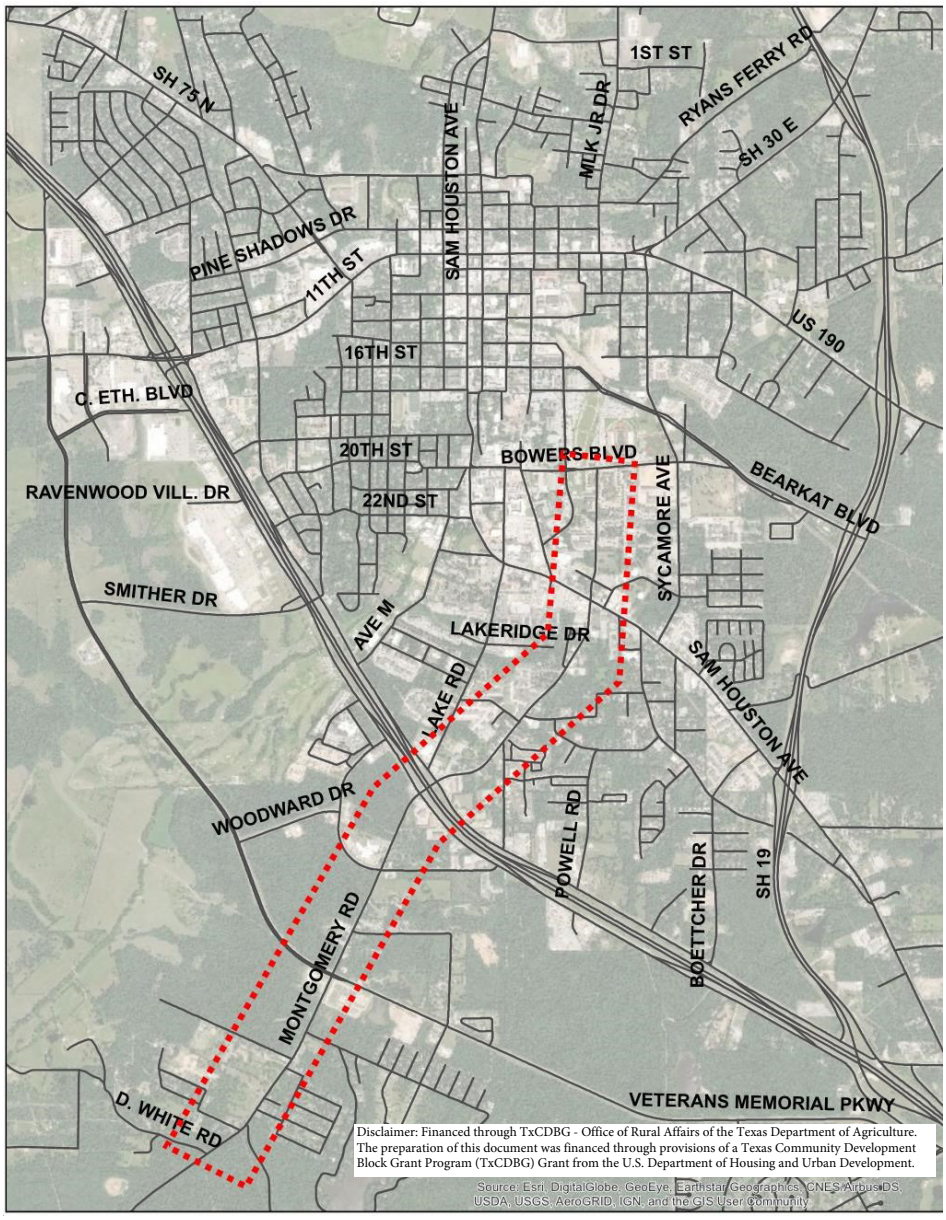


Figure 3-13: Montgomery Road Corridor

Figure 3-14: Montgomery Road and Sam Houston Avenue

Issues

Montgomery Road is a primary access to SHSU campus and into the City. TxDOT is rebuilding the interchange with IH 45 as part of the segment 2A project. This may increase the demand of vehicular traffic along this corridor. The middle segment of the corridor is expected to receive about 17,000 vehicles per day in 2045. In addition, the intersection of Montgomery Road and Sam Houston Avenue is highly congested during peak periods with major queuing on the northbound approach during the afternoon peak period.

Recommended Improvements

Short-Term

The functional classification of Montgomery Road from IH 45 to Sam Houston Avenue should be upgraded from a secondary arterial to a primary arterial. The Montgomery Road and Sam Houston Avenue intersection should be improved. Adding a dedicated right-turn lane for the northbound approach is likely a part of the solution. A traffic study is needed to determine the best lane geometry for this intersection and to update the signal timing appropriately.

Mid-Term

The south side of Montgomery Road from IH 45 to Darrell White Road should be widened to four (4) lanes for future developments, west of IH 45 and along Veterans Memorial Parkway.

Cross Sections

For the segment of Montgomery Road between IH 45 and Sam Houston Avenue, a four-lane roadway with a raised median and side paths is a potential cross section (Figure 3-15). The raised median would provide a physical barrier for opposing vehicular traffic decreasing the chance for head-on collisions. The raised median would also provide turning lanes at appropriate intersections, which promotes safer left-turn movements into the housing developments along Montgomery Road. The side path is a shared path for pedestrians and cyclists and would allow the use of bikes as a viable means of alternative transportation.

For the segment of Montgomery Road from Sam Houston Avenue to Bowers Boulevard, a two-lane roadway with a raised median, sidewalks, and a bike lane is a potential cross section (Figure 3-16). As stated previously, the raised median has safety benefits. The bike path would allow citizens to use bikes as a means of travel to and from SHSU and Sam Houston Avenue.

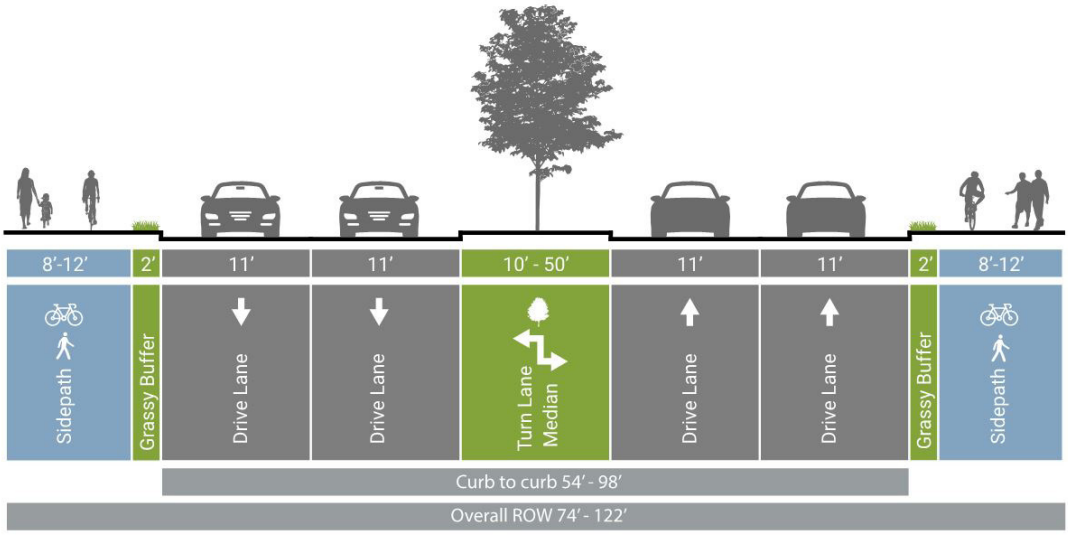


Figure 3-15: Four Lanes with Side Path

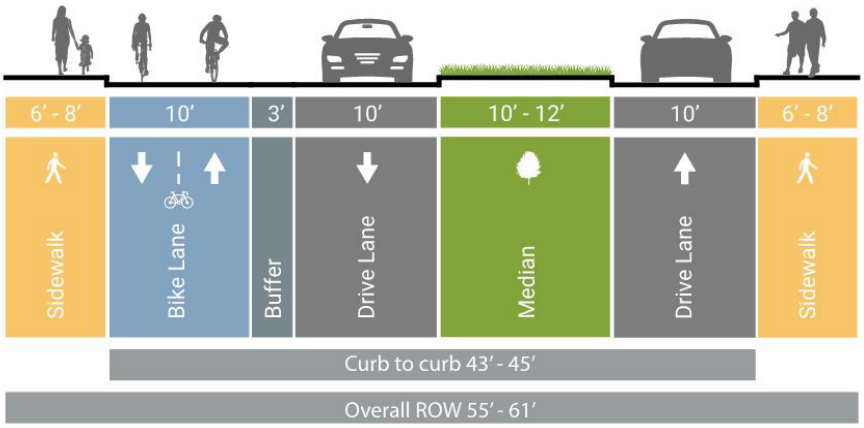


Figure 3-16: Two Lanes with Bike Path

3.3.4 Sycamore Avenue

Profile

Sycamore Avenue is a north-south roadway with one (1) lane in each direction and a two way left-turn lane for the majority of the roadway. This corridor begins at Sam Houston Avenue and ends at 11th Street (Figure 3-17 and Figure 3-18). The main land use for Sycamore Avenue is residential with a mix of apartments and single family homes. The speed limit on Sycamore Avenue is 30 mph. Overall, the corridor has two (2) signalized intersections and eight (8) unsignalized intersections within a 1.5-mile stretch.

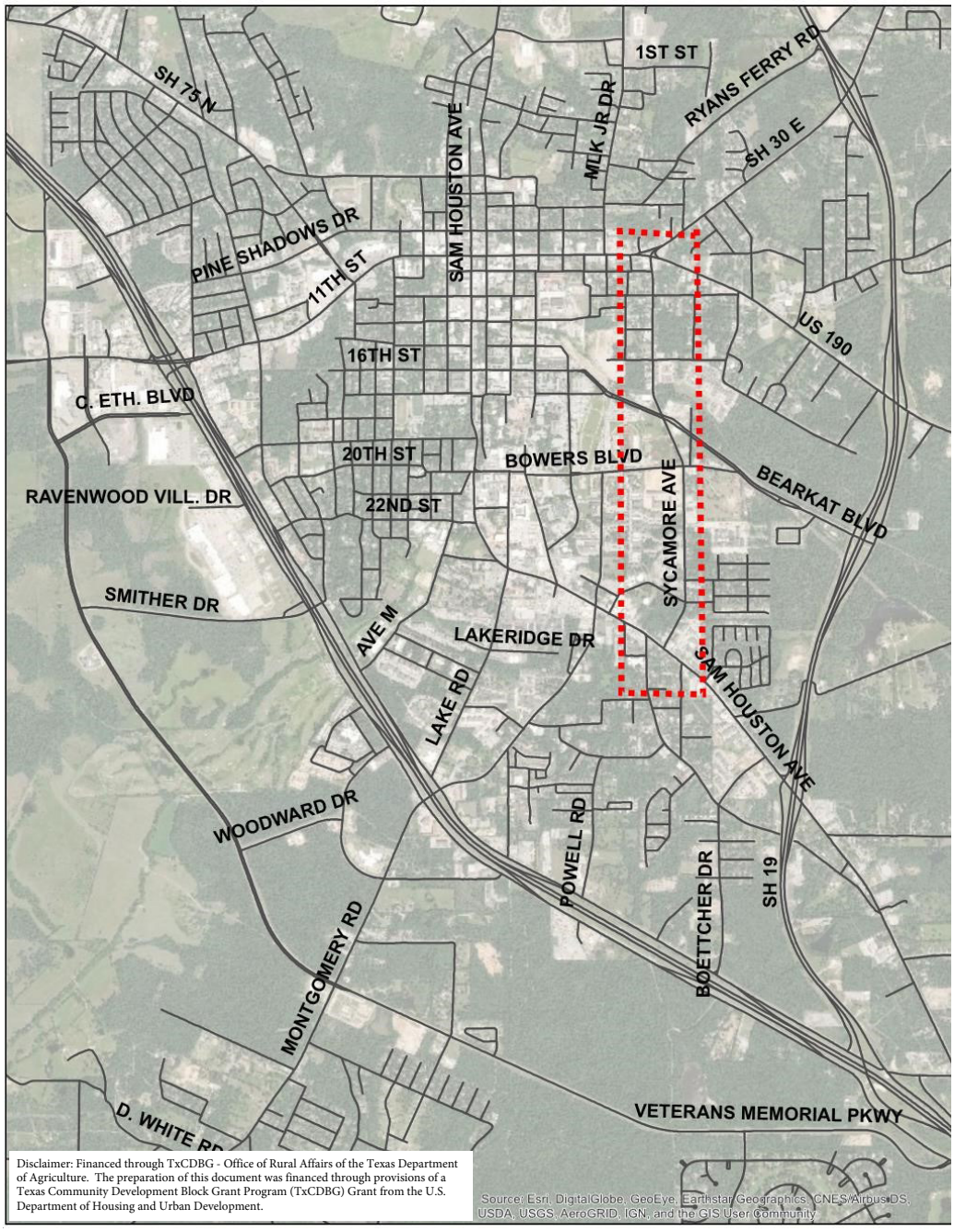


Figure 3-17: Sycamore Avenue Corridor

Figure 3-18: Sycamore Avenue South of Bowers Boulevard

Issues

This corridor does not currently show any major issues. The travel demand model daily traffic estimates (9,500 vehicles per day in 2045) for Sycamore Avenue suggest that this roadway is a good alternative north-south corridor to other congested corridors such as Sam Houston Avenue.

Recommended Improvements

Short-Term

Upgrading the functional classification of Sycamore Avenue from Collector to a secondary arterial will provide opportunities to preserve enough right of way and utilize it as an alternative north-south corridor.

Mid-Term

This corridor should be expanded to two (2) lanes in each direction with sidewalks and bike lanes.

Cross Sections

A four-lane roadway with a raised median and side paths is a potential cross section for Sycamore Avenue (Figure 3-15). The raised median would provide a physical barrier for opposing vehicular traffic decreasing the chance for head-on collisions. The raised median would also provide turning lanes at appropriate intersections, which promotes safer left-turn movements into the housing developments along Sycamore Avenue. The side path is a shared path for pedestrians and cyclists that would allow the use of bikes as a viable means of alternative transportation to Sam Houston Avenue, University Avenue, and 11th Street.

3.3.5 Lake Road

Profile

Lake Road is a northeast-southwest roadway with one (1) lane in each direction. This corridor begins at IH 45 and ends at Sam Houston Avenue where it becomes Avenue J on the north side of Sam Houston Avenue (Figure 3-19 and Figure 3-20). The main land use for Lake Road is residential with multiple apartments, most of which are occupied by SHSU students. The speed limit on Lake Road is 35 mph from IH 45 to Lakeridge Drive and 30 mph from Lakeridge Drive to Sam Houston Avenue. Overall, the corridor has one (1) signalized intersection and four (4) unsignalized intersections within a one-mile stretch.

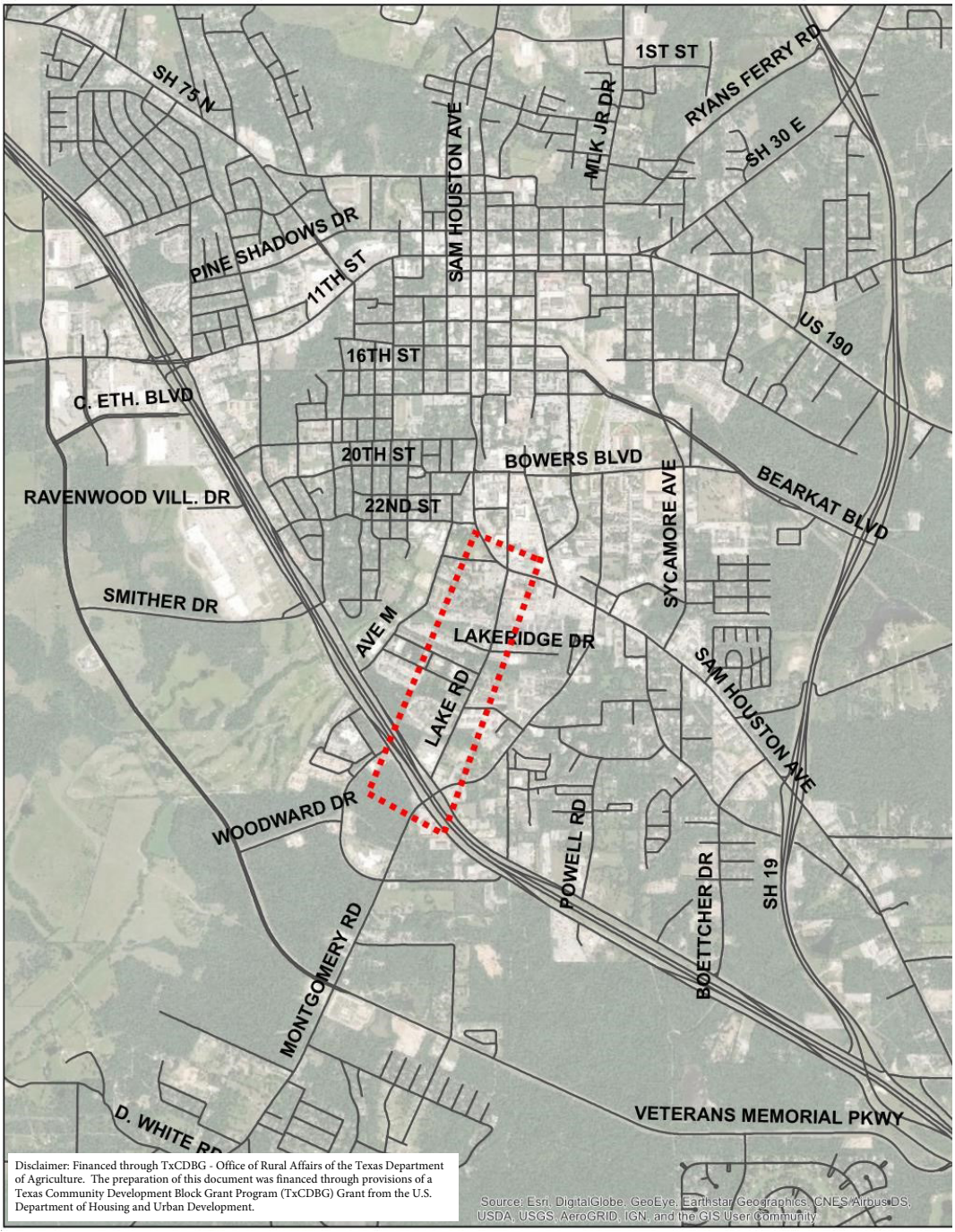


Figure 3-19: Lake Road Corridor

Figure 3-20: Lake Road and Sam Houston Avenue

Issues

The major issue along this corridor is at the Sam Houston Avenue intersection. This is an active pedestrian zone with many students walking back and forth from the campus to the apartments. Vehicles making a left-turn on the northbound approach were noted to nearly miss colliding with pedestrians crossing the west crosswalk, and the pedestrian walk time needs reevaluation. Lack of pavement markings and signs, narrow ROW, and steep grades are other issues.

Recommended Improvements

Short-Term

The signal timing and operation for vehicles and pedestrians at the Lake Road and Sam Houston Avenue intersection should be reevaluated. Implementing protected left-turn only signal operation would allocate a certain amount of time for drivers to safely make left-turns, rather than forcing drivers to be aware of both opposing traffic and pedestrians on the crosswalks during permissive left-turn signal operation.

Long-Term

A pedestrian-only bridge to cross Sam Houston Avenue is a potential solution to improving pedestrian safety. However, this option might require a detailed analysis to evaluate an appropriate location, the cost-benefit aspect and funding through a public-private partnership with SHSU, TxDOT and City as primary partners.

Cross Sections

A two-lane roadway with a raised median, sidewalks, and a bike lane is a potential cross section for Lake Road (Figure 3-16). The bike path would allow the residents of this corridor, much of whom are students, to use bikes as a means of travel from the housing developments to Sam Houston Avenue and to the campus.

3.3.6 Veterans Memorial Parkway

Profile

Veterans Memorial Parkway is mainly a northwest-southeast roadway that begins and ends at IH 45 and also runs parallel to the interstate (Figure 3-21 and Figure 3-22). The first segment of this corridor from IH 45 to SH 30 has one (1) lane in each direction with a two way left-turn lane. The middle segment from SH 30 to Montgomery Road has two (2) lanes in each direction with a raised median, which has crossovers at different intervals. The third segment from Montgomery Road to IH 45 has one (1) lane in each direction with only a painted median. The land use along this roadway is mixed with large shopping complexes and the Huntsville Medical Center established between Veterans Memorial Parkway and IH 45 on the south end. Along the south segment of this roadway from Montgomery Road to IH 45 are many upcoming housing developments. The speed limit on Veterans Memorial Parkway starting at the north end of the roadway is 30 mph from IH 45 to Colonel Etheridge Boulevard and 45 mph from Colonel Etheridge Boulevard to IH 45 at the south end of the roadway. Overall, the corridor has one (1) signalized intersection and nine (9) unsignalized intersections within a six-mile stretch.

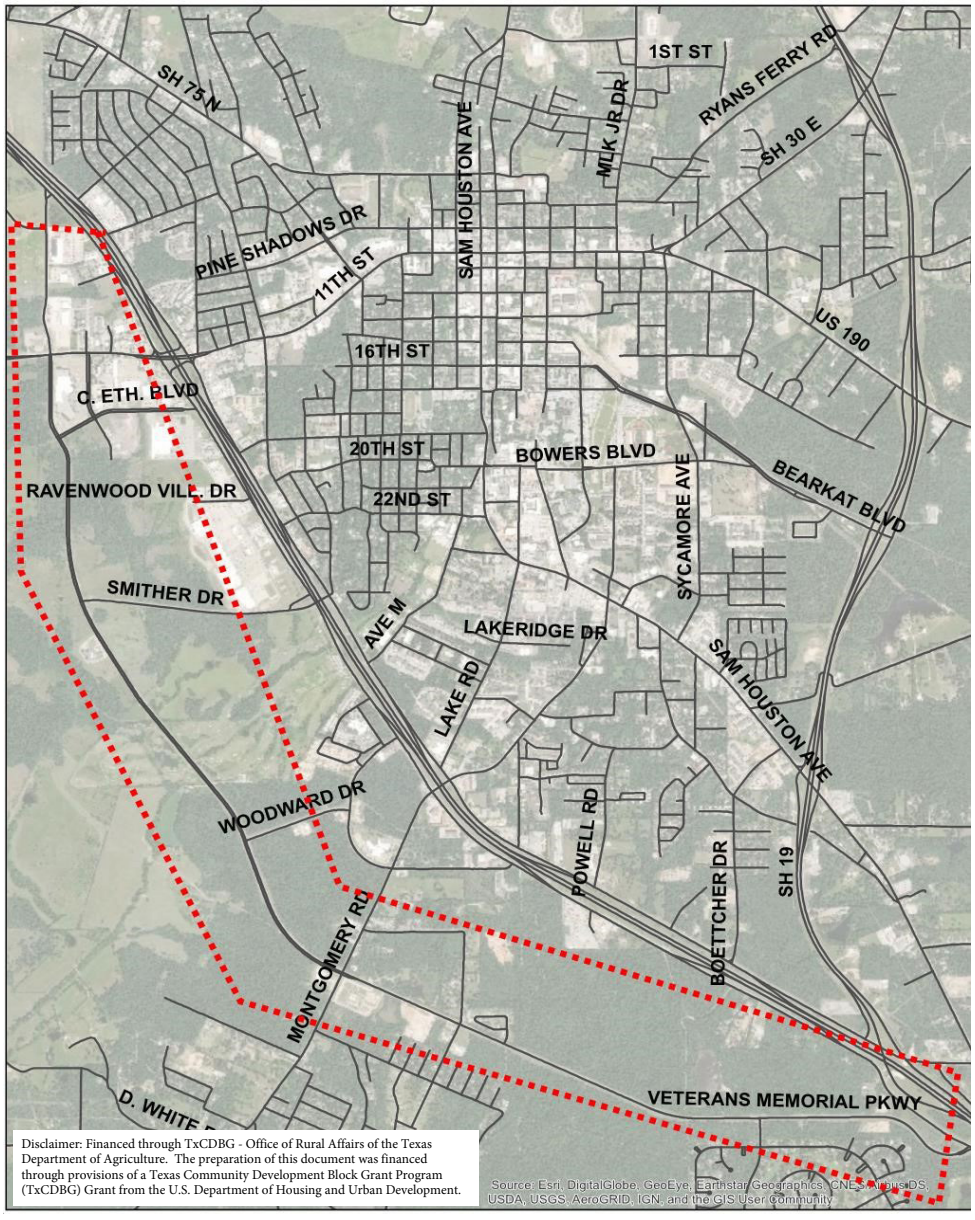


Figure 3-21: Veterans Memorial Parkway Corridor

Figure 3-22: Veterans Memorial Parkway Corridor

Issues

The completion of the IH 45 and Veterans Memorial Parkway interchange on the south end will provide easier access to and from SH 19, IH 45, and SH 75 with this corridor. This may increase the demand on Veterans Memorial Parkway. Currently, this roadway provides an alternative route along the west side of Huntsville in case of any traffic congestion or emergencies along IH 45. In addition, as development increases within the ETJ of the City, Veterans Memorial Parkway may need further improvements.

Recommended Improvements

Mid-Term

Veterans Memorial Parkway should be widened to four (4) lanes from Montgomery Road to IH 45. This will increase the capacity of the roadway for future developments such as the improved interchange along IH 45 and other upcoming commercial and residential developments within the ETJ.

Long-Term

Veterans Memorial Parkway should be extended from IH 45 to FM 2821 to increase the connectivity of this corridor to the north side of the City.

Cross Sections

A four-lane roadway with a raised median and sidewalks on both side is a potential cross section for Veterans Memorial Parkway between Montgomery Road and IH 45 (Figure 3-8). This type of cross section would be similar to the segment north of Montgomery Road and allow the corridor to have a consistent lane geometry and roadway capacity. The raised median would provide a physical barrier for opposing vehicular traffic decreasing the chance for head-on collisions. The raised median would also provide turning lanes at appropriate intersections, which promotes safer left-turn movements.

3.3.7 University Avenue

Profile

University Avenue from 11th Street to near Bowers Boulevard is a north-south roadway with a speed limit of 30 mph (Figure 3-23 and Figure 3-24). This corridor can be divided into two segments. The first segment is from 11th Street to 17th Street, which is a roadway with one (1) lane in each direction. The second segment from 17th Street to near Bowers Boulevard is a roadway that only allows vehicles to travel northbound and has one (1) lane. Most of the corridor has street parking on both sides of the roadway. The land use is mixed with commercial developments, student housing, and campus buildings. Overall, the corridor has one (1) signalized intersection and six (6) unsignalized intersections within three quarters of a mile.

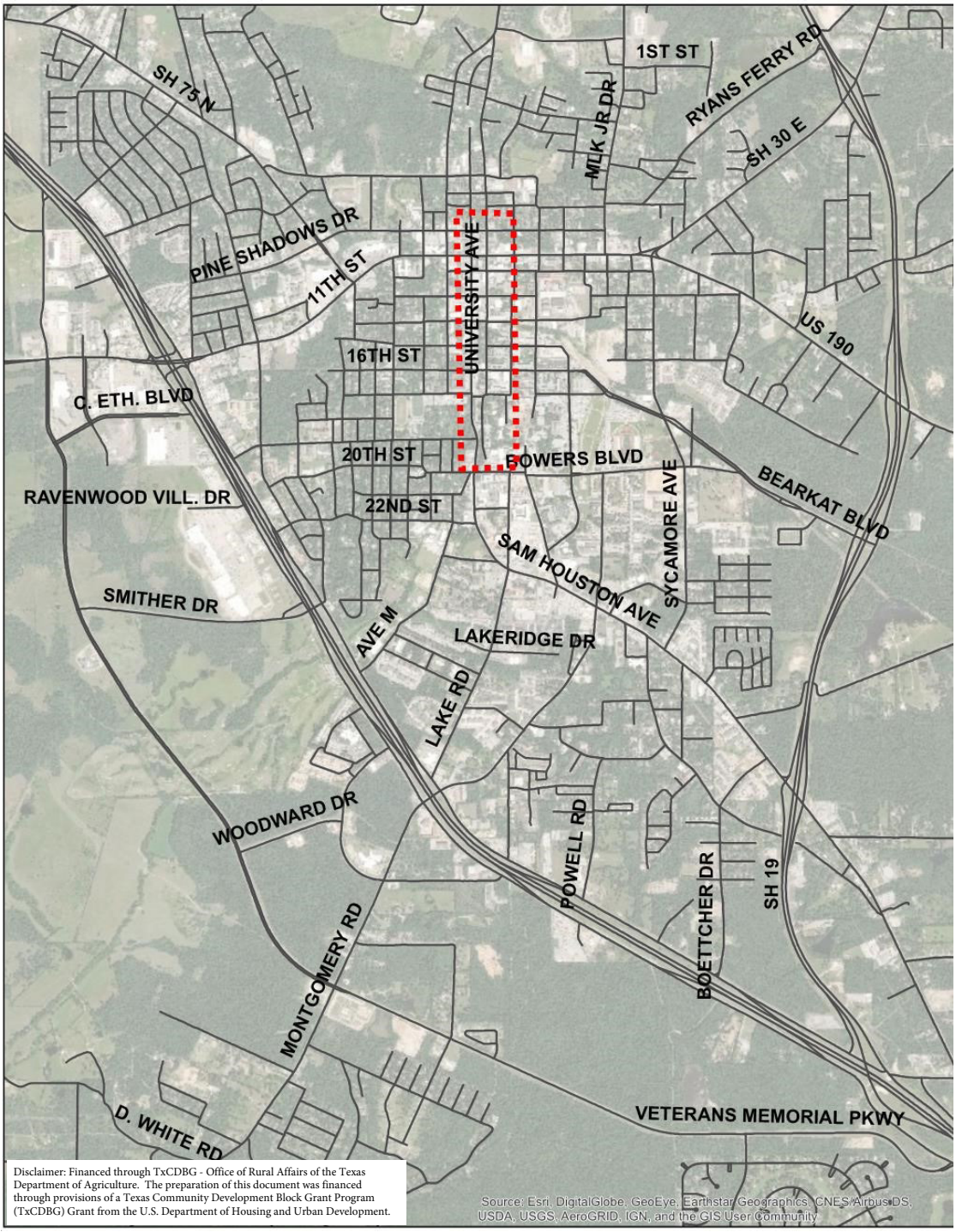


Figure 3-23: University Avenue Corridor

Figure 3-24: University Avenue

Issues

This corridor does not currently show any major issues, thus this roadway has the potential to be an alternative route for parallel streets such as Sam Houston Avenue.

Recommended Improvements

Long-Term

As described in Section 3.3.2, University Avenue and Sam Houston Avenue could be converted to a one-way couplet. This change would eliminate opposing traffic conflicts such as the left-turn movement on the north/south approaches and provides both operational and safety benefits. In addition, this roadway change will also increase the space for turn lanes, additional thru lanes, bike lanes, and wider sidewalks while maintaining street parking. Lowering the speed limit and improving pedestrian walkability can create a downtown atmosphere promoting social and economic benefits. This potential solution would also provide an opportunity to develop livable streets along the corridor to convert it into a destination rather than a pass-through. Detailed traffic analysis will be needed to fully comprehend the impact of converting University Avenue and Sam Houston Avenue into a one-way couplet.

Cross Sections

Please refer to Section 3.2 Potential Cross Sections to understand the different elements of a cross section: sidewalks, bike lanes, buffers, etc. that could be used for this corridor if University Avenue and Sam Houston Avenue are converted into a one-way couplet.

3.4 Multi-Modal Improvements

The City of Huntsville recognizes the importance of utilizing multiple modes of travel. Transportation improvements for all modes are important to encourage sustainable growth. The City took a step in this direction through its 2009 Sidewalk Master Plan. This plan emphasized the need for developing an inventory of the current sidewalk facilities and to determine policies for developing a complete sidewalk system. An early stage of implementing multi-modal transportation is to improve the sidewalks. This encourages walking to destinations as a comfortable, convenient, a safe means of travel. Once this mode has been established, further development of the sidewalks can allow the implementation of bikeways and public transit as other travel options.

The goal of multi-modal improvements is different from that of traditional roadway improvements because the focus is on moving people rather than vehicles. Integration of the different modes into the transportation system of Huntsville is critical to reducing dependency on single occupancy vehicles, and to provide more opportunities for the public to travel within the City. The following recommendations are provided to alter the physical environment in order to improve mobility for residents, through traffic, and for visitors to the City while maintaining the character and identity of the City.

Source: HDR, Inc.

3.4.1 Walkability

Sidewalk Network

Sidewalk gaps were evaluated as part of this plan to inform recommendations. The City's GIS tool was used in tandem with field observations and Google Street View to create an updated GIS inventory of Huntsville's sidewalk network (Figure 3-25). The sidewalk network map illustrates where sidewalks exist on both sides of the street (green), sidewalks on one side of the street (yellow), and areas with no sidewalks on either side (red).

Research suggests most people are likely to walk five (5) minutes to a destination and a majority would likely walk up to ten (10) minutes if the walk is comfortable and safe[3] . Therefore, residential areas proximate to schools were analyzed at the quarter-mile (5 minute walk) and half-mile (10 minute walk) to better understand where gaps in the network may be inhibiting more walking. Areas within two (2) miles of schools were also analyzed, since they are unserved by school buses, though this catchment area is more pertinent to the bicycle network due to the lower likelihood of people walking over twenty (20) to thirty (30) minutes to a destination.

Recommendations in this plan prioritize completing these gaps within the five (5) and ten (10) minute walk sheds of schools and could be leveraged through Safe Routes to School funding sources (see 5.3 Funding & Implementation for more details).

3 Morphocode. "The 5-minute walk" https://morphocode.com/the-5-minute-walk/

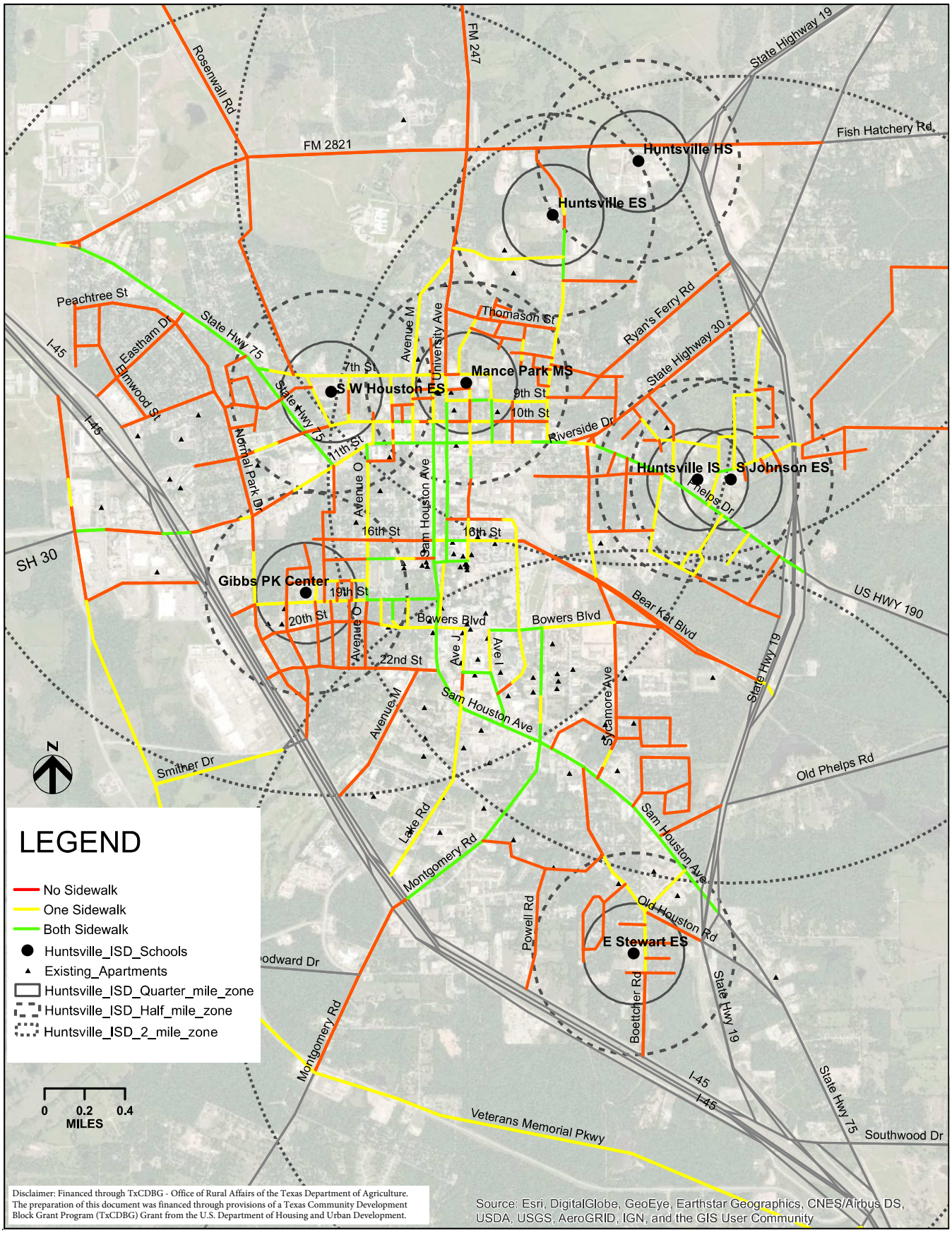


Figure 3-25: Existing Huntsville Sidewalk Network

Crosswalks

In addition to completing the gaps in the sidewalk network, improving the existing pedestrian infrastructure such as sidewalks, crosswalks and curb ramps should be considered. As described in Section 2.2.3, it was observed that there was a high level of pedestrian activity along Sam Houston Avenue and multiple intersections have sub-standard conditions. Many students walk back and forth across Sam Houston Avenue from the SHSU campus to student housing. In addition to updating the pedestrian infrastructure at signalized intersections, the following varying levels of improvements can be considered depending on the traffic volumes and speed limits:

- Midblock pedestrian crossings using one of the following:
  - Crosswalks with signs and pavement markings
  - Illuminated crosswalks with illuminated signs and push buttons
  - Raised crosswalks with illuminated signs and push buttons
  - Raised intersection with signs and pavement markings
  - Rectangular Rapid Flash Beacon (RRFB)
  - High Intensity Activated Crosswalk (HAWK) signals

- A pedestrian bridge to cross Sam Houston Avenue somewhere between 17th Street and Lake Road came into discussion during Council meetings. In addition to the purpose and need, other factors such as applicability, potential usage, funding sources, stakeholder buy-in, and benefit-cost ratio need to be considered. Also, constructability factors such as the grade, cross-slopes, right-of-way availability, and the hilly terrain would make it difficult to construct a pedestrian bridge to American Disability Act (ADA) standards. A more detailed study of the practicality of a pedestrian bridge will be needed before implementing a project of this magnitude.

3.4.2 Bike Network

The proposed bike network focuses on creating a network of safe, connected bike facilities that would connect people to important destinations in Huntsville. Empirical evidence demonstrates that sixty (60) percent of the population are would-be bicyclists though are "interested but concerned" about riding in mixed-traffic situations, where only eight (8) percent of the population is both "strong and fearless" and "enthused and confident" [4] . Therefore, low-stress or high-comfort bike facilities are designed to encourage bicycling for people of all ages and abilities and are becoming a critical factor for redefining safe mobility options.

Recommendations in the bike network were generated by analyzing areas with low automobile ownership, low household incomes, high household occupants, employment and shopping destinations, and population density, with the purpose of identifying where bikeway projects would make a positive impact to people in need of safe bikeway facilities to access work, school, or shopping destinations. Other specific points of interest include a connection to the Huntsville State Park and the bat colony on 14th Street.

In addition, constraints within the core of Huntsville had to be considered. These include existing buildings, available ROW, utilities, and other obstacles. In order to mitigate these constraints, some of the bikeways are proposed along floodplain/channels, abandoned railroad ROW, and electrical/transmission easements/ ROW.

The following four (4) types of bike lanes are provided for consideration as part of implementing a bike network in the City: Neighborhood Bikeway, Bikeway Sidepath, Buffered Bikeway, and Raised Cycletracks.

4 Mineta Transportation Institute. (2012). "Low Stress Bicycling and Network Connectivity" https://transweb.sjsu.edu/sites/default/files/1005-low-stress-bicycling-network-connectivity.pdf

Neighborhood Bikeway

Neighborhood bikeways are shared on-street facilities on which both bike and automobiles share the same lane. These shared driving and biking lanes are implemented on streets with low traffic volumes and speeds, and are marked with either signage or painted markings such as "sharrows." The proposed neighborhood bikeway cross section is suitable for existing two-lane roadways with designated speed limits up to 30 mph and generally provides a good level of comfort for people biking (Figure 3-26).

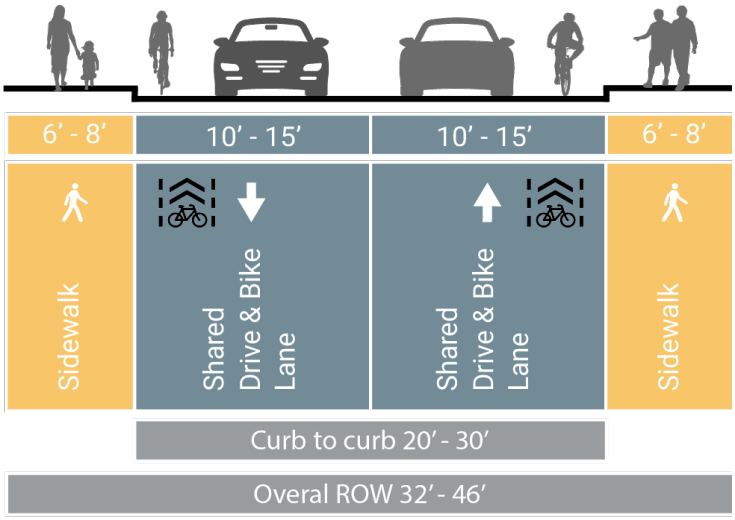


Figure 3-26: Proposed Neighborhood Bikeway

Bikeway Sidepaths

Bikeway sidepaths are off-street facilities on public rights-of-way that separate vehicular users from bicyclists and pedestrians (Figure 3-27). These sidepaths may be shared or separated between bicyclists and pedestrians and may be located on one (1) or both sides of the adjacent roadway. These separated facilities are implemented on streets with higher traffic volumes and speeds as right-of-way allows. Sidepaths generally provide a high level of comfort, particularly for people who bike primarily for recreation or leisure.

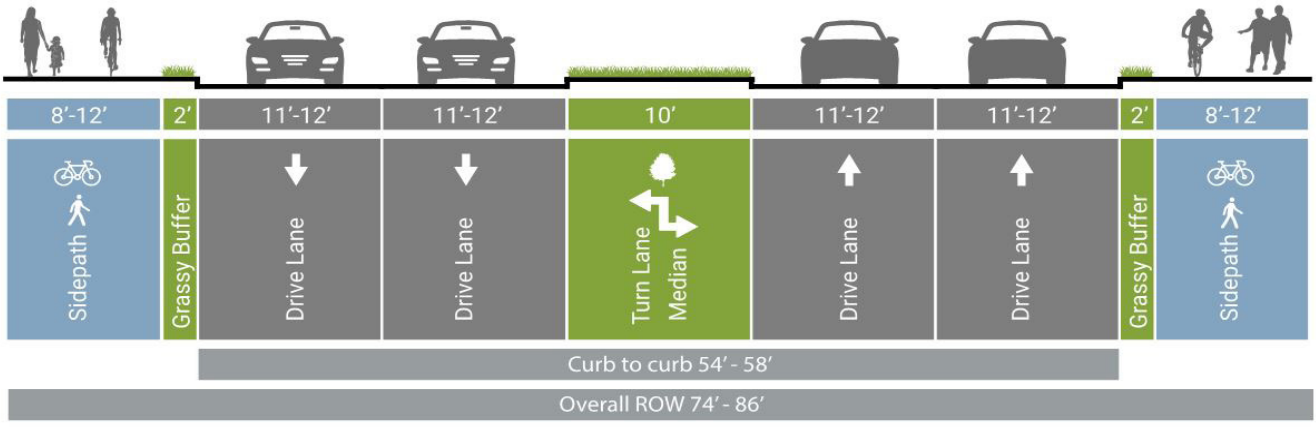


Figure 3-27: Sidepaths

Buffered Bikeway

Buffered bikeways are on-street facilities in which space dedicated to people biking is both separated from people driving and people walking (Figure 3-28). These designated facilities are implemented on streets with higher traffic volumes and speeds, than streets more suitable for neighborhood bikeways or bikeway sidepaths. Buffered bikeways are at grade with the adjacent street, separated from vehicular traffic with a painted or raised buffer, and generally provide a high level of comfort for bicyclists. In addition, neighborhood bikeway zones are identified to provide connections from existing low-stress neighborhood streets to the network's dedicated on-street bike facilities.

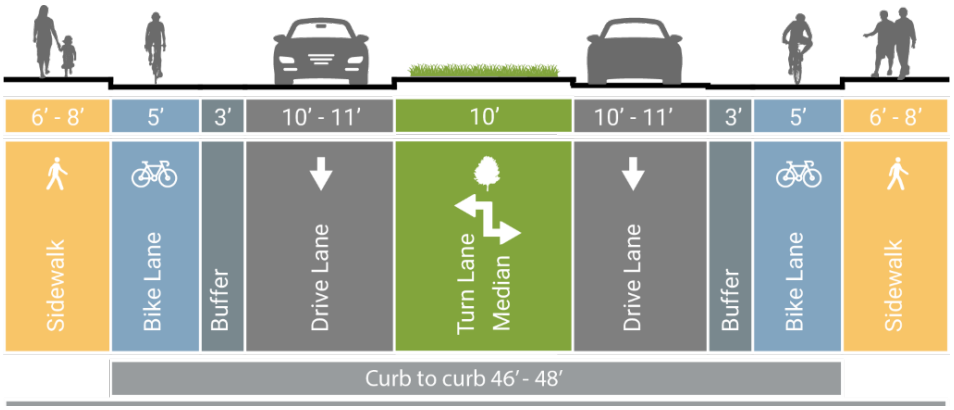


Figure 3-28: Buffered Bikeway

Raised Cycletrack

Raised cycletracks are separated bike-only facilities that are at grade with the sidewalk and are situated behind the curb away from vehicular traffic (Figure 3-29). These designated facilities are implemented on streets with higher traffic volumes and speeds that potentially present more user conflicts due to congestion and parking. Raised cycletracks generally provide the highest level of comfort for bicyclists. The proposed raised cycletrack cross section is suitable for existing four-lane roadways in the City of Huntsville.

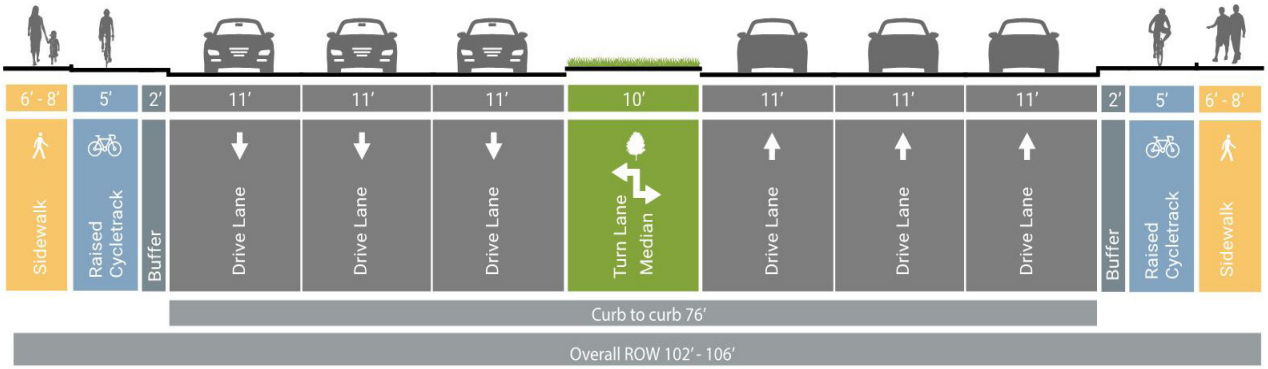


Figure 3-29: Raised Cycletrack for Six-Lane Roadway

The recommended bike network shown below in Figure 3-30 illustrates a series of dedicated on-street bike lanes as the city's spines, located on streets that connect across Huntsville. Two levels of bike lanes are proposed as part of this interim plan – first intended to be used as a neighborhood bikeway with bikes and automobiles sharing the same lane, while the second providing a barrier separated bike lane such as bikeway sidepath, buffered bikeway or a raised cycletrack.

A network of fifteen (15) miles is proposed as part of the bike plan, out of which nine (9) miles serve:

- Sixty (60) percent of households with more than four (4) people
- Sixty (60) percent of households with one (1) or no vehicle
- Seventy (70) percent of households with annual income less than $25,000.

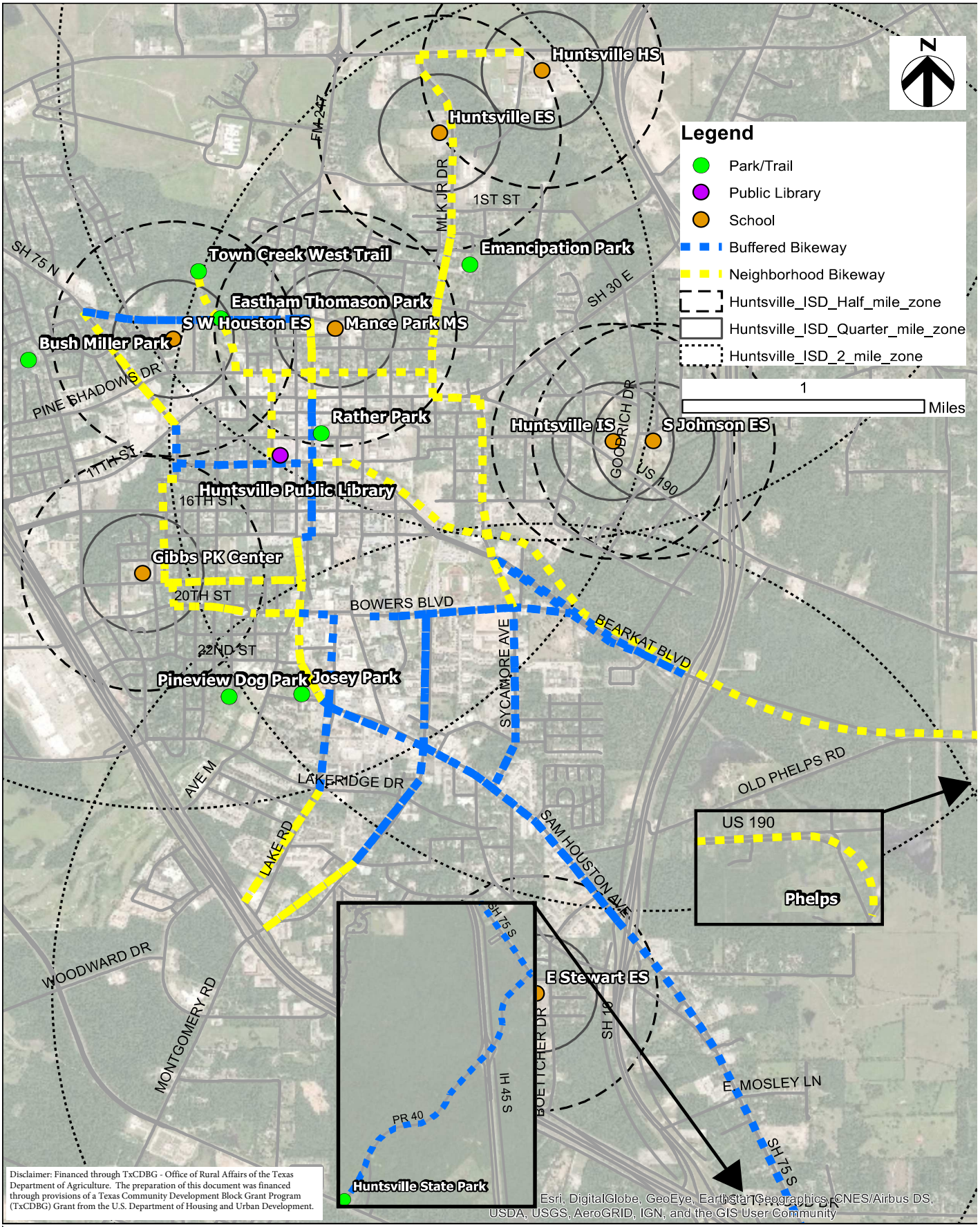


Figure 3-30: Proposed Bike Network

3.4.3 Public Transit

In order to ensure the residents of the City of Huntsville are given all transportation options, a high level transit plan was developed in this update. The benefits offered by a well-designed transit plan are multitude. Transit helps connect people with the places they want to go. It opens up economic opportunities for local residents and businesses, enables students who do not own cars to get to school or college classes, and helps the elderly stay independent. It gives city's populations access to jobs, retail centers, health care and social services. In short, transit can enhance the quality of life and economic vitality of growing cities like Huntsville.

A number of factors were considered in the development of the conceptual transit plan. The process involved identifying transit opportunities by assessing several factors:

- Existing demographic and socio-economic profiles (distribution of low income populations)
- Current and future land uses
- Popular destinations
- Special trip generators

The travel demand model developed for the city also provided important insights regarding current and future travel patterns. Knowing the geographic origins of where trips are generated and destined to, a set of conceptual transit routes were developed. The routes were designed to connect residents with small businesses, shopping malls, health care facilities, University and senior care establishments.

Shown in Figure 3-31 is a set of proposed transit routes that can serve as starter routes. As shown, the western portion of both Red and Blue routes provide access to a number of retail establishments such as coffee shops, sit-in restaurants, shopping malls, super market and health care facilities. The Blue route is within walking distance from multi-family housing on Lake Road while the Red route provides direct access to several small businesses along Montgomery Road. The Red route on Sam Houston Avenue connects the largest trip generator in the city, Sam Houston State University, with area residents and places of economic activity. The two transit routes are designed such that with only one transfer, most of the top trip destinations can be accessed.

Since this is a conceptual transit plan, other details such as bus stop locations, vehicle technology, fleet size, service frequencies, and span of operations are not determined.

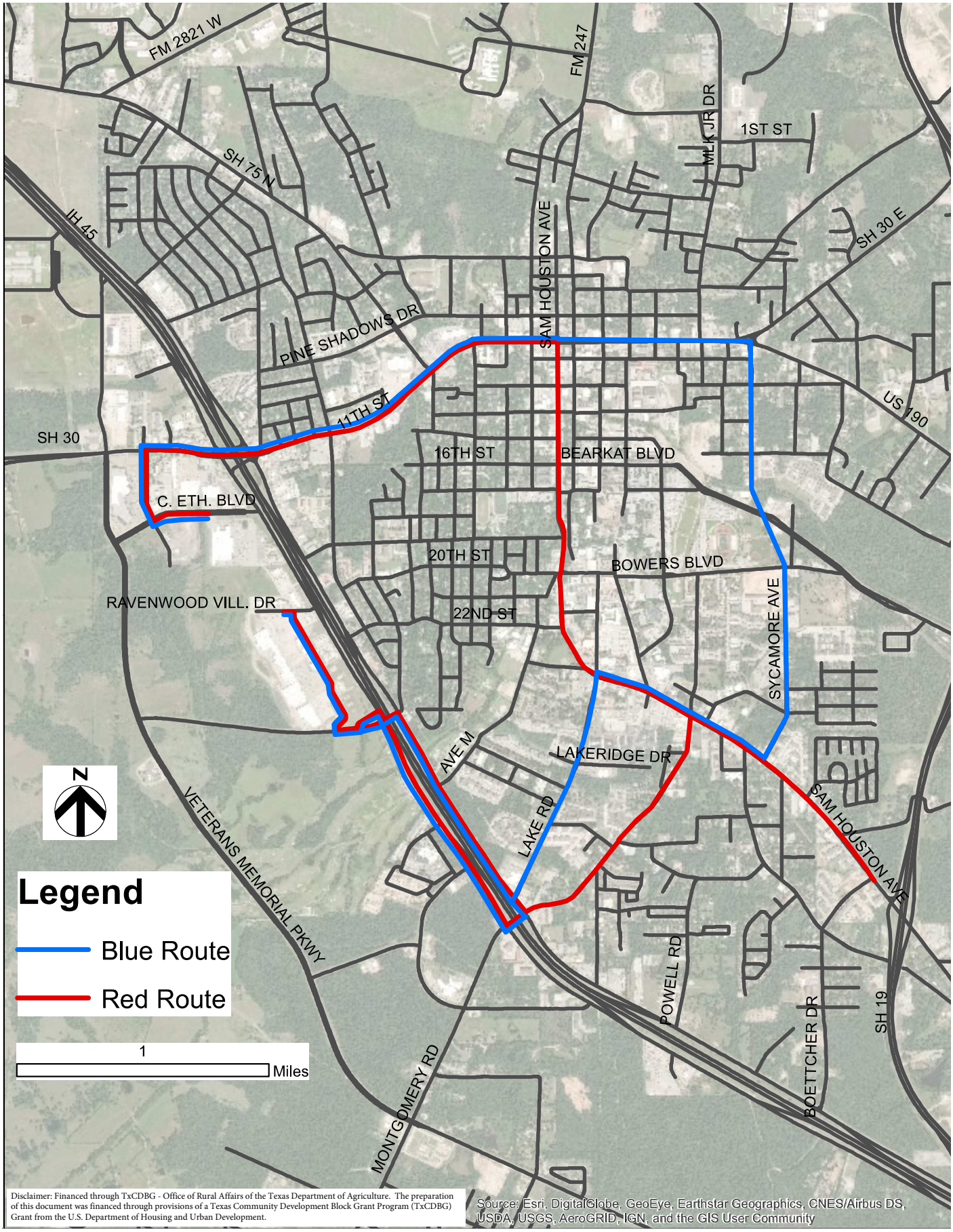


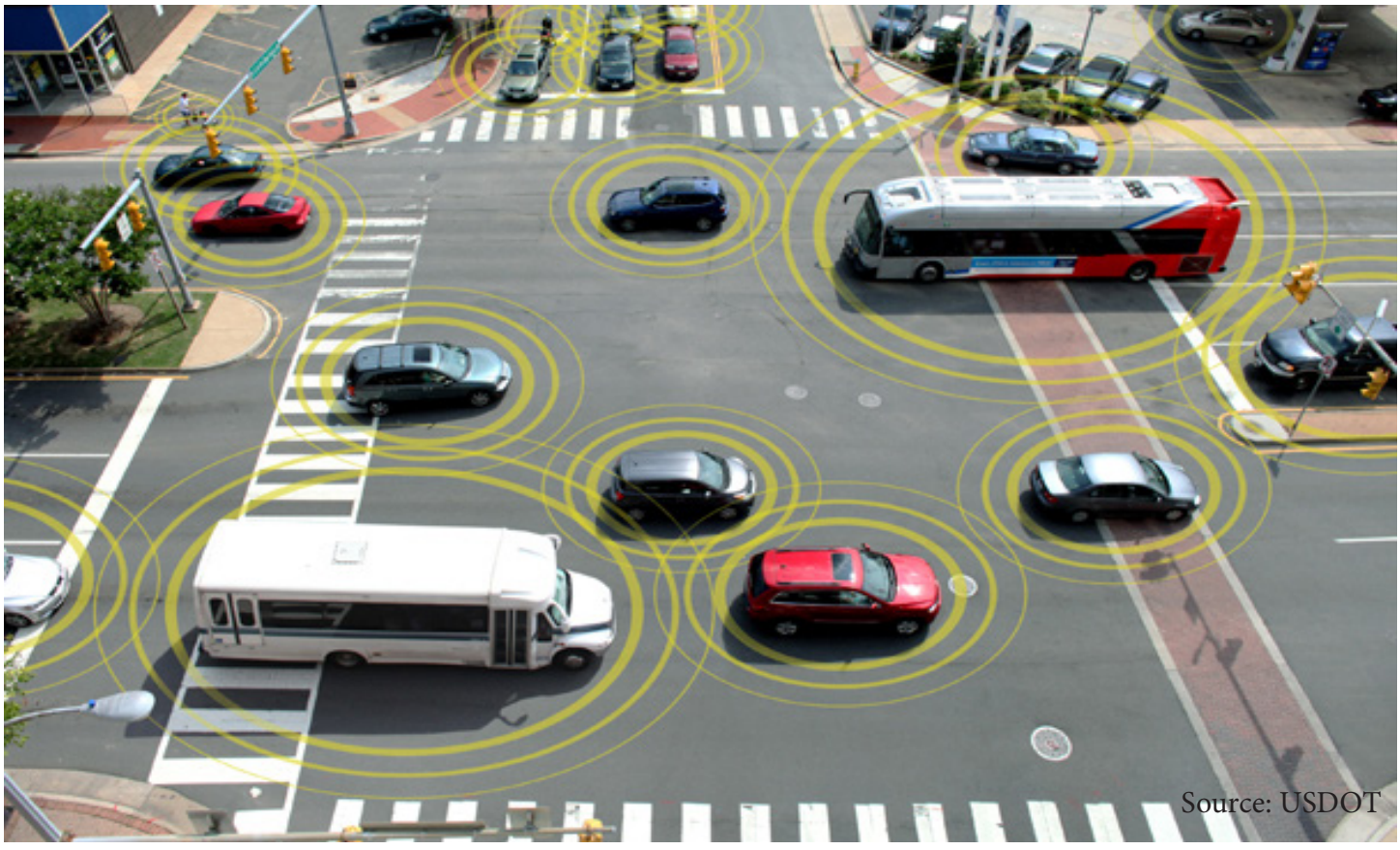
Figure 3-31: Conceptual Transit Network for the City of Huntsville

3.5 General Recommendations

3.5.1 Intelligent Transportation Systems (ITS)

Intelligent Transportation Systems are advanced applications that provide innovative solutions to traffic management. ITS offer many opportunities to gather and communicate real-time data that can enable drivers to operate vehicles with greater knowledge of existing traffic conditions. This exchange of information allows users to be better informed and to make more educated, smarter choices about how and when they travel. The following ITS practices are recommended for the City of Huntsville:

- Implement dynamic message signs (DMS) on major roadways to provide motorists with en-route traffic information and travel times. Information such as "ACCIDENT IH 45 FRONTAGE RD" or direction information during special events can be displayed and updated as needed to provide travelers with real-time information. DMS can vary in price depending on type, size, and location. Typical DMS costs range from $75,000 to $200,000.
- Develop a smart phone app to provide real-time roadway information, such as travel time, crash information and construction alerts
- Upgrade signal infrastructure to provide better connectivity and management
- Install cameras to monitor traffic conditions
- Install traffic sensors throughout the network to send data back to the City about travel times, congestion and incidents on the roadways. This information helps City staff manage and respond to problems within the network and can be shared with the public.
- Invest for a future Traffic Management Center facility where cameras and wireless communication systems will monitor traffic conditions.



Source: USDOT

3.5.2 Travel Demand Management

Travel Demand Management (TDM) utilizes a set of strategies, policies and best practices to influence and regulate traffic. Managing demand can often be more cost-effective than simply increasing capacity. For example, TDM can increase overall network efficiency by encouraging a shift from single-occupant vehicle (SOV) trips to other types of travel mode, or by shifting auto trips out of peak travel periods.

TDM seeks to focus on moving people and goods rather than motor vehicles, and to reduce the number of SOV trips by increasing the number of travel options, providing incentives and information to encourage and help individuals modify their travel behavior, or by reducing the physical need to travel.

The following are some example TDM strategies:

- Off-Peak Travel
- Telecommuting
- Employer-based programs such as In-House Ride-Matching, Transit Pass Subsidies or Alternative Work Hours
- Carpooling or Van Pooling
- Rideshare
- Mixed Use Development

Effective demand management can also have long-term benefits for the environment, communities and public health.

Source: HDR, Inc.

3.5.3 Access Management

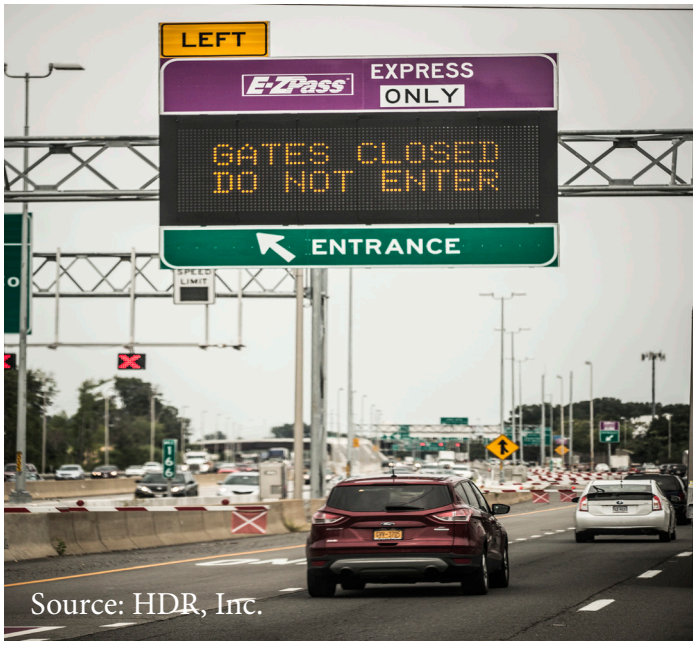
Access management is the practice of controlling access along the roadways and manages placement of driveways and other access points. Too many access points within close proximity to each other can cause congestion and a higher potential for conflicts and crashes. Access management programs aim to balance access to businesses, residences and institutions with roadway safety and mobility.

Some best practices for access management include:

- Limit the number of access points to major roadways and direct frequent property access to local streets.
- Consolidate access driveways to reduce access points on major roadways.
- Provide enough space between intersections and access points to ensure the safe and efficient operation of the intersection. In addition, traffic signals and stop signs should be spaced to minimize traffic queuing at intersections.
- Raised medians with breaks for turning are safer than continuous center-turn lanes by reducing potential conflicts and dangerous maneuvering
- Limit the number of conflicts and separate areas of conflict, for example, separate turning movements from through movements when possible.
- Restrict left-turns and U-turns at congested and critical locations. Provide enough storage lanes to allow them at less critical locations.

Successful access management programs provide safe and efficient access to businesses, institutions and residences, keep traffic flowing optimally along streets, and enhance the overall safety and mobility of the transportation network.

Source: HDR, Inc.



Source: HDR, Inc.

3.5.4 Wayfinding

A 'trailblazing' or wayfinding sign system can direct commuters and motorists to the optimal facility and on to their further destinations. To better distribute traffic from more congested routes to less congested alternatives, Dynamic Message Signs placed in advance of a route decision point, provide real-time information to motorists where and when they need it and offer an alternative route.

4. Public and Stakeholder Involvement

As part of the public and stakeholder outreach, a stakeholder committee was formed early on, to receive feedback and comments contributing to the delivery of an integrated transportation plan that serves the need of all regional entities and residents. The stakeholder committee involved the following members:

- Texas Department of Transportation (TxDOT)
- Walker County
- Sam Houston State University (SHSU)
- Huntsville Independent School District (ISD)
- Texas Department of Correctional Justice (TDCJ)
- City Council and Planning Commission
- City Police and Fire Department.

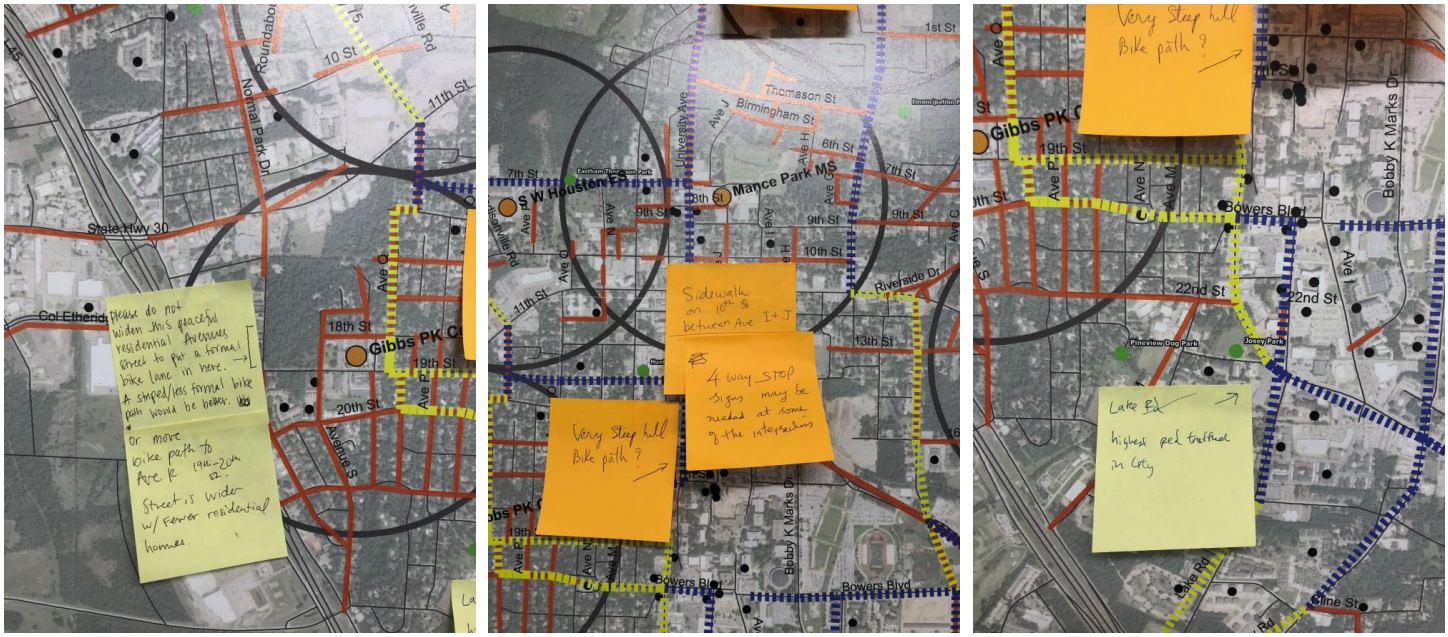
The following is a schedule of outreach events that took place:

- A workgroup meeting with the stakeholders on October 12, 2018
- A City Council meeting on November 1, 2018
- A second workgroup meeting with the stakeholders on January 31, 2019
- A workshop with the City and TxDOT staff on March 12, 2019
- A public workshop for City residents and stakeholders on April 9, 2019
- A second City Council meeting on May 7, 2019.

4.1 City and Stakeholder Meetings

During the first round of meetings in October and November, the project background, data collection, current issues, and goals and objectives were discussed. The transportation concerns of attendees were documented and taken into consideration during the plan development process. The following is a summary of key findings during these meetings:

- Huntsville ISD requests that any sidewalk and pedestrian improvements should be implemented in the proximity of HISD schools. HISD is not required to provide bus service for a two (2) mile radius.
- TxDOT has plans to update signal timings and coordination along 11th Street
- SHSU Police Department suggests developing Sycamore Avenue and Bear Kat Boulevard as access points to the campus to reduce congestion on Sam Houston Avenue. Also, the SH 19 expansion should allow Bear Kat Boulevard to develop as one of the primary access points to the campus. 16th Street was converted to a one-way street to encourage the use of Bear Kat Boulevard as an access point to the university.
- Currently, shuttle services are offered by SHSU on Wednesday and Saturday, but it is limited. The shuttle service maintains records of number of riders, and an ID is required to ride. Prior shuttle service was partnered with Brazos Valley Transit to provide service to SHSU Woodlands Campus. There used to be a shuttle to travel around the campus, but it was discontinued due to low demand.
- TDCJ facilities typically do not expect congestion at their facilities except during the daily release event at Huntsville Unit near the intersection of 12th Street and Ave I.
- Walker County Judge believes that the east-west connection within the City is a primary concern and should be addressed in the transportation master plan.
- Restricting left-turns at few intersections along the core of 11th Street was discussed to preserve travel lane capacity lost due to turning vehicles at the intersections
- Concern for updating signal timings and maintaining state highways in the City. The TMP would help in requesting funding from TxDOT for periodic maintenance and upgrades of signals
- Bicycles and other modes of transportation such as scooters and segways, and dedicated bike ways are required to keep up with the changes in transportation choices.



During the second round of meetings in January, March and May, the process involved in developing the transportation master plan was discussed along with a draft plan.

The section below is a summary of comments and feedback received during meetings with City Council, City staff, and Stakeholders.

- A request was made for a high-level transit plan framework
- Desired cross-sections provided in the TMP update will be taken into consideration by TxDOT for future improvements along state highways.
- Left-turn restrictions along 11th Street to relieve congestion on the eastern end of 11th Street was discussed.
- Bike lanes along 11th Street are expected to provide circulation and access to students.
- Reduction of travel lane widths to reduce speeds and provide sidewalks was discussed. If speeds along Sam Houston Avenue were reduced, through traffic would redirect itself to alternative streets. Therefore, those alternative streets would need to be improved to process the increased traffic.
- Discussed the viability of each proposed roadway in the Thoroughfare Plan:
- Plans for a loop roadway around Huntsville could relieve the City of through traffic and connect to the future IH 14 on the east side of the City.
- Need frontage roads along SH 19 from IH 45 to SH 30 and along IH 45 from PR 40 to FM 1374
- Need improvements at Montgomery Road and Sam Houston Avenue
- Discussed projects to be included as part of the short, mid, and long-term improvements

4.2 Public Workshop

On April 9, 2019, a public workshop was conducted to provide citizens the opportunity to participate in the update of the TMP. Citizens were encouraged to attend the workshop to present their views and provide input to the City regarding the TMP. Noticing for the public workshop was issued via the following methods:

- Notice published in the Huntsville Item on Sunday, March 24, 2019
- Notices published on the City of Huntsville Facebook page on April 2, 2019, and April 8, 2019
- Flyers posted in the City of Huntsville government buildings.

Informational exhibits were available for public viewing, including a proposed Thoroughfare Plan, Transit Network Plan, Bike and Pedestrian Plan, and exhibits displaying Short, Mid, and Long-Term Projects.

The public workshop was conducted in an open house format. An informational project handout and comment forms were provided to the attendees along with post-it notes that can be pasted on the exhibit boards. Project team representatives were available to answer questions and collect feedback.

A total of twenty-five (25) citizens attended the public workshop, and a few others submitted their comments through emails following the public meeting. A total of forty-three (43) public comments were received as a result of the workshop. A summary of the feedback received is provided below and a more detailed report including the individual attendee list and comments is provided in Appendix C:

- Support and request for transit, bike and pedestrian plans
- Support for one-way couplets along 10th and 11th Streets and Sam Houston Avenue and University Avenue
- Opposition to Sumac Road, 16th Street, and 20th Street extensions. Concerns with pass-through traffic, safety, and damage to neighborhood character
- Support for traffic signal coordination and other signal related improvements
- Requests for pedestrian related improvements along Sam Houston Avenue
- Requests to relieve congestion at the intersection of Montgomery Road and Sam Houston Avenue.

5. Implementation Plan

Source: Facebook @ City of Huntsville, TX

5.1 Thoroughfare Plan

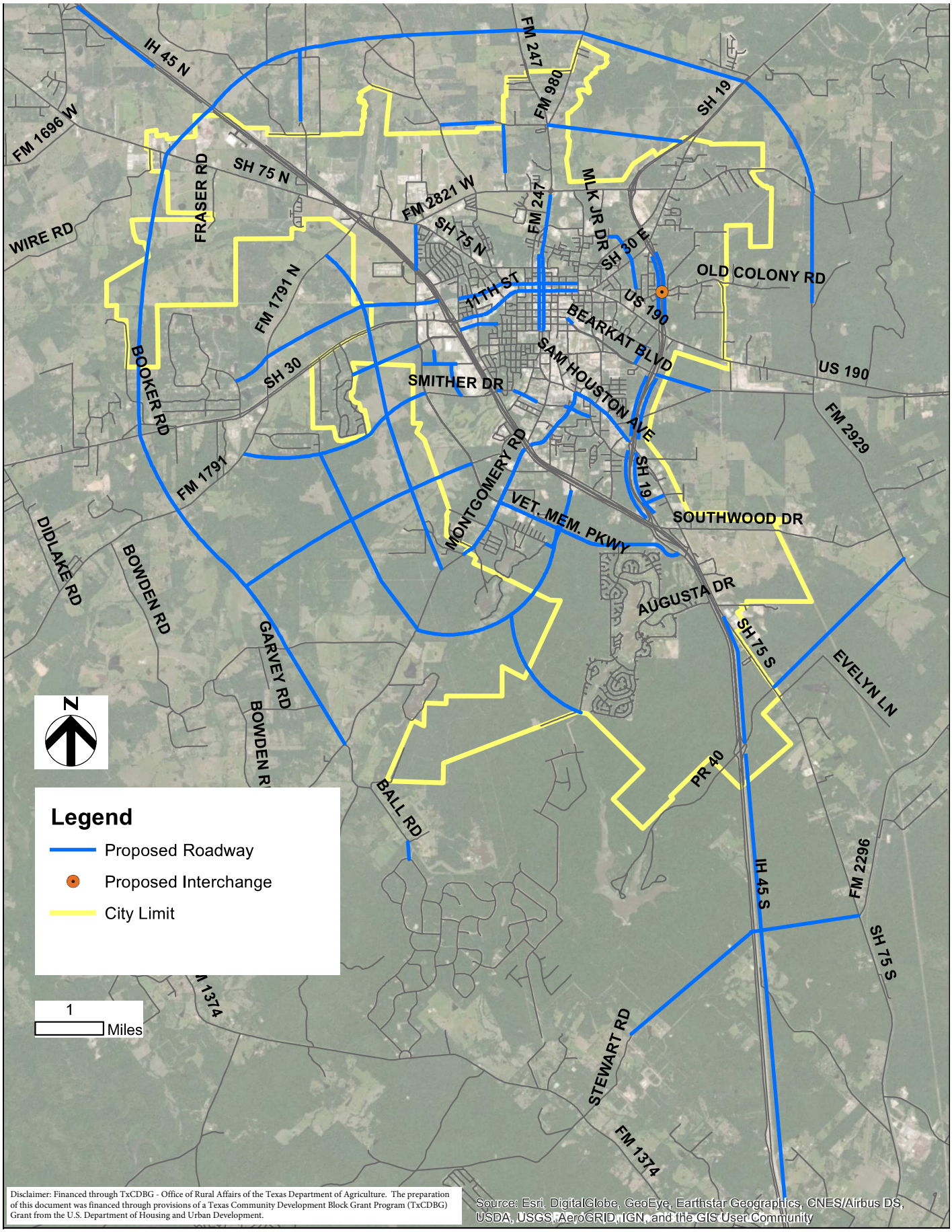
As part of the update to the TMP, a Thoroughfare plan was developed to fill the gaps and provide better connectivity for the City of Huntsville and the ETJ. The goals of the updated Thoroughfare plan shown in Figure 5-1 include:

- Preserving right-of-way for future thoroughfare needs
- Providing a roadway network for regional connectivity and mobility
- Promoting redevelopment and/or economic development opportunities and
- Providing linkages for pedestrians, transit, and bicycles.

The updated thoroughfare plan also provides a new loop roadway around the City to connect various state highways traversing through the middle of the City. This would allow an alternative roadway for the regional traffic to bypass the City, thus relieving some severe congestion experienced on key corridors.

The proposed loop roadway along with other alternative roadways proposed in the Thoroughfare Plan are expected to serve other major regional projects, such as the Houston-Dallas High Speed Train through Brazos Valley and a potential interstate: IH 14 alignment along US 190. See Appendix D for expanded exhibits for this section.

Figure 5-1: Thoroughfare Plan



Source: Facebook @ City of Huntsville, TX

5.2 Prioritization of Improvements

The recommendations developed in Section 3 along with projects identified as part of the updated Thoroughfare Plan were categorized into short, mid and long-term improvements based on the need, implementation cost and timeline, and preparation required.

5.2.1 Short-Term Improvements

The short-term improvements include projects that require low implementation cost and can be quickly implemented (within five years). These projects are expected to address majority of the critical issues discussed in Section 1.4. Examples of these projects include:

- Intersection improvements such as signal timing improvements, signalization, pavement markings, update signing and adding turn lanes
- Policy changes such as redefining functional classification of a roadway, updating typical cross-sections and ROW requirements for various roadway classes
- Extension of roadways by about half-mile or less.

Table 5-1 and Figure 5-2 show the short-term improvements identified along with a table showing description, type of project and approximate cost of implementation.

Table 5-1: Short-Term Improvements

Number	Project Description	Project Type	Cost Estimate as of 2019
1	Ravenwood Village Dr Extension to Veterans Memorial Pkwy	Extension	$5,883,239
2	Financial Plaza Extension to Ravenwood Village Dr	Extension	$2,858,008
3	Upgrade Functional Classification of Montgomery Rd from IH 45 to Sam Houston Ave to Primary Arterial	Functional Classification Change	N/A
4	Upgrade Functional Classification of Sycamore Ave from 11th St to Sam Houston Ave to Primary Arterial	Functional Classification Change	N/A
5	Southwood Dr and SH 75 Intersection Improvement	Intersection Improvement	N/A
6	SH 75 and Montgomery Rd Intersection Improvement	Intersection Improvement	N/A
7*	Signing and Pavement Marking Improvements (Signalized Intersections)	Intersection Improvement	N/A
8	Coordinate Traffic Signals along 11th St from Veterans Memorial Pkwy to Normal Park Dr	Signal Coordination	$20,000
9	Coordinate Traffic Signals along 11th St from SH 75N to Sycamore Ave	Signal Coordination	$35,000
10	Coordinate Traffic Signals along Sam Houston Ave from 16th St to Bowers Blvd	Signal Coordination	$20,000
11	Coordinate Traffic Signals along Sam Houston Ave from Lake Rd to Sycamore Ave	Signal Coordination	$20,000
12	Signalize FM 2821 and Rosenwall Rd	Signalization	$300,000
13	Signalize Sam Houston Ave and 22nd St	Signalization	$300,000
14	Signalize Bear Kat Blvd at SH 19	Signalization	$300,000
15	Powell Rd Extension from IH 45 to Veterans Memorial Pkwy	Extension	$6,322,309
*Applies to all signalized intersections, thus not shown on the map.			

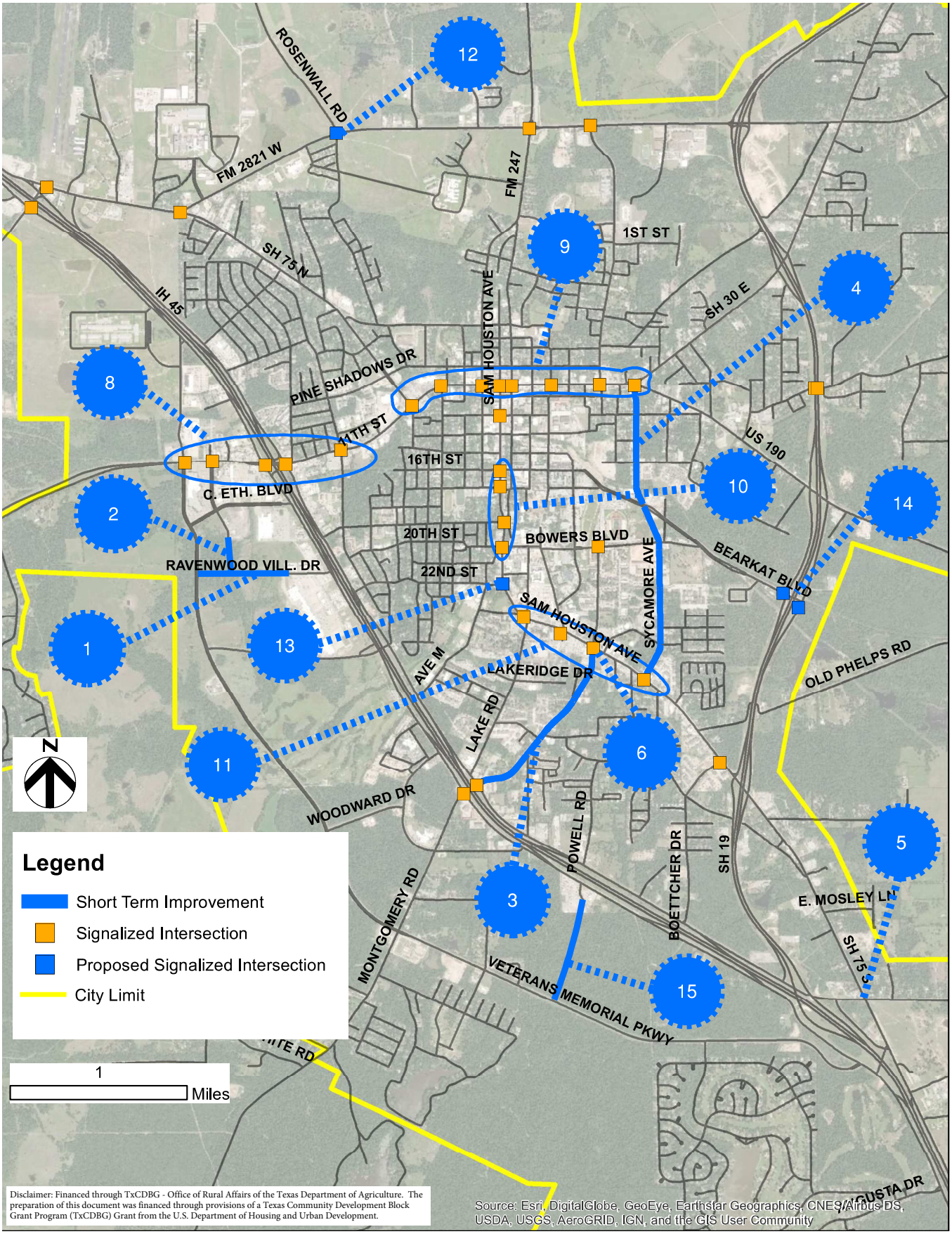


Figure 5-2: Short-Term Improvements

5.2.2 Mid-Term Improvements

The mid-term improvements include projects that require moderate to high implementation cost and require right-of-way acquisition and designing new roadways. These projects can take up to fifteen (15) years to implement and will address the upcoming growth in the region as well as some critical needs. Examples of these projects include roadways extensions up to a mile and roadway widening up to three (3) miles. Figure 5-3 shows the mid-term improvements identified along with Table 5-2 showing description, type of project and approximate cost of implementation.

Table 5-2: Mid-Term Improvements

Number	Project Description	Project Type	Cost Estimate as of 2019
1	Pineshadows Dr Extension to IH 45	Extension	$2,435,340
2	Smither Dr/25th St Extension from IH 45 to Old Houston Rd	Extension	$9,352,632
3	16th St Extension to IH 45	Extension	$3,088,512
4	Bearkat Blvd Extension to 15th St	Extension	$1,448,716
5	Roadway Extension from Ravenwood Village Dr to Smither Dr	Extension	$5,589,345
6	Sycamore Ave Widening to Five Lanes with Sidewalks and Bike Lanes	Widening	$19,593,991
7	Veterans Memorial Pkwy Widening to Four Lanes from Montgomery Rd to IH 45	Widening	$28,301,225
8	Montgomery Rd Widening to Four Lanes from IH 45 to Darrell White Rd	Widening	$19,694,077
9	Interchange at SH 19 and Old Colony Road	Interchange	$5,000,000

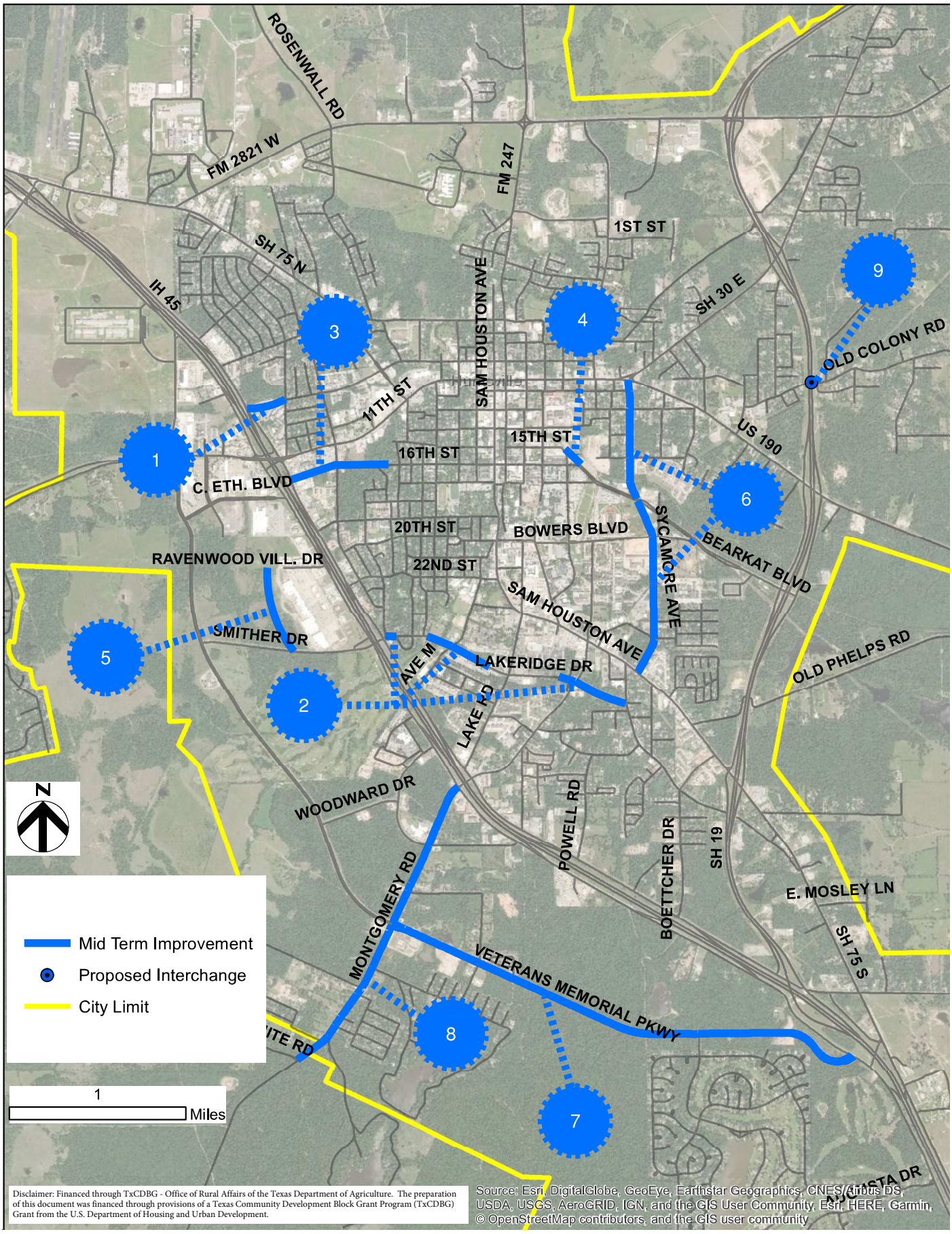


Figure 5-3: Mid-Term Improvements

5.2.3 Long-Term Improvements

The long-term improvements include projects that require moderate to high implementation cost and require additional planning, right-of-way acquisition and designing new roadways. These projects are not critical in nature and can be implemented over the next twenty-five (25) years. Examples of these projects include roadway extensions, roadway widening and conversion of two way streets to one-way couplets. Figure 5-4 shows the long-term improvements identified along with Table 5-3 showing description, type of project and approximate cost of implementation.

Table 5-3: Long-Term Improvements

Number	Project Description	Project Type	Cost Estimate as of 2019
1	Build IH 45 Northbound Frontage Roads from FM 1374 to SH 75	Extension	$110,731,162
2	Connect Stewart Rd to FM 2296 over IH 45	Extension	$60,375,056
3	Park Road 40 Extension from SH 75 to FM 2929	Extension	$38,288,804
4	Build SH 19 Frontage Roads from IH 45 to SH 30	Extension	$45,353,224
5	E Mosley Ln Extension to SH 19	Extension	$5,047,565
6	Bearkat Blvd Extension to Old Phelps Rd	Extension	$11,602,189
7	Summer Pl St Extension to Veterans Memorial Pkwy	Extension	$80,639,011
8	Woodward Dr Extension from Veterans Memorial Pkwy to Outer Loop	Extension	$53,203,391
9	Outer Loop	Extension	$320,031,611
10	Veterans Memorial Pkwy Extension from IH 45 to FM 2821	Extension	$9,944,209
11	Moffett Springs Rd Extension to Outer Loop	Extension	$14,805,741
12	Build Southbound Frontage Road along IH 45 from Pinedale Rd to Existing Frontage Road	Extension	$18,298,260
13	Build Roadway Parallel to Veterans Memorial Pkwy from FM 1791 to Montgomery Rd	Extension	$70,528,724
14	Parkwood St Extension from IH 45 to Timberwilde Way	Extension	$46,618,548
15	Colonel Etheridge Blvd Extension to Westridge Dr	Extension	$15,452,225
16	Smither Dr Extension from Veterans Memorial Pkwy to FM 1791	Extension	$42,201,509
17	Ball Rd Extension to Winchester Rd (Texas Grand Ranch)	Extension	$3,500,060
18	American Legion Dr Extension to Jenkins Rd	Extension	$10,648,077
19	Jenkins Rd Extension to Rosenwall Rd	Extension	$11,070,518
20	Roadway Extension from FM 247 and FM 980 to SH 19	Extension	$28,838,085
21	1st St Extension to Goodrich Dr	Extension	$13,430,935
22	Persimmon Dr Extension to Bear Kat Blvd	Extension	$4,335,358
23	Couplets: NORTH - SOUTH: Sam Houston Ave and University Ave (FM 247)	Couplet	N/A
24	Couplets: EAST - WEST: 10th St and 11th St	Couplet	N/A
25	Sam Houston Ave Widening to Seven Lanes from Montgomery Rd to SH 19	Widening	$15,371,362
26	FM 247 Widening to Four Lanes from FM 2821 to 11th St	Widening	$16,310,523

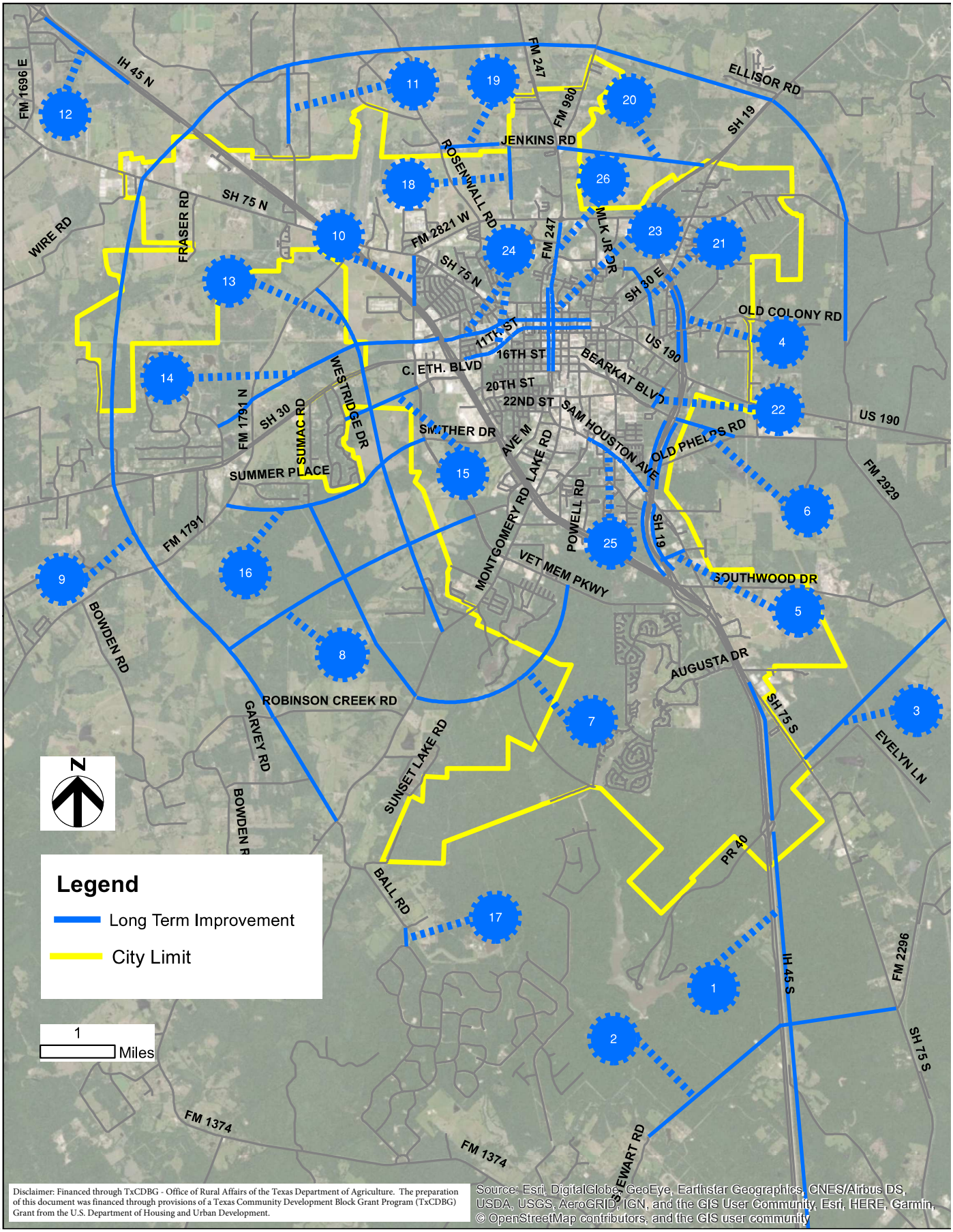


Figure 5-4: Long-Term Improvements

5.3 Cost Estimates

In order to develop cost estimates for each proposed project, these items were considered: construction costs; ROW acquisition; a percentage of the construction costs for preliminary studies, engineering and surveying; utility relocation; and contingency. A different unit cost for ROW acquisition was used for short, mid, and long-term projects based on historical ROW acquisition costs. See Appendix E for more detailed calculations of these estimates for each project.

5.4 Funding Strategies

Funding and financing of the short-term, mid-term and long-term improvements will require the combination of existing sustainable sources of funds, identification of new sustainable sources and the ability of the City to position improvements for competitive funding opportunities that may arise from time to time throughout the planning and implementation time frame. Certain projects may be funded entirely through existing or new sustainable sources; other projects may require some level of existing or new sustainable sources for early project development (e.g., environmental, design, corridor preservation, etc.) so that when competitive funding opportunities arise, these projects would be well-positioned to compete (in most cases, be "shovel-ready").

The competition for federal and state funding will continue to be very strong in Texas. Revenue from the City's one and a half-cent sales tax can continue to be used to leverage other funding sources (e.g., H-GAC project application, partnership with Walker County), in additional to bond issue repayments.

Funding sources that are currently available to the City include:

- Property tax (general obligation bonds and certificates of obligation)
- Cost-participation with local and state partners (e.g., Walker County, Developers, TxDOT)
- Economic Development Corporation
- Voter-Approved Sales Taxes
- Tax Increment Reinvestment Zones (TIRZs) and Tax Increment Finance Districts (TIFs)
- Public-Private Partnerships
- Development Impact Fees
- General Fund
- Municipal Management Districts (MMDs)
- Parking Benefit Districts
- State Infrastructure Bank (SIB) loans
- State and Community Safety Programs, such as
    - Federal High Risk Rural Roads
    - Highway Safety Improvement Program
    - Railway Highway Safety Program
    - Safety Bond Program
    - Safe Routes to School
- Federal Transit Administration Urban Areas Formula Funds (5307) and Enhanced Mobility of Seniors and Individuals with Disabilities Grant (5310). Huntsville qualifies to this fund once they reach a 50,000 population threshold.
- Federal discretionary grant funding opportunities (e.g., Better Utilizing Investments to Leverage Development (BUILD) or possibly Infrastructure for Rebuilding America (INFRA))

* Links to the programs are attached in Appendix F

Source: Facebook @ City of Huntsville, TX

6. Summary and Conclusions

The initial recommended actions identified in this plan will serve as a valuable planning guide for the City in the years to come. This TMP Update should be revised by the City on a regular basis, when engaging in transportation improvements and new development activity.

This is necessary to ensure consistency with goals and priorities of the plan and to include any identified improvements from the Master Plan into developments, as they occur. With changes to transportation, traffic, land use, and other conditions over time, the plan should be reassessed every five years to determine if an update is needed.

Source: Facebook @ City of Huntsville, TX

Outside Agency Coordination

Huntsville will continue to grow, as will its infrastructure. As the City continues to move forward with planned developments and future projects, close coordination with the various agencies operating these roadways will help to ensure developments are implemented efficiently and smoothly. To lessen the impact of transportation improvements on residents outside City limits, cultivating a relationship and coordinating with the County will help smooth the road for future growth.

Design Complete Streets

Complete streets are designed to provide an optimal and safe transportation experience for all users. There are many ways to create more complete roadways that are inexpensive, easy to implement, and impactful. Huntsville has several major arterials such as 11th Street and Sam Houston Avenue running through residential and business districts that could provide an enhanced user experience should a 'Complete Streets' design be implemented in the future.

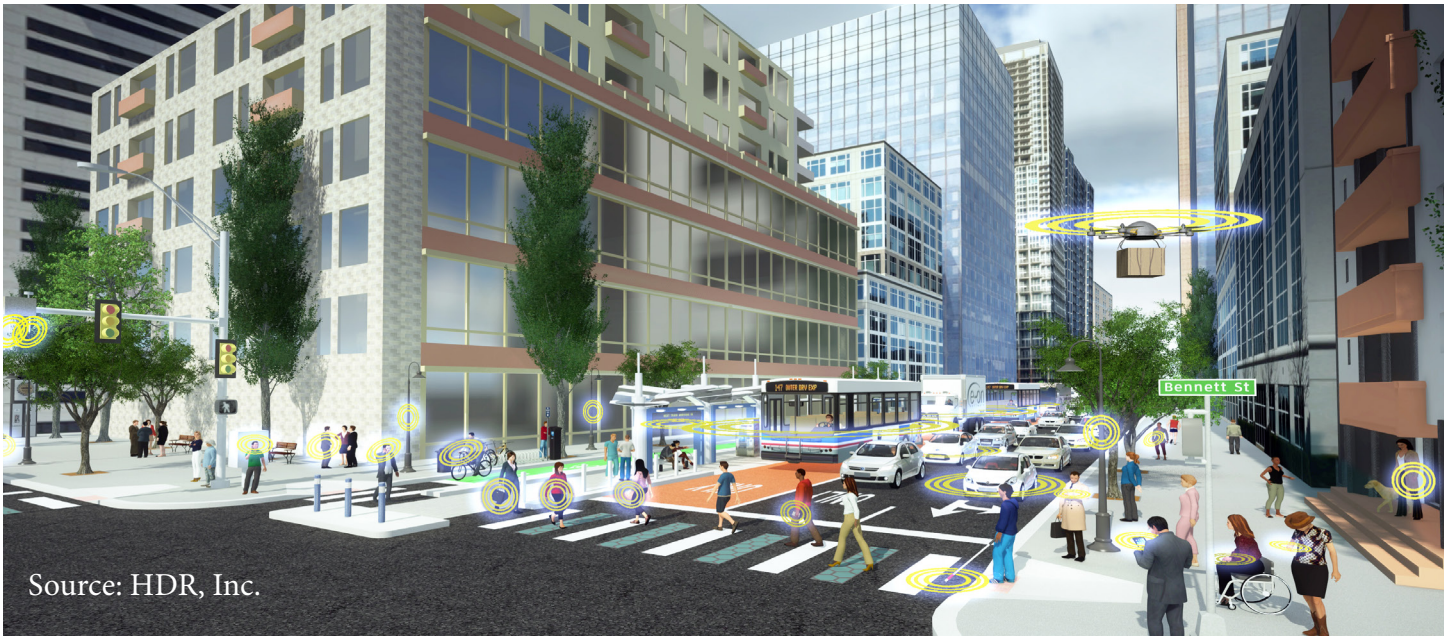
Intersection Improvements

Huntsville has multiple intersections that could use updated infrastructure and improvements such as pavement markings, signing, signal timing improvements, signal coordination, turn lanes, and turn restrictions. Providing these low cost improvements could relieve congestion with immediate effect and enhance the driver experience.

Pedestrian Improvements

As noted in previous sections, multiple corridors have sub-standard, obstructed, or discontinuous sidewalks. Some streets without crosswalks have desire lines where people walking have made natural paths that prove a need for sidewalks. The City can start with desire lines and upgrade/provide sidewalks in the immediate vicinity of schools followed by streets leading from student housing to SHSU campus.

Source: HDR, Inc.



Source: HDR, Inc.

Bicycle Network

Huntsville, a college town with a large campus accessed by a young population, can promote and provide biking options to relieve congestion and parking requirements. A well-planned bicycle network connecting student housing to campus, shopping, and downtown will promote healthy living as well as an alternative travel option.

Transit

Public transportation has many benefits. Enhanced personal opportunities such as mobility, savings in time, not needing to purchase fuel, and a smaller footprint on the environment are just a few of the benefits of public transit. Public transportation provides an affordable alternative to driving and is proven to help reduce congestion. The shuttle systems from various student housing communities to the SHSU campus proves that an opportunity for Huntsville to develop its own transit system currently exists. Implementing a framework for public transportation will provide congestion relief to the people who make Huntsville home, as well as benefit the low income population, SHSU students, and elderly/disabled residents.

Access Management

Access management strategies can promote safety and mobility. As growth continues and businesses move or expand in Huntsville, systematic planning of driveway location, spacing, and design will help to ensure smooth traffic operations. By managing roadway access, public safety will increase, congestion will decrease, and the appearance and quality of the built environment will improve.

Intelligent Transportation Systems

ITS technologies can enhance the driving experience in many ways. As ITS become more integrated with our transportation infrastructure, drivers can expect safe, networked communications among vehicles, infrastructure, and personal communication devices that enable drivers to operate vehicles with greater knowledge of existing traffic conditions. Huntsville may consider utilizing available ITS options to ease congestion where possible and enhance the drivers experience through real-time travel information and adaptive control systems.