NOTICE OF MEETING OF THE GOVERNING BODY OF THE CITY OF NAVASOTA, TEXAS AUGUST 10, 2021

Notice is hereby given that a Special Meeting of the governing body of the City of Navasota will be held on the 10th of August, 2021 at 5:30 PM at the City Hall in the City Council Chambers, Room No. 161, located at 200 E. McAlpine Street, Navasota, Texas 77868, at which time the following subjects will be considered, to wit:

To watch the City Council meeting live please visit the City of Navasota's Youtube here: https://www.youtube.com/channel/UCltnx7BQt0TCIYJRiZ14g5w If you have any questions during the meeting please email them to council@navasotatx.gov or text 936-825-5557. Please ensure to provide your full name and home address. If you prefer to call-in please dial +13462487799 and enter Meeting ID: 709 770 2250 # To Join Meeting virtually please click link below:https://zoom.us/j/7097702250

1 Call to Order.

2 Invocation
Pledge of Allegiance

3 Public meeting and review of final drafts from Strand and Associates on the Thoroughfare Plan and the Pedestrian and Bicycle System Plan.

4 Adjourn.

DATED THIS

/BS/

BY: BRAD STAFFORD, CITY MANAGER

I, the undersigned authority, do hereby certify that the above notice of meeting of the governing body of the CITY OF NAVASOTA, is a true and correct copy of said notice and that I posted a true and correct copy of said notice in the glass bulletin board, in the foyer, on the south side of the Municipal Building as well as in the bulletin board on the north side of the Municipal Building of the City of Navasota, Texas, a place convenient and readily accessible to the general public at all times, and said notice was posted on at 12:00 AM and will remain posted continuously for at least 72 hours preceding the scheduled time of said meeting. Agendas may be viewed at www.navasotatx.gov.

The City Council reserves the right to convene in Executive Session at any time deemed necessary for the consideration of confidential matters under the Texas Government Code, Sections 551.071-551.089.

DATED THIS

/SMH/

BY: SUSIE M. HOMEYER, CITY SECRETARY

THIS FACILITY IS WHEELCHAIR ACCESSIBLE AND ACCESSIBLE PARKING SPACES ARE AVAILABLE. REQUESTS FOR ACCOMMODATIONS OR INTERPRETIVE SERVICES MUST BE MADE 48 HOURS PRIOR TO THIS MEETING. PLEASE CONTACT THE CITY SECRETARY'S OFFICE AT(936) 825-6475 OR (936) 825-6408 OR BY FAX AT (936) 825-2403.

CITY OF NAVASOTA
CITY COUNCIL AGENDA

AGENDA ITEM NO.: **3** **AGENDA DATE:** August 10, 2021

PREPARED BY: Rayna Willenbrink, Economic Development Specialist

APPROVED BY: **BS**

ITEM: Public meeting and review of final drafts from Strand and Associates on the Thoroughfare Plan and the Pedestrian and Bicycle System Plan.

ITEM BACKGROUND:
Strand Associates will provide an update on the final drafts of the Thoroughfare Plan and Pedestrian and Bicycle Plan for the City of Navasota.

BUDGETARY AND FINANCIAL SUMMARY:
N/A

STAFF RECOMMENDATION:
Staff recommends holding the town hall meeting.

ATTACHMENTS:
1. Thoroughfare Plan Update
2. Proposed Routing Map
3. Pedestrian and Bike System Plan

DRAFT 07.28.2021

Report for
City of Navasota, Texas

Thoroughfare Plan Update Report

Prepared by:

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TBPE No. F-8405
www.strand.com

July 2021

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SECTION 1
INTRODUCTION

1.01 INTRODUCTION

The City of Navasota (City) hired Strand Associates, Inc.® (Strand) to complete a review of the existing Thoroughfare Plan and document it in this Thoroughfare Plan Update Report (Report). This Report builds upon the City of Navasota Comprehensive Plan 2015-2025 adopted in August 2015 (Comp Plan). Specifically, the focus of this Report is on three items documented in the Comp Plan. These are:

1. Review the City's Thoroughfare Plan.
2. Review traffic operations at LaSalle Street and Washington Avenue intersection.
3. Identify high frequency crash zones for future projects.

1.02 REPORT PROCESS

The Report process consisted of four main components:

1. Existing thoroughfare plan review
2. Traffic operations analysis at the LaSalle Street and Washington Avenue intersection
3. Crash records review
4. Community involvement and Report development.

A. Existing Thoroughfare Plan Review

The first step was a review of the City's current comprehensive plan for the City, followed by a review of current Thoroughfare Plan Map and a review of the existing street classification system. The study team also summarized concepts for priority corridor projects.

B. Traffic Operations Analysis

The study team requested several types of data from Texas Department of Transportation (TxDOT) including 24-hour roadway traffic volume counts and current signal timings of the study intersection of Washington Avenue and LaSalle Street. Strand also collected traffic counts of peak period traffic at the intersection. Using City, TxDOT, and Strand data, the study team completed an analysis of existing and future conditions of the intersection. Following this analysis, several different alternatives were reviewed for modifying the intersection.

C. Crash Records Review

The study team used the Crash Record Information System (CRIS) tool from TxDOT to compile reported crashes from 2015 through 2019. Analysis includes a review of intersection crash rates, corridor crash rates, and possible contributing factors.

D. Community Involvement

Strand assisted the City with a community meeting to present the draft findings of the project and gather community input. A summary of the meeting is included in Section 5.

E. Development of the Report

The final step in the process was to document the approach and results in this Report. This City of Navasota Thoroughfare Plan Review Report was approved by the Navasota City Council on XXXX, XX, 2021.

1.03 EXECUTIVE SUMMARY AND RECOMMENDATIONS (TO BE UPDATED)

SECTION 2
EXISTING THOROUGHFARE PLAN REVIEW

2.01 INTRODUCTION

The Existing Thoroughfare Plan Review consists of a review of the existing street classifications and recommended modifications.

2.02 REVIEW OF STREET CLASSIFICATIONS

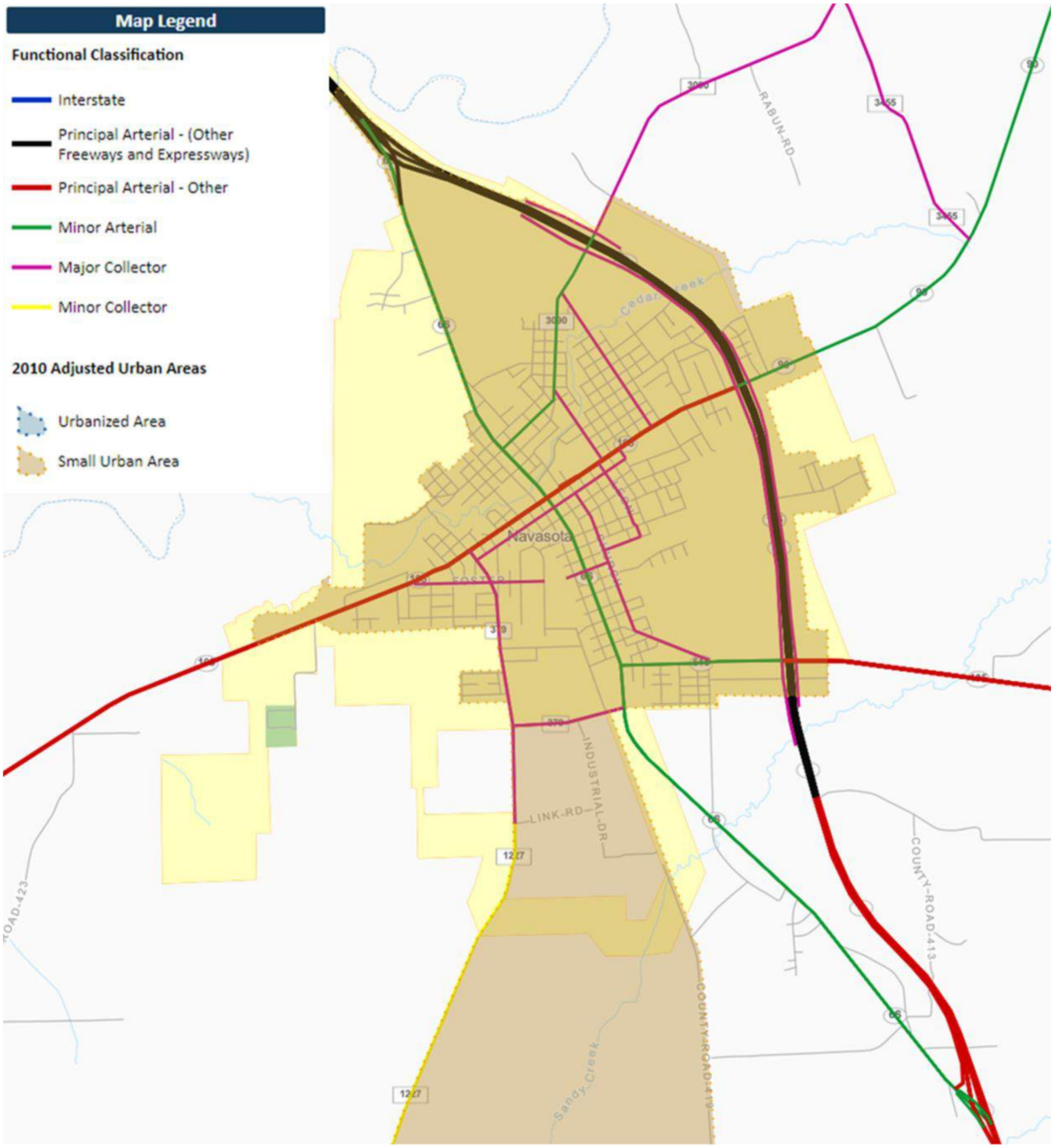
A. Street Classification

Streets are classified according to the functions they serve. There are two primary functions of a highway or street for motor vehicles: mobility, or throughput; and access to adjacent land uses. The highest level of street classification regarding mobility is an Interstate corridor. Interstates provide the highest level of mobility of any highway and provide zero direct access to adjacent land uses. The lowest level of street classification is a Local Street. A Local Street's primary goal is to provide access to the adjacent land uses. The hierarchy of street classifications from highest mobility and lowest access to lowest mobility and highest access is:

1. Interstate
2. Principal Arterial–Other Freeways and Expressways
3. Other Principal Arterial
4. Minor Arterial
5. Major Collector
6. Minor Collector
7. Local Street

B. Existing Street Classifications

Figure 2.02-1 shows the current TxDOT street classifications near the downtown of the City.



Source: https://www.txdot.gov/apps/statewide_mapping/StatewidePlanningMap.html

Figure 2.02-1 TxDOT Street Classification Map of the City

The current street classifications defined by TxDOT are generally appropriate based on the cross sections, land uses, basic functionality, traffic volumes, and speeds on the streets and highways shown. Figure 2.02-2 shows the existing Thoroughfare Plan in use by the City.

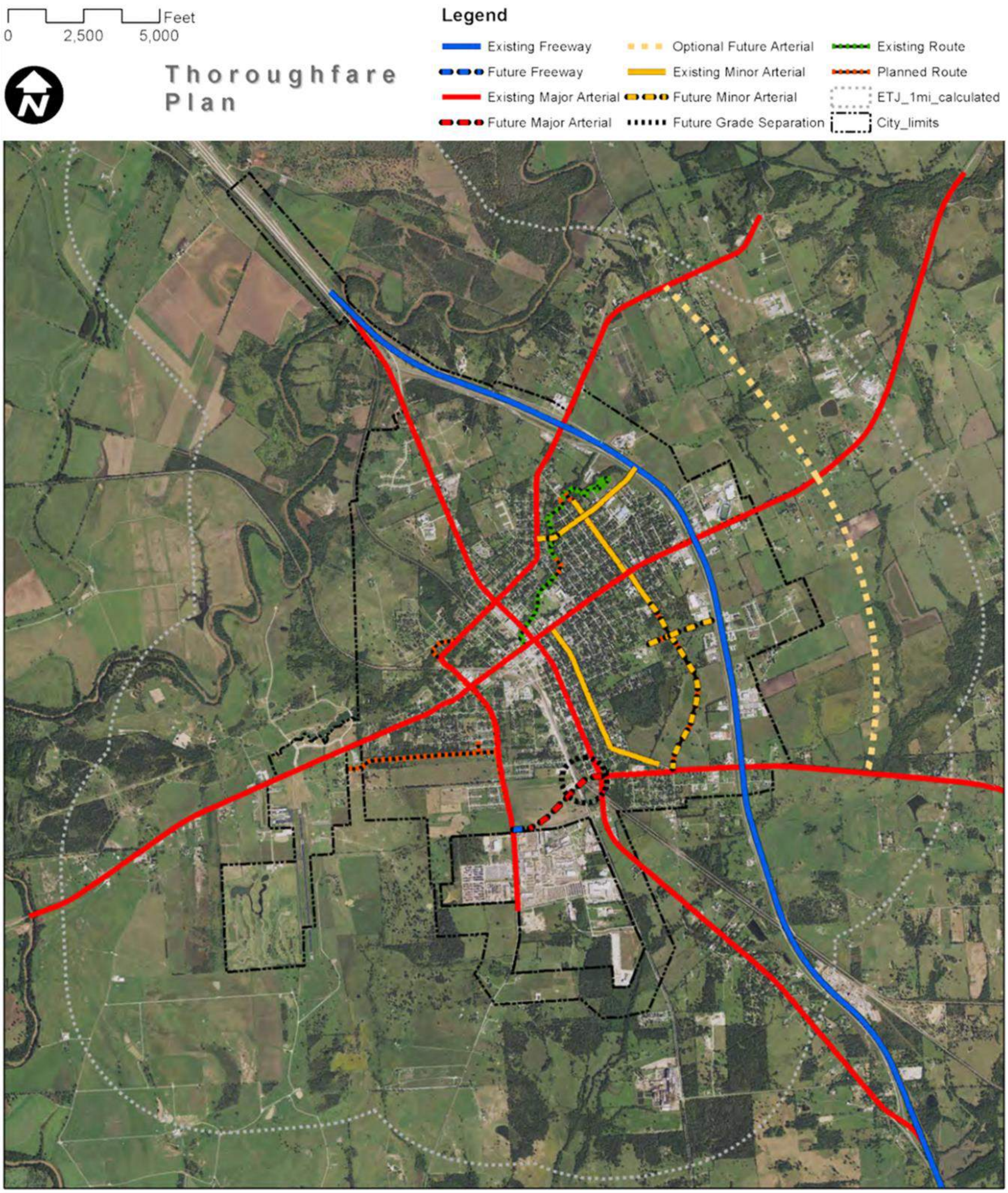


Figure 2.02-2 City Thoroughfare Plan

The City's Thoroughfare Plan, while differing in some areas from the TxDOT functional classification, is well suited for the City. The main differences lie in the fewer classification types that the City's Thoroughfare Plan has, and the future roadways the City is planning. The key connections the City is proposing include:

1. A new East Arterial running north to south between State Highway (SH) 105 and SH 90 and/or SH 90 and Force Main (FM) 3090.
2. The Spur 515 grade separation extending this east to west arterial to connect with FM 379 directly.
3. An extension of the Minor Arterial Judson Street to the south to connect to Spur 515.
4. An extension of the Minor Arterial Manley Street to the east to connect to the SH 6 frontage road.
5. A new east to west street connection just south of Roosevelt Street running between FM 379 and FM 422/Veteran's Memorial Drive.
6. A new 5th Street connection to Blackshear Street. This route serves as a Major Arterial for this section of the City according to the Thoroughfare Plan.
7. Local street connections generally along Cedar Creek.

These proposed routes are appropriate based on City layout and roadway functionalities. Additional discussion regarding the East Arterial and Spur 515 grade separation is included in the next section.

C. Typical Street Sections

Required right-of-way (R/W) widths tend to vary for different classifications of streets.

1. Local streets need the least amount of R/W being able to function with 40 to 60 feet typically used for travel lanes, parking, and sidewalk.
2. Collectors typically need 60 to 80 feet of R/W because they sometimes have multiple lanes in each direction.
3. Major and minor arterials have an even wider footprint to accommodate higher traffic of as low as 80 feet, but typically 100 to 120 feet of R/W. This wider footprint can accommodate multiple lanes in each direction, turn lanes, and medians as well as sidewalks and curb and gutter or drainage ditches.

For future planning, these general R/W widths should be used for new roadways based on their planned functional classification.

2.03 PRIORITY FUTURE IMPROVEMENTS

Based on the City's Thoroughfare Plan and discussions held during the development of this Report, the City is considering the following higher priority new street connections and improvements.

A. The City's East Arterial

The City is interested in understanding the possible location, impacts, and costs for a new north to south arterial east of SH 6 that would improve mobility, increase safety, and provide connectivity for local traffic. SH 6 is an important regional arterial carrying substantial traffic volumes. The 1.8-mile section of SH 6 along the east side of the City between SH 105 and SH 90 also functions as a local arterial for residents and visitors because there are no parallel alternate routes to destinations such as the high school and light industrial establishments. In 2015, SH 6 traffic volumes south of SH 105 were 19,553 vehicles per day (vpd)[1]. Between SH 105 and SH 90 they rose to 29,564 vpd, an increase of 10,000 vpd, largely made up of traffic from SH 105. North of SH 90 volumes dropped to 25,098 vpd. This suggests that up to 4,500 vpd on SH 6 could be local traffic that uses SH 6 because there are no parallel alternative routes.

TxDOT forecasts volumes on this section of SH 6 will increase more than 100 percent to 43,430 vpd by 2035. Factors fueling this growth include:

1. The City's comprehensive plan that designates the area east of SH 6 between SH 105 and SH 90 as a growth center, planned for single-family residential.

2. The lack of a good alternate connection between SH 105 and SH 90

3. The completion of the SH 249 project, which will likely generate additional traffic on SH 6.

An alternative arterial route located east of SH 6 could improve safety, reduce congestion, and reduce local traffic on this important SH 6 regional route. An alternative route east of SH 6 would address all of these concerns and provide relief for those drivers with destinations within the area of the City, and also provide alternative connections to routes SH 105 and SH 90 that do not interfere with regional traffic heading toward Bryan and College Station or Montgomery County.

This project would likely be completed in two stages with the first stage extending from SH 105 to SH 90. The second stage would extend from SH 90 to FM 3090.

[1]Source: http://www.dot.state.tx.us/apps/statewide_mapping/StatewidePlanningMap.html

1. Alignment Layout of Proposed Roadway

The initial stage of the proposed east arterial between SH 105 and SH 90 would be approximately 1.7 miles long. The centerline of the roadway would begin approximately 3,400 feet to the east of the centerline of the east SH 6 frontage road. This roadway would run to the north with one horizontal curve with a radius of approximately 6,200 feet and a superelevation of 2.5 percent, meeting a design speed of 60 miles per hour (mph). The centerline of the roadway would tie into SH 90 approximately 2,500 feet northeast of the SH 6 frontage road. The roadway would generally need a R/W of 150 feet, with additional R/W potentially necessary at both the SH 105 and SH 90 intersections to accommodate turn lanes and provide adequate sight distance. A traffic signal warrant analysis would be required at both intersections to determine the intersection control type. A conceptual layout is shown in Figure 2.03-1 and can be found in Appendix A.

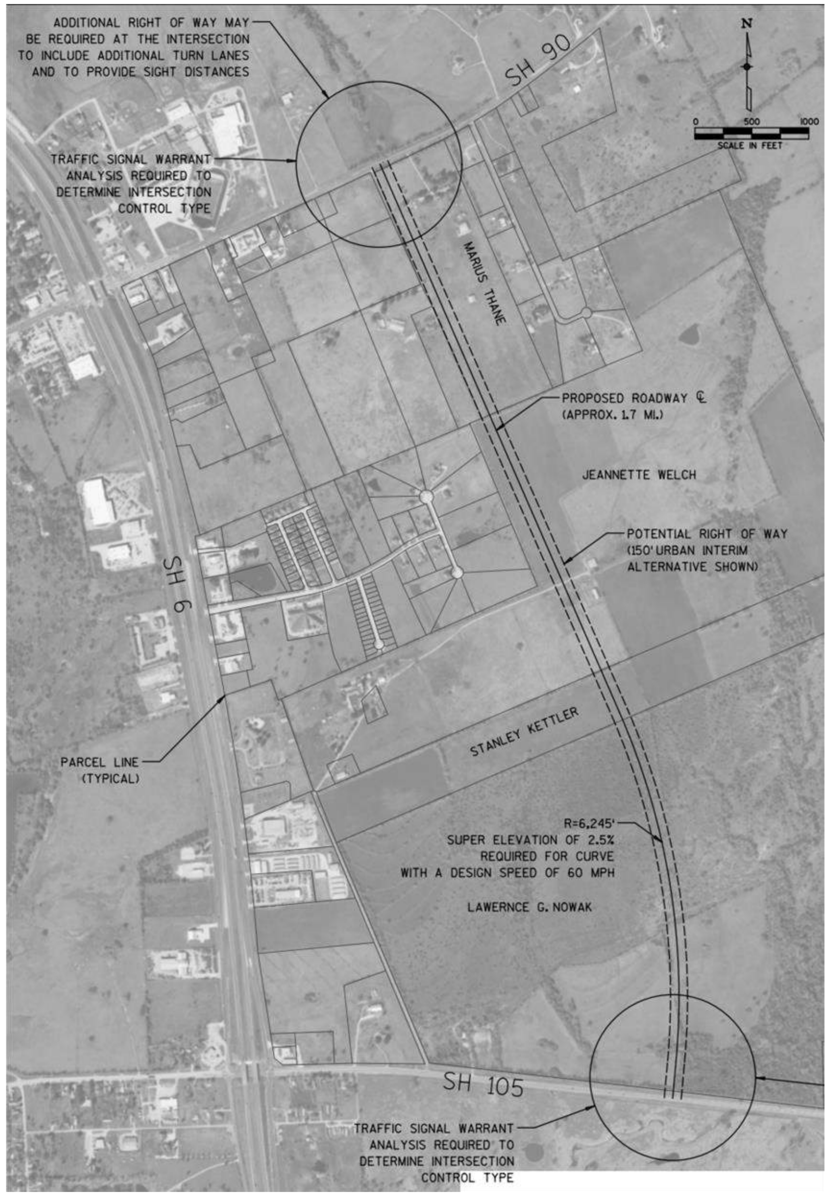


Figure 2.03-1 East Arterial Conceptual Layout

2. Proposed Typical Sections

Based on the current land use, using a three-lane rural typical section would be appropriate. This includes one 12-foot travel lane with a 10-foot outside shoulder in each direction and a 16-foot shared turning lane in the center of the roadway. This would also require a 30-foot clear zone from the edge of the travel lanes and slopes at 6:1 away from the shoulder and 4:1 on the back side of the ditch. As noted, this option would need approximately 150 feet for R/W.

Depending on the intensity of future land uses and City preferences, there are at least two other options available for the typical section. The second option is a two-lane divided suburban typical section. This section would be appropriate if the City anticipates residential development nearby. It has the same 12-foot travel lanes and 10-foot shoulder in each direction, and the same clear zone and ditch requirements as the two-lane rural section. However, the center of the roadway would have a 22-foot raised median with curb. This would allow left-turn bays in the median leading into residential subdivisions as those develop around this area, and would provide potential two-stage pedestrian and bicycle crossings resulting in a more pedestrian and bicycle-friendly environment. This section would also likely require some drainage structures in the median to capture stormwater during rain events. This option would need approximately 150 feet for R/W. This option could serve as an interim section with the ability to expand it in the future to the third option listed in the following.

A third option for typical section is a four-lane divided urban typical section. This would be appropriate if the City anticipates mixed commercial and residential land uses and the higher traffic that such development would generate. This typical section includes two 12-foot travel lanes in each direction with curb and gutter, a 6-foot buffer/on-street bike accommodation, and sidewalk on the outside in each direction along with a 22-foot raised median with turn lanes where needed. This option would need approximately 106 feet for R/W.

Figure 2.03-2 shows the possible typical sections.

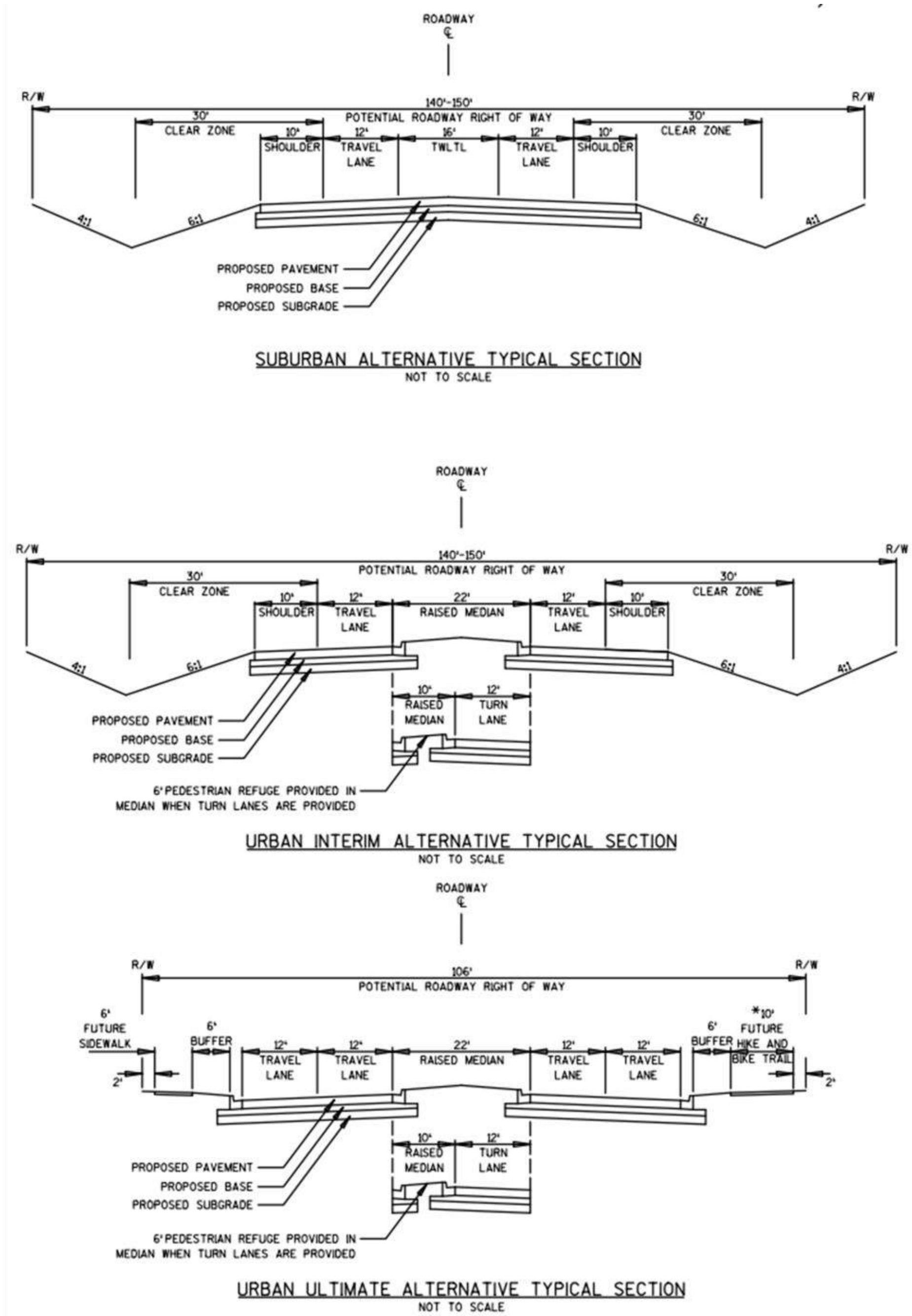


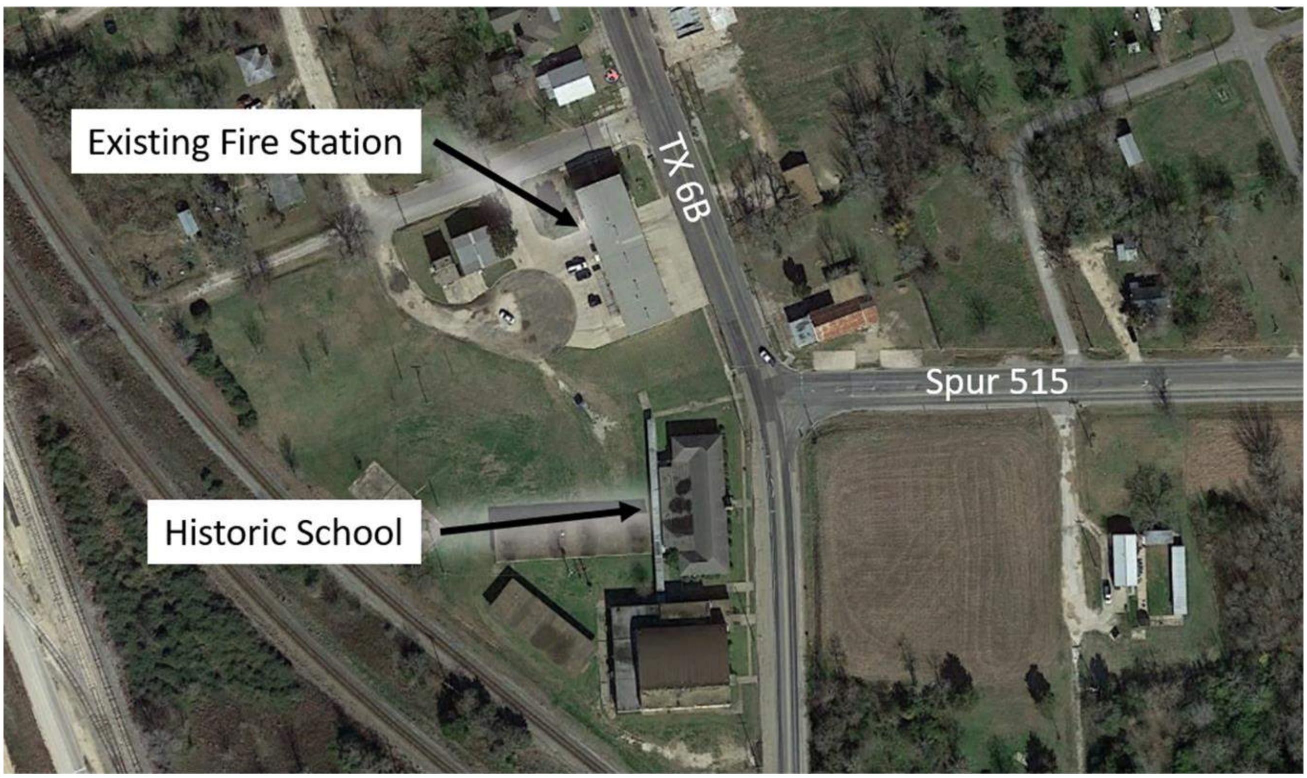
Figure 2.03-2 Possible East Arterial Typical Sections

B. Spur 515 Grade Separation

The need for improved provision of emergency services to Navasota resident's west of the Union Pacific (UP) and BSNF railroads is a concern voiced throughout the City of Navasota Comprehensive Plan 2015-2025. The City is interested in understanding possible locations, impacts, and costs for roadway improvements to address this need.

Currently, Washington Avenue is the only arterial to cross the UP and the BSNF Railroad. There are three local roads that also provide access, but these roads are close to downtown. There are several subdivisions on the southwest side of the City that experience reduced access and longer response times for emergency services. To resolve this problem, the City is looking to extend the Spur 515 across both railroads and connect into FM 379 to provide grade separated arterial access to the southwest portions of the City.

Extending this road has some challenges because of the locations of several buildings where the Spur 515 currently ends. The area is shown in Figure 2.03-3.



Aerial from Google Earth Pro

Figure 2.03-3 Buildings Near the Possible Spur 515 Extension

As shown, there is an existing fire station serving the south side of the City, as well as a historic school building directly across from where the Spur 515 tees into SH 6B. The City would like to avoid relocating or significantly impacting either of these locations, if possible. Strand has developed four different alternatives to connect the existing Spur 515 roadway with a grade separation over the railroad. The alternatives are shown on the following pages and are also provided in Appendix B.

1. Alternative 1–Single Structure, Two-Span Bridge Over All Railroads

Alternative 1 connects Spur 515 to FM 379 approximately across from Heritage Drive. It crosses over all three railroad lines as well as Interstate Drive and Hollister Road in a single span at the railroad curve just south of Abraham Street. Before crossing over SH 6B, the road veers north, impacting several lots north of existing Spur 515 including the existing fire station. The road then crosses over the railroad tracks using a bridge that is perpendicular to Interstate Drive and curves on the west end to the north before running along the edge of the south lot line parallel to Camelot Lane and connecting at FM 379. This route affects approximately 18 parcels. The bridge itself would be a two-span bridge structure with 200-foot and 140-foot span lengths. The center pier would be located off railroad R/W. A schematic of this alternative is shown in Figure 2.03-4. While this option has lower impacts on the neighborhood than some of the other alternatives and only a single structure, most of the parcels affected have residential homes that would require relocation. Additionally, the existing fire station would need to be relocated which would increase the cost of this alternative. Furthermore, the current quarry and materials land use on the west side of SH 6B may render this alternative no longer feasible. Because of these issues, this alternative is not recommended for further development.

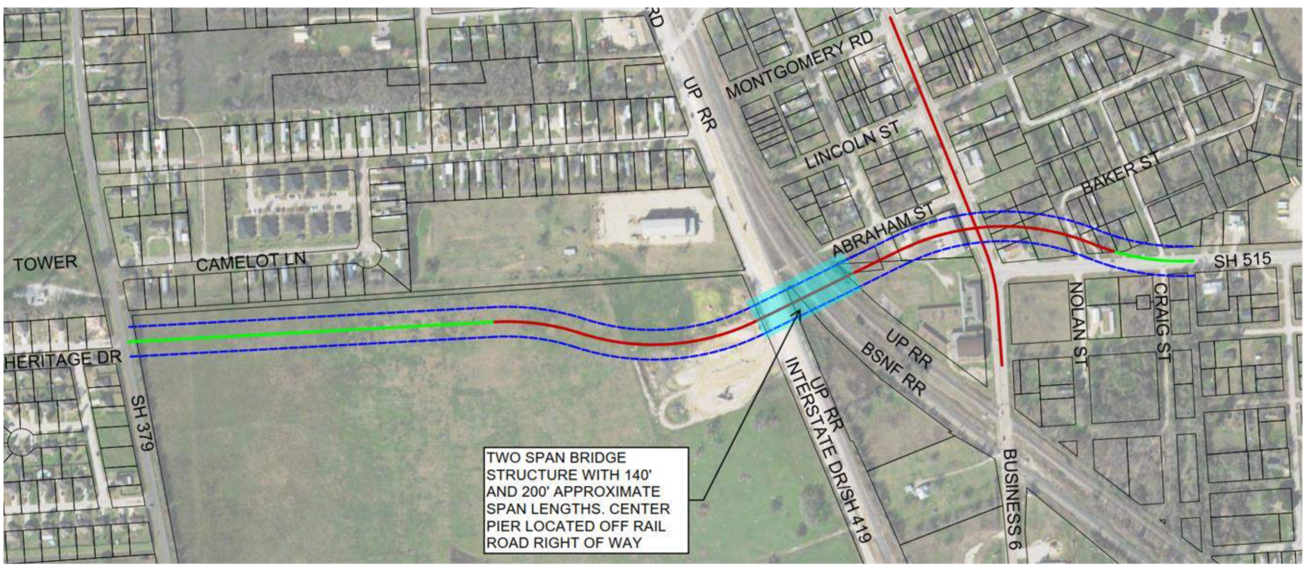


Figure 2.03-4 Alternative 1 Geometric Layout

2. Alternative 2–Single Structure, Single-Span Bridge Over All Railroads

Alternative 2 connects Spur 515 to FM 379 approximately 200 feet north of Heritage Drive. From the east end, the Spur 515 corridor curves north at Craig Street and then south near the existing fire station, crossing the railroad perpendicular to Hollister Street/Interstate Drive at approximately Lincoln Street. The road then curves north again to run parallel to Camelot Lane through the line of parcels on the south side of the street. Both ends of SH 6B would need to be realigned, connecting into Spur 515 in different locations and impacting the continuity of SH 6B for through traffic. This alternative affects approximately 44 parcels directly, and may impact others because of the realignment of other roads. The bridge itself is a single-span structure with an approximately 230-foot span. A schematic of Alternative 2 is shown in Figure 2.03-5. While this alternative minimizes the length of the bridge and only requires a single structure, it also has the most impacts of the alternatives considered including many likely residential relocations as well as the fire station. For these reasons, this alternative is not recommended for further development.

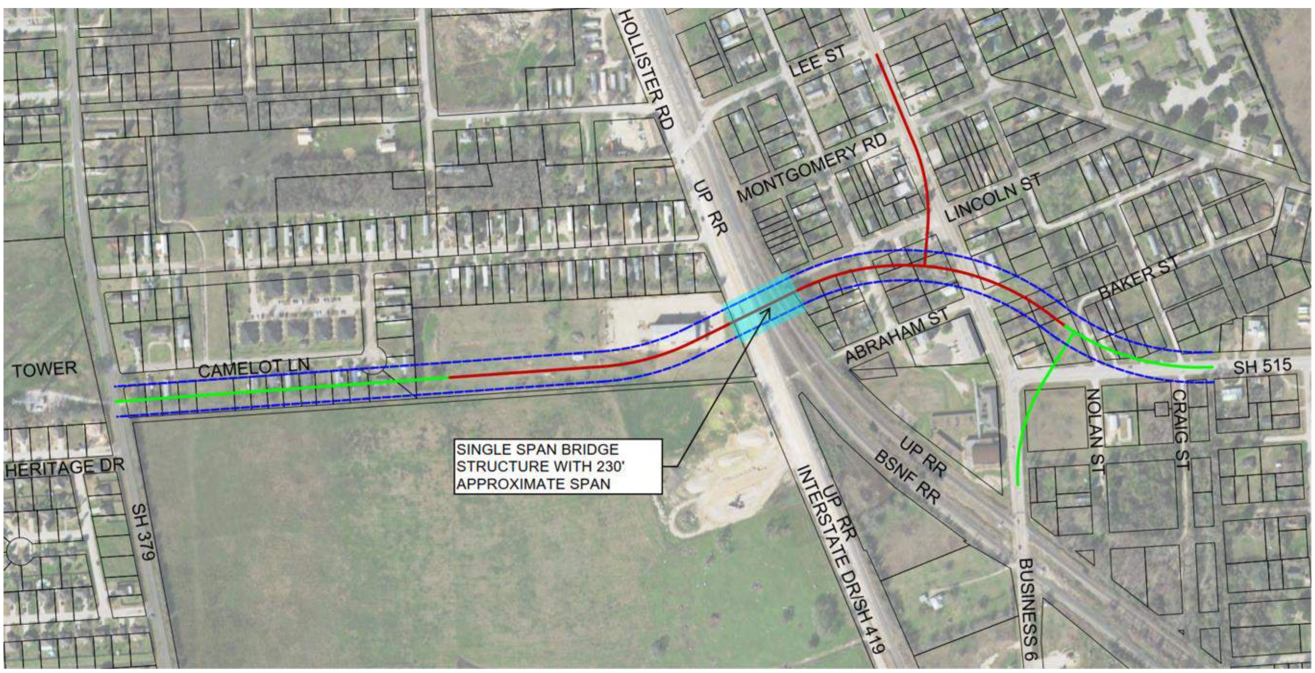


Figure 2.03-5 Alternative 2 Geometric Layout

3. Alternative 3–Two Single-Span Structures Over Railroads

Alternative 3 connects Spur 515 to FM 379 south of the previous two alternatives on the current alignment of FM 379 at Hollister Street/Interstate Drive. The Spur 515 corridor curves to the south at Texas Street and crosses perpendicular to the UP and BSNF railroad lines on a bridge before curving back east and passing over SH 6B on a second bridge. The corridor crosses over the second UP railroad line and Hollister Street/Interstate Drive on a third bridge. This requires a realignment of the west end of the existing Spur 515 to connect the new roadway into Business 6 north of the railroad tracks. This alternative directly impacts approximately 14 parcels; however, most of these appear to be vacant, so there are fewer relocations anticipated than Alternative 1 or Alternative 2.

The eastern bridge over the UP and BSNF railroads would be a single-span structure with an approximate span of 200 feet. The center bridge over SH 6B would be a single-span structure of approximately 100 feet. The western bridge over the UP railroad and Hollister Street/Interstate Drive would be a single-span structure of approximately 150 feet. A schematic of Alternative 3 is shown in Figure 2.03-6. The alternative includes three bridge structures that will increase the construction and maintenance costs; however, it does not impact the quarry or materials land use on the west side of SH 6B and it does not impact the fire station. Strand recommends this alternative be considered for further development.

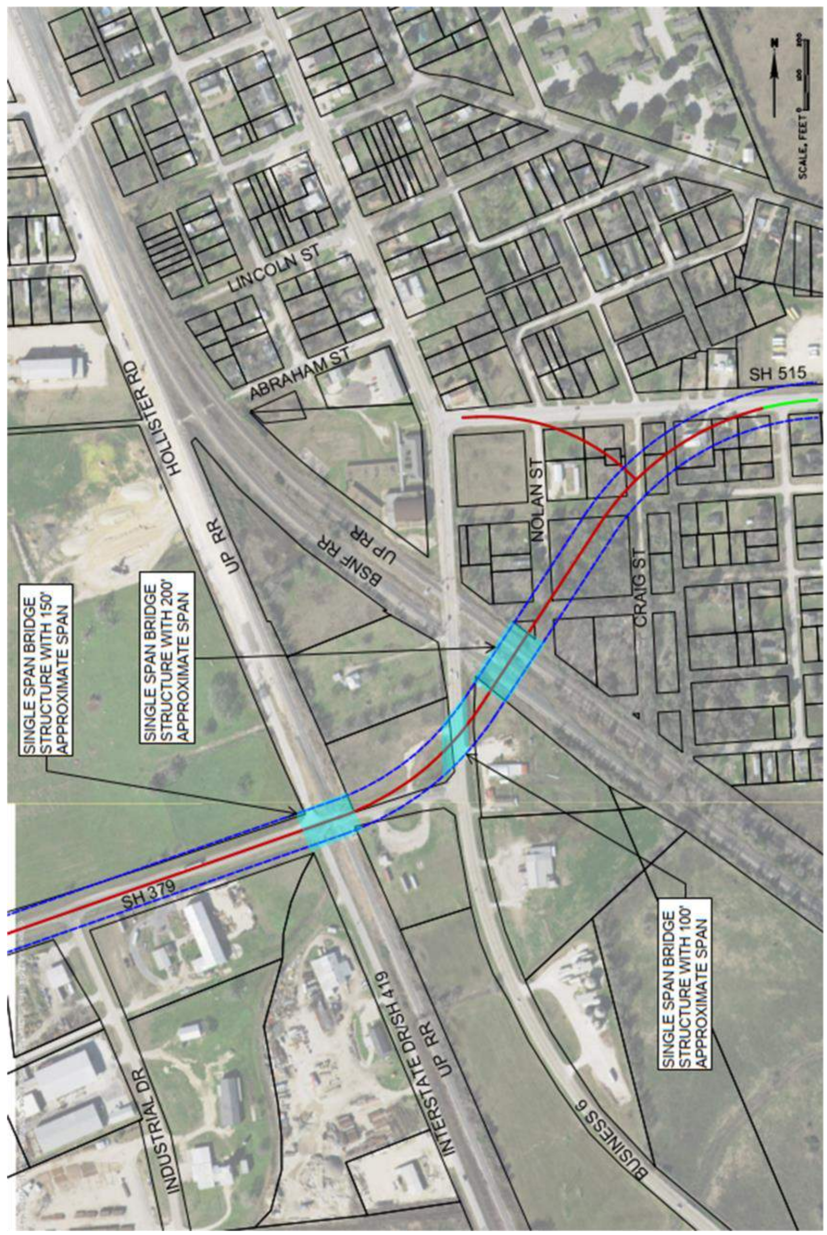


Figure 2.03-6 Alternative 3 Geometric Layout

4. Alternative 4–Two Single-Span Structures with Realignment of Business 6

Alternative 4 takes a slightly different approach. Instead of connecting the existing Spur 515 to FM 379, it realigns SH 6B and provides a grade separated crossing over the UP and BSNF railroads. It connects Spur 515 and FM 379 as tee intersections with SH 6B, with FM 379 having a grade separated crossing over the UP railroad and Hollister Street/Interstate Drive. The SH 6B corridor is realigned to cross the BSNF and UP railroads perpendicularly. This alternative would directly affect approximately 25 parcels. Most of these lots appear to be vacant; however, there are several buildings that would need to be relocated including a gas station. The eastern bridge over the UP and BSNF railroads would be a single-span structure with an approximate span of 200 feet. The western bridge on FM 379 over Interstate Drive and the UP railroad would be a single-span structure with an approximate span of 150 feet. A schematic of Alternative 4 is shown in Figure 2.03-7. This alternative has good continuity SH 6B through traffic. It shares many of the benefits of Alternative 3; however, it has more impacts and these impacts affect more residential uses. Because of these issues, this alternative is not recommended for additional development.

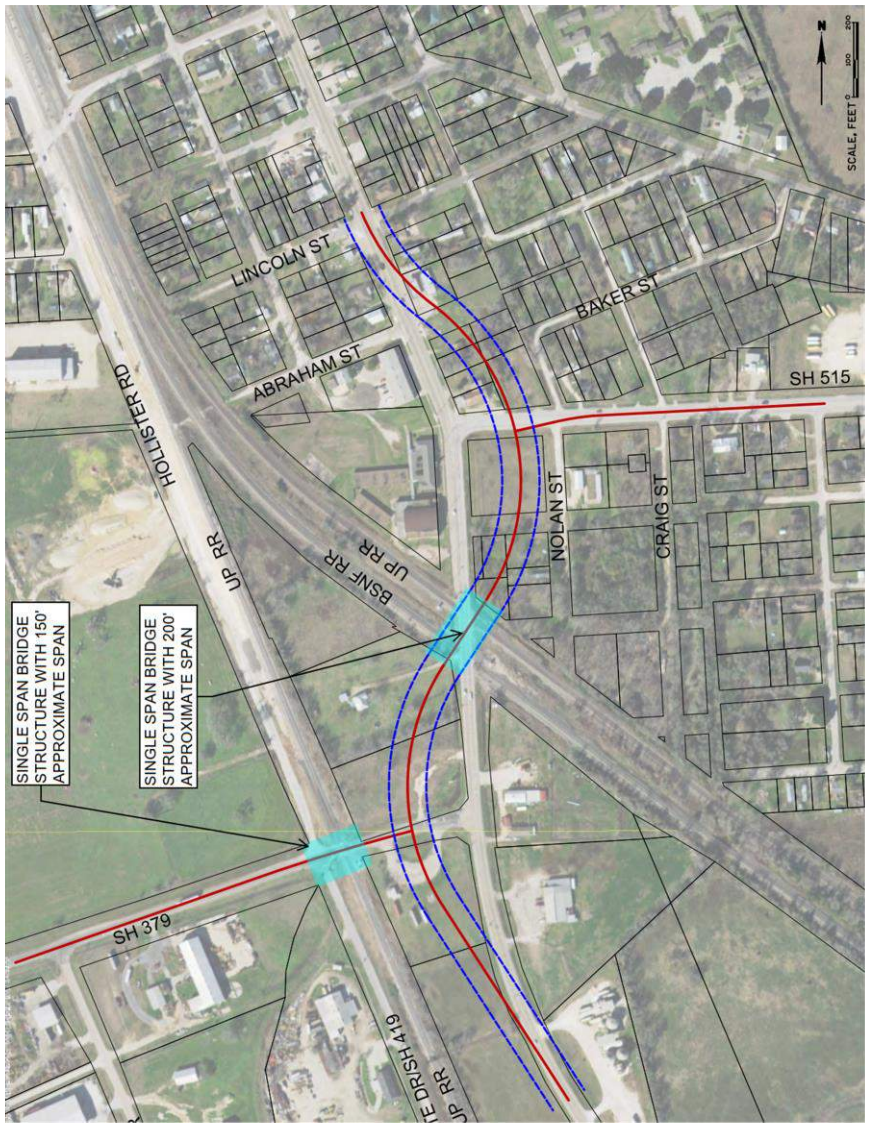


Figure 2.03-7 Alternative 4 Geometric Layout

SECTION 3
TRAFFIC OPERATIONS ANALYSIS

3.01 INTRODUCTION

The project team collected traffic data, forecasted future traffic volumes, performed traffic operations modeling, and tested improvement alternatives for the intersection of SH 105/Washington Avenue and SH 6B/LaSalle Street. The following sections document the process and results.

3.02 TRAFFIC VOLUMES AND PATTERNS

A. Existing Conditions

1. Daily Roadway Volumes

Traffic volumes were gathered for the two main corridors in the downtown of the City: Washington Avenue and LaSalle Street. The average annual daily traffic (AADT) volumes were taken from the TxDOT statewide planning map website to get traffic counts from the past 20 years. These volumes for each leg of the Washington Avenue and LaSalle Street intersection are shown in Table 3.02-1.

	Eastbound	Northbound	Westbound	Southbound
Year	Washington Avenue	South LaSalle Street	Washington Avenue	North LaSalle Street
2018	12,550	6,361	11,347	9,703
2017	10,387	6,917	9,152	10,327
2016	10,387	6,918	9,700	10,414
2015	9,738	7,730	9,740	11,173
2014	7,913	6,950	5,694	10,522
2013	9,350	7,481	9,908	10,513
2012	9,100	6,600	8,800	10,500
2011	10,700	6,800	11,200	8,600
2010	10,400	10,100	10,700	9,400
2009	10,900	9,600	11,600	8,600
2008	10,000	6,000	10,800	8,000
2007	10,400	9,400	11,000	9,600
2006	10,200	9,400	10,900	9,000
2005	10,600	10,620	11,000	10,680
2004	10,400	8,100	10,700	8,100
2003	11,000	7,400	11,700	9,600
2002	9,400	7,400	9,900	8,100
2001	8,800	7,100	10,500	8,500
2000	8,200	7,400	10,200	8,600
1999	8,900	7,500	8,000	8,600

Table 3.02-1 AADT Volumes 1999 to 2018

2. Hourly Turning Movement Volumes

In addition to the daily traffic volumes, the study team collected existing AM and PM peak-hour turning movements at the Washington Avenue and LaSalle Street intersection. These volumes are shown in Figure 3.02-1 and Figure 3.02-2. The AM peak hour was from 7:30 A.M. to 8:30 A.M., and the PM peak hour was from 5 P.M. to 6 P.M.

Figure 3.02-1 2019 AM Peak Hour Volumes

Figure 3.02-2 2019 PM Peak Hour Volumes

B. Future Conditions

1. Daily Traffic Volume Trends

To develop the forecast volumes, the AADT from the past 20 years was analyzed to find growth trends. These trends were used to calculate annual growth rates for each leg of the intersection. These growth rates are shown in Table 3.02-2.

	Eastbound	Northbound	Westbound	Southbound
	Washington Avenue	South Lasalle Street	Washington Avenue	North Lasalle Street
Growth Rate	2.1%	0.5%	0.5%	1.1%

Table 3.02-2 Washington Avenue and LaSalle Street Growth Rates

The eastbound volume had the most consistent growth trend over the past 20 years. The northbound volumes had a slight decrease in growth overall, so the growth rate was set to a modest 0.5 percent. The WB volumes increased overall between 1999 to 2018 but had annual growth rates that varied greatly when looking at all 20 years. For this reason, a growth rate of 0.5 percent was set for westbound as well. The southbound volume did not have consistent growth over the past 20 years, but did trend toward positive growth. Because of this, the highest yearly growth rate from the past five years of 1.1 percent was selected as a conservative value that tended to match the overall 20-year growth rate trend. These rates were used to project the base volume to get a projection for the 20-year hourly intersection volumes in 2040.

2. Hourly Turning Movement Forecasts

The AM and PM peak hour volumes were increased to 2040 conditions using linear application of the annual growth rates from each leg of the intersection. These forecasted volumes can be found in Figures 3.02-3 and 3.02-4.

Figure 3.02-3 Forecasted 2040 AM Peak Hour Volumes

Figure 3.02-4 Forecasted 2040 PM Peak Hour Volumes

3.03 INTERSECTION TRAFFIC OPERATIONS AND RANGE OF IMPROVEMENTS

The study team used Synchro10/SimTraffic10 software to perform traffic modeling of the intersection of Washington Avenue and LaSalle Street The traffic signal timings were provided by TxDOT. Motor vehicle operations are typically evaluated based on the Level of Service (LOS) criteria as defined in the Highway Capacity Manual (HCM) from the Federal Highway Administration (FHWA). LOS values range from A through F with LOS A representing very low delay to drivers and LOS F representing conditions where the vehicular demand (arrivals at an intersection) exceeds the capacity of the intersection. LOS F conditions result in long delays and queuing at intersections.

Because of limitations in the methodology, the HCM values do not adequately reflect the queueing times for the shared northbound and southbound left-turn/through lanes. To modify this issue, the northbound and southbound lanes were reconfigured to separate the left turn and the through movements for LOS reporting purposes. This model was used to get the output for the HCM ratings, and the original base model with the combined left and through lane for northbound and southbound was used with SimTraffic to determine queue lengths and general operations. This methodology was used for all alternatives that had a shared lane configuration. The intersection operations reports can be found in Appendix C, and the intersection queue length reports can be found in Appendix D.

A. Existing Conditions

The traffic modeling results for existing conditions of Washington Avenue and LaSalle Street are shown in Tables 3.03-1 and 3.03-2.

Washington Ave & Lasalle St - Existing AM*

Control	Traffic Signal									
Approach	Movement	Volume	Delay (s)	LOS	V/C	Queue (veh)	95th Queue (ft)	Average Queue (ft)	Max. Queue (ft)	Intersection Delay (s)
Northbound	NBL	70	14.8	B	0.20	0.9	25	80	136	12.8
	NBT	116	13.1	B	0.28	1.4	35	80	136	
	NBR	124	13.4	B	0.35	1.5	40	70	121	
Eastbound	EBL	152	8.7	A	0.28	1.3	35	77	125	
	EBT	188	0.0	A	0.49	0.0	25	104	167	Intersection LOS
	EBR	22	12.9	B	0.49	2.6	65	104	167	B
Southbound	SBL	41	14.5	B	0.11	0.5	25	69	124	
	SBT	105	13.0	B	0.25	1.2	30	69	124	
	SBR	168	14.0	B	0.47	2.1	55	90	151	
Westbound	WBL	87	9.0	A	0.16	0.8	25	46	110	Max Movement V/C
	WBT	185	0.0	A	0.63	0.0	25	117	204	0.63
	WBR	48	14.7	B	0.63	3.2	80	117	204	
* Modified Lanes							Operations:	SimTraffic	SimTraffic	HCM 6

Table 3.03-1 AM Existing Conditions LOS Operations

Washington Ave & Lasalle St - Existing PM*

Control	Traffic Signal									
Approach	Movement	Volume	Delay (s)	LOS	V/C	Queue (veh)	95th Queue (ft)	Average Queue (ft)	Max. Queue (ft)	Intersection Delay (s)
Northbound	NBL	54	16.2	B	0.17	0.8	25	107	171	13.8
	NBT	140	13.6	B	0.32	1.8	45	107	171	
	NBR	118	13.6	B	0.32	1.5	40	71	108	
Eastbound	EBL	222	9.5	A	0.41	2.1	55	118	140	
	EBT	274	0.0	A	0.71	0.0	25	208	346	Intersection LOS
	EBR	59	14.2	B	0.71	4.6	115	208	346	B
Southbound	SBL	122	16.6	B	0.35	1.8	45	151	245	
	SBT	174	13.9	B	0.40	2.2	55	151	245	
	SBR	188	14.5	B	0.51	2.5	65	104	180	
Westbound	WBL	70	10.1	B	0.16	0.7	25	52	116	127
	WBT	160	0.0	A	0.68	0.0	25	127	221	0.71
	WBR	82	15.9	B	0.68	3.6	90	127	221	
* Modified Lanes							Operations:	SimTraffic	SimTraffic	HCM 6

Table 3.03-2 PM Existing Conditions LOS Operations

As shown in Tables 3.03-1 and 3.03-2, the intersection operates adequately with LOS of B for the overall intersection for both the AM and PM peak hour. The queuing (vehicles backed up waiting) is moderate reaching up to approximately 350 feet eastbound in the afternoon, according to the models.

B. Future No-Build

The future no-build conditions model the existing roadway configuration with the future traffic volumes. The HCM results are shown in Tables 3.03-3 and 3.03-4.

Washington Ave & Lasalle St - Future No Build AM *

Control	Traffic Signal									
Approach	Movement	Volume	Delay (s)	LOS	V/C	Queue (veh)	95th Queue (ft)	Average Queue (ft)	Max. Queue (ft)	Intersection Delay (s)
Northbound	NBL	78	15.9	B	0.24	1.1	30	113	163	13.7
	NBT	129	13.6	B	0.31	1.6	40	113	163	
	NBR	138	14.0	B	0.39	1.7	45	90	147	
Eastbound	EBL	233	9.3	A	0.43	2.1	55	126	140	
	EBT	288	0.0	A	0.74	0.0	25	217	336	Intersection LOS
	EBR	34	14.8	B	0.74	4.5	115	217	336	B
Southbound	SBL	52	15.3	B	0.15	0.7	25	109	189	
	SBT	132	13.6	B	0.32	1.6	40	109	189	
	SBR	211	15.1	B	0.60	2.8	70	118	177	
Westbound	WBL	97	9.6	A	0.20	0.9	25	63	129	Max Movement V/C
	WBT	205	0.0	A	0.72	0.0	25	148	240	0.74
	WBR	53	15.9	B	0.72	3.8	95	148	240	
* Modified Lanes							Operations:	SimTraffic	SimTraffic	HCM 6

Table 3.03-3 AM Future No Build LOS Operations

Washington Ave & Lasalle St - Future No Build PM *

Control	Traffic Signal									
Approach	Movement	Volume	Delay (s)	LOS	V/C	Queue (veh)	95th Queue (ft)	Average Queue (ft)	Max. Queue (ft)	Intersection Delay (s)
Northbound	NBL	60	21.5	C	0.22	1.3	35	134	183	17.2
	NBT	155	16.9	B	0.32	2.8	70	134	183	
	NBR	131	16.9	B	0.32	2.4	60	92	165	
Eastbound	EBL	340	11.2	B	0.61	4.4	110	135	140	
	EBT	420	0.0	A	0.90	0.0	25	1667	2058	Intersection LOS
	EBR	90	19.2	B	0.90	10.2	255	1667	2058	B
Southbound	SBL	154	21.9	C	0.47	3.4	85	206	304	
	SBT	219	17.7	B	0.45	4.1	105	206	304	
	SBR	237	18.6	B	0.58	0.1	25	158	237	
Westbound	WBL	78	12.8	B	0.23	1.0	25	76	129	Max Movement V/C
	WBT	178	0.0	A	0.59	0.0	25	193	307	0.90
	WBR	91	17.5	B	0.59	5.3	135	193	307	
* Modified Lanes							Operations:	SimTraffic	SimTraffic	HCM 6

Table 3.03-4 PM Future No Build LOS Operations

Under the future volumes, the intersection functions well when looking at the LOS, with operations at LOS B for both the AM and PM peak hour. The issue is with the average and maximum queue length for the eastbound traffic. The first railroad to the west of the intersection (UP Railroad) is approximately 650 feet from the eastbound stop bar at the intersection. The SimTraffic model shows the eastbound queue extending to approximately 1,670 feet on average with a maximum queue of approximately 2,060 feet, which puts the queue past both RR crossings and as far west as 7th Street without modifications. Because this queue is long and could pose a safety hazard, five alternatives were created to attempt to shorten the queue length to be out of conflict with the railroad.

C. Future Alternative 1–Existing Geometry with New Signal Timings and Lengthened Turn Bays

Alternative 1 was modeled with the existing roadway geometric configuration, but with adjusted signal timings and a lengthened eastbound left-turn bay. The left turn bay was extended from the existing 115 feet to 200 feet. Because of this extension, the left-turn bay extends through Farquhar Street, with queued vehicles sometimes blocking the westbound and northbound left-turning movements. As a result, the operations at the intersection of Washington Avenue and Farquhar Street were changed to right in-right out (Figure 3.03-1). The HCM results can be found in Tables 3.03-5 and 3.03-6.

Figure 3.03-1 Alternative 1 Geometric Layout with Farquhar Street Access Change

Washington Ave & Lasalle St - Future Alt 1 AM*

Control	Traffic Signal									
Approach	Movement	Volume	Delay (s)	LOS	V/C	Queue (veh)	95th Queue (ft)	Average Queue (ft)	Max. Queue (ft)	Intersection Delay (s)
Northbound	NBL	78	21.8	C	0.31	1.5	40	118	170	
	NBT	129	18.6	B	0.39	2.3	60	118	170	16.4
	NBR	138	19.2	B	0.49	2.5	65	79	115	
Eastbound	EBL	233	10.1	B	0.43	2.6	65	125	212	
	EBT	288	0.0	A	0.64	0.0	25	169	279	Intersection LOS
	EBR	34	15.3	B	0.64	5.4	135	169	279	
Southbound	SBL	52	20.9	C	0.20	1.0	25	111	189	
	SBT	132	18.6	B	0.40	2.3	60	111	189	B
	SBR	211	21.1	C	0.75	4.1	105	113	170	
Westbound	WBL	97	10.1	B	0.20	1.1	30	65	110	Max Movement V/C
	WBT	205	0.0	A	0.58	0.0	25	133	214	0.75
	WBR	53	15.9	B	0.58	4.3	110	133	214	
* Modified Lanes							Operations:	SimTraffic	SimTraffic	HCM 6

Table 3.03-5 AM Alternative 1 LOS Operations

Washington Ave & Lasalle St - Future Alt 1 PM*

Control	Traffic Signal									
Approach	Movement	Volume	Delay (s)	LOS	V/C	Queue (veh)	95th Queue (ft)	Average Queue (ft)	Max. Queue (ft)	Intersection Delay (s)
Northbound	NBL	60	25.7	C	0.25	1.5	40	185	251	
	NBT	155	20.2	C	0.33	3.4	85	185	251	20.4
	NBR	131	20.2	C	0.33	2.9	75	122	182	
Eastbound	EBL	340	13.3	B	0.65	5.5	140	215	225	
	EBT	420	0.0	A	0.91	0.0	25	576	887	Intersection LOS
	EBR	90	22.5	C	0.91	12.0	300	477	748	
Southbound	SBL	154	26.3	C	0.52	4.2	105	452	661	
	SBT	219	21.1	C	0.47	5.1	130	452	661	C
	SBR	237	22.2	C	0.60	5.7	145	223	255	
Westbound	WBL	78	15.5	B	0.26	1.3	35	73	129	Max Movement V/C
	WBT	178	0.0	A	0.61	0.0	25	173	283	0.91
	WBR	91	20.7	C	0.61	6.4	160	173	283	
* Modified Lanes							Operations:	SimTraffic	SimTraffic	HCM 6

Table 3.03-6 PM Alternative 1 LOS Operations

With the timing change and left-turn bay length modification, the PM peak-hour LOS decreased to LOS C. However, the average eastbound queueing was shortened from approximately 1,670 feet to approximately 580 feet during the PM peak hour with only the maximum queues of approximately 890 feet extending past the railroad. The maximum queues would be expected to occur during one weekday afternoon every two weeks, or less. This alternative improves conditions compared to the future no-build scenario.

D. Future Alternative 2–Realign and Reconstruct North Leg and Remove Building

To provide a more significant improvement to the intersection, the geometry could be modified to allow normal signal phasing instead of the existing split-phase system where the northbound and southbound traffic operate independently rather than together. This is not possible with the current geometry, so

Alternative 2 was evaluated with a geometric configuration that moves the north end of LaSalle Street to the east to align it with the south approach. A portion of the existing building in the northeast quadrant would need to be removed. This realignment allows a change in the lane designations and vehicle paths that would permit a two-phase permitted and protected phasing system at the intersection. This geometric setup is shown in Figure 3.03-2.

Figure 3.03-2 Alternative 2 Geometric Configuration

Alternative 2 was modeled using the future peak volumes, and the HCM results can be found in Tables 3.03-7 and 3.03-8.

Washington Ave & Lasalle St - Future Alt 2 AM

Control	Traffic Signal									
Approach	Movement	Volume	Delay (s)	LOS	V/C	Queue (veh)	95th Queue (ft)	Average Queue (ft)	Max. Queue (ft)	Intersection Delay (s)
Northbound	NBL	78	25.6	C	0.33	1.9	50	55	89	17.3
	NBT	129	0.0	A	0.53	0.0	25	99	139	
	NBR	138	17.5	B	0.53	5.2	130	99	139	
Eastbound	EBL	233	14.0	B	0.54	3.7	95	95	136	
	EBT	288	0.0	A	0.45	0.0	25	136	242	Intersection LOS
	EBR	34	11.3	B	0.45	4.9	125	136	242	B
Southbound	SBL	52	21.8	C	0.18	1.1	30	32	54	
	SBT	132	0.0	A	0.69	0.0	25	138	194	
	SBR	211	18.9	B	0.69	7.2	180	138	194	
Westbound	WBL	97	19.2	B	0.27	2.0	50	66	118	Max Movement V/C
	WBT	205	0.0	A	0.68	0.0	25	130	222	0.69
	WBR	53	21.5	C	0.68	5.9	150	130	222	
							Operations:	SimTraffic	SimTraffic	HCM 6

Table 3.03-7 AM Alternative 2 LOS Operations

Washington Ave & Lasalle St - Future Alt 2 PM

Control	Traffic Signal									
Approach	Movement	Volume	Delay (s)	LOS	V/C	Queue (veh)	95th Queue (ft)	Average Queue (ft)	Max. Queue (ft)	Intersection Delay (s)
Northbound	NBL	60	32.1	C	0.30	1.9	50	57	92	24.4
	NBT	155	0.0	A	0.84	0.0	25	148	213	
	NBR	131	31.7	C	0.84	9.1	230	148	213	
Eastbound	EBL	340	20.3	C	0.80	8.1	205	125	139	
	EBT	420	0.0	A	0.73	0.0	25	337	484	Intersection LOS
	EBR	90	18.1	B	0.73	11.7	295	337	484	C
Southbound	SBL	154	22.1	C	0.51	3.8	95	74	119	
	SBT	219	0.0	A	0.75	0.0	25	214	332	
	SBR	237	24.5	C	0.75	12.0	300	214	332	
Westbound	WBL	78	29.2	C	0.33	2.5	65	73	158	Max Movement V/C
	WBT	178	0.0	A	0.85	0.0	25	158	246	0.85
	WBR	91	31.9	C	0.85	8.8	220	158	246	
							Operations:	SimTraffic	SimTraffic	HCM 6

Table 3.03-8 PM Alternative 2 LOS Operations

E. Future Alternative 3–Existing Geometry with Added Right-Turn Bays

Alternative 3 used Alternative 1 as a starting point but investigated adding short right-turn bays to the eastbound and westbound legs of the intersection. Each of these turn bays were only 50 feet in length but result in each approach losing a few parking spaces. The HCM results can be found in Tables 3.03-9 and 3.03-10.

Washington Ave & Lasalle St - Future Alt 3 AM*

Control	Traffic Signal									
Approach	Movement	Volume	Delay (s)	LOS	V/C	Queue (veh)	95th Queue (ft)	Average Queue (ft)	Max. Queue (ft)	Intersection Delay (s)
Northbound	NBL	78	21.6	C	0.30	1.5	40	137	208	15.9
	NBT	129	18.4	B	0.37	2.3	60	138	208	
	NBR	138	19.0	B	0.47	2.5	65	76	132	
Eastbound	EBL	233	9.8	A	0.39	2.7	70	117	204	
	EBT	288	14.5	B	0.51	4.5	115	163	271	Intersection LOS
	EBR	34	12.3	B	0.08	0.5	25	24	66	B
Southbound	SBL	52	20.7	C	0.19	1.0	25	96	156	
	SBT	132	18.4	B	0.38	2.3	60	96	156	
	SBR	211	20.8	C	0.72	4.1	105	110	156	
Westbound	WBL	97	9.9	A	0.19	1.1	30	60	121	Max Movement V/C
	WBT	205	14.9	B	0.40	3.3	85	125	230	0.72
	WBR	53	13.6	B	0.14	0.8	25	41	72	
* Modified Lanes							Operations:	SimTraffic	SimTraffic	HCM 6

Table 3.03-9 AM Alternative 3 LOS Operations

Washington Ave & Lasalle St - Future Alt 3 PM*

Control	Traffic Signal									
Approach	Movement	Volume	Delay (s)	LOS	V/C	Queue (veh)	95th Queue (ft)	Average Queue (ft)	Max. Queue (ft)	Intersection Delay (s)
Northbound	NBL	60	23.1	C	0.24	1.4	35	106	191	18.0
	NBT	155	18.2	B	0.33	3.0	75	266	423	
	NBR	131	18.2	B	0.33	2.6	65	266	423	
Eastbound	EBL	340	12.4	B	0.59	5.2	130	195	225	
	EBT	420	18.8	B	0.73	8.7	220	397	677	Intersection LOS
	EBR	90	14.9	B	0.21	1.6	40	3.7	74	B
Southbound	SBL	154	23.6	C	0.49	3.7	95	266	423	
	SBT	219	19.0	B	0.47	4.5	115	266	423	
	SBR	237	20.0	B	0.59	5.0	125	180	255	
Westbound	WBL	78	14.2	B	0.21	1.3	35	67	118	Max Movement V/C
	WBT	178	19.2	B	0.40	3.7	95	155	262	0.73
	WBR	91	18.5	B	0.27	1.8	45	44	75	
* Modified Lanes							Operations:	SimTraffic	SimTraffic	HCM 6

Table 3.03-10 PM Alternative 3 LOS Operations

The operations improve the eastbound queue length with the average queue being well short of the railroad tracks and only the through lane maximum queue extending to the tracks. Again, the maximum queues would be expected to occur during one weekday afternoon every two weeks, or less.

F. Future Alternative 4–Square Up Northbound and Southbound Crosswalks with New Timings

Alternative 4 operates with the same HCM motor vehicle functionality as Alternatives 1 or 3. The main difference is that the northbound and southbound crosswalks are squared up to be perpendicular to Washington Avenue. This improves crossings for the pedestrians by shortening the crossing distance by approximately 10 feet. The existing queue storage is decreased by approximately 15 feet for eastbound and westbound traffic, so the queue lengths from Alternatives 1 and 3 would be shifted 15 feet back when considering this alternative. Considering the maximum queues for Alternative 1 and 3 are both past the railroad to the west, and the extra 15 feet would not push the average queue length to or past the railroad, Alternative 4 works well to improve both vehicle and pedestrian conditions at this intersection, with impacts limited to on-street parking only. See Tables 3.03-5 and 3.03-6 for the motor vehicle operations.

G. Future Alternative 5–Centered Crosswalk with Overlapping Right and Left Turns

Alternative 5 uses the offset of the intersection to its advantage and connects a single crosswalk from the southwest to northeast corners of the intersection. Geometrically, this allows the eastbound left turns and southbound right turns to operate at the same time on one side of the crosswalk and the northbound right turns and westbound left turns on the other side of the crosswalk while pedestrians are crossing the street. This geometric orientation is shown in Figure 3.03-3. This alternative also lengthened the left-turn bay of eastbound Washington Avenue through Farquhar Street, resulting in recommended right-in right-out operations at that intersection.

Figure 3.03-3 Alternative 5 Geometric Layout

The HCM results of Alternative 5 are shown in Tables 3.03-11 and 3.03-12. As with all of the alternatives, because of the single lane leading up to the intersection in the eastbound direction, the end of the left-turn bay is often blocked by traffic. Because these vehicles are released first with a longer left-turn phase than in the other options, left-turning vehicles that are blocked by the nonmoving through vehicles typically do not progress through the intersection and are stopped in the turn bay once the through traffic starts moving. The opposing through movements are heavy in both the eastbound and westbound directions, allowing minimal left-turning vehicles to complete their turn outside of their protected (left-turn arrow) movement. This results in fewer left-turning vehicles traveling through the intersection overall and the eastbound queue extending longer than in previous options. While there is improvement compared to the future no build option, there is less improvement than the other alternatives in both operations and queue length.

Washington Ave & Lasalle St - Future Alt 5 AM*

Control	Traffic Signal									
Approach	Movement	Volume	Delay (s)	LOS	V/C	Queue (veh)	95th Queue (ft)	Average Queue (ft)	Max. Queue (ft)	Intersection Delay (s)
Northbou	NBL	78	21.7	C	0.30	1.5	40	127	196	15.0
	NBT	129	18.5	B	0.38	2.3	60	127	196	
	NBR	138	13.7	B	0.29	2.0	50	71	130	
Eastboun	EBL	233	10.2	B	0.43	2.7	70	127	212	
	EBT	288	0.0	A	0.64	0.0	25	179	304	Intersection LOS
	EBR	34	15.4	B	0.64	5.4	135	179	304	B
Southbou	SBL	52	20.8	C	0.20	1.0	25	116	187	
	SBT	132	18.5	B	0.38	2.4	60	116	187	
	SBR	211	13.2	B	0.41	3.0	75	79	128	
Westbou	WBL	97	10.2	B	0.20	1.1	30	64	113	Max Movement V/C
	WBT	205	0.0	A	0.57	0.0	25	147	243	0.64
	WBR	53	16.0	B	0.57	4.4	110	147	243	
* Modified Lanes							Operations:	SimTraffic	SimTraffic	HCM 6

Table 3.03-11 AM Alternative 5 LOS Operations

Washington Ave & Lasalle St - Future Alt 5 PM*

Control	Traffic Signal									
Approach	Movement	Volume	Delay (s)	LOS	V/C	Queue (veh)	95th Queue (ft)	Average Queue (ft)	Max. Queue (ft)	Intersection Delay (s)
Northbou	NBL	60	25.3	C	0.25	1.5	40	136	214	21.7
	NBT	155	19.9	B	0.32	3.3	85	136	214	
	NBR	131	15.1	B	0.25	2.4	60	86	150	
Eastboun	EBL	340	13.1	B	0.65	5.3	135	209	225	
	EBT	420	0.0	A	0.92	0.0	25	631	964	Intersection LOS
	EBR	90	34.0	C	0.92	14.2	355	631	964	C
Southbou	SBL	154	25.9	C	0.52	4.0	100	499	721	
	SBT	219	20.8	C	0.49	4.9	125	499	721	
	SBR	237	13.1	B	0.37	3.9	100	189	255	
Westbou	WBL	78	15.2	B	0.26	1.3	35	73	129	Max Movement V/C
	WBT	178	0.0	A	0.62	0.0	25	188	299	0.92
	WBR	91	20.4	C	0.62	6.2	155	188	299	
* Modified Lanes							Operations:	SimTraffic	SimTraffic	HCM 6

Table 3.03-12 PM Alternative 5 LOS Operations

SECTION 4
CRASH RECORDS REVIEW

4.01 INTRODUCTION

The study team used the Crash Record Information System (CRIS) tool from TxDOT to compile reported crashes from 2015 through 2019. A heat map of the crashes in the City during this time period is shown in Figure 4.01-1.

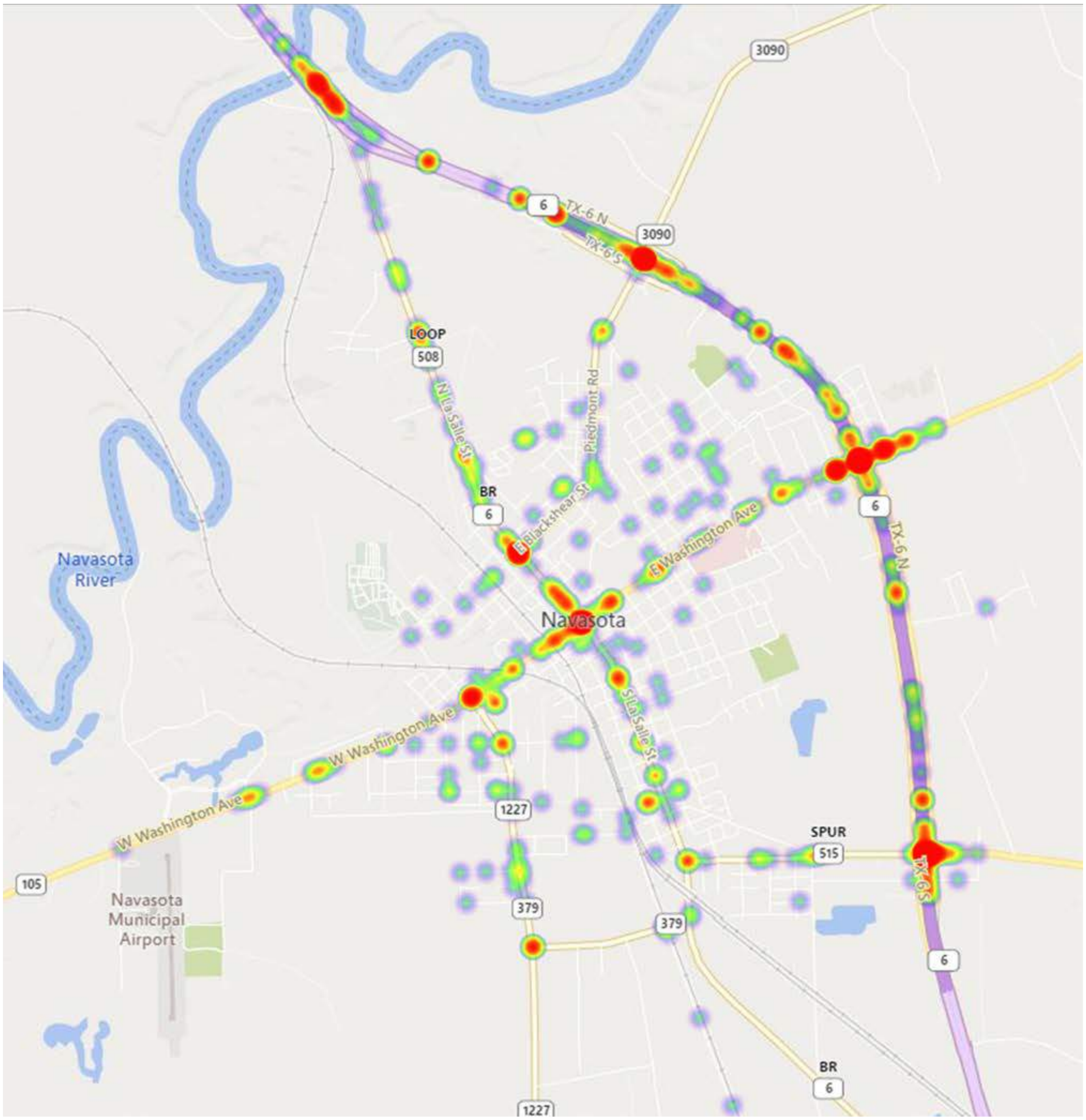


Figure 4.01-1 Crashes in the City from 2015 through 2019

Crash rates were calculated for intersections of major collectors, as well as the major corridors through town identified in the Thoroughfare Plan. Crash rates are typically used rather than the number of crashes because it allows for safety to be compared between intersections and along corridors with different traffic volumes. For intersections, the standard crash rate is determined by calculating the number of crashes per one million entering vehicles (MEV). For corridors, the standard crash rate is determined by calculating the number of crashes per 100 million vehicle miles traveled (HMVMT).

4.02 CRASH RECORD REVIEW

A. <u>Intersection Crash Rates</u>

1. City Intersections

The 2015 to 2019 intersection number of crashes and crash rates are shown in Figure 4.02-1. The number of crashes ranged from 5 to 27, and the intersection crash rates ranged from 0.58 to 1.37. Typically, a crash rate over 2.0 MEV warrants further investigation. Intersection motor vehicle crash rates do not appear to be a significant factor in the need for improvements at the five intersections considered.

While the intersection at SH 6B (LaSalle Street) and FM 3090 (Blackshear Street) has a crash rate below 2.0 MEV, it has a high number of crashes for an intersection with such low volumes. It was found during further evaluation that approximately 68 percent of those crashes involve vehicles coming from the northeast (heading southwest on Blackshear Street). This leg of the intersection has poor visibility because of the existing vegetation adjacent to the intersection. Efforts to clear the vegetation could improve the visibility for this leg of the intersection.

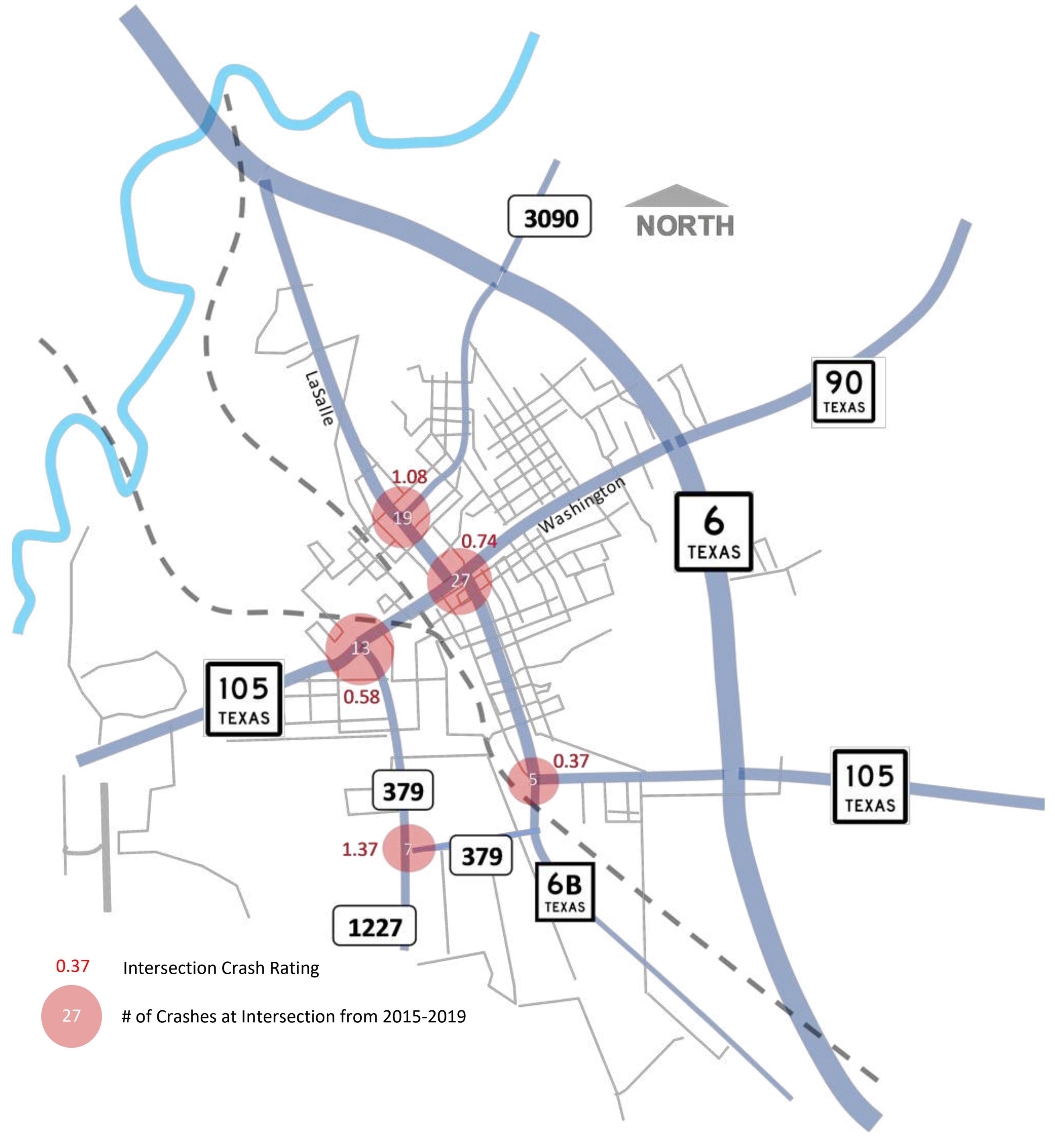


Figure 4.02-1 Intersection Crashes and Crash Rates

2. Route 6 Intersections

While AADT data is available for SH 6, the CRIS tool does not clearly separate freeway crashes from frontage road crashes. Because of this lack of information for the frontage roads, the crash rates for intersections along SH 6 were not able to be accurately calculated. To review crashes on TX 6, the number of crashes were analyzed along the corridor and reported in Figure 4.02-2 at each interchange as percentages of fatal (K) and serious injury (A) crashes and the percentage of intersection-related crashes.

Additionally, both of the interchange areas at SH 6 and Washington Avenue and at SH 6 and Spur 515 have multiple businesses with driveways directly adjacent to the interchanges. For these two locations, Figure 4.02-2 also shows the percentage of driveway-related crashes near the interchange areas. For example, at SH 6 and Washington Avenue there were 51 total crashes within the interchange area. Of these 51 crashes, 0 percent were severe crashes (K or A), 59 percent were intersection-related crashes, and 27 percent were crashes related to adjacent driveways. Because of the relatively high percentage of driveway-related crashes at Washington Avenue and Spur 515 interchanges, access management should be evaluated for the businesses directly adjacent to the interchange areas.

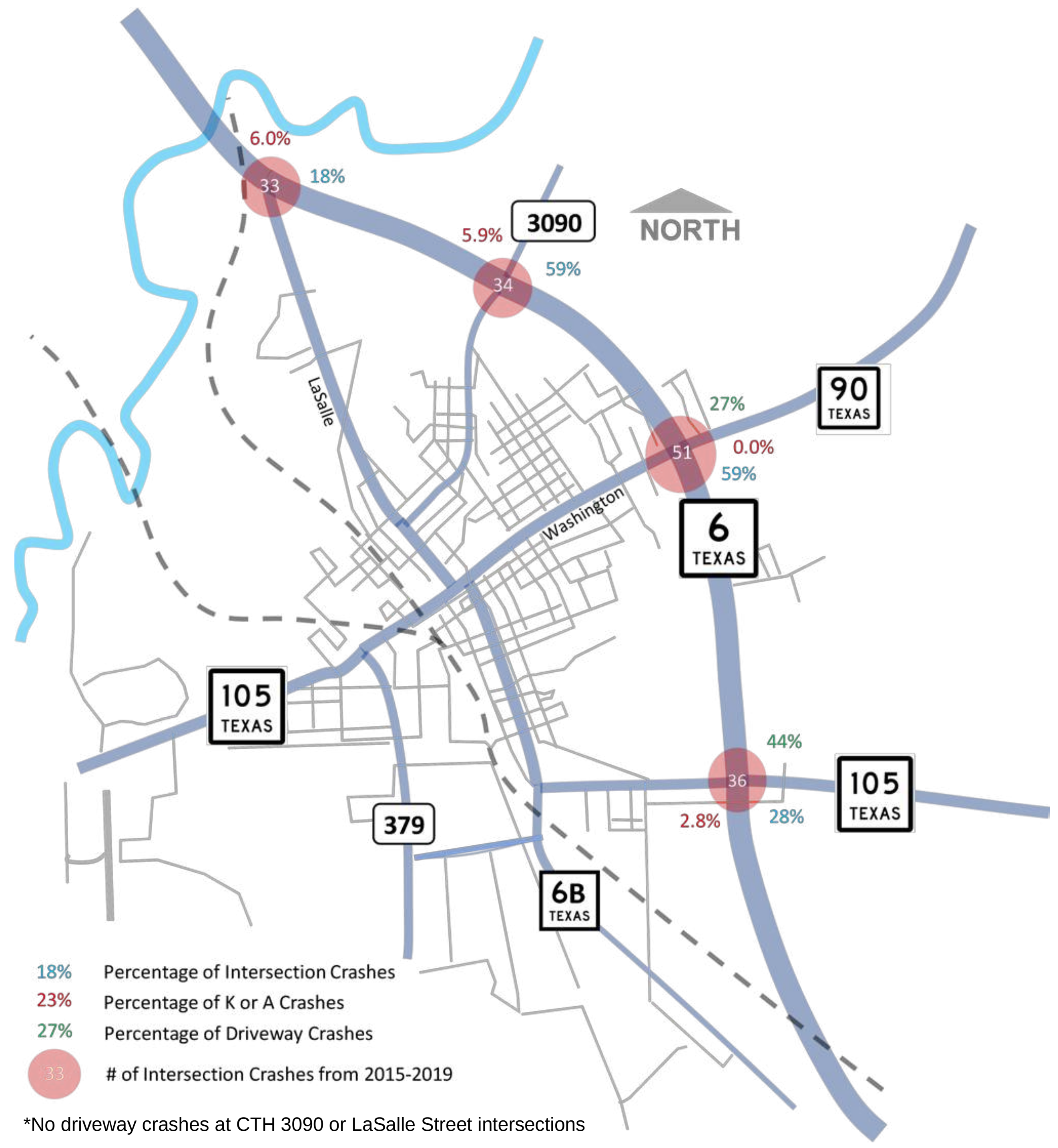


Figure 4.02-2 Crash Percentages on SH 6 Corridor

B. Corridor Crash Rates

1. SH 6B (LaSalle Street)

SH 6B runs north and south through downtown and connects at both ends to SH 6. This corridor was analyzed in three segments: SH 6 on the north end to Washington Avenue, Washington Avenue to Spur 515, and Spur 515 to SH 6 on the south end of the City. These three segments are shown in Figure 4.02-3 with the number of crashes per section as well as crash rates. None of the three segments of this corridor have crash rates that exceed statewide averages, which typically indicates the need to consider further investigation.

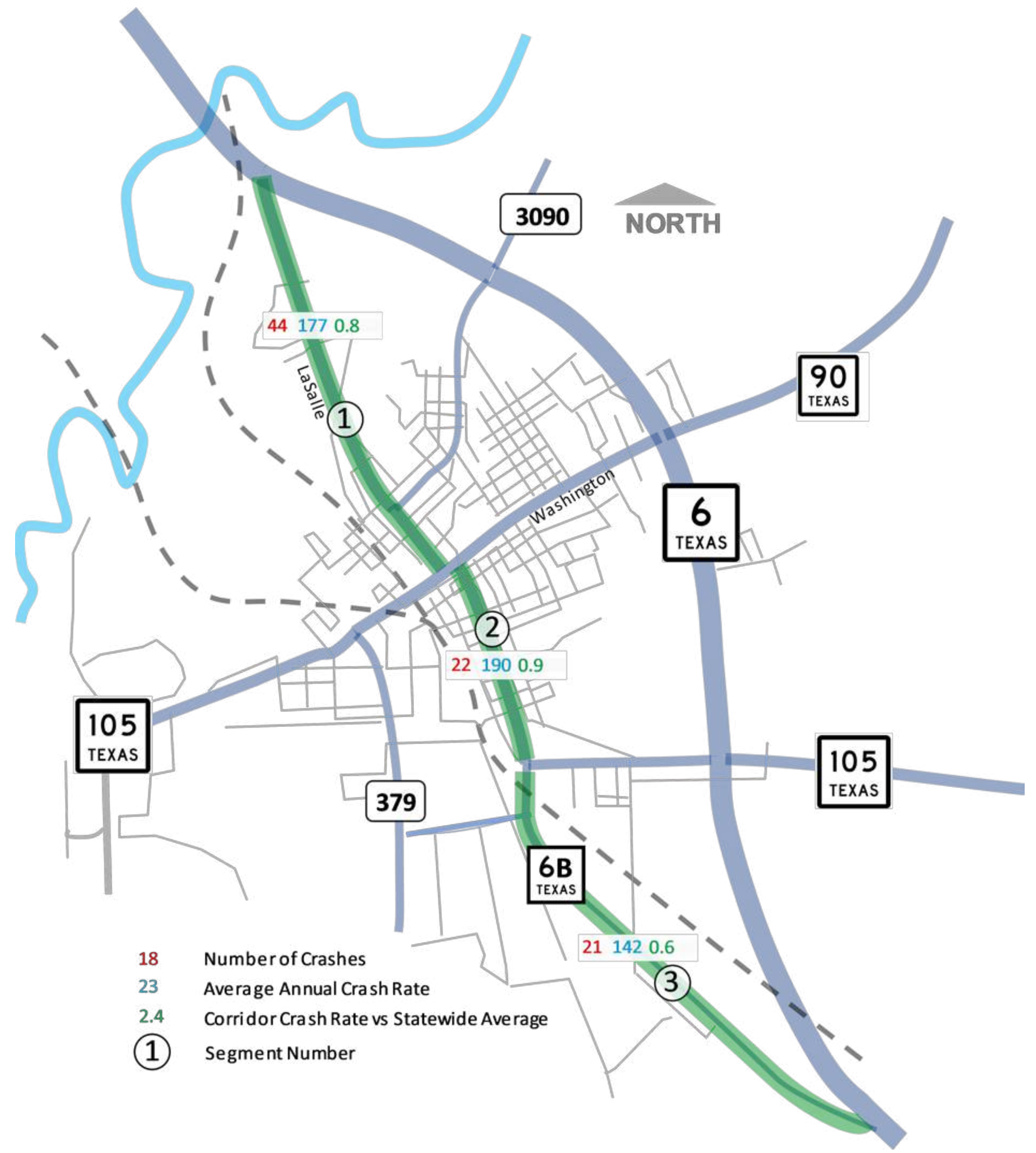


Figure 4.02-3 Business 6 Corridor Crash Rates

2. SH 105 (Washington Avenue)

Route 105 runs from the west end of town to the northeast until it connects with SH 6. This corridor was split into four sections: Veteran's Memorial Drive to FM 379, FM 379 to LaSalle Street/SH 6B, LaSalle Street/SH 6B to SH 6, and SH 6 to Alamo Drive just past the high school. These four segments are shown in Figure 4.02-4 with the number of crashes per section as well as crash rates. While segment 1 is approximately one-half the crash rate of the statewide average for similar facilities, segment 2 is 2.2 times higher than the statewide average crash rate, segment 3 is 1.3 time higher than the statewide average crash rate, and segment 4 is 2.4 times higher than the statewide average crash rate. Segments 2, 3 and 4 should all be considered for further investigation.

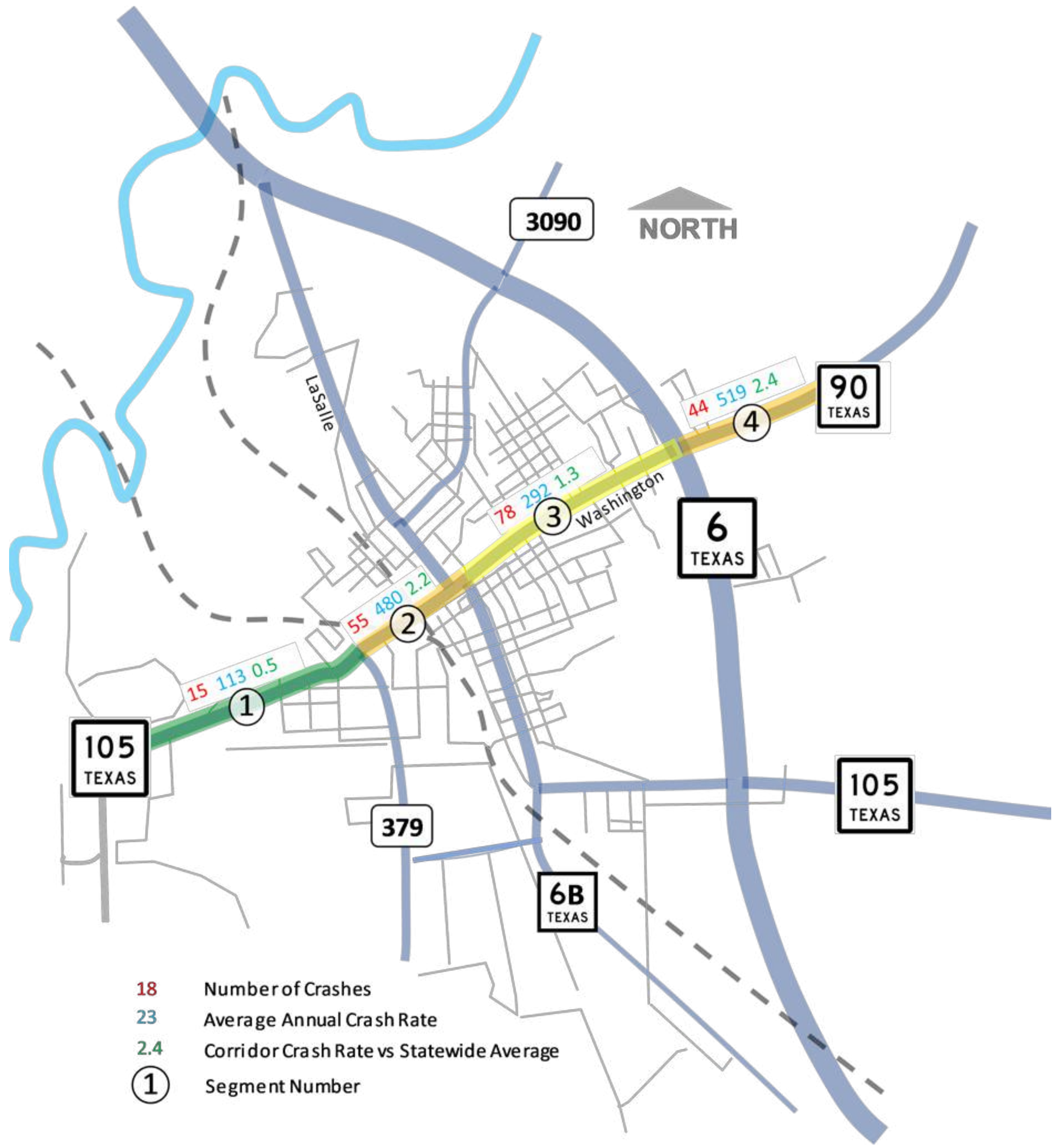


Figure 4.02-4 Route 105 Corridor Crash Rates

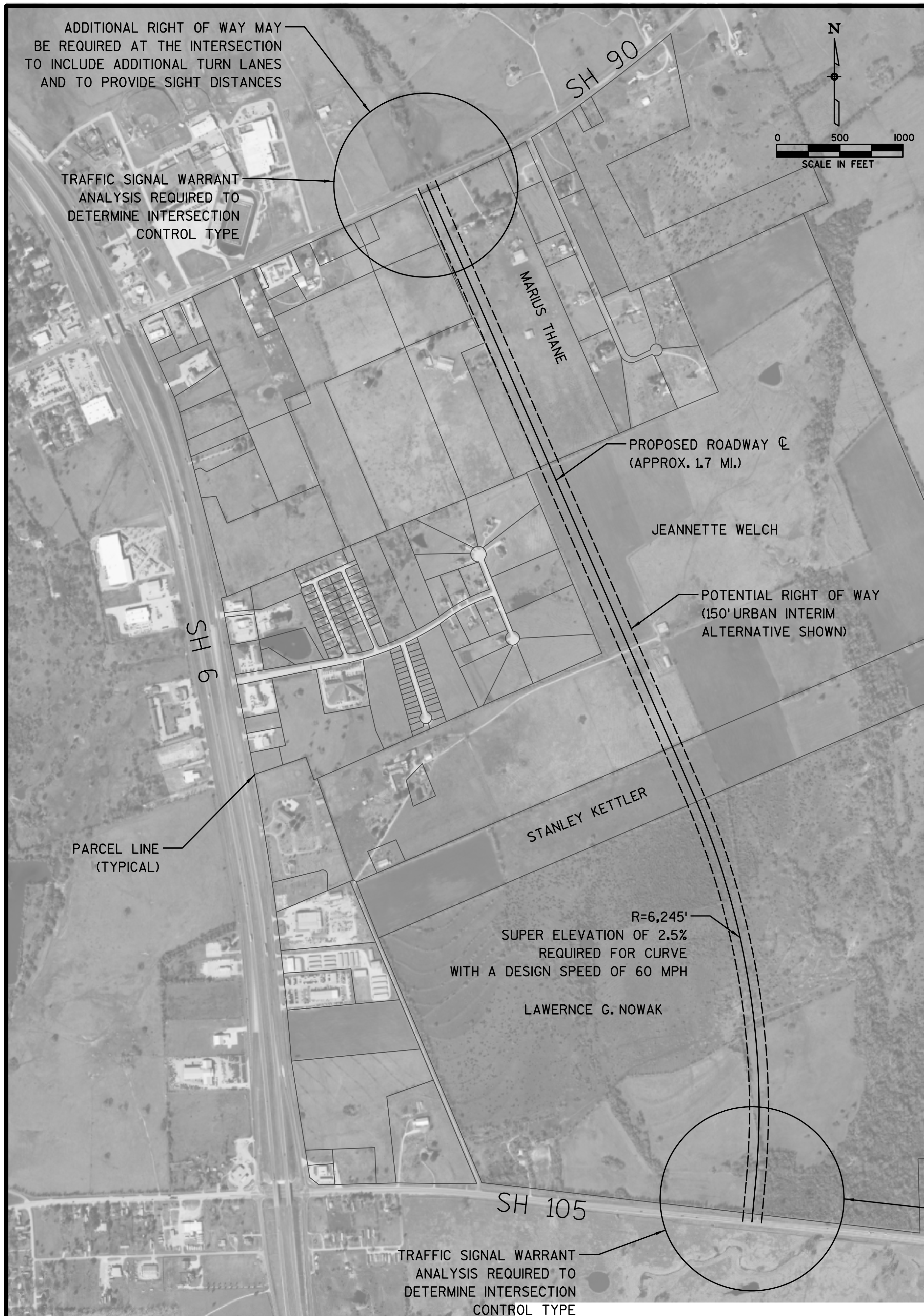
In segment 2, 73 percent of the crashes were intersection-related crashes, with the most frequent type of crash being a rear-end crash (38 percent). This is likely due to the intersection at Washington Avenue and LaSalle Street, which has issues with queueing in the eastbound direction. Modifying the intersection timings to reduce queuing could improve the crash rating of this section.

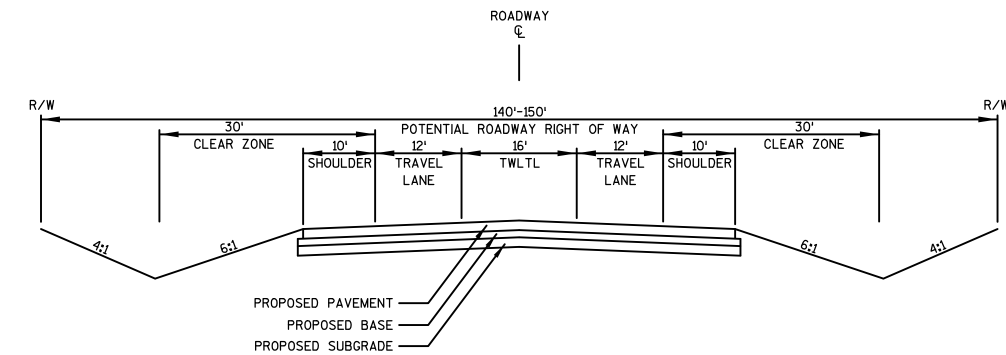
In segment 3, there are 23 intersections with 47 driveway access points. Approximately 60 percent of the crashes in this section of the corridor are intersection related crashes, and 20 percent are driveway related. The most common crash types are angle crashes (40 percent) and rear-end crashes (23 percent). These angle crashes are likely the result of all the local street connections as well as the numerous driveway connections to the arterial. Evaluating access management along this section of the corridor to reduce redundant and unnecessary access point could reduce vehicle crashes.

In segment 4, there are only four intersections and ten driveways; however, this is the shortest segment with the most traffic. The segment consists of approximately 24 percent intersection crashes and 49 percent driveway crashes. The most common crash types are opposite direction crashes (31 percent), rear end crashes (27 percent), and angle crashes (20 percent). Many of these crashes seem to be the result of the high density of commercial access points for such a short section of arterial. Developing access control for the intersections and driveway access points along this section of the corridor could help decrease the crash rating of this section of the corridor.

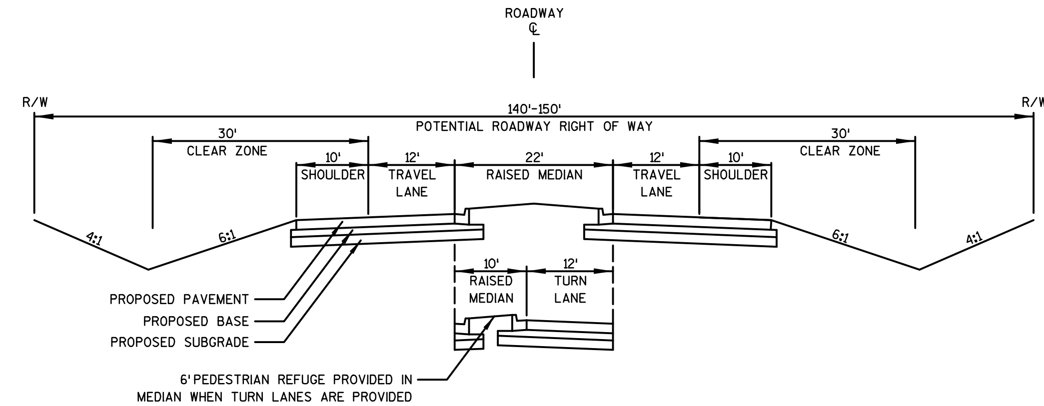
APPENDIX A
EAST ARTERIAL LAYOUT

APPENDIX A
EAST ARTERIAL LAYOUT

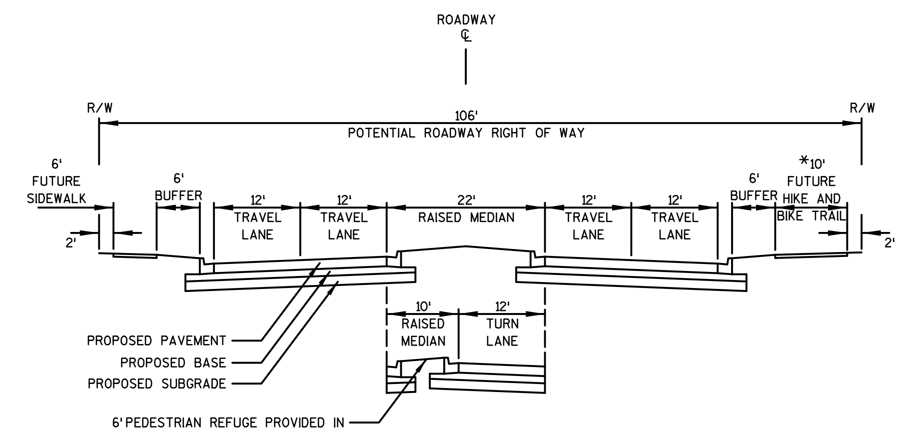




2-LANE RURAL TYPICAL SECTION
NOT TO SCALE



2-LANE SUBURBAN TYPICAL SECTION
NOT TO SCALE



4-LANE URBAN TYPICAL SECTION
NOT TO SCALE

* 14' OUTSIDE TRAVEL LANES CAN BE PROVIDED INSTEAD OF A HIKE AND BIKE TRAIL TO PROVIDE BICYCLE ACCOMMODATIONS.

NOTES:

ALL LANE, SHOULDER, MEDIAN, BUFFER, SIDEWALK, DITCH SLOPES AND CLEAR ZONE WIDTHS MEET DESIRABLE STANDARDS IN TxDOT'S ROADSIDE DESIGN MANUAL.

DITCH BOTTOM IS ANTICIPATED TO BE 1' BELOW SUBGRADE IN CUT SECTIONS AND 1' BELOW EXISTING GROUND IN FILL SECTIONS. A PAVEMENT STRUCTURE OF 2' WAS ASSUMED.

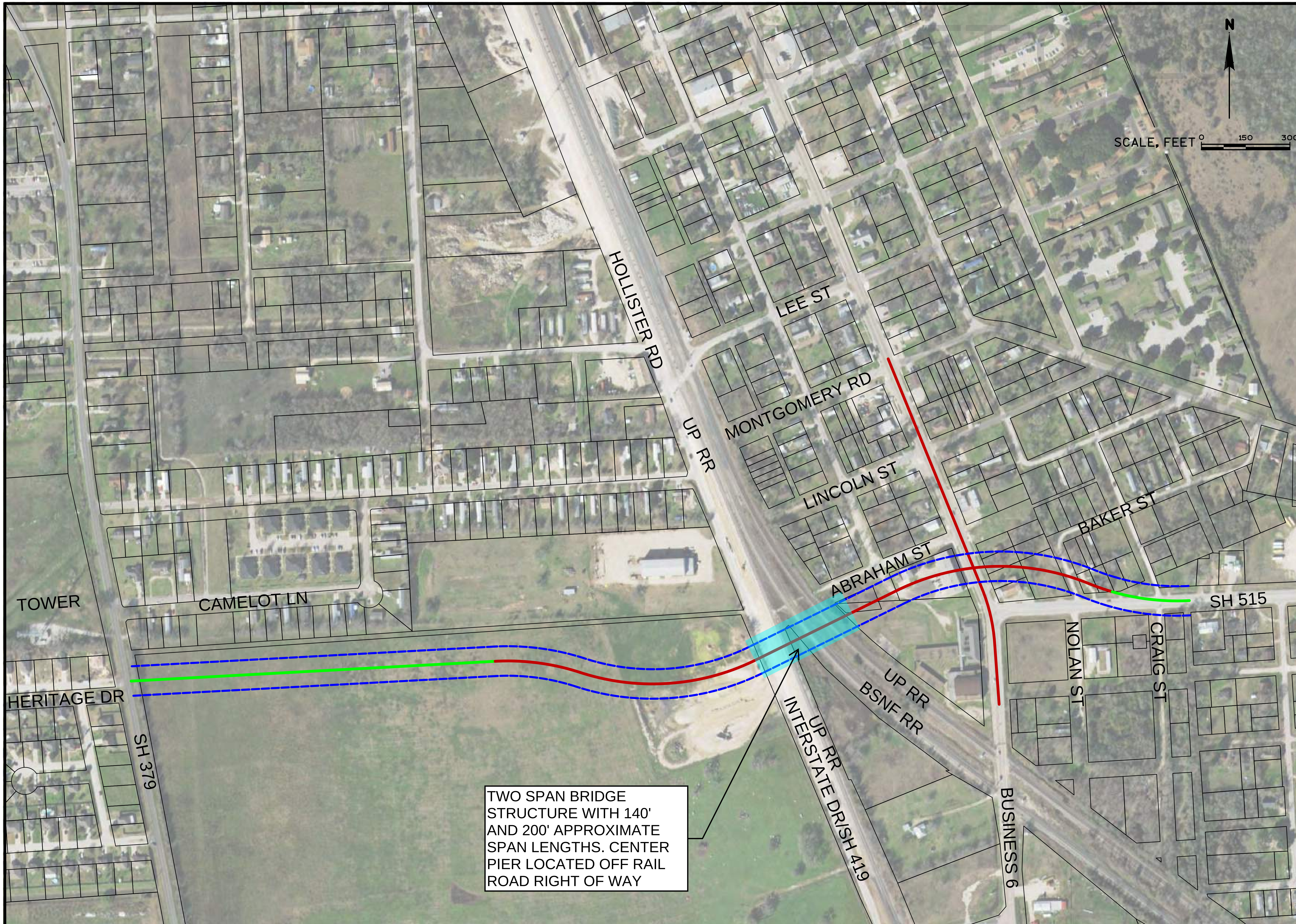
MEDIAN IN URBAN ALTERNATIVE IS SIZED TO PROVIDE A 12' TURN LANE AND 6' FOR PEDESTRIAN REFUGE IN MEDIAN.

CITY OF NAVASOTA
POTENTIAL EAST ARTERIAL ROUTE

NAVASOTA

STRAND ASSOCIATES®

APPENDIX B
SPUR 515 CONNECTION ALTERNATIVES



NAVASOTA
SH 515 NORTH B
POTENTIAL NORTH GRADE-SEPARATED RAILROAD CROSSING
ALTERNATIVE 1

STRAND ASSOCIATES®

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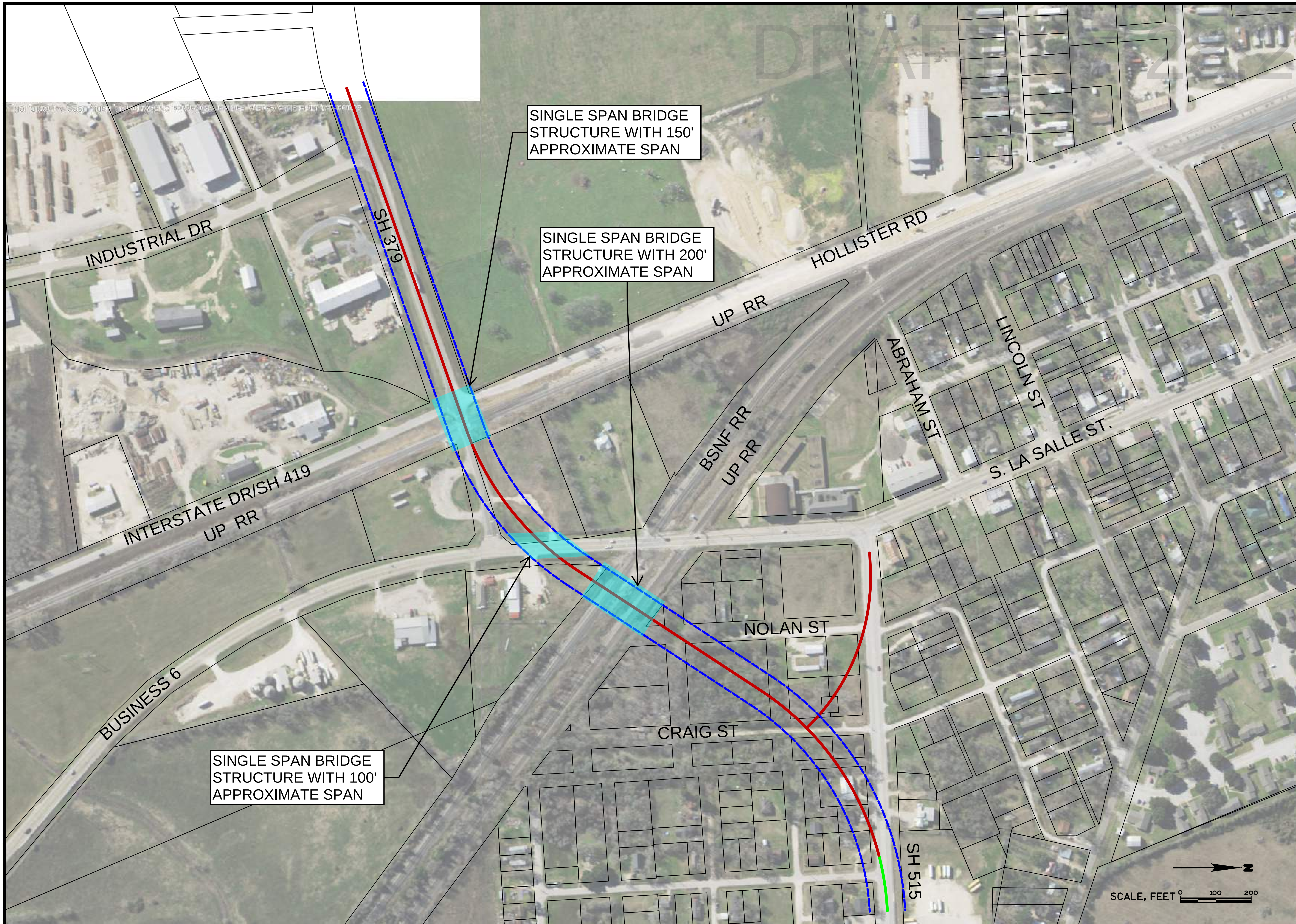
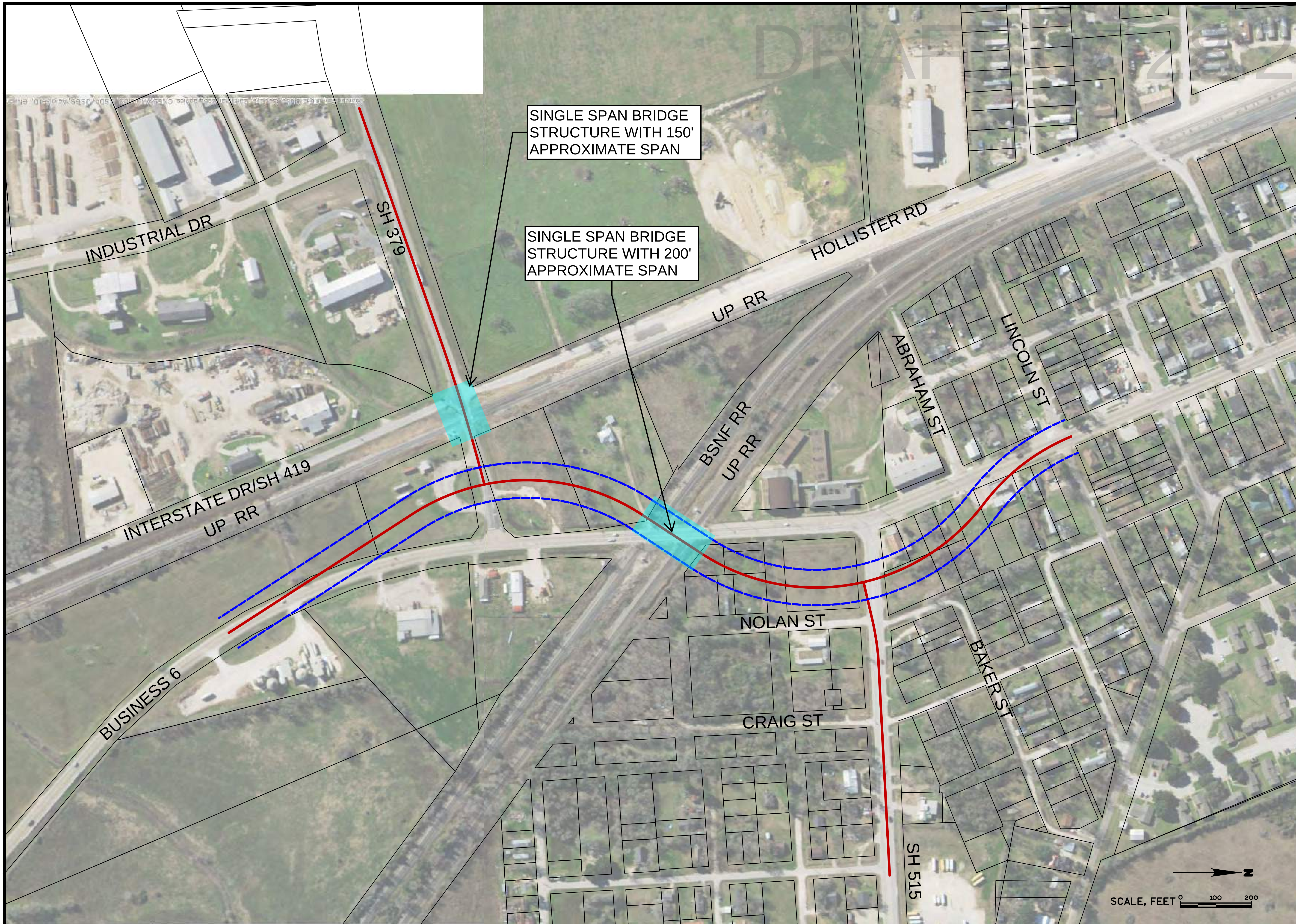
NAVASOTA
SH 515 NORTH A
POTENTIAL NORTH GRADE-SEPARATED RAILROAD CROSSING
ALTERNATIVE 2

STRAND
ASSOCIATES®



NAVASOTA
SH 515 SOUTH
POTENTIAL GRADE-SEPARATED RAILROAD CROSSING
ALTERNATIVE 3

STRAND ASSOCIATES®



NAVASOTA
BUSINESS 6
POTENTIAL GRADE-SEPARATED RAILROAD CROSSING
ALTERNATIVE 4

STRAND ASSOCIATES®

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APPENDIX C
INTERSECTION OPERATIONS REPORTS

2020 EXISTING CONDITIONS AM PEAK HOUR

HCM 6th Signalized Intersection Summary
3: S LaSalle St/N LaSalle St & E Washington Ave

03/09/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	152	188	22	87	185	48	70	116	124	41	105	168
Future Volume (veh/h)	152	188	22	87	185	48	70	116	124	41	105	168
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	0.90	1.00	1.00	0.90	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1841	1841	1870	1870	1870	1870	1870	1870	1885	1885	1885
Adj Flow Rate, veh/h	160	198	23	92	195	51	74	122	131	43	111	177
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	4	4	4	2	2	2	2	2	2	1	1	1
Cap, veh/h	574	404	47	587	308	81	378	441	373	380	444	376
Arrive On Green	0.16	0.28	0.28	0.13	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Sat Flow, veh/h	1753	1457	169	1781	1280	335	1091	1870	1585	1136	1885	1598
Grp Volume(v), veh/h	160	0	221	92	0	246	74	122	131	43	111	177
Grp Sat Flow(s),veh/h/ln	1753	0	1626	1781	0	1614	1091	1870	1585	1136	1885	1598
Q Serve(g_s), s	2.5	0.0	4.7	1.4	0.0	5.7	2.5	2.2	2.9	1.3	2.0	4.0
Cycle Q Clear(g_c), s	2.5	0.0	4.7	1.4	0.0	5.7	4.4	2.2	2.9	3.6	2.0	4.0
Prop In Lane	1.00		0.10	1.00		0.21	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	574	0	451	587	0	389	378	441	373	380	444	376
V/C Ratio(X)	0.28	0.00	0.49	0.16	0.00	0.63	0.20	0.28	0.35	0.11	0.25	0.47
Avail Cap(c_a), veh/h	1134	0	1763	1221	0	1750	1041	1577	1336	1070	1589	1347
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	8.6	0.0	12.6	8.9	0.0	14.1	14.7	13.0	13.2	14.4	12.9	13.6
Incr Delay (d2), s/veh	0.1	0.0	0.3	0.0	0.0	0.6	0.1	0.1	0.2	0.0	0.1	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	1.3	0.0	2.6	0.8	0.0	3.2	0.9	1.4	1.5	0.5	1.2	2.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	8.7	0.0	12.9	9.0	0.0	14.7	14.8	13.1	13.4	14.5	13.0	14.0
LnGrp LOS	A	A	B	A	A	B	B	B	B	B	B	B
Approach Vol, veh/h		381			338			327			331	
Approach Delay, s/veh		11.1			13.2			13.6			13.7	
Approach LOS		B			B			B			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	11.7	15.0		14.8	10.2	16.5		14.8				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	20.0	45.0		35.0	20.0	45.0		35.0				
Max Q Clear Time (g_c+I1), s	4.5	7.7		6.0	3.4	6.7		6.4				
Green Ext Time (p_c), s	0.1	0.5		0.7	0.0	0.5		0.8				
Intersection Summary												
HCM 6th Ctrl Delay			12.8									
HCM 6th LOS			B									

2020 EXISTING CONDITIONS PM PEAK HOUR

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	222	274	59	70	160	82	54	140	118	122	174	188
Future Volume (veh/h)	222	274	59	70	160	82	54	140	118	122	174	188
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	0.90	1.00	1.00	0.90	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	234	288	62	74	168	86	57	147	124	128	183	198
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	1	1	1	1	1	1
Cap, veh/h	576	403	87	473	247	126	331	460	390	368	460	390
Arrive On Green	0.17	0.30	0.30	0.11	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Sat Flow, veh/h	1781	1342	289	1781	1047	536	1010	1885	1598	1117	1885	1598
Grp Volume(v), veh/h	234	0	350	74	0	254	57	147	124	128	183	198
Grp Sat Flow(s),veh/h/ln	1781	0	1631	1781	0	1583	1010	1885	1598	1117	1885	1598
Q Serve(g_s), s	3.9	0.0	8.3	1.2	0.0	6.3	2.2	2.8	2.8	4.6	3.5	4.6
Cycle Q Clear(g_c), s	3.9	0.0	8.3	1.2	0.0	6.3	5.7	2.8	2.8	7.4	3.5	4.6
Prop In Lane	1.00		0.18	1.00		0.34	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	576	0	490	473	0	373	331	460	390	368	460	390
V/C Ratio(X)	0.41	0.00	0.71	0.16	0.00	0.68	0.17	0.32	0.32	0.35	0.40	0.51
Avail Cap(c_a), veh/h	1090	0	1696	1102	0	1645	901	1524	1292	998	1524	1292
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	9.3	0.0	13.5	10.1	0.0	15.1	16.1	13.4	13.4	16.4	13.7	14.1
Incr Delay (d2), s/veh	0.2	0.0	0.7	0.1	0.0	0.8	0.1	0.1	0.2	0.2	0.2	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	2.1	0.0	4.6	0.7	0.0	3.6	0.8	1.8	1.5	1.8	2.2	2.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	9.5	0.0	14.2	10.1	0.0	15.9	16.2	13.6	13.6	16.6	13.9	14.5
LnGrp LOS	A	A	B	B	A	B	B	B	B	B	B	B
Approach Vol, veh/h		584			328			328			509	
Approach Delay, s/veh		12.3			14.6			14.0			14.8	
Approach LOS		B			B			B			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	12.5	15.2		15.6	9.7	18.0		15.6				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	20.0	45.0		35.0	20.0	45.0		35.0				
Max Q Clear Time (g_c+I1), s	5.9	8.3		9.4	3.2	10.3		7.7				
Green Ext Time (p_c), s	0.1	0.6		1.2	0.0	0.8		0.8				
Intersection Summary												
HCM 6th Ctrl Delay			13.8									
HCM 6th LOS			B									

2040 FUTURE NO BUILD AM PEAK HOUR

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	233	288	34	97	205	53	78	129	138	52	132	211
Future Volume (veh/h)	233	288	34	97	205	53	78	129	138	52	132	211
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	0.90	1.00	1.00	0.90	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1841	1841	1870	1870	1870	1870	1870	1870	1885	1885	1885
Adj Flow Rate, veh/h	245	303	36	102	216	56	82	136	145	55	139	222
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	4	4	4	2	2	2	2	2	2	1	1	1
Cap, veh/h	569	409	49	500	302	78	346	437	370	362	440	373
Arrive On Green	0.18	0.28	0.28	0.13	0.24	0.24	0.23	0.23	0.23	0.23	0.23	0.23
Sat Flow, veh/h	1753	1453	173	1781	1282	332	1021	1870	1585	1107	1885	1598
Grp Volume(v), veh/h	245	0	339	102	0	272	82	136	145	55	139	222
Grp Sat Flow(s),veh/h/ln	1753	0	1626	1781	0	1615	1021	1870	1585	1107	1885	1598
Q Serve(g_s), s	4.0	0.0	8.0	1.6	0.0	6.6	3.1	2.6	3.3	1.8	2.6	5.3
Cycle Q Clear(g_c), s	4.0	0.0	8.0	1.6	0.0	6.6	5.7	2.6	3.3	4.4	2.6	5.3
Prop In Lane	1.00		0.11	1.00		0.21	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	569	0	458	500	0	380	346	437	370	362	440	373
V/C Ratio(X)	0.43	0.00	0.74	0.20	0.00	0.72	0.24	0.31	0.39	0.15	0.32	0.59
Avail Cap(c_a), veh/h	1083	0	1722	1104	0	1711	948	1541	1306	1015	1553	1316
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	9.2	0.0	13.9	9.5	0.0	14.9	15.8	13.5	13.7	15.3	13.5	14.5
Incr Delay (d2), s/veh	0.2	0.0	0.9	0.1	0.0	0.9	0.1	0.1	0.3	0.1	0.2	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	2.1	0.0	4.5	0.9	0.0	3.8	1.1	1.6	1.7	0.7	1.6	2.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	9.3	0.0	14.8	9.6	0.0	15.9	15.9	13.6	14.0	15.3	13.6	15.1
LnGrp LOS	A	A	B	A	A	B	B	B	B	B	B	B
Approach Vol, veh/h		584			374			363			416	
Approach Delay, s/veh		12.5			14.2			14.3			14.6	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	12.6	15.0		14.9	10.6	17.0		14.9
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	20.0	45.0		35.0	20.0	45.0		35.0
Max Q Clear Time (g_c+I1), s	6.0	8.6		7.3	3.6	10.0		7.7
Green Ext Time (p_c), s	0.1	0.6		1.0	0.0	0.7		0.9

Intersection Summary	
HCM 6th Ctrl Delay	13.7
HCM 6th LOS	B

2040 FUTURE NOT BUILD PM PEAK HOUR

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	340	420	90	78	178	91	60	155	131	154	219	237
Future Volume (veh/h)	340	420	90	78	178	91	60	155	131	154	219	237
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	0.90	1.00	1.00	0.90	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	358	442	95	82	187	96	63	163	138	162	231	249
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	1	1	1	1	1	1
Cap, veh/h	586	493	106	355	316	162	281	511	433	345	511	433
Arrive On Green	0.17	0.37	0.37	0.10	0.30	0.30	0.27	0.27	0.27	0.27	0.27	0.27
Sat Flow, veh/h	1781	1343	289	1781	1046	537	922	1885	1598	1087	1885	1598
Grp Volume(v), veh/h	358	0	537	82	0	283	63	163	138	162	231	249
Grp Sat Flow(s),veh/h/ln	1781	0	1631	1781	0	1582	922	1885	1598	1087	1885	1598
Q Serve(g_s), s	7.5	0.0	17.9	1.7	0.0	8.8	3.5	4.0	4.0	8.1	5.9	7.8
Cycle Q Clear(g_c), s	7.5	0.0	17.9	1.7	0.0	8.8	9.4	4.0	4.0	12.0	5.9	7.8
Prop In Lane	1.00		0.18	1.00		0.34	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	586	0	599	355	0	478	281	511	433	345	511	433
V/C Ratio(X)	0.61	0.00	0.90	0.23	0.00	0.59	0.22	0.32	0.32	0.47	0.45	0.57
Avail Cap(c_a), veh/h	907	0	1273	792	0	1235	591	1145	970	710	1145	970
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	10.9	0.0	17.2	12.7	0.0	17.1	21.3	16.8	16.8	21.6	17.5	18.1
Incr Delay (d2), s/veh	0.4	0.0	2.0	0.1	0.0	0.4	0.1	0.1	0.2	0.4	0.2	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	4.4	0.0	10.2	1.0	0.0	5.3	1.3	2.8	2.4	3.4	4.1	0.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	11.2	0.0	19.2	12.8	0.0	17.5	21.5	16.9	16.9	21.9	17.7	18.6
LnGrp LOS	B	A	B	B	A	B	C	B	B	C	B	B
Approach Vol, veh/h		895			365			364			642	
Approach Delay, s/veh		16.0			16.5			17.7			19.1	
Approach LOS		B			B			B			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	14.6	22.4		20.6	10.8	26.2		20.6				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	20.0	45.0		35.0	20.0	45.0		35.0				
Max Q Clear Time (g_c+I1), s	9.5	10.8		14.0	3.7	19.9		11.4				
Green Ext Time (p_c), s	0.1	0.6		1.6	0.0	1.3		1.0				
Intersection Summary												
HCM 6th Ctrl Delay			17.2									
HCM 6th LOS			B									

ALTERNATIVE 1 - AM PEAK HOUR

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	233	288	34	97	205	53	78	129	138	52	132	211
Future Volume (veh/h)	233	288	34	97	205	53	78	129	138	52	132	211
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	0.90	1.00	1.00	0.90	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1841	1841	1870	1870	1870	1870	1870	1870	1885	1885	1885
Adj Flow Rate, veh/h	245	303	36	102	216	56	82	136	145	55	139	222
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	4	4	4	2	2	2	2	2	2	1	1	1
Cap, veh/h	567	471	56	505	375	97	265	349	296	276	352	298
Arrive On Green	0.15	0.32	0.32	0.12	0.29	0.29	0.19	0.19	0.19	0.19	0.19	0.19
Sat Flow, veh/h	1753	1453	173	1781	1282	332	1021	1870	1585	1107	1885	1598
Grp Volume(v), veh/h	245	0	339	102	0	272	82	136	145	55	139	222
Grp Sat Flow(s),veh/h/ln	1753	0	1626	1781	0	1615	1021	1870	1585	1107	1885	1598
Q Serve(g_s), s	4.6	0.0	9.1	1.8	0.0	7.4	3.9	3.3	4.2	2.4	3.3	6.7
Cycle Q Clear(g_c), s	4.6	0.0	9.1	1.8	0.0	7.4	7.3	3.3	4.2	5.6	3.3	6.7
Prop In Lane	1.00		0.11	1.00		0.21	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	567	0	526	505	0	472	265	349	296	276	352	298
V/C Ratio(X)	0.43	0.00	0.64	0.20	0.00	0.58	0.31	0.39	0.49	0.20	0.40	0.74
Avail Cap(c_a), veh/h	1156	0	1520	674	0	1070	333	474	401	566	845	716
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	9.9	0.0	14.8	10.0	0.0	15.5	21.5	18.3	18.7	20.8	18.3	19.7
Incr Delay (d2), s/veh	0.2	0.0	0.5	0.1	0.0	0.4	0.2	0.3	0.5	0.1	0.3	1.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	2.6	0.0	5.4	1.1	0.0	4.3	1.5	2.3	2.5	1.0	2.3	4.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	10.1	0.0	15.3	10.1	0.0	15.9	21.8	18.6	19.2	20.9	18.6	21.1
LnGrp LOS	B	A	B	B	A	B	C	B	B	C	B	C
Approach Vol, veh/h		584			374			363			416	
Approach Delay, s/veh		13.1			14.3			19.5			20.3	
Approach LOS		B			B			B			C	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	12.8	22.0		16.6	11.1	23.6		16.6				
Change Period (Y+Rc), s	5.0	7.0		7.0	5.0	7.0		7.0				
Max Green Setting (Gmax), s	25.0	34.0		23.0	11.0	48.0		13.0				
Max Q Clear Time (g_c+I1), s	6.6	9.4		8.7	3.8	11.1		9.3				
Green Ext Time (p_c), s	0.1	0.6		0.9	0.0	0.7		0.4				
Intersection Summary												
HCM 6th Ctrl Delay			16.4									
HCM 6th LOS			B									

Notes

User approved pedestrian interval to be less than phase max green.

ALTERNATIVE 1 - PM PEAK HOUR

HCM 6th Signalized Intersection Summary
3: S LaSalle St/N LaSalle St & E Washington Ave

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	340	420	90	78	178	91	60	155	131	154	219	237
Future Volume (veh/h)	340	420	90	78	178	91	60	155	131	154	219	237
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	0.90	1.00	1.00	0.90	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	358	442	95	82	187	96	63	163	138	162	231	249
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	1	1	1	1	1	1
Cap, veh/h	550	486	105	318	307	157	251	488	413	313	488	413
Arrive On Green	0.16	0.36	0.36	0.09	0.29	0.29	0.26	0.26	0.26	0.26	0.26	0.26
Sat Flow, veh/h	1781	1343	289	1781	1046	537	922	1885	1598	1087	1885	1598
Grp Volume(v), veh/h	358	0	537	82	0	283	63	163	138	162	231	249
Grp Sat Flow(s),veh/h/ln	1781	0	1631	1781	0	1583	922	1885	1598	1087	1885	1598
Q Serve(g_s), s	8.7	0.0	20.8	2.0	0.0	10.2	4.1	4.7	4.7	9.5	6.9	9.1
Cycle Q Clear(g_c), s	8.7	0.0	20.8	2.0	0.0	10.2	11.0	4.7	4.7	14.1	6.9	9.1
Prop In Lane	1.00		0.18	1.00		0.34	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	550	0	591	318	0	464	251	488	413	313	488	413
V/C Ratio(X)	0.65	0.00	0.91	0.26	0.00	0.61	0.25	0.33	0.33	0.52	0.47	0.60
Avail Cap(c_a), veh/h	929	0	1176	445	0	809	251	488	413	407	651	552
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	12.8	0.0	20.2	15.3	0.0	20.3	25.5	20.0	20.0	25.8	20.8	21.7
Incr Delay (d2), s/veh	0.5	0.0	2.3	0.2	0.0	0.5	0.2	0.1	0.2	0.5	0.3	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	5.5	0.0	12.0	1.3	0.0	6.4	1.5	3.4	2.9	4.2	5.1	5.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	13.3	0.0	22.5	15.5	0.0	20.7	25.7	20.2	20.2	26.3	21.1	22.2
LnGrp LOS	B	A	C	B	A	C	C	C	C	C	C	C
Approach Vol, veh/h		895			365			364			642	
Approach Delay, s/veh		18.8			19.6			21.1			22.8	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	15.8	26.5		24.2	11.2	31.1		24.2				
Change Period (Y+Rc), s	5.0	7.0		7.0	5.0	7.0		7.0				
Max Green Setting (Gmax), s	25.0	34.0		23.0	11.0	48.0		13.0				
Max Q Clear Time (g_c+I1), s	10.7	12.2		16.1	4.0	22.8		13.0				
Green Ext Time (p_c), s	0.1	0.6		1.1	0.0	1.3		0.0				

Intersection Summary			
HCM 6th Ctrl Delay			20.4
HCM 6th LOS			C

Notes

User approved pedestrian interval to be less than phase max green.

ALTERNATIVE 2 - AM PEAK HOUR

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	233	288	34	97	205	53	78	129	138	52	132	211
Future Volume (veh/h)	233	288	34	97	205	53	78	129	138	52	132	211
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	0.90	1.00	1.00	0.90	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	245	303	36	102	216	56	82	136	145	55	139	222
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	1	1	1	1	1	1
Cap, veh/h	454	678	81	376	317	82	246	259	276	313	203	324
Arrive On Green	0.13	0.46	0.46	0.25	0.25	0.25	0.31	0.31	0.31	0.31	0.31	0.31
Sat Flow, veh/h	1781	1476	175	1041	1282	332	1029	835	890	1107	654	1044
Grp Volume(v), veh/h	245	0	339	102	0	272	82	0	281	55	0	361
Grp Sat Flow(s),veh/h/ln	1781	0	1652	1041	0	1615	1029	0	1725	1107	0	1697
Q Serve(g_s), s	5.7	0.0	8.5	5.0	0.0	9.3	4.6	0.0	8.1	2.6	0.0	11.3
Cycle Q Clear(g_c), s	5.7	0.0	8.5	5.0	0.0	9.3	15.9	0.0	8.1	10.8	0.0	11.3
Prop In Lane	1.00		0.11	1.00		0.21	1.00		0.52	1.00		0.61
Lane Grp Cap(c), veh/h	454	0	758	376	0	399	246	0	535	313	0	527
V/C Ratio(X)	0.54	0.00	0.45	0.27	0.00	0.68	0.33	0.00	0.53	0.18	0.00	0.69
Avail Cap(c_a), veh/h	957	0	1170	856	0	1144	401	0	796	572	0	923
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	13.6	0.0	11.2	19.1	0.0	20.7	25.3	0.0	17.3	21.7	0.0	18.3
Incr Delay (d2), s/veh	0.4	0.0	0.2	0.1	0.0	0.8	0.3	0.0	0.3	0.1	0.0	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	3.7	0.0	4.9	2.0	0.0	5.9	1.9	0.0	5.2	1.1	0.0	7.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	14.0	0.0	11.3	19.2	0.0	21.5	25.6	0.0	17.5	21.8	0.0	18.9
LnGrp LOS	B	A	B	B	A	C	C	A	B	C	A	B
Approach Vol, veh/h		584			374			363			416	
Approach Delay, s/veh		12.4			20.8			19.4			19.3	
Approach LOS		B			C			B			B	

Timer - Assigned Phs	1	2		4		6		8				
Phs Duration (G+Y+Rc), s	12.9	22.0		25.8		34.9		25.8				
Change Period (Y+Rc), s	5.0	7.0		7.0		7.0		7.0				
Max Green Setting (Gmax), s	25.0	43.0		33.0		43.0		28.0				
Max Q Clear Time (g_c+I1), s	7.7	11.3		13.3		10.5		17.9				
Green Ext Time (p_c), s	0.1	0.7		1.5		0.7		1.0				

Intersection Summary			
HCM 6th Ctrl Delay			17.3
HCM 6th LOS			B

Notes

User approved pedestrian interval to be less than phase max green.

DRAFT 07.28.2021

ALTERNATIVE 2 - PM PEAK HOUR

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	340	420	90	78	178	91	60	155	131	154	219	237
Future Volume (veh/h)	340	420	90	78	178	91	60	155	131	154	219	237
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	0.90	1.00	1.00	0.90	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	358	442	95	82	187	96	63	163	138	162	231	249
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	1	1	1	1	1	1
Cap, veh/h	447	604	130	249	220	113	210	194	165	315	307	331
Arrive On Green	0.18	0.45	0.45	0.21	0.21	0.21	0.21	0.21	0.21	0.10	0.37	0.37
Sat Flow, veh/h	1781	1343	289	868	1045	537	922	943	798	1795	830	894
Grp Volume(v), veh/h	358	0	537	82	0	283	63	0	301	162	0	480
Grp Sat Flow(s),veh/h/ln	1781	0	1631	868	0	1582	922	0	1741	1795	0	1724
Q Serve(g_s), s	11.5	0.0	21.0	6.7	0.0	13.4	5.0	0.0	12.9	5.2	0.0	18.9
Cycle Q Clear(g_c), s	11.5	0.0	21.0	9.0	0.0	13.4	11.1	0.0	12.9	5.2	0.0	18.9
Prop In Lane	1.00		0.18	1.00		0.34	1.00		0.46	1.00		0.52
Lane Grp Cap(c), veh/h	447	0	734	249	0	333	210	0	359	315	0	638
V/C Ratio(X)	0.80	0.00	0.73	0.33	0.00	0.85	0.30	0.00	0.84	0.51	0.00	0.75
Avail Cap(c_a), veh/h	707	0	1531	546	0	874	352	0	627	598	0	731
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	18.9	0.0	17.5	28.9	0.0	29.6	31.8	0.0	29.6	20.8	0.0	21.4
Incr Delay (d2), s/veh	1.5	0.0	0.5	0.3	0.0	2.4	0.3	0.0	2.0	1.3	0.0	3.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	8.1	0.0	11.7	2.5	0.0	8.8	1.9	0.0	9.1	3.8	0.0	12.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	20.3	0.0	18.1	29.2	0.0	31.9	32.1	0.0	31.7	22.1	0.0	24.5
LnGrp LOS	C	A	B	C	A	C	C	A	C	C	A	C
Approach Vol, veh/h		895			365			364			642	
Approach Delay, s/veh		19.0			31.3			31.7			23.9	
Approach LOS		B			C			C			C	
Timer - Assigned Phs	1	2		4		6	7	8				
Phs Duration (G+Y+Rc), s	18.7	23.4		35.8		42.0	12.8	23.0				
Change Period (Y+Rc), s	5.0	7.0		7.0		7.0	5.0	7.0				
Max Green Setting (Gmax), s	25.0	43.0		33.0		73.0	20.0	28.0				
Max Q Clear Time (g_c+I1), s	13.5	15.4		20.9		23.0	7.2	14.9				
Green Ext Time (p_c), s	0.1	0.8		1.7		1.3	0.3	1.1				

Intersection Summary			
HCM 6th Ctrl Delay			24.4
HCM 6th LOS			C

Notes

User approved pedestrian interval to be less than phase max green.

ALTERNATIVE 3 - AM PEAK HOUR

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	233	288	34	97	205	53	78	129	138	52	132	211
Future Volume (veh/h)	233	288	34	97	205	53	78	129	138	52	132	211
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	0.90	1.00	1.00	0.90	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	245	303	36	102	216	56	82	136	145	55	139	222
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	1	1	1	1	1	1
Cap, veh/h	625	600	458	549	542	405	271	363	308	283	363	308
Arrive On Green	0.15	0.32	0.32	0.12	0.29	0.29	0.19	0.19	0.19	0.19	0.19	0.19
Sat Flow, veh/h	1781	1870	1427	1781	1870	1396	1029	1885	1598	1107	1885	1598
Grp Volume(v), veh/h	245	303	36	102	216	56	82	136	145	55	139	222
Grp Sat Flow(s),veh/h/ln	1781	1870	1427	1781	1870	1396	1029	1885	1598	1107	1885	1598
Q Serve(g_s), s	4.6	6.8	0.9	1.9	4.8	1.5	3.9	3.2	4.2	2.4	3.3	6.7
Cycle Q Clear(g_c), s	4.6	6.8	0.9	1.9	4.8	1.5	7.2	3.2	4.2	5.6	3.3	6.7
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	625	600	458	549	542	405	271	363	308	283	363	308
V/C Ratio(X)	0.39	0.50	0.08	0.19	0.40	0.14	0.30	0.37	0.47	0.19	0.38	0.72
Avail Cap(c_a), veh/h	1218	1735	1323	716	1229	918	332	474	401	562	838	710
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	9.7	14.2	12.2	9.9	14.7	13.6	21.3	18.2	18.5	20.6	18.2	19.6
Incr Delay (d2), s/veh	0.1	0.2	0.0	0.1	0.2	0.1	0.2	0.2	0.4	0.1	0.2	1.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	2.7	4.5	0.5	1.1	3.3	0.8	1.5	2.3	2.5	1.0	2.3	4.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	9.8	14.5	12.3	9.9	14.9	13.6	21.6	18.4	19.0	20.7	18.4	20.8
LnGrp LOS	A	B	B	A	B	B	C	B	B	C	B	C
Approach Vol, veh/h		584			374			363			416	
Approach Delay, s/veh		12.4			13.4			19.3			20.0	
Approach LOS		B			B			B			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	12.8	22.0		17.0	11.2	23.6		17.0				
Change Period (Y+Rc), s	5.0	7.0		7.0	5.0	7.0		7.0				
Max Green Setting (Gmax), s	25.0	34.0		23.0	11.0	48.0		13.0				
Max Q Clear Time (g_c+I1), s	6.6	6.8		8.7	3.9	8.8		9.2				
Green Ext Time (p_c), s	0.1	0.4		0.9	0.0	0.6		0.4				
Intersection Summary												
HCM 6th Ctrl Delay			15.9									
HCM 6th LOS			B									

Notes

User approved pedestrian interval to be less than phase max green.

ALTERNATIVE 3 - PM PEAK HOUR

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	340	420	90	78	178	91	60	155	131	154	219	237
Future Volume (veh/h)	340	420	90	78	178	91	60	155	131	154	219	237
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	0.90	1.00	1.00	0.90	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	358	442	95	82	187	96	63	163	138	162	231	249
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	1	1	1	1	1	1
Cap, veh/h	610	607	463	395	467	354	267	497	421	329	497	421
Arrive On Green	0.17	0.32	0.32	0.10	0.25	0.25	0.26	0.26	0.26	0.26	0.26	0.26
Sat Flow, veh/h	1781	1870	1427	1781	1870	1418	922	1885	1598	1087	1885	1598
Grp Volume(v), veh/h	358	442	95	82	187	96	63	163	138	162	231	249
Grp Sat Flow(s),veh/h/ln	1781	1870	1427	1781	1870	1418	922	1885	1598	1087	1885	1598
Q Serve(g_s), s	8.4	12.7	2.9	1.9	5.1	3.3	3.7	4.2	4.2	8.6	6.2	8.3
Cycle Q Clear(g_c), s	8.4	12.7	2.9	1.9	5.1	3.3	10.0	4.2	4.2	12.8	6.2	8.3
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	610	607	463	395	467	354	267	497	421	329	497	421
V/C Ratio(X)	0.59	0.73	0.21	0.21	0.40	0.27	0.24	0.33	0.33	0.49	0.46	0.59
Avail Cap(c_a), veh/h	1034	1479	1128	542	1048	794	267	497	421	455	715	606
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	12.1	18.1	14.8	14.1	19.0	18.3	22.9	18.0	18.0	23.2	18.8	19.5
Incr Delay (d2), s/veh	0.3	0.6	0.1	0.1	0.2	0.2	0.2	0.1	0.2	0.4	0.3	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	5.2	8.7	1.6	1.3	3.7	1.8	1.4	3.0	2.6	3.7	4.5	5.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	12.4	18.8	14.9	14.2	19.2	18.5	23.1	18.2	18.2	23.6	19.0	20.0
LnGrp LOS	B	B	B	B	B	B	C	B	B	C	B	B
Approach Vol, veh/h		895			365			364			642	
Approach Delay, s/veh		15.8			17.9			19.0			20.5	
Approach LOS		B			B			B			C	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	15.5	22.2		23.0	11.0	26.7		23.0				
Change Period (Y+Rc), s	5.0	7.0		7.0	5.0	7.0		7.0				
Max Green Setting (Gmax), s	25.0	34.0		23.0	11.0	48.0		13.0				
Max Q Clear Time (g_c+I1), s	10.4	7.1		14.8	3.9	14.7		12.0				
Green Ext Time (p_c), s	0.1	0.4		1.2	0.0	1.0		0.1				
Intersection Summary												
HCM 6th Ctrl Delay			18.0									
HCM 6th LOS			B									
Notes												

User approved pedestrian interval to be less than phase max green.

ALTERNATIVE 5 - AM PEAK HOUR

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	233	288	34	97	205	53	78	129	138	52	132	211
Future Volume (veh/h)	233	288	34	97	205	53	78	129	138	52	132	211
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	0.90	1.00	1.00	0.90	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	245	303	36	102	216	56	82	136	145	55	139	222
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	1	1	1	1	1	1
Cap, veh/h	570	477	57	505	376	98	270	362	497	282	362	546
Arrive On Green	0.15	0.32	0.32	0.12	0.29	0.29	0.19	0.19	0.19	0.19	0.19	0.19
Sat Flow, veh/h	1781	1476	175	1781	1287	334	1029	1885	1598	1107	1885	1598
Grp Volume(v), veh/h	245	0	339	102	0	272	82	136	145	55	139	222
Grp Sat Flow(s),veh/h/ln	1781	0	1652	1781	0	1621	1029	1885	1598	1107	1885	1598
Q Serve(g_s), s	4.6	0.0	9.1	1.9	0.0	7.4	3.9	3.3	3.6	2.4	3.3	5.5
Cycle Q Clear(g_c), s	4.6	0.0	9.1	1.9	0.0	7.4	7.3	3.3	3.6	5.6	3.3	5.5
Prop In Lane	1.00		0.11	1.00		0.21	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	570	0	534	505	0	474	270	362	497	282	362	546
V/C Ratio(X)	0.43	0.00	0.64	0.20	0.00	0.57	0.30	0.38	0.29	0.20	0.38	0.41
Avail Cap(c_a), veh/h	1402	0	891	1391	0	874	429	654	744	453	654	793
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	10.1	0.0	15.0	10.1	0.0	15.6	21.5	18.3	13.6	20.7	18.3	13.1
Incr Delay (d2), s/veh	0.2	0.0	0.5	0.1	0.0	0.4	0.2	0.2	0.1	0.1	0.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	2.7	0.0	5.4	1.1	0.0	4.4	1.5	2.3	2.0	1.0	2.4	3.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	10.2	0.0	15.4	10.2	0.0	16.0	21.7	18.5	13.7	20.8	18.5	13.2
LnGrp LOS	B	A	B	B	A	B	C	B	B	C	B	B
Approach Vol, veh/h		584			374			363			416	
Approach Delay, s/veh		13.3			14.4			17.3			16.0	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	12.8	22.2		17.0	11.2	23.8		17.0
Change Period (Y+Rc), s	5.0	7.0		7.0	5.0	7.0		7.0
Max Green Setting (Gmax), s	32.0	28.0		18.0	32.0	28.0		18.0
Max Q Clear Time (g_c+I1), s	6.6	9.4		7.6	3.9	11.1		9.3
Green Ext Time (p_c), s	0.1	0.5		0.8	0.0	0.7		0.6

Intersection Summary			
HCM 6th Ctrl Delay			15.0
HCM 6th LOS			B

ALTERNATIVE 5 - PM PEAK HOUR

HCM 6th Signalized Intersection Summary
3: S LaSalle St/N LaSalle St & E Washington Ave

03/11/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	340	420	90	78	178	91	60	155	131	154	219	237
Future Volume (veh/h)	340	420	90	78	178	91	60	155	131	154	219	237
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	0.90	1.00	1.00	0.90	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	358	442	95	82	187	96	63	163	138	162	231	249
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	1	1	1	1	1	1
Cap, veh/h	551	480	103	319	302	155	248	476	556	309	476	667
Arrive On Green	0.16	0.36	0.36	0.10	0.29	0.29	0.25	0.25	0.25	0.25	0.25	0.25
Sat Flow, veh/h	1781	1343	289	1781	1046	537	922	1885	1598	1087	1885	1598
Grp Volume(v), veh/h	358	0	537	82	0	283	63	163	138	162	231	249
Grp Sat Flow(s),veh/h/ln	1781	0	1631	1781	0	1582	922	1885	1598	1087	1885	1598
Q Serve(g_s), s	8.5	0.0	20.3	1.9	0.0	10.0	4.0	4.6	4.0	9.3	6.7	6.9
Cycle Q Clear(g_c), s	8.5	0.0	20.3	1.9	0.0	10.0	10.8	4.6	4.0	13.8	6.7	6.9
Prop In Lane	1.00		0.18	1.00		0.34	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	551	0	584	319	0	456	248	476	556	309	476	667
V/C Ratio(X)	0.65	0.00	0.92	0.26	0.00	0.62	0.25	0.34	0.25	0.52	0.49	0.37
Avail Cap(c_a), veh/h	1140	0	707	1031	0	686	272	526	598	338	526	709
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	12.6	0.0	19.8	15.0	0.0	19.9	25.1	19.7	15.0	25.4	20.6	13.0
Incr Delay (d2), s/veh	0.5	0.0	14.2	0.2	0.0	0.5	0.2	0.2	0.1	0.5	0.3	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	5.3	0.0	14.2	1.3	0.0	6.2	1.5	3.3	2.4	4.0	4.9	3.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	13.1	0.0	34.0	15.2	0.0	20.4	25.3	19.9	15.1	25.9	20.8	13.1
LnGrp LOS	B	A	C	B	A	C	C	B	B	C	C	B
Approach Vol, veh/h		895			365			364			642	
Approach Delay, s/veh		25.6			19.2			19.0			19.1	
Approach LOS		C			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	15.6	25.6		23.3	11.2	30.1		23.3				
Change Period (Y+Rc), s	5.0	7.0		7.0	5.0	7.0		7.0				
Max Green Setting (Gmax), s	32.0	28.0		18.0	32.0	28.0		18.0				
Max Q Clear Time (g_c+I1), s	10.5	12.0		15.8	3.9	22.3		12.8				
Green Ext Time (p_c), s	0.1	0.6		0.5	0.0	0.8		0.5				

Intersection Summary			
HCM 6th Ctrl Delay			21.7
HCM 6th LOS			C

APPENDIX D
INTERSECTION SIMTRAFFIC QUEUE REPORTS

2020 EXISTING CONDITIONS AM PEAK HOUR

3: S LaSalle St/N LaSalle St & E Washington Ave Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	2.1	0.5	0.6	1.2	0.3	0.4	0.5	0.5	3.7	0.5	0.6	3.4
Total Del/Veh (s)	20.5	23.4	22.2	20.3	29.5	26.6	24.6	23.0	23.8	27.8	23.5	24.0

3: S LaSalle St/N LaSalle St & E Washington Ave Performance by movement

Movement	All
Denied Del/Veh (s)	1.4
Total Del/Veh (s)	24.2

Intersection: 3: S LaSalle St/N LaSalle St & E Washington Ave

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	LT	R	LT	R
Maximum Queue (ft)	125	167	110	204	136	121	124	151
Average Queue (ft)	77	104	46	117	80	70	69	90
95th Queue (ft)	136	183	107	210	136	129	125	153
Link Distance (ft)		2040		2324	886		1252	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	115		105			260		230
Storage Blk Time (%)	1	8	0	9				
Queuing Penalty (veh)	3	13	0	8				

2020 EXISTING CONDITIONS PM PEAK HOUR

3: S LaSalle St/N LaSalle St & E Washington Ave Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	1.9	0.8	0.6	1.9	0.3	0.3	0.6	0.5	3.6	0.7	0.7	3.3
Total Del/Veh (s)	36.5	36.3	33.0	27.1	33.7	32.8	26.0	34.0	27.8	27.6	31.8	29.0

3: S LaSalle St/N LaSalle St & E Washington Ave Performance by movement

Movement	All
Denied Del/Veh (s)	1.4
Total Del/Veh (s)	32.3

Intersection: 3: S LaSalle St/N LaSalle St & E Washington Ave

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	LT	R	LT	R
Maximum Queue (ft)	140	346	116	221	171	108	245	180
Average Queue (ft)	118	208	52	127	107	71	151	104
95th Queue (ft)	166	349	119	234	175	125	257	185
Link Distance (ft)		2040		2324	886		1252	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	115		105			260		230
Storage Blk Time (%)	12	26	0	13			2	
Queuing Penalty (veh)	42	60	0	9			3	

2040 FUTURE NO BUILD AM PEAK HOUR

3: S LaSalle St/N LaSalle St & E Washington Ave Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	2.2	0.9	1.0	1.6	0.4	0.4	0.6	0.6	3.7	0.6	0.7	3.2
Total Del/Veh (s)	36.2	32.7	29.2	28.6	34.0	34.6	28.7	29.8	33.7	28.1	29.6	32.7

3: S LaSalle St/N LaSalle St & E Washington Ave Performance by movement

Movement	All
Denied Del/Veh (s)	1.5
Total Del/Veh (s)	32.3

Intersection: 3: S LaSalle St/N LaSalle St & E Washington Ave

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	LT	R	LT	R
Maximum Queue (ft)	140	336	129	240	163	147	189	177
Average Queue (ft)	126	217	63	148	113	90	109	118
95th Queue (ft)	161	382	137	245	179	156	213	197
Link Distance (ft)		2040		2324	886		1252	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	115		105			260		230
Storage Blk Time (%)	17	22	2	19				1
Queuing Penalty (veh)	59	54	6	19				2

2040 FUTURE NOT BUILD PM PEAK HOUR

3: S LaSalle St/N LaSalle St & E Washington Ave Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	17.7	15.4	13.6	1.6	0.4	0.4	0.5	0.6	3.6	1.0	0.8	2.9
Total Del/Veh (s)	213.4	205.4	199.3	37.2	46.1	44.9	39.0	40.7	40.8	37.6	36.1	32.4

3: S LaSalle St/N LaSalle St & E Washington Ave Performance by movement

Movement	All
Denied Del/Veh (s)	7.3
Total Del/Veh (s)	107.5

Intersection: 3: S LaSalle St/N LaSalle St & E Washington Ave

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	LT	R	LT	R
Maximum Queue (ft)	140	2058	129	307	183	165	304	237
Average Queue (ft)	135	1667	76	193	134	92	206	158
95th Queue (ft)	161	2292	156	385	210	166	325	264
Link Distance (ft)		2040		2324	886		1252	
Upstream Blk Time (%)		27						
Queuing Penalty (veh)		0						
Storage Bay Dist (ft)	115		105			260		230
Storage Blk Time (%)	40	45	2	28			4	1
Queuing Penalty (veh)	215	160	4	23			10	2

ALTERNATIVE 1 - AM PEAK HOUR

3: S LaSalle St/N LaSalle St & E Washington Ave Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	1.8	0.8	0.6	1.3	0.3	0.2	0.8	0.6	3.5	0.8	0.7	3.3
Total Del/Veh (s)	25.4	28.7	25.2	26.7	31.5	29.3	38.6	42.8	33.4	31.5	33.3	31.7

3: S LaSalle St/N LaSalle St & E Washington Ave Performance by movement

Movement	All
Denied Del/Veh (s)	1.4
Total Del/Veh (s)	31.1

Intersection: 3: S LaSalle St/N LaSalle St & E Washington Ave

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	LT	R	LT	R
Maximum Queue (ft)	212	279	110	214	170	115	189	170
Average Queue (ft)	125	169	65	133	118	79	111	113
95th Queue (ft)	227	314	136	257	194	130	213	192
Link Distance (ft)		2040		2324	886		1252	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	200		105			260		230
Storage Blk Time (%)	1	6	0	16			1	0
Queuing Penalty (veh)	4	14	0	15			2	1

ALTERNATIVE 1 - PM PEAK HOUR

3: S LaSalle St/N LaSalle St & E Washington Ave Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	1.9	1.3	1.3	1.5	0.4	0.4	0.5	0.6	3.6	0.9	0.9	3.0
Total Del/Veh (s)	69.5	65.2	62.2	38.3	41.3	39.4	56.6	67.6	66.6	82.2	87.3	76.0

3: S LaSalle St/N LaSalle St & E Washington Ave Performance by movement

Movement	All
Denied Del/Veh (s)	1.5
Total Del/Veh (s)	66.6

Intersection: 3: S LaSalle St/N LaSalle St & E Washington Ave

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	LT	R	LT	R
Maximum Queue (ft)	225	887	129	283	251	182	661	255
Average Queue (ft)	215	576	73	173	185	122	452	223
95th Queue (ft)	267	1065	155	298	321	251	759	311
Link Distance (ft)		2042		2324	886		1252	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	200		105			260		230
Storage Blk Time (%)	16	32	2	25	2	3	43	6
Queuing Penalty (veh)	85	115	6	21	2	7	107	25

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ALTERNATIVE 2 - AM PEAK HOUR

3: S LaSalle St/N LaSalle St & E Washington Ave Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	1.7	0.7	0.4	1.3	0.4	0.2	3.6	0.5	0.5	3.2	0.5	0.4
Total Del/Veh (s)	18.9	15.6	16.4	26.3	22.2	24.1	37.1	19.2	18.1	25.9	23.0	20.0

3: S LaSalle St/N LaSalle St & E Washington Ave Performance by movement

Movement	All
Denied Del/Veh (s)	1.0
Total Del/Veh (s)	20.9

Intersection: 3: S LaSalle St/N LaSalle St & E Washington Ave

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	136	242	118	222	89	139	54	194
Average Queue (ft)	95	136	66	130	55	99	32	138
95th Queue (ft)	152	257	128	247	108	167	62	227
Link Distance (ft)		2066		2334		886		1257
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	115		105		260		230	
Storage Blk Time (%)	5	7	0	14				1
Queuing Penalty (veh)	16	16	0	13				0

ALTERNATIVE 2 - PM PEAK HOUR

3: S LaSalle St/N LaSalle St & E Washington Ave Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	2.1	1.2	1.2	1.4	0.4	0.3	3.6	0.4	0.5	3.0	0.6	0.6
Total Del/Veh (s)	38.2	28.5	24.7	40.2	36.8	35.6	67.5	31.5	34.4	24.8	28.3	24.8

3: S LaSalle St/N LaSalle St & E Washington Ave Performance by movement

Movement	All
Denied Del/Veh (s)	1.2
Total Del/Veh (s)	32.6

Intersection: 3: S LaSalle St/N LaSalle St & E Washington Ave

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	139	484	125	246	92	213	119	332
Average Queue (ft)	125	337	73	158	57	148	74	214
95th Queue (ft)	170	554	147	261	113	244	150	341
Link Distance (ft)		2066		2334		886		1257
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	115		105		260		230	
Storage Blk Time (%)	21	20	3	25		0		6
Queuing Penalty (veh)	109	69	9	19		0		10

ALTERNATIVE 3 - AM PEAK HOUR

3: S LaSalle St/N LaSalle St & E Washington Ave Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	1.9	0.8	1.5	1.3	0.4	1.2	0.7	0.5	3.6	0.7	0.7	3.2
Total Del/Veh (s)	27.3	29.9	31.4	26.6	32.0	35.6	35.3	45.5	36.8	32.4	30.4	31.8

3: S LaSalle St/N LaSalle St & E Washington Ave Performance by movement

Movement	All
Denied Del/Veh (s)	1.4
Total Del/Veh (s)	32.2

Intersection: 3: S LaSalle St/N LaSalle St & E Washington Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	R	L	T	R	LT	R	LT	R
Maximum Queue (ft)	204	271	66	121	230	72	208	132	156	156
Average Queue (ft)	117	163	24	60	125	41	137	76	96	110
95th Queue (ft)	217	329	73	117	244	93	223	135	165	175
Link Distance (ft)		2040			2326		874		1247	
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)	200		50	105		50		260		230
Storage Blk Time (%)	2	43	1	1	28	5	0			
Queuing Penalty (veh)	7	122	4	2	45	17	0			

ALTERNATIVE 3 - PM PEAK HOUR

3: S LaSalle St/N LaSalle St & E Washington Ave Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	2.0	1.3	2.0	1.5	0.4	1.3	0.5	0.8	3.4	0.8	0.9	3.0
Total Del/Veh (s)	46.9	45.7	43.2	31.9	41.6	39.2	61.4	62.7	49.4	48.2	54.1	43.6

3: S LaSalle St/N LaSalle St & E Washington Ave Performance by movement

Movement	All
Denied Del/Veh (s)	1.6
Total Del/Veh (s)	47.0

Intersection: 3: S LaSalle St/N LaSalle St & E Washington Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	R	L	T	R	LT	R	LT	R
Maximum Queue (ft)	225	677	74	118	262	75	250	191	423	255
Average Queue (ft)	195	397	37	67	155	44	164	106	266	180
95th Queue (ft)	273	702	90	142	290	94	281	216	467	286
Link Distance (ft)		2040			2326		874		1247	
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)	200		50	105		50		260		230
Storage Blk Time (%)	10	52	5	1	37	9	3	0	14	1
Queuing Penalty (veh)	56	235	43	1	66	25	5	0	35	5

ALTERNATIVE 5 - AM PEAK HOUR

3: S LaSalle St/N LaSalle St & E Washington Ave Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	1.7	0.8	0.7	1.3	0.5	0.3	0.6	0.7	3.5	0.7	0.9	3.2
Total Del/Veh (s)	28.1	31.7	33.2	27.5	38.5	33.0	34.2	35.6	21.9	37.3	38.6	14.4

3: S LaSalle St/N LaSalle St & E Washington Ave Performance by movement

Movement	All
Denied Del/Veh (s)	1.4
Total Del/Veh (s)	30.2

Intersection: 3: S LaSalle St/N LaSalle St & E Washington Ave

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	LT	R	LT	R
Maximum Queue (ft)	212	304	113	243	196	130	187	128
Average Queue (ft)	127	179	64	147	127	71	116	79
95th Queue (ft)	226	309	137	265	201	134	185	125
Link Distance (ft)		2040		2324	886		1252	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	200		105			260		230
Storage Blk Time (%)	1	6	0	17	0		0	0
Queuing Penalty (veh)	5	15	1	18	0		1	0

ALTERNATIVE 5 - PM PEAK HOUR

3: S LaSalle St/N LaSalle St & E Washington Ave Performance by movement

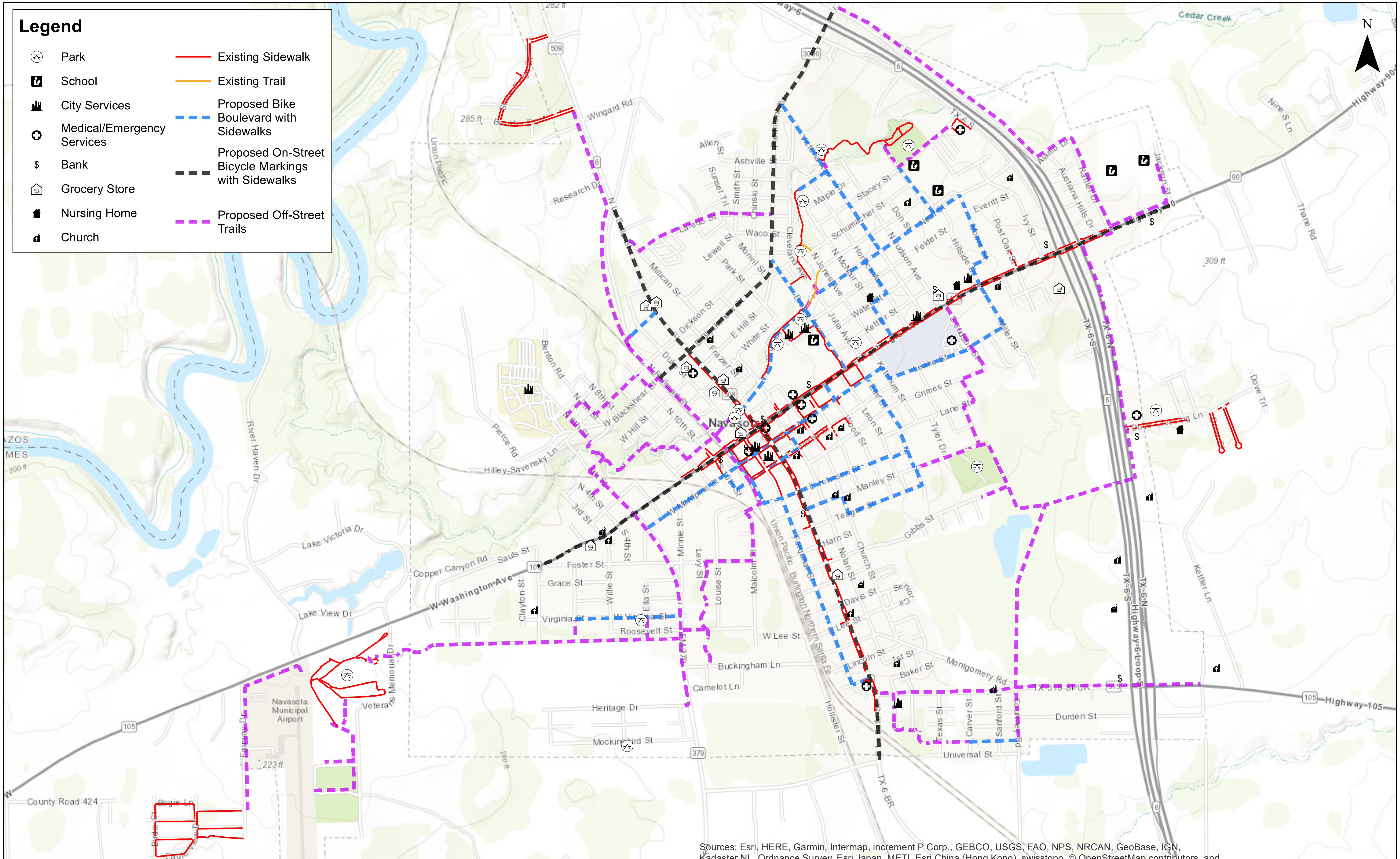
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	1.9	1.3	1.3	1.3	0.4	0.4	0.7	0.5	3.5	0.9	0.9	2.9
Total Del/Veh (s)	78.2	73.6	72.9	39.4	47.9	46.1	41.6	42.6	30.2	116.3	117.6	60.0

3: S LaSalle St/N LaSalle St & E Washington Ave Performance by movement

Movement	All
Denied Del/Veh (s)	1.5
Total Del/Veh (s)	69.8

Intersection: 3: S LaSalle St/N LaSalle St & E Washington Ave

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	LT	R	LT	R
Maximum Queue (ft)	225	964	129	299	214	150	721	255
Average Queue (ft)	209	631	73	188	136	86	499	189
95th Queue (ft)	272	1203	151	320	211	163	1003	336
Link Distance (ft)		2040		2324	886		1252	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	200		105			260		230
Storage Blk Time (%)	18	37	2	32		0	45	0
Queuing Penalty (veh)	96	134	5	27		1	111	1



City of Navasota: Bike & Pedestrian Connections - Proposed Facilities Overview

Report for
City of Navasota, Texas

Pedestrian and Bicycle System Plan

Prepared by:

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July 2021

STRAND ASSOCIATES®

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SECTION 1
INTRODUCTION

1.01 INTRODUCTION

The City of Navasota (City) hired Strand Associates, Inc.® (Strand) to create a Pedestrian and Bicycle System Plan (Plan) for the City. This Plan builds off the values the city has expressed in its City of Navasota Comprehensive Plan 2015 to 2025 (CP). Specifically, this Plan focuses on: a review of the existing connections and data affecting routes in the City; an alternatives analysis with proposed routing options and typical sections as well as discussion of safety, materials, and routing options; and a documented map and report of the system.

A. <u>Reason for the Plan</u>

The desire for improved conditions for walkers and bicyclists in the City has been frequently expressed by City staff and residents. The following are the primary reasons for the Plan.

1. Consistency with the CP

Several different locations in the CP mention pedestrian and bicycle facilities. These are listed in the next section, along with a summary of the statements and the goal for the Plan.

2. Helps Secure Funding

Having a pedestrian and bicycle plan ready and available with future plans for development and a priority corridors or projects list is very beneficial when funding opportunities become available. Often when submitting grant proposals for funding, having a pedestrian and bicycle plan and map already in place can be an added benefit on the application, allowing more local facilities to be built with state and federal funding.

3. Promotes Public Health

In the United States (US), 55 percent of the adult population falls short of physical activity guidelines. Providing pedestrian infrastructure can help improve this. Recommended activity levels were met by 43 percent of people with safe places to walk within ten minutes, compared to 27 percent who did not have safe places to walk. In addition, people in walkable neighborhoods did approximately 45 more minutes of physical activity per week.[1] Additionally, infrastructure that helps people feel safe on the roads to get out biking or walking can have a positive effect on air quality as more people use alternative methods of commuting.

4. Promotes Equity

Bicycling is becoming an increasingly important mode of transportation with bicycle commuting rising 47 percent nationally between 2000 and 2011, with a larger rise by women commuters.[2] Yet only 9 percent of Americans say they will ride on all roads and feel confident riding in traffic. A strong and diverse majority of Americans say more bike lanes and trails would encourage them

[1] www.completestreets.org
[2] American Community Survey, U.S. Census Bureau

to ride more, including 60 percent of people of color, and 59 percent of those earning less than $30,000 a year.[3] Bicycling offers a less expensive form of transportation for low income individuals, with annual operating cost for a bicycle of approximately $308 compared to $8,220 for the average car.[4] Building better integrated multimodal networks provides opportunities to reduce transportation costs and close gaps in job access for low income families and individuals.

5. Promotes Safety

Since 2015 there have been eight vehicle crashes involving pedestrians in the City.[5] Most of these crashes involved serious injuries, and all occurred on streets without adequate pedestrian or bicycle facilities. Providing these pedestrian and bicycle accommodations moves these users off the road and/or provides dedicated space for them, reducing potential conflicts with vehicles, and creating a safer environment for all road users.

6. Promotes Tourism

With the Adventure Cycling Associations Southern Tier National Bike Route (discussed further in Section 2) traveling through the City, having acceptable and welcoming bicycle accommodations can promote the City as a tourist destination where people look forward to passing though on their journey.

1.02 GOALS AND OBJECTIVES

There are several areas in the existing City CP that mention pedestrian and bicycle accommodation. These sections provide background that informs the goal and objectives that this pedestrian and bicycle plan strives to help achieve.

In Section 1, under Mobility, the current CP indicated, “Transportation planning around centers will focus on walkability and bicycle opportunities,” and further mentions that as streets are repaved or new developments are implemented, sidewalk should be added, and bike paths considered.

Later in Section 1 under Parks, Paths and Play, the CP indicates, “Participate in the Rails to Trails System” as well as, “Build bike paths and trails.” Both of these statements indicate a desire to work on creating a bike system and working with the local railroads to connect neighborhoods and the park system.

In Section 3, the CP lists several principles and policies that pertain to pedestrian and bicycle accommodations:

1. Growth Management Policy 8–Walkability

Walkability and non-vehicular mobility will be encouraged and enforced through policies that promote and require sidewalks, crosswalks and bicycle paths where safe and practical as 1) new

[3]Princeton Survey Research Associates, September 27 to 30, 2012, Omnibus Survey
[4]Pocket Guide to Transportation 2009, Bureau of Transportation Statistics, 2009
[5]https://cris.dot.state.tx.us/public/Query/app/home

arterials are constructed, 2) when existing streets are repaired or widened, and 3) in new subdivision or construction in the Growth Centers.

2. Transportation Principle 2–Multi-Modal Choices

Navasota encourages facilitating the availability of multiple mobility choices-walking, biking, and transit to Navasota citizens to help reduce vehicular trips on all streets and Washington Avenue in particular.

3. Transportation Policy 1–Street Design

Streets and roads should conform to the City's Design Manual and reinforce streetscaping efforts particularly on Washington Avenue. Design existing and new streets to include traffic calming measure that ensure safety for all vehicular and pedestrian traffic. Facilitate on-street parking design requirements. Prioritize traffic calming measures in Neighborhoods Centers. The City can encourage private participation to ensure implementation of the guidelines during the pre-development process.

4. Transportation Policy 9–Pedestrians

Promote pedestrian-oriented transportation and active living choices as an integral part of the growth of the city. Ensure the development of a well-connected network of streets and sidewalks. Identify bicycle and pedestrian connections to key community facilities, such as schools, parks and downtown amenities. Improve safety and accessibility for all community members by developing speed zones and providing clearly marked crosswalks. Review the requirements for sidewalk construction in the subdivision regulations. Efforts should be made to complete connections within the current sidewalk system and implementation of proposed trail connections.

5. Heritage Policy 13–Open Space and Recreational Facilities

Encourage and guide development of public open space and amenities such as Cedar Creek Park, with pedestrian-centered connections to the downtown Central Business District.

All these statements can be summarized by a goal for the Pedestrian and Bicycle plan with three main objectives.

A. <u>Goal</u>

Provide safe and convenient pedestrian and bicycle accommodations that connect Navasota neighborhoods to community destinations.

B. Objectives

1. Provide off-street pedestrian facilities that better connect schools, community facilities, and businesses to improve walkability.

2. Provide bike route options that better connect neighborhoods to schools, community facilities, and businesses through a combination of on-street accommodations and trails.

3. Promote street and intersection design that reduces automobile travel speeds and improves conditions and comfort levels for pedestrians and bicyclists.

1.03 ABBREVIATIONS AND DEFINITIONS

ADA	Americans with Disabilities Act
ADT	Average Daily Traffic
BUILD	Better Utilizing Investments to Leverage Development
City	City of Navasota
CP	Comprehensive Plan
FHWA	Federal Highway Administration
FM	Farm-to-Market
mph	miles per hour
MUTCD	Manual on Uniform Traffic Control Devices
NACTO	National Association of City Transportation Offiicials
OPC	Opinion of Probable Cost
Plan	Pedestrian and Bicycle System Plan
RAISE	Rebuilding American Infrastructure with Sustainability and Equity
SH	State Highway
Strand	Strand Associates, Inc.®
TA	Transportation Alternatives Set-Aside
TIGER	Transportation Investment Generation Economic Recovery
TPWD	Texas Parks Wildlife Department
TxDOT	Texas Department of Transportation

SECTION 2
EXISTING CONDITIONS ANALYSIS

2.01 DATA COLLECTION

The goal to "provide safe and convenient pedestrian and bicycle accommodations that connect Navasota neighborhoods to community destinations", dictates information is needed about popular community destinations, vehicle traffic volumes, and speeds on the local roadways.

A. Important Community Destinations

The study team identified eight different community destination types to evaluate key routes that could be included on the system map. These categories were parks, schools, city services, medical/emergency services facilities, banks and ATMs, grocery and food stores, nursing homes, and places of worship. Figure 2.01-1 shows a map highlighting the locations of these community destinations in Navasota. This map with different categories was shared at a public meeting held on May 18, 2021, and posted online with a form that asked community members to rank the priority of these different facilities to be connected into the pedestrian and bicycle system. The top three ranked categories were parks, schools, and grocery stores. A map highlighting each individual category can be found in Appendix A. A summary of the feedback from the public meeting is provided in Appendix B.

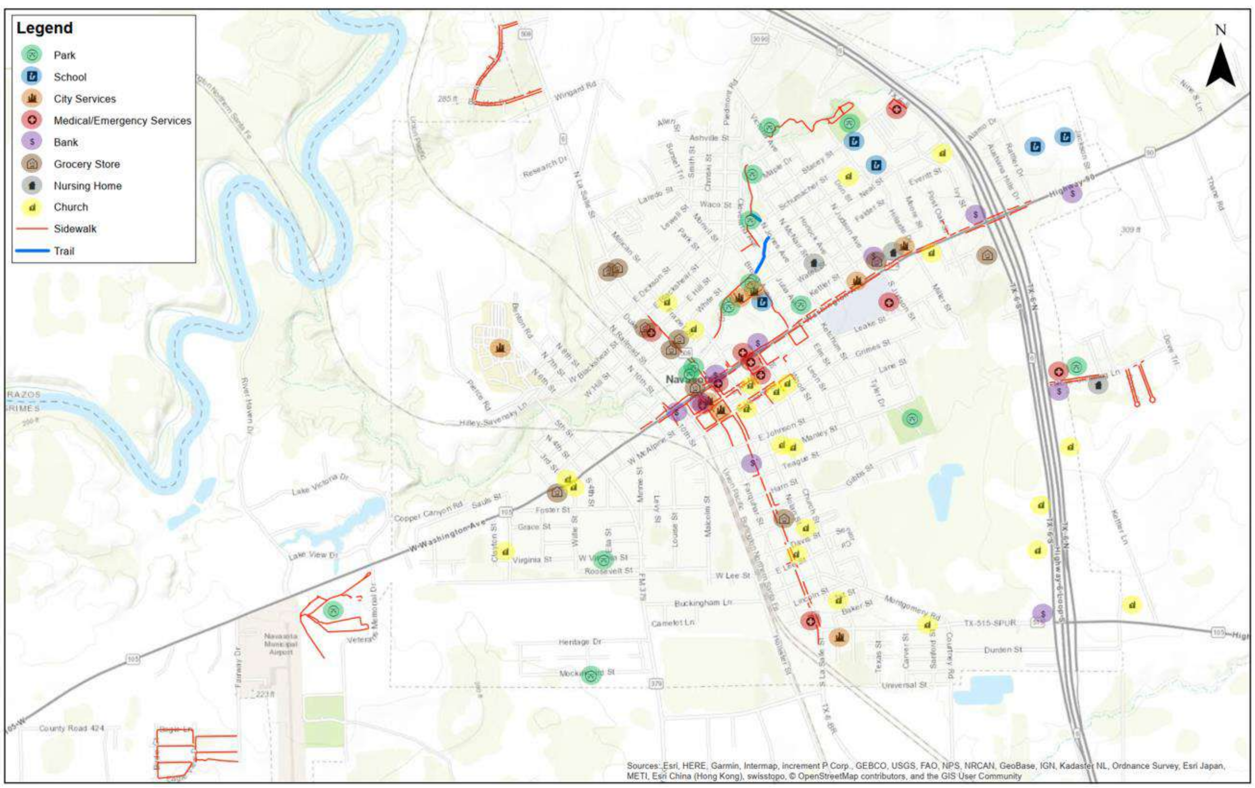


Figure 2.01-1 Community Destinations in the City

B. Southern Tier National Bicycle Route

Another important feature of the City is that the Adventure Cycling Associations Southern Tier National Bicycle Route travels right through town on Washington Avenue. The Southern Tier National Bicycle Route is a multistate bicycle route that spans from San Diego, California to St. Augustine, Florida, traveling through Arizona, New Mexico, Texas, Louisiana, Mississippi, and Alabama along the way. The route is split into seven different sections. The City is featured prominently along the route, ending Section 4 and beginning Section 5. This route is shown in its entirety in Figure 2.01-2.

Source: https://www.adventurecycling.org/routes-and-maps/adventure-cycling-route-network/southern-tier/

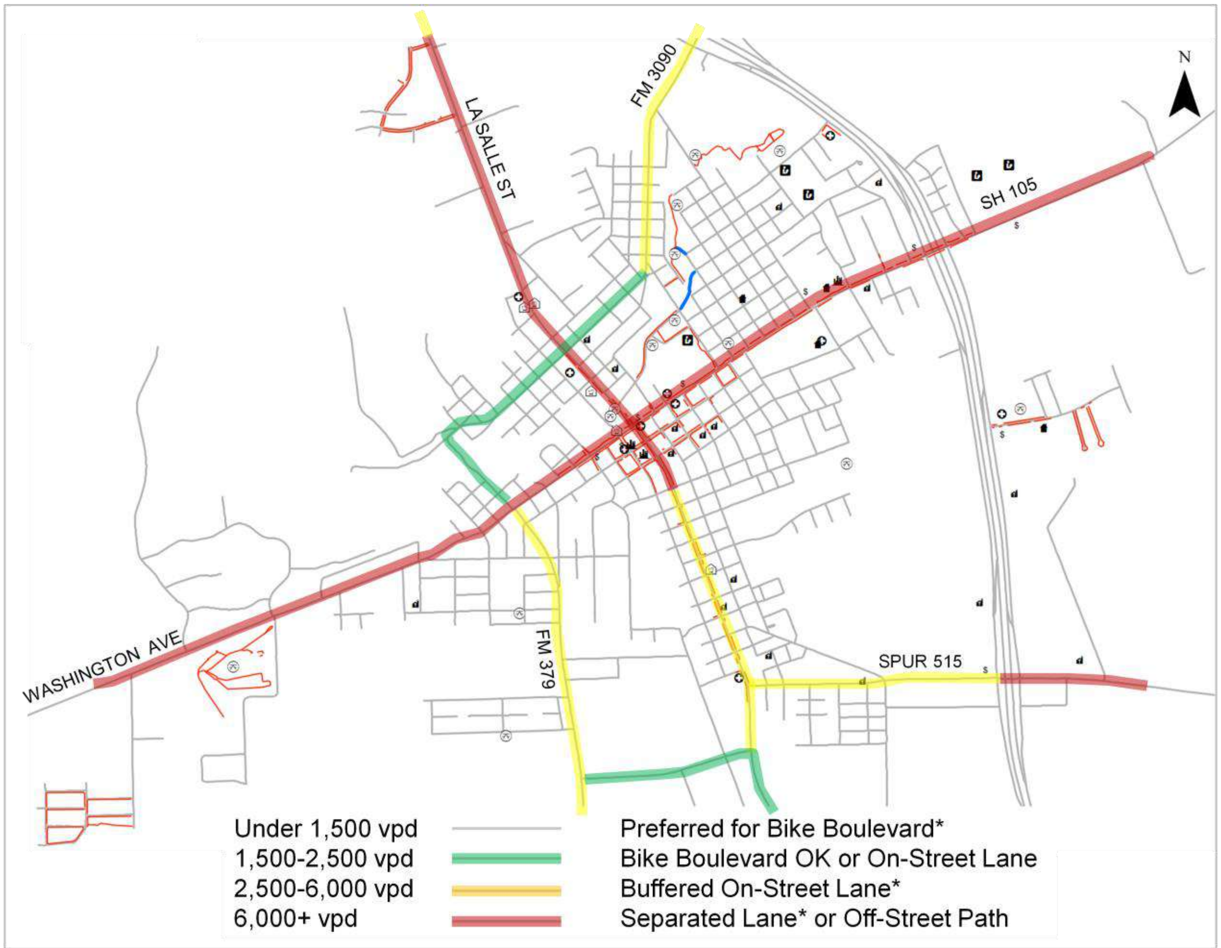
Figure 2.01-2 Southern Tier Bicycle Route

This route travels east-west through the City entering on and traveling along Washington Avenue (TX 105) and exiting on TX 90. Providing improved accommodations for this bicycle traffic and considering ways to promote tourism, especially for the bicycle routing through the downtown area, are important factors to consider when choosing future projects to pursue.

C. Traffic Volumes and Speeds

To incorporate the desirable type of accommodation for pedestrians and bicycles into the Plan, it is vital to understand the vehicular traffic volumes and speeds along the major arterials throughout the City. This allows different types of accommodations to work together and minimize impact to vehicle traffic as well as provide key connections for pedestrians and bicycles. The vehicle volumes were found using the

Texas Statewide Planning Map[1] and are shown in Figure 2.01-3. Traffic speed limits are shown in Figure 2.01-4. Speeds more than 40 miles per hour (mph) were grouped together based on guidance from Federal Highway Administration (FHWA) Bikeway Selection discussed further later in this Plan.



Notes:
*See Section 3 for descriptions of bike boulevards, buffered lanes, and separated lanes
vpd=vehicles per day

Figure 2.01-3 City Traffic Volumes

[1] https://www.txdot.gov/apps/statewide_mapping/StatewidePlanningMap.html

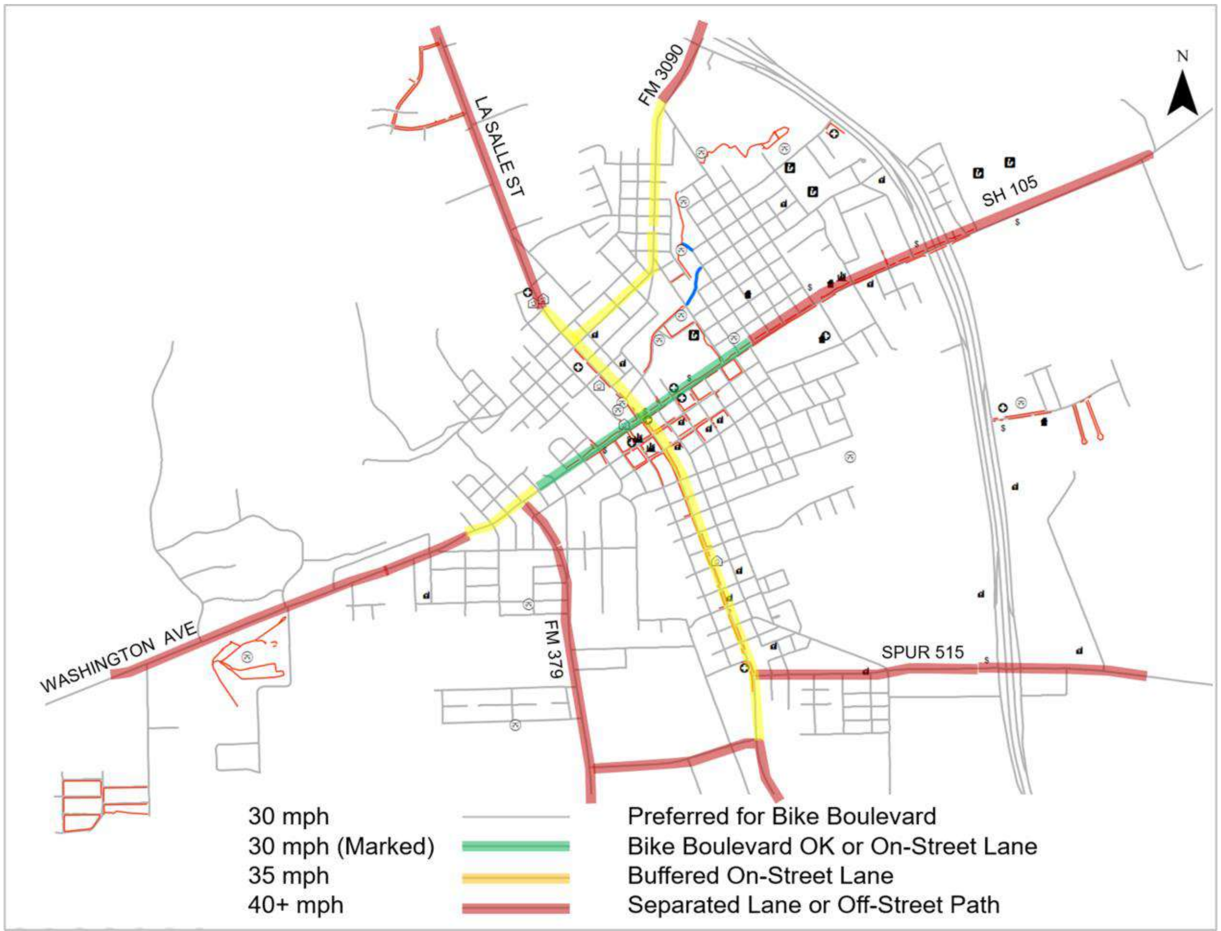


Figure 2.01-4 City Speed Limits

2.02 EXISTING PEDESTRIAN AND BICYCLE FACILITIES

The City currently has a sidewalk network setup through downtown, as well as paths connecting several parks on the northern end of the City. There are currently no bicycle facilities provided. Figure 2.02-1 shows a map of the existing pedestrian and bicycle facilities.

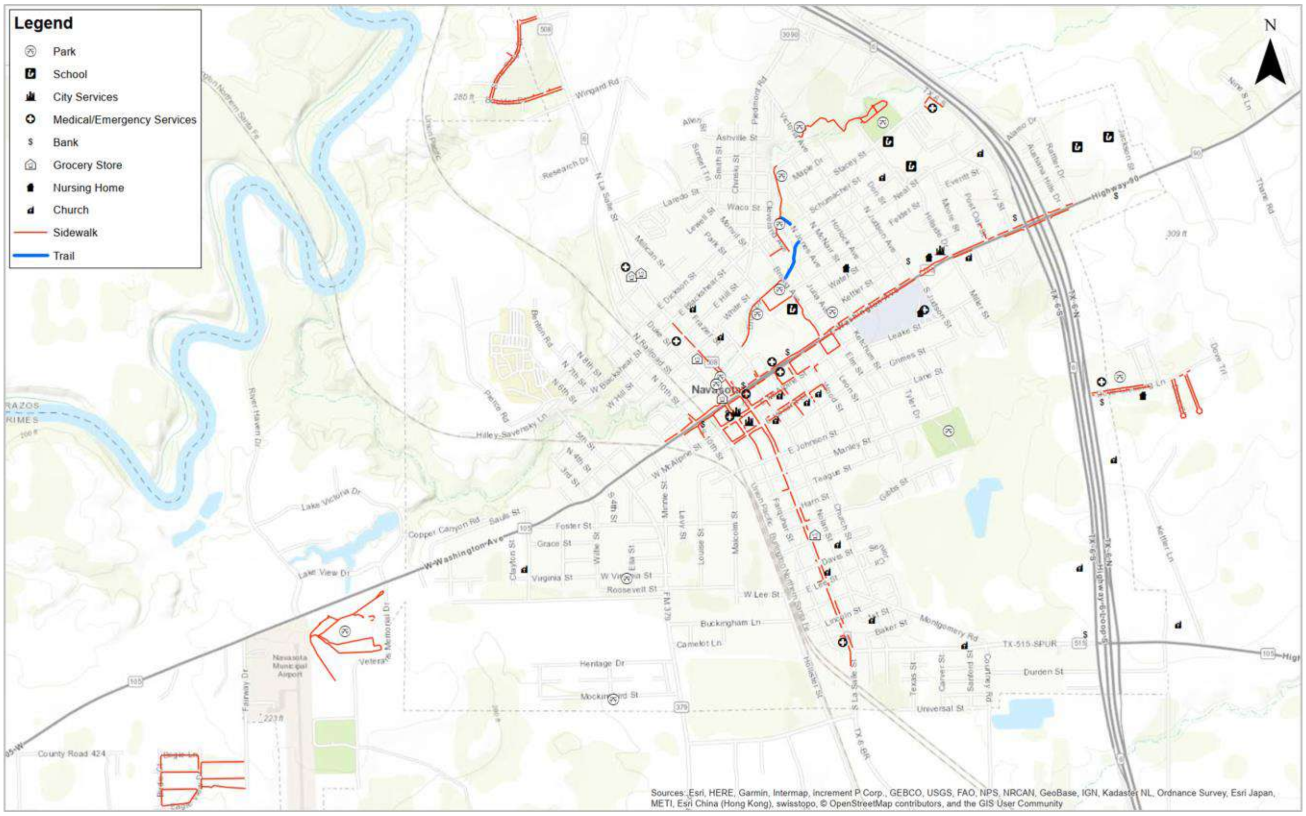


Figure 2.02-1 Existing Pedestrian and Bicycle Facilities

2.03 PLANNED PROJECTS

The City applied for two 2021 Transportation Alternatives Program grants from the Texas Department of Transportation (TxDOT) on June 14, 2021. Provided the applications receive funding, these projects are planned to be constructed by the City.

A. State Highway (SH) 105 Segment B (West Washington Avenue) Pedestrian Improvements

This project is intended to construct sidewalk on both sides of Washington Avenue, lengthening the existing sidewalk from 8th Street and extending it to 3rd Street (see Figure 2.03-1). Sidewalk is proposed to be 6 feet wide and installed with a 2-foot grass buffer to the back of curb. Additionally, the project will include pedestrian crossing signals at the intersection of Washington Avenue with Farm-to-Market (FM) Road 379 (5th Street). The project will also include installation of continental crosswalk markings as well as railroad planking at crossings of the respective facilities.

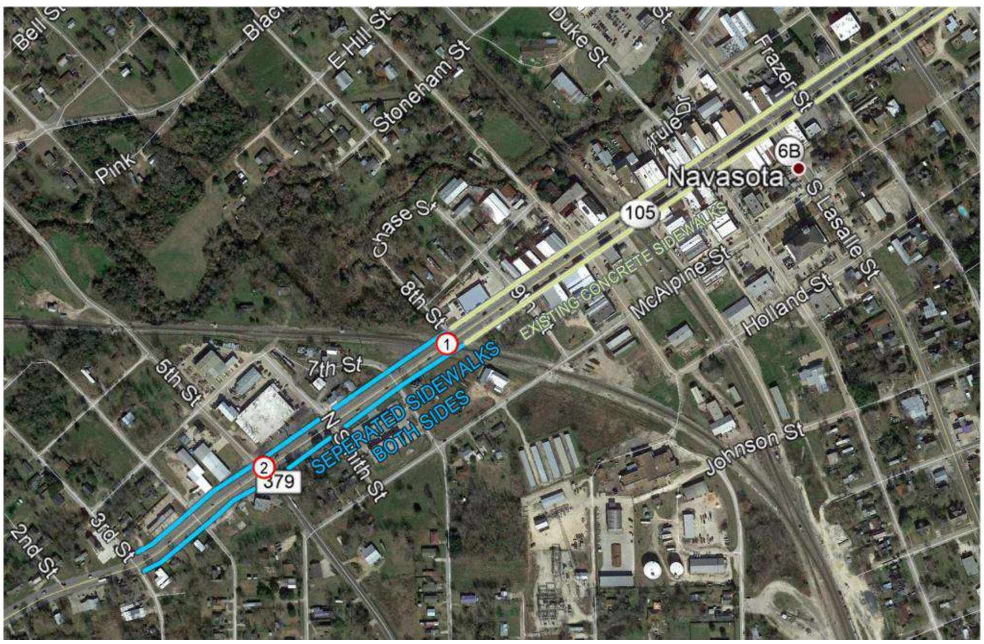


Figure 2.03-1 Proposed Project on Washington Avenue

B. Brosig Avenue Pedestrian Improvements

Figure 2.03-2 shows the proposed limits of this project, which is intended to provide sidewalk along the southwest side of Brosig Avenue from Washington Avenue to Piedmont Avenue. To complete this connection, a separated pedestrian bridge will be constructed across Ceder Creek. Additionally, a shared-use path will be added to connect Brosig Avenue to Neal Street on the south side of Ceder Creek. To accommodate both connections, continental crosswalk markings will be added to cross Brule Street and to cross Brosig Avenue at Brule Street as shown in Figure 2.03-3.

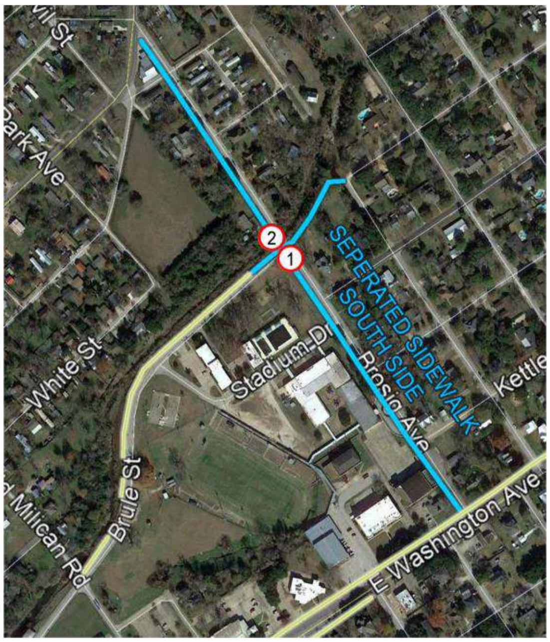


Figure 2.03-2 Proposed Project on Brosig Avenue

Figure 2.03-3 Brule Street and Brosig Avenue Crossings

SECTION 3
ROUTE ANALYSIS

3.01 PEDESTRIAN TREATMENTS

At some point in the day everyone is a pedestrian, even if that is just the trip from a parked car to a final destination. For this reason, it is very important to consider ways to improve pedestrian trips and movements. This is primarily done by expanding and broadening the pedestrian network by adding sidewalk or shared-use paths along local roads. Adding sidewalk helps keep pedestrians and motor vehicles from using the same space, but this is not always preventable. Crosswalks and locations without sidewalk create conflict points where pedestrians and vehicles are using the same space. One of the main ways to reduce crash risk and severity is to slow traffic down. Slower moving traffic has more decision time if there is a conflict and can adapt to suddenly changing conditions. Furthermore, the risk of serious injury for a pedestrian or bicyclist is substantially impacted by prevailing traffic speeds. The following are some strategies to be considered for reconstruction projects that that promote pedestrian safety by making them more visible and protected at crossings, as well as to slow vehicle traffic down at these locations.

A. Traffic Calming Measures

Traffic calming measures implemented on roadways are very important to improving pedestrian comfort. As noted, higher roadway speeds have a direct link to the likelihood of a crash and likelihood of a serious injury or fatality. The National Association of City Transportation Officials (NACTO) has a chart (shown in Table 3.01-1) that links a range of speeds with their required spotting distance, percentage crash risk, and percentage fatality risk. As shown, there is a big difference in crash risk and fatalities even between 25 and 30 mph. Reducing these roadway speeds in areas where pedestrians will be present is key to maintaining safety for all roadway users. This is especially important in areas that have high pedestrian traffic and where sidewalk has not yet been installed. There are four main concepts that should be considered for traffic calming measures on the streets of the City.

SPEED (MPH)	STOPPING DISTANCE (FT)*	CRASH RISK (%)†	FATALITY RISK (%)†
10–15	25	5	2
20–25	40	15	5
30–35	75	55	45
40+	118	90	85

* Stopping Distance includes perception, reaction, and braking times.

† Source: Traditional Neighborhood Development: Street Design Guidelines (1999), ITE Transportation Planning Council Committee 5P-8.

Table 3.01-1 Crash Risks Based on Vehicle Speed

1. Speed Humps, Speed Tables, and Speed Cushions

Speed humps, speed tables, and speed cushions are all different variations on the same concept. A speed hump is a rectangular vertical traffic calming device raised 3 to 4 inches above the normal pavement. This "bump" slows traffic down to between 15 and 20 mph. Speed humps are typically placed midblock, or in several locations along a block to keep speeds down between them. They extend from curb to curb across the whole roadway, but match into the curb gutter pan to allow drainage around them. A speed table is a speed hump that is longer and flat across the top to raise the entire wheelbase of a vehicle and connects into the curb. This added space lends itself well to a midblock crosswalk and is often used at high demand pedestrian crossing locations such as parks, plazas, or schools. Speed cushions are speed humps or speed tables that have sections at the edge of the lanes removed to allow vehicles with wide wheelbases such as busses or emergency vehicles to pass unobstructed while slowing down a typical passenger vehicle. These are more common on key emergency response routes or bicycle boulevards to allow emergency vehicles and bicycles to pass unobstructed while slowing other traffic. Figure 3.01-1 illustrates these devices.

Source: NACTO Urban Street Design Guide

Figure 3.01-1 Speed Bump

Source: NACTO Urban Street Design Guide

Figure 3.01-2 Speed Table

2. Traffic Circles

Traffic circles are center islands installed in the middle of an intersection as shown in Figure 3.01-2. By placing an obstacle in the middle of the intersection, vehicles coming from both directions are forced to slow down to maneuver around the obstacle. These are primarily designed for installation in neighborhoods at uncontrolled intersections. Plants or landscaping can be installed in these traffic circles to help add to the aesthetic of the neighborhood but are not required if maintenance will be an issue. They would be ideal in locations where sidewalk is installed in all four directions and vehicle traffic on the local roads is high. When installed properly, there should be 15 feet between the outer edge of the traffic circle and each corner of the intersection.

Source: NACTO Urban Street Design Guide

Figure 3.01-3 Traffic Circle

3. Raised Intersections

Raised intersections combine the concepts of speed tables and traffic circles. Instead of placing an obstacle in the center of the intersection, the entire intersection is raised like a speed hump, forcing traffic to slow down as it passes through the intersection. They are typically installed on lower volume (approximately 3000 average daily traffic [ADT]) collector roadways with high volumes of pedestrian traffic, although there have been successful applications on high volume arterial streets. Crosswalks can be marked to increase driver awareness of pedestrian movements, but do not need to be if the crossing is at the same grade as the sidewalk. Raised intersections are typically constructed with concrete adjacent to asphalt roadways. This allows the street to be resurfaced multiple times, while the intersection can remain in place and still be operational during construction. They are typically installed at yield or stop-controlled intersections but can be used at low volume signalized intersections as well. Figures 3.01-3 and 3.01-4 show examples of raised intersections.

Source: NACTO Urban Street Design Guide

Figure 3.01-4 Raised Intersection

Source: Google Earth Pro

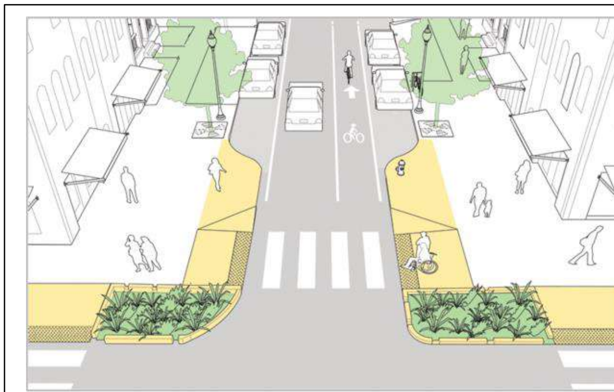
Figure 3.01-5 Raised Intersection in the City of Madison, Wisconsin

4. Pinch Points and Gateways

Pinch points are areas where the curb is extended a few feet into the roadway on each side to create an hourglass shape. When this happens at an intersection, it is called a gateway. This "pinches" the roadway, narrowing the effective roadway space and causing vehicles to slow down to safely traverse the narrowed roadway. These also have the benefit of reducing the pedestrian crossing width of the roadway and are often combined with crosswalks and speed tables for midblock crossings. Examples of these are shown in Figure 3.01-5.

Source: NACTO Urban Street Design Guide

Figure 3.01-6 Pinch Point



Source: NACTO Urban Street Design Guide

Figure 3.01-7 Gateway

B. Crosswalks

Crosswalks are a very important part of the transportation system. While pedestrians without accommodation walking along the roadway share the road with vehicles for longer, they are also typically seen better and longer because they are visible for a longer duration. Pedestrians planning to cross a roadway can be blocked from view by a variety of different things and are walking directly in front of where a vehicle would be traveling. Because of this, it is important to draw driver attention to crosswalks to improve safety for pedestrians. Several methods for this are detailed in the following, and often work best when paired with a traffic calming device as was described previously.

1. Conventional Crosswalks

Crosswalks should be designed to offer as much protection and visibility to pedestrians as possible. Conventional methods include: using continental pavement markings to increase visibility and cause traffic to instinctively yield, providing crosswalks as wide or wider than the pedestrian facilities they are connecting to in order to provide room for passing in the crosswalk, aligning crossings with the sidewalks they connect so minimize pedestrian deviation, shortening the length of road required to cross by adding pinch points where possible, and adding Americans with Disabilities Act (ADA)-compliant curb ramps. Stop bars should be located 8 feet from crosswalks and installed perpendicular to the travel lane, not parallel to the crosswalk. All of these methods increase the safety and visibility of the crosswalks included in the pedestrian transportation system and should be implemented wherever possible with new reconstruction projects.

2. Midblock Crossings

Midblock crossings are ideal in locations where there is high pedestrian crossing demand that is not adequately addressed by the existing network, or where people may be crossing already without a crosswalk. Common locations for this are outside schools, parks, midblock passages, or pedestrian malls. Providing a midblock crossing at these locations helps add safety to the network. These crossings should be clearly marked, and button-controlled flashing beacons should be considered for higher volume roadways. Yield bars should be considered in front of the crosswalks to encourage vehicles to stop when pedestrians are present. Additionally, speed tables and pinch points should be considered to be incorporated into the crossing. Figure 3.01-6 shows an example of a midblock crossing with flashing beacons. Locations for midblock crossings in the City are limited, but the concept can be applied to the many T-intersections along key routes in the City.

Source: New Rapid-Flashing Beacon Shows Great Promise in Improving Pedestrian Safety, Texas Transportation Researcher, Volume 52, Number 1, March 2016

Figure 3.01-8 Midblock Crossing with Rapid-Flashing Beacons

3. Pedestrian Safety Islands

Pedestrian safety islands are small median curbed spaces in the middle of the roadway to provide a refuge between crossing travel lanes. They can be used at intersections or at midblock crosswalks. Ideally at least 6 feet wide and 40 feet long, they provide a place for pedestrians to cross one direction of traffic before having to worry about the other direction. As such they are ideal for nonsignalized intersections where a pedestrian might not be able to cross the whole roadway at once. Where 6 feet cannot be attained, a narrower raised median is still preferable to nothing.[1] Figure 3.01-7 shows an example of an ideal pedestrian safety island, and a minimalist one that slows traffic. Pedestrian safety islands should be considered at all major pedestrian crossings along Washington Avenue and La Salle Street, especially in locations where other traffic calming methods are not being considered.

[1]NACTO Urban Streets Design Guide Page 116

Source: NACTO Urban Street Design Guide

Figure 3.01-9 Pedestrian Safety Islands

3.02 BICYCLE CONNECTIONS

Bicycle trips are very important to consider when defining a transportation network. Bicycles are not quite a motorized vehicle, but not quite a pedestrian either. Because of this they often must choose between acting as a pedestrian or acting as a vehicle. This can often change multiple times per trip depending on the accommodations provided and the perceived safety of acting as a vehicle on certain roadways. Providing bicycle-specific accommodations can help provide a safe and effective space for bicycles to use the roadway, as well as prevent them from becoming a nuisance to motorists and a hazard to pedestrians. When providing bicycle connections to the system, there are three different ways to provide that connection: Separated bike/shared-use paths, on-road bicycle lanes, or shared lanes (bicycle boulevards). FHWA has a chart for ideal bikeway selection based on speeds and volumes of the existing roadway shown in Figure 3.02-1.

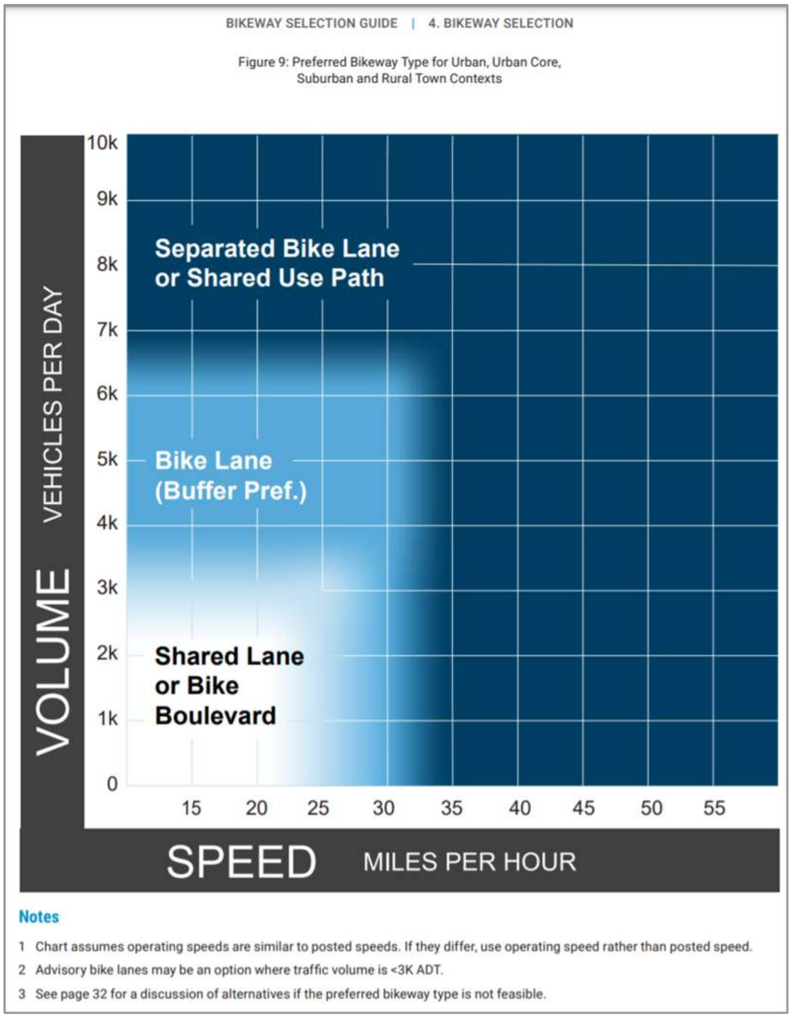


Figure 3.02-1 FHWA Bikeway Selection Guide Volume/Speed Thresholds

A. Separated Bicycle/Shared-Use Paths

The highest level of safety and service that can be provided for bicycles is a dedicated off-road shared-use path. These are typically built with asphalt but can be built from concrete or gravel as well. Shared-use paths provide a space where pedestrians and bicycles do not have to compete for road space with vehicles. They also generally serve as the core routes and the backbone of a bicycle and pedestrian system. Often they are able to be constructed along a railroad taking advantage of the railroad right-of-way.

Cycle Tracks are also an option that is a hybrid of an on-street bicycle lane and a separated path. They are typically on-street, but separated by either curb or delineator posts. They also can be raised and placed adjacent to sidewalk. They can be marked as a single direction like a bicycle lane, or bi-directional like a shared-use path. An example of a cycle track from the City of Austin, Texas is shown in Figure 3.02-2.

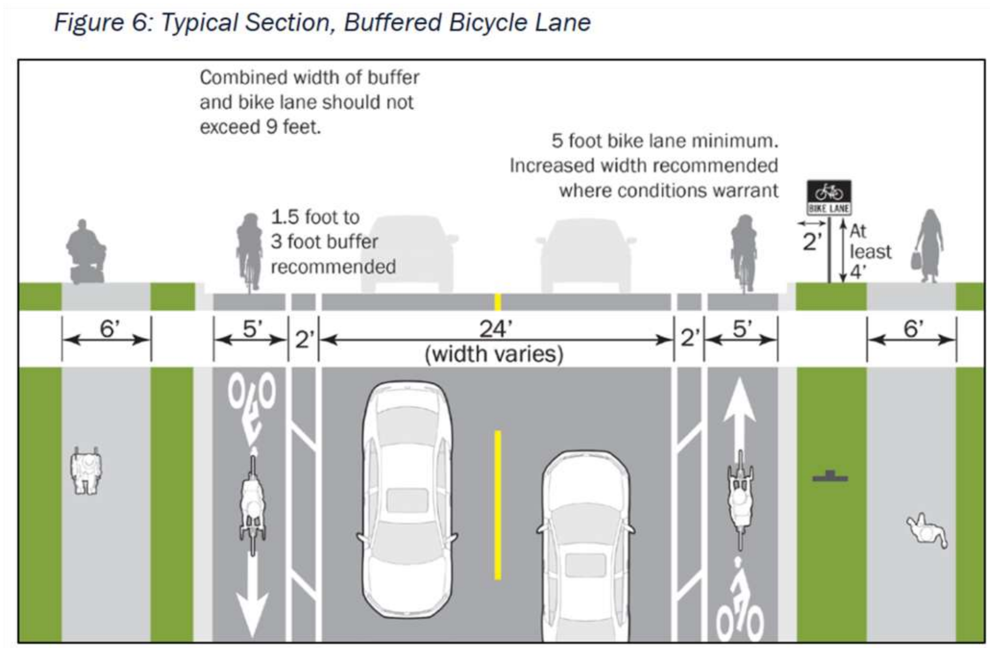
While this is the best option for bicyclists, the separated facilities can also cost more and take up more space than other accommodations do.

Bluebonnet Lane, Austin, TX (Source: City of Austin)

Figure 3.02-2 Cycle Track

B. On-Street Bicycle Lanes

Bicycle lanes are the most common type of bicycle accommodation on roadways. They are typically 5 to 6 feet wide and placed on the edge of the road next to the curb. They offer great accommodations for bicyclist that are comfortable around vehicle traffic. On roads with higher speeds or volumes, it is best to also provide a minimum 2-foot buffer between the main travel lanes and the bicycle lane. An example of this typical section is shown in Figure 3.02-3.



Source: (TxDOT Bicycle Tourism Trails Study Technical Memorandum No. 3)

Figure 3.02-3 On-Street Bicycle Lane Accommodation

On-street bicycle lanes are an economical option for providing bicycle accommodation to roadways that have the horizontal width to add them without adding pavement. They can be added quickly and easily with pavement marking and will have the same replacement timeline as the main roadway.

C. Shared Lanes (Bicycle Boulevard)

Bicycle boulevards are a shared lane where bicycles can take the full travel lane and are treated like a vehicle. They work best on local roads that have lower volumes and speeds and can serve well as a grid system to connect into other places in the bicycle network throughout the City. An example of a bicycle boulevard at a route turn is shown in Figure 3.02-4.

Source: NACTO Urban Bikeway Design Guide

Figure 3.02-4 Example of a Bicycle Boulevard in the City of Portland, Oregon

These are typically the least expensive to install as they only require a few pavement markings (called shared lane markings or "sharrows") and signs denoting them as bicycle boulevards, provided the pavement is adequate for bicycle travel. Shared lane markings reinforce the legitimacy of bicycles taking the full lane, as well as provide direction for the route and any turns. Figure 3.02-5 shows an example of shared lane markings as well as some typical signing for bicycle boulevards. Additional traffic calming measures can be added to provide a safer environment for bicycles by slowing vehicle traffic. The Manual on Uniform Traffic Control Devices (MUTCD) outlines guidance for shared lane markings in Section 9C.07.

Source: NACTO Urban Bikeway Design Guide

Figure 3.02-5 Bicycle Boulevard Sharrows and Signing

3.03 PROPOSED ROUTES

After analyzing the key community destinations as well as looking at the speeds and volumes of local roads in the City and determining which routing options worked best for different roads, a route map was developed for proposed pedestrian and bicycle routing through the City. This map is shown in Figure 3.03-1 and can also be found in Appendix C. What follows is a discussion of the different connections proposed for each of the major route connections.

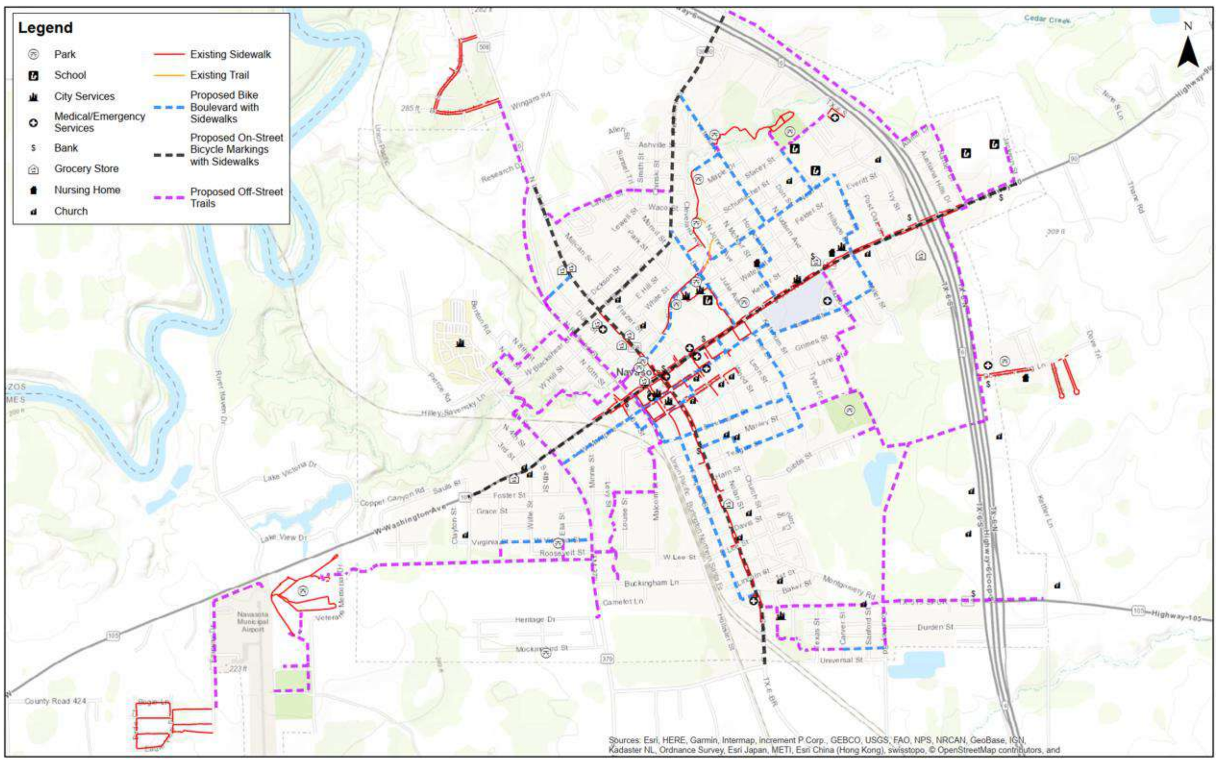


Figure 3.03-1 Proposed Pedestrian and Bicycle Routing Map

A. Off Road Bike Paths

The following is a list of all the major off-road paths proposed in priority order based on their anticipated use, upcoming projects that could implement them, importance to the connectivity of the system, and likelihood for external funding. These would require standalone projects for construction or need to be included with projects reconstructing existing roadways.

1. Spur 515

This connection running along Spur 515 from La Salle Street through TX 6 is an important connection for the south end of the City. Even without pedestrian accommodations, it is used frequently by the residents in the south side neighborhoods. There is also potential for a future route along TX 6 to tie into it, adding to the connectivity with the City as it grows on the east side of TX 6. Based on the volumes of this road, it could be a buffered bicycle lane; however, because of the lack of pavement width available as well as the high speeds of the roadway, an off-street shared-use path would work better in this location. There is also potential for this to be included with a future Spur 515 reconstruction project, which would help see reduced cost in construction because of higher quantities associated with a larger project.

2. Farm-to-Market Road (FM) 379

FM 379 runs through a neighborhood with a larger number of households below 50 percent of the poverty level[2] on the southwest side of the City. Providing connectivity to the downtown areas for pedestrians that may have fewer transportation options could improve the equity of the transportation system in the City. The bicycle connection could be provided as a buffered on-street bike lane based on the volumes; however, the speeds are too high for an on-street bicycle lane. Additionally, with only 1-foot existing paved shoulders and limited right-of-way available, the 14 feet of additional pavement required, not including sidewalks, is not practical. A shared-use path would take an additional 10 feet of paved surface with a 1-foot gravel shoulder on each side for a total of 12 feet providing access for both bicycles and pedestrians. This would lead to the removal of one of the ditches, so a storm sewer system would need to be installed the full length of the path, but would otherwise not affect the roadway and could be constructed with minor impacts. A typical section of this configuration is shown in Section 3.04. Providing a shared-use path removes the need for sidewalk on both sides of the roadway and provides adequate bicycle routing with less total horizontal width.

3. Railroad and Railroad Street

The proposed shared-use path along the railroad and Railroad Street would serve as a main connection to the northwest side of the City from downtown. The crossing at Washington Avenue would be an ideal location for a pedestrian island and midblock crossing to promote a safer crossing for businesses. This route would also serve as an access point to many of the grocery stores located on La Salle Street. There is also the potential to work with the Rails to Trails organization to help with funding and railroad coordination.

4. TX 6 to the Navasota High School

A shared-use path routed along the east side of TX 6 is very important because it provides pedestrian and bicycle access to all the businesses along TX 6, and serves as an important connection for the neighborhood east of TX 6 to have access to the rest of the City. This route also serves as an important connection to the middle school and high school, enabling the mobility of the City's youth with safer routes to and from school. Because of the nature of TX 6 and its frontage roads (high speed with ramps to and from the freeway), it is not recommended to put a bicycle lane along the frontage road, but instead provide a separated facility.

[2]https://data.census.gov/cedsci/

5. Connection from Manley Street to TX 6

A connection from the park on Manley Street to the path on the east end of TX 6 is an important connection for the City. The shared-use path running along the length of TX 6 provides great access to the high school and middle school for the neighborhoods that are already on the east side of TX 6, and are great for future expansion of the City there, but there is not a good connection to the rest of the City. This route would serve as one of those connections, not only opening the shared route along TX 6 to the rest of the City, but also connecting the neighborhoods there and any future expansion to the rest of the City. This route requires a grade separated crossing of TX 6, which is a higher cost, so opportunities to have TxDOT assist with the funding of it on a future project should be explored.

6. FM 379 to Downtown

This connection serves an important role in connecting the neighborhood directly west of the Union Pacific Railroad into the bicycle and pedestrian system. This route provides an alternative to Washington Avenue for those that do not feel comfortable traveling on the main road. This route also ties into the route running along Railroad Street.

7. Veterans Memorial Park to FM 379

This route serves as an important connection for the neighborhood southwest of the Union Pacific Railroad. This would provide an important connection that serves to provide access to a neighborhood with a larger number of households below 50 percent of the poverty level[3]. A protected pedestrian crossing could be provided at FM 379 to help slow traffic down as it enters the residential neighborhood, providing a safer space for residents. This route also helps serve as a connector for a future path from the Pecan Lakes subdivision.

8. Manley Street, Woodrow Jackson Drive, and Judson Street

Manley Street through Judson Street is a main connection to the baseball diamonds from Washington Avenue. Ideally this connection would be a bicycle boulevard, however, the streets used on this connection are both narrow and have poor pavement. Because of this and the potential for a connection to the south and the east from this point, it is recommended as a shared-use path.

9. 5th Street and Fanthorp Street

This route serves two important connections. On the south end, it connects into FM 379 to continue the path there. After diverting from 5th Street and crossing Ceder Creek it splits, with one trail following the river and connecting into the Brule Street area with connections to the school system as well as to parks, and the other routing through the neighborhood to the cemetery before routing to Blackshear Street to connect into the north end of the City. With very little space and poor pavement quality on the existing roads and no road to follow for the trail that runs along

[3]https://data.census.gov/cedsci/

the river, these connections would ideally be provided with a shared-use path. They also provide a better way for children living on the southwest side of the City to get access to the school system without having to travel through downtown.

10. Pecan Lakes to Veterans Memorial Park

The shared-use path from Pecan Lakes to the rest of the system is an important one. It connects a growing subdivision to the rest of the City and enables pedestrian and bicycle access to downtown. While there is great benefit to connecting this subdivision to the system, there needs to be a system for it to connect into before this connection becomes valuable. Additionally, with the distance from downtown and the necessity to route this path around the airport, it is unlikely to get as much use as some of the other trails in the system.

11. Laredo Street

The connection along Laredo Street connects two existing routes through the north end of the City. Because of the narrow roadways, a reconstruction that widens the road or a shared-use path would be ideal. This connection serves to tie in the neighborhoods on the north side into the system and provides better access to businesses on the north end of La Salle Street for bicycles and pedestrians.

12. Hillside Park and Stacey Street

The path provided at Hillside Park would connect to the existing shared-use path on the west end of the park, and continue east along Stacey Street, culminating in a grade-separated crossing of TX 6 to connect into the shared-use path that routes to the middle school and high school. This shared-use connection provides great access to the high school and middle school for the neighborhoods on the west side of TX 6, and would allow younger children to walk or bicycle to school. This route serves to connect the shared-use path route through the north side park system, as well as the bicycle boulevard system running through this neighborhood. This route requires a grade-separated crossing of TX 6, which is a higher cost, so opportunities to have TxDOT assist with the funding of it on a future project should be explored.

13. Manley Street to Spur 515

The connection from the Spur 515 to Manley Park is an ideal connection for the neighborhood south of Spur 515 to the baseball diamonds located at the park. It would also serve as a connection to the route running along the east side of TX 6. This route is ideal based on its ease of use for that neighborhood and the users of the system, but this connection could also be provided by extending the TX 6 path to the Spur 515. Ideally, both of these connections would be made because the extension to the TX 6 path would benefit future users as this area develops further.

14. Spur 515 West Connection

The Spur 515 west connection is not shown on the proposed routing map. If an expansion of Spur 515 was made to the west over the railroad, this new routing should include bicycle and pedestrian accommodations along the route. This connection would follow the Spur 515 to the west of La Salle Street and would connect into the path on FM 379. This would serve as a route for the neighborhoods near the airport to connect with those on the south side of the City without having to go through downtown. This route is ranked low based on anticipated overall use.

B. On Street Bicycle Lanes

The following is the list of roads in priority order that should receive bicycle lanes. This work could be performed the next time the roadway is resurfaced or could be completed with a restriping project. These routes should also add sidewalk on one or both sides of the road where not already provided.

1. Washington Avenue

Because Washington Avenue is on a national bicycle route, runs through downtown, and is the only current connection to the middle school and high school, adding pedestrian and bicycle accessibility from Clayton Street through Alamo Street should be a high priority. Because of the narrow widths in the downtown area, this whole stretch is recommended as on-street bicycle lanes, buffered, if possible. Ideally, these would be placed in between the angled parking and the curb to provide additional safety for bicycles and improved visibility for drivers, but other alternatives could be considered. Additionally, based on comments received during the TAP application process, pedestrian access in the downtown area is the community's top priority.

2. La Salle Street

La Salle Street is an ideal candidate for a buffered on-street bicycle lane. There is currently no parking on La Salle, and there is a fairly wide pavement profile with 38 feet of paved surface. This is wide enough to provide 6-foot bicycle lanes with a 2-foot buffer and 11-foot driving lanes, or 5-foot bicycle lanes with a 2-foot buffer and 12-foot driving lanes. Because of the high volumes north of Washington Avenue and the higher speed along the roadway, it is recommended to install the bike lanes with the 2-foot buffer from vehicle traffic for added safety.

3. Blackshear Street and Piedmont Avenue

Blackshear Street and Piedmont Avenue are important connections to the north side of the City and provides a great crossing of TX 6 that could be used as a future tie-in with a shared-use path along TX 6. It is currently marked with an 8-foot shoulder on each side, which is more than adequate for a bicycle lane in each direction. With the slightly higher volumes on Piedmont Avenue, a buffered bike lane would be recommended. However, with the road already marked for bike lanes, bicycle lane marking to indicate their purpose would be all that is needed for this road to be added to the bicycle network.

C. Shared Lanes (Bicycle Boulevard)

The bicycle boulevards in the system have the advantage of being able to be implemented quickly at relatively low cost. Often the only work that needs to be completed is minor pavement markings and some signage. Even when the roads need to be reconstructed or resurfaced, most community members will support improvements for vehicles as well as bicycles and pedestrians. With little work required, the bicycle boulevard system can provide early success in connecting the City until the funding becomes available to construct some of the other routes listed above. The proposed bicycle boulevard routes are listed in priority order based on their importance to the system. There is also a recommendation that the road should be repaved before implementing because of the current pavement condition. All of these routes should have sidewalk added to one or both sides of the road; however, they are able to be implemented as a bicycle boulevard without sidewalk and have the sidewalk added later upon reconstruction. These routes should also be prioritized for reconstruction over other roads when in need of new pavement.

1. Brosig Avenue

Brosig Avenue serves an important connection from Washington Avenue to Brule Elementary School, the connection at Brule Street, and the path system that connects the parks along the north side of the City. This route also connects into Piedmont Avenue, providing an important connection to the north side of the City. This route is a project currently under development by the City.

2. McAlpine Street, Leake Street and Miller Street

This is the main alternate route through the City. Just a block off of Washington Avenue, it can serve to provide access to all the major businesses quickly. It provides an alternative route to travel on than Washington Avenue for bicycles and pedestrians while other accommodations are being constructed/implemented on Washington Avenue, and also provides an alternative for those still cautious about the traffic on Washington Avenue after those accommodations have been implemented. This is especially important as it runs parallel to the Southern Tier Route and provides an alternative way for tourists to navigate the City from the southwestern end to as far northeast as is possible without traveling on Washington Avenue.

Most of this route provides adequate pavement to install this route immediately, but there are several locations that would require reconstruction or resurfacing of the roadway before installation of this route. McAlpine Street would need to be reconstructed between the railroads because of poor pavement condition. It should also be resurfaced from Church Street through the intersection with Ketchum Street. Leake Street and Miller Street have no issues, but Oakwood Street connecting these two should be reconstructed. Additionally, a protected pedestrian crossing should be considered at Miller Street and Washington Avenue. With the crossroads lining up well and the convergence of two bicycle boulevard routes, this would be an ideal location for an improved crossing of Washington Avenue.

3. Foster Street and Ella Street

Foster Street and Ella Street provide the perfect extension of the McAlpine Street route to the southwest. Adding this connection would allow bicyclists and pedestrians entering the City to have a good option for traveling through the City, as well as providing additional options for residents living in the southwest part of the City. Foster Street is also important because of its future connection into the planned shared-use paths from FM 379 to Railroad Street.

Foster Street itself has pavement in sufficient condition to be implemented immediately. Ella Street would need to be reconstructed before implementation. Minnie Street could be used as an alternative to Ella Street without reconstruction before use; however, Ella Street is a better connection for the network because it feeds directly into the end of McAlpine Street adding benefits to that connection for the users.

4. Farquhar Street

Farquhar Street is a key connection for the south side of the city to downtown. In the same way that McAlpine Street provides an alternative to Washington Avenue, Farquhar Street provides an alternative to La Salle Street. This route could continue north of Washington Avenue, but was not added because of the proposed shared-use path route along the railroad that would serve the purpose of an alternate route.

Farquhar Street would likely need to be reconstructed from Holland Street to Johnson Street, and resurfaced from Johnson Street to Anderson Street, as well as resurfaced from Lincoln Street to the southern end of Farquhar Street.

5. Brule Street

Brule Street is very important to the connectivity of the north side, and especially the park system. It connects three different park features on its own, follows the river, and connects into the existing park trail system on the north side that connect to four other parks. Another interesting feature of Brule Street is that it is a connection that could be any of these three connection options. It is along the river and connects into trail systems on both ends, so it would be an ideal candidate for a shared-use path. The existing pavement is wide enough to include bicycle lanes, and there is low enough traffic for it to be marked as a bicycle boulevard. For this Plan, Strand Associates, Inc.® (Strand) is recommending starting with it as a bicycle boulevard, and potentially adding an off-road shared-use path here if there is high usage of the roadway by bicycles and pedestrians.

6. Neil Street

Neil Street serves as an important connection for the northern neighborhood as a collector for trips, as well as connecting local schools to the school district administration building.

Most of the pavement on Neil Street is adequate for implementation as a bicycle boulevard; however, the intersections at Jones Street and Horlock Street should be reconstructed or resurfaced before implementation.

7. Victoria Avenue and McNair Street

Victoria Avenue serves as a connection in the system from Neil Street to Piedmont Street, connecting the neighborhood to the north end of the system. McNair Street serves as a connection from Washington Avenue to Neil Street, and would provide pedestrian options for the skilled nursing facility located there. The current state of the pavement for both roads is adequate to provide a bicycle boulevard without repaving, and they would be connected by the improvements on Neil Street.

8. Moore Street

Moore Street and Hillside Street are an ideal connection from the library to the schools on the north side. This is an important route because it connects the neighborhood south of Washington Avenue to the neighborhood north of Washington Avenue through adjoining routes. This connection would ideally occur all on Hillside Street, but because of local feedback and the greater availability of right-of-way for sidewalk, it was routed onto Moore Street.

9. Brosig Avenue

Brosig Avenue serves an important connection from Washington Avenue to Brule Elementary School, the connection at Brule Street, and the path system that connects the parks along the north side of the City. This route also connects into Piedmont Avenue, providing an important connection to the north side of the City. This route is a project currently under development by the City.

10. Leon Street

Leon Street is an important connection as an alternative to the Manley Street through Judson Street path. It serves as the major north-south connection from McAlpine Street to Manley Park. Leon Street is an ideal candidate for this connection because the pavement is in good condition so it can be implemented immediately, and the terrace is wide enough to support future sidewalk. The City could evaluate changing the stop signs on Leon Street to yield signs to improve the through movement for bicycles. Elm Street could be used as as an alternative to Leon Street. It also has pavement in good condition and has ample terrace room for future sidewalks. However, there is an offset alignment at the intersection with Lane Street, making this a more complicated through movement and a less ideal route.

11. Johnson Street

Johnson Street provides an east-west connection that serves as an alternative to Washington Avenue, and serves the community further south of McAlpine Street. On the west end it connects into the bicycle boulevard on Farquhar Street as well as the path connection at Railroad Street. On the east end it connects into the path at Manley Park with eventual routing to the path on TX 6. Once these other trails are in place, this will be an important route that connects the two ends of the system. Johnson Street is an ideal candidate over Manley Street because of the anticipated traffic on Manley Street as a main route to Manley Park. A reconstruction of the pavement at the Johnson Street and Railroad Street intersection is recommended. However, the rest of the pavement appears to be in good condition for immediate implementation, with ample room on the terraces for future sidewalk.

3.04 PROPOSED TYPICAL SECTIONS

Based on the proposed connection types introduced in section 3.02 and the routing proposed in Section 3.03, several recommended typical sections have been developed to better illustrate the available spacing and widths as well as the proposed layouts. A proposed typical section has been provided for shared-use paths, as well as for bicycle boulevards. A more detailed section has been provided for La Salle Street and FM 379.

A. <u>Typical Shared-Use path</u>

The proposed typical section for a shared-use path is shown in Figure 3.04-1. Based on discussion with City staff, it was determined that providing enough space for emergency vehicles on the paths was important based on several locations for paths that are not street adjacent. Emergency vehicles tend to have a distance between wheels of 8 to 10 feet. This allows them to travel on a typical 10-foot path. However, this added weight applied directly on the edge of the pavement would lead to early failure of the pavement and a reduced life for the path. Because of this, it is recommended that the shared-use path be constructed with 1 foot of gravel on either side of the path to prevent damage to the path when used by emergency vehicles.

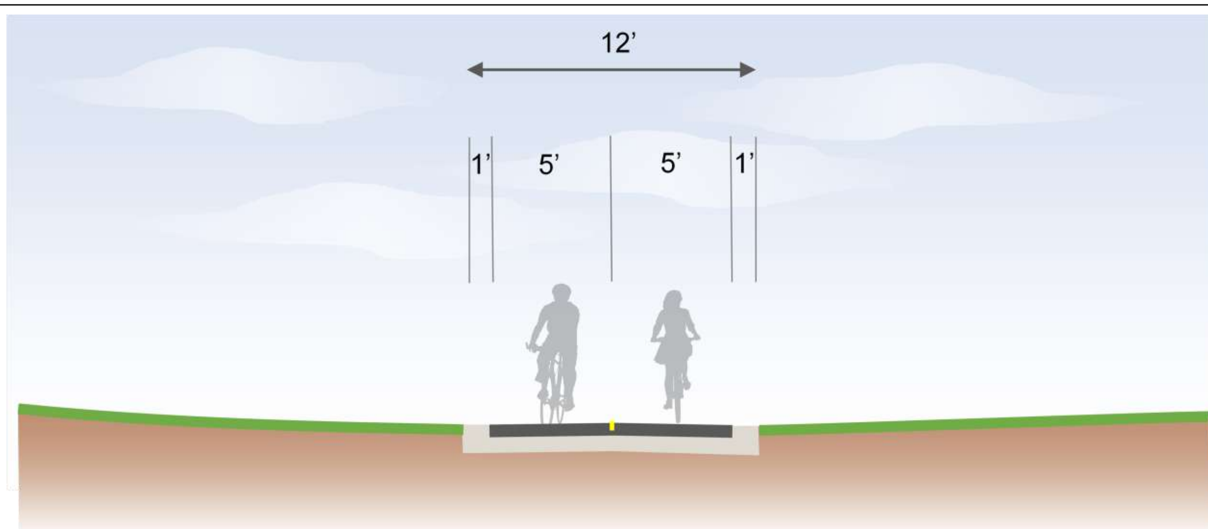


Figure 3.04-1 Proposed Typical Section for Shared-Use Paths

B. Typical Bicycle Boulevard

Most existing local streets in the City have a width from curb-face to curb-face of somewhere between 28 and 38 feet. A proposed typical section of each of these scenarios is shown in Figure 3.04-2. The 38-foot width is the ideal standard for bicycle boulevards. For the 28-foot width scenarios, allowing parking on only one side of the roadway would fix narrower profile conflicts. If not possible, a 10-foot shared bidirectional lane should be adequate provided the volumes and speeds on the road are low and the on-street parking is not heavily used. Both options show sidewalk on both sides of the roadway. While not required during initial bicycle boulevard implementation, all roads should add sidewalk to at least one side of the road during the next reconstruction.

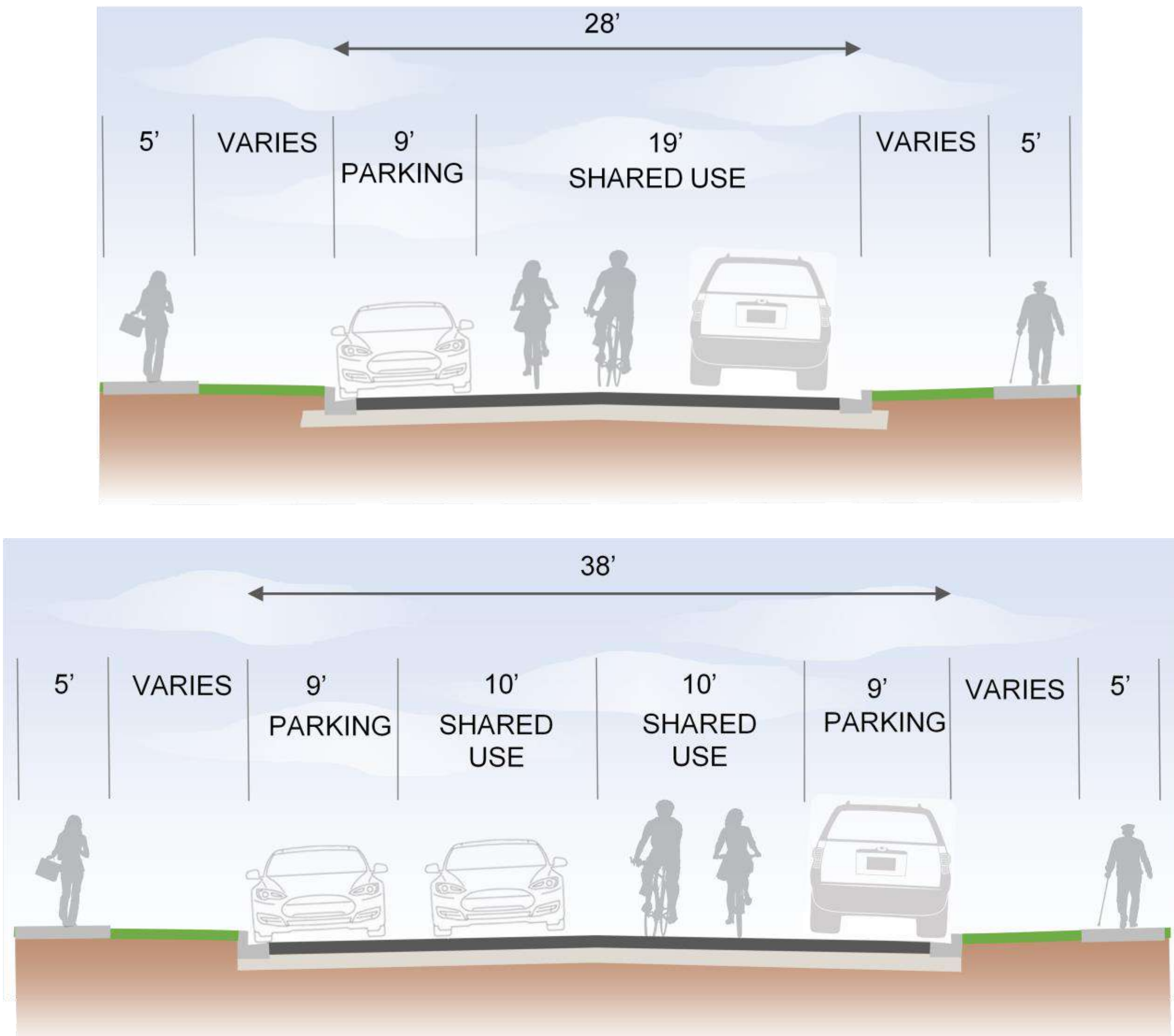


Figure 3.04-2 Proposed Typical Section for Bicycle Boulevards

C. Bicycle Lanes on La Salle Street

The proposed accommodation on La Salle Street was to add bicycle lanes in each direction and add sidewalk to locations that do not currently have any. There is no parking on La Salle Street, which helps accommodate the dimensions. The speeds and volumes on the roadway dictate a buffered bicycle lane. Based on recommendations for on-street bicycle accommodations, a 6-foot bicycle lane should be provided when adjacent to curb. This would extend each travel lane to 11 feet, which is typically adequate, and would provide a calming effect on traffic, potentially reducing speeds and providing a safer environment for pedestrians and residents. If residents are unwilling to accept 11-foot lanes, a 5-foot bicycle lane would be acceptable under current design standards. Both of these typical sections are shown in Figure 3.04-3.

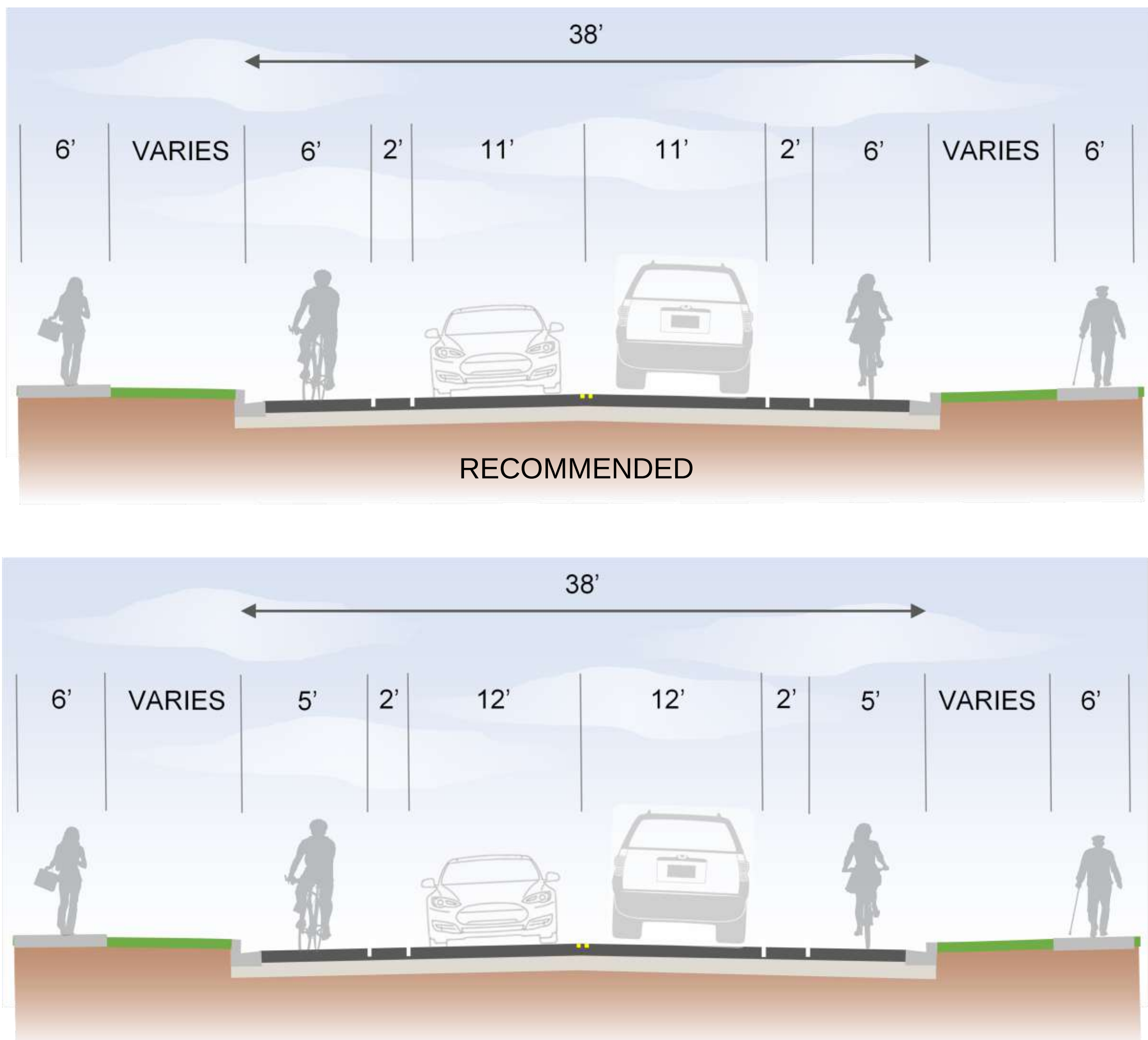


Figure 3.04-3 Proposed Typical Section for La Salle Street

D. Shared-Use path on FM 379

Based on the discussion in Section 3.03, this route would be served best by an off-street shared-use path. There is enough right-of-way to construct this with minimal impacts the roadway; however, doing so removes a ditch on one side of the road causing drainage issues. This results in the need for a storm sewer pipe to be installed under the shared-use path, as well as a curb and gutter along one side of the roadway. While this does make the path more expensive, it is still a better option than widening the road by 14 feet and providing sidewalk on both sides, which would require storm sewer with curb and gutter along both sides of the roadway. The proposed typical section for FM 379 is shown in Figure 3.04-4.

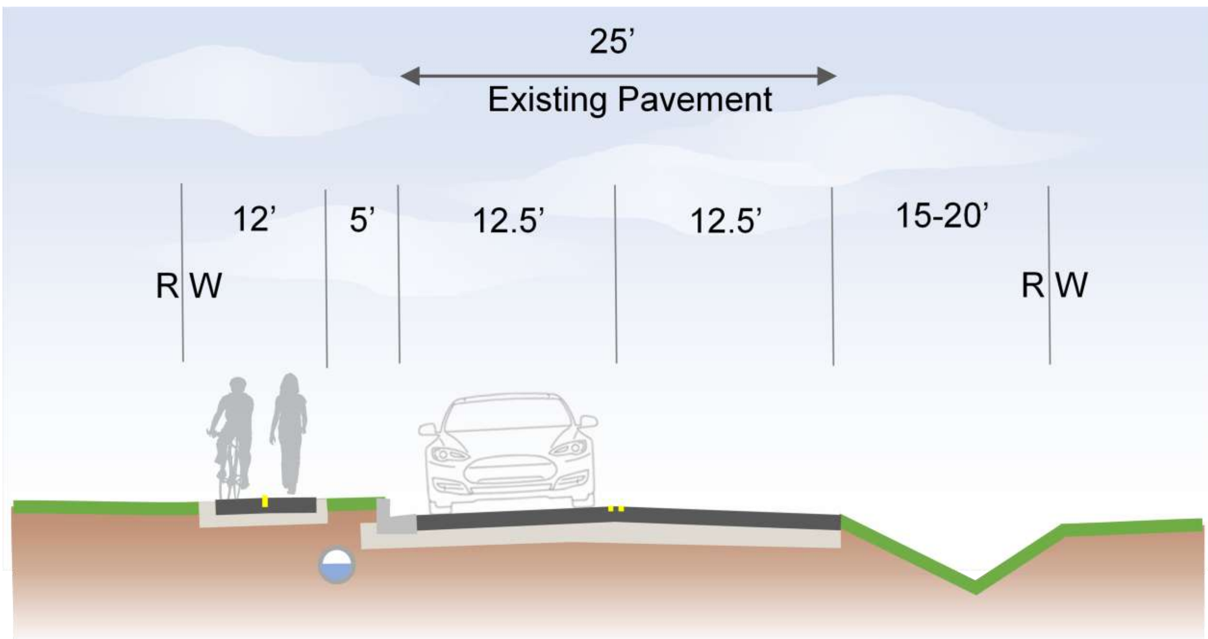


Figure 3.04-4 Proposed Typical Section for FM 379

SECTION 4
MATERIAL AND COST ANALYSIS

4.01 SAFETY CONSIDERATIONS

Several different safety considerations were discussed in the meetings leading to this Plan. There are also several standards that are required to be met with new projects. These are detailed for each type of safety consideration discussed.

A. Emergency Vehicles

In any area where pedestrians or bicycles will be traveling, it is important that emergency vehicles have access as well. This is not an issue on sidewalks or bicycle boulevards that are constructed on existing roadways, but several shared-use paths do not travel on the typical roadway right-of-way. For paths to accommodate emergency vehicles they need to maintain 10 feet of width. To keep pavement from being damaged by the heavier emergency vehicles, it is recommended to construct the paths with a 1-foot gravel shoulder on each side to keep edges from cracking due to the high load, and to increase the depth of the pavement structure to hold up the additional weight. After discussion with City staff, all routes proposed are assumed to have these recommendations incorporated.

B. Lighting

Another safety consideration with shared-use paths is the addition of lighting. Lighting makes a path more visible at night, which can increase safety. This is most important where the path crosses local roads and may have conflicts with motor vehicles, but also increases safety in other locations. Typically, it is installed every 100 feet, which adds some cost to projects. It can be installed as overhead luminaires for the most visibility but can have other lower pedestrian scale lighting as well. When installed, these lights either need to be connected to the power grid, or have solar panels mounted on top to power them at night. There can be pushback from adjacent property owners due to the new source of light as well, though modern applications using LED fixtures and baffles can significantly reduce light pollution concerns. After discussion of these variables with City staff, it was determined to analyze on a case-by-case basis whether lighting should be included as projects move to design.

4.02 ASSUMPTIONS

Several assumptions were made about each of the different connection types for both functionality and cost of construction. These assumptions are stated in the following.

A. Pedestrian Infrastructure

Pedestrian infrastructure is the amenity that is most desired in the community based on public comments. To complete a more robust pedestrian network through the City, all routes that are bicycle boulevards or have dedicated bicycle lanes should also have sidewalk ideally on both sides of the roadway. While this was not assumed necessary for the initial implementation of the bicycle connections, it is assumed that upon reconstruction and/or as separate standalone projects all of these routes will have sidewalk installed to further improve pedestrian routing options and safety. It is also assumed that all pedestrian facilities will be constructed to be ADA-compliant, and that crosswalks will have continental style markings to increase visibility of pedestrians in the roadway.

B. Shared-Use Paths

Shared-use paths are where most of the construction assumptions were made because they can have a wide variety of designs. All shared-use paths are assumed to be constructed to accommodate emergency vehicles, which entails a 10-foot-wide pavement design with a 1-foot shoulder on each side of the path. Lighting was assumed to be determined on a project by project basis, and lighting costs were included in the high end of the cost analysis but omitted from the low end. Shared-use paths were also assumed to accommodate both pedestrian and bicycle traffic.

C. On-Street Bicycle Facilities

On-street bicycle facilities were assumed have a 2-foot buffer from the driving lanes where possible. They were also assumed to be included with the roadway construction costs and were not included in the cost analysis.

D. Bicycle Boulevards

Bicycle boulevards have very little that differentiates them from a normal road. The few additional pavement markings and signs will have such a low cost and will be insignificant compared to the reconstruction costs of the roadway. For this reason, bicycle boulevards were also not included in the cost analysis.

4.03 SHARED-USE PATH MATERIALS

The proposed routes in Section 3.03 recommend several different shared-use paths. These paths have different construction alternatives that have advantages and disadvantages discussed in the following.

A. Crushed Gravel

Crushed gravel is a common material used for off-road paths. Typically, these are constructed with limestone screenings on the surface that provides a smoother ride like pavement when compacted correctly. Unpaved surfaces are best used where few traffic control measures are necessary and in natural settings outside of residential areas.

1. Advantages

There are many advantages to unpaved off-road paths. It does not crack, is easily maintained and repaired, and generally provides a comfortable riding surface. They also tend to have a lower construction cost. These features make them ideal for rural locations that have lower ridership.

2. Disadvantages

While there are advantages, there are some disadvantages as well. Crushed gravel can lose cohesion over time if not regularly compacted, increasing the likelihood of skids. They are subject to erosion and vegetation encroachment if not maintained frequently. Paths can also get damaged if used in wet weather. Additionally, limestone or gravel paths can have a damaging effect on bicycles over time because of dust in dry weather, and emulsifying limestone spray in wet conditions. Gravel paths are also very difficult for wheelchair users, as ADA standards are nearly impossible to maintain with consistency.

B. Asphalt Pavement

Asphalt pavement is typically the preferred material for shared-use paths and bicycle lanes. They are typically constructed with a gravel base and just a few inches of asphalt, as users tend to be light enough that they do not damage the pavement. Asphalt tends to be the best material to use if bicycles are the primary users of the route, or if cost is an issue preventing concrete pavement.

1. Advantages

Asphalt pavement is the preferred path material because there are many benefits. It is less prone to erosion and vegetation encroachment, paths are wheelchair accessible and ADA compliance is usually maintainable (at least after initial construction), less maintenance is required, and it tends to have the nicest riding surface of any material.

2. Disadvantages

Asphalt does have some disadvantages as well. Typically, there is a higher initial cost when compared to a gravel path, and when repairs are necessary, they are also more expensive because of the specialized equipment required to place the material, as well as the material itself. While cracking is not likely to happen due to heavy loads on the path, it can occur and cause maintenance problems. Additionally, when crossing other roads, asphalt can settle differently than concrete when it is adjoined against concrete curb, which can cause a lip that is unfriendly to bicycles and wheelchair users and can be a trip hazard for pedestrians.

C. Concrete Pavement

Concrete pavement is often used for shorter segments of shared-use path especially in highly urbanized areas. It is also the standard for pedestrian facilities because of its reliability to provide ADA standards throughout its lifespan. Typically installed 6 inches deep, paths can be constructed with gravel base underneath to improve stability and durability, or without if the existing ground is adequate to hold up pavement without much settlement. This material is best used if pedestrians are the primary user and bicycles will have access to the facility.

1. Advantages

Concrete pavement shares many of the benefits of asphalt pavement. It is also less prone to erosion and vegetation encroachment. The paths are wheelchair accessible and ADA compliance is easily maintained. Additionally, concrete offers good rolling resistance for bicycles, and is a very durable surface and will last the longest of these three path types with minimal maintenance. Further, concrete is the recommended material for use in trails from the TxDOT Bicycle Tourism Trails Study.

2. Disadvantages

The main disadvantage to concrete is the high cost of construction. Concrete will always cost more than the alternatives. Additionally, concrete requires jointing which can be uncomfortable to the rider if not done correctly. The jointing can also cause different pieces to settle differently if not constructed with metal reinforcement, requiring more maintenance to adjust the lip of the high end of the concrete.

4.04 COST ANALYSIS AND RECOMMENDATION

A planning-level cost analysis was created to compare each of the materials listed in the previous section to get an understanding of magnitude of the possible cost for a shared-use path. An opinion of probable cost (OPC) was determined for initial construction, as well as maintenance over an assumed 30-year life cycle. It is possible that with low use these paths would last longer, but all sources indicated that a 30-year life cycle was appropriate for a concrete path. Based on the initial cost and the overall maintenance cost, a total present day lifecycle cost was determined for each path material and a recommendation has been made.

A. Material Unit Prices

Each path has different materials and costs associated with both initial construction and yearly maintenance. Where possible, the same unit prices were used for each of the three construction materials. These unit prices for materials were taken from the TxDOT Unit Costs spreadsheet from March 2021. Initial construction for bicycle route signing, as well as the optional pedestrian counters and lighting were taken from the TxDOT Bicycle Tourism Trails Study, Technical Memorandum No. 3: Recommended Bikeway Criteria (2018). For maintenance costs, standard maintenance items that affect all three materials were also taken from the TxDOT Bicycle Tourism Trails Study, Technical Memorandum 3: Recommended Bikeway Criteria (2018). Additional items required for specific maintenance were taken from the TxDOT Unit Costs spreadsheet. The assumed unit prices and costs can be found in Appendix D.

B. Lifecycle Cost Analysis

An approximate cost per mile calculation is shown in Table 4.04-1.

Item	Gravel	Asphalt	Concrete
Construction			
Roadway	\$50,000 to \$70,000	\$60,000 to \$80,000	\$350,000 to \$450,000
Maintenance (30 years)	\$250,000 to \$310,000	\$210,000 to \$250,000	\$180,000 to \$220,000
Totals	**\$300,000 to \$380,000**	**\$270,000 to \$330,000**	**\$430,000 to \$670,000**

Table 4.04-1 Shared-Use Path Cost per Mile

1. Initial Construction Costs

The initial construction costs are as anticipated with concrete being the most expensive option, asphalt in the middle, and gravel as the lowest cost option. Based on the difference in price of initial construction, the gravel path can be discounted almost immediately solely based on the large benefits of asphalt over gravel both for the user as well as for maintenance.

2. Annual Maintenance Costs

Concrete is assumed to last for the full 30 years before it needs replacement, so it has the cheapest maintenance costs. Asphalt is assumed to need a mill and overlay of the pavement in year 15, but otherwise has very minimal yearly maintenance. The gravel is inexpensive to maintain, but also gets damaged more easily especially during rainstorms. It was assumed that it needed to be rebladed and compacted about once every five years, with spot maintenance every year. The frequent necessity of maintenance increased the overall cost.

C. Recommendation

During conversations with City staff, they indicated they were not interested in anything with significant maintenance and wanted to remove gravel paths from consideration. Based on the remaining two available options, asphalt paths would provide the best benefit to the user for the lowest cost and maintenance, with just less than one-half the cost of a concrete path.

SECTION 5
PRIORITIZATION AND FUNDING

5.01 PRIORITIZATION OF ROUTES

There are several ways to look at the prioritization of projects proposed in this Plan. In addition to the project listings in Section 3.03, which are in priority order for each type of facility, the study team has provided three additional lenses that can be used to prioritize projects: importance to the pedestrian and bicycle system; ease of implementation; and anticipated use of the new facility. The three top projects for each category have been ranked below with a summary of why they are important. These categories are not mutually exclusive, so projects of high importance may be listed in multiple categories.

A. Importance to the System

This category evaluates how important a route is to the pedestrian and bicycle system as a whole. These will likely be the backbone routes that are in constant use and are the more important projects to accomplish to provide adequate pedestrian and bicycle accommodations to as much of the City as possible.

1. Washington Avenue On-Street Bicycle Lanes and Sidewalks

Washington Avenue is the most important connection in the Plan. It connects to the most community destinations, is on a national bike trail, and is the heart of the downtown area. It is also one of the most difficult projects to implement bicycle facilities on because of the limited width and parking requirements of the businesses downtown. Any project that adds to the pedestrian or bicycle accommodations on Washington Avenue should be given priority, and a corridor-long solution should be evaluated for the best result of continuity along the corridor.

2. La Salle Street Buffered Bicycle Lanes and Sidewalks

La Salle Street is the primary north and south route through the City. It connects to the second most community destinations and connects many neighborhoods that are not on Washington Avenue. The true backbone of the pedestrian and bicycle plan is Washington Avenue and La Salle Street. Everything else is secondary to these main two route connections in the City.

3. McAlpine Street Bicycle Boulevard

McAlpine Street is an important connection because it is an alternative parallel route that will be more easily implemented than Washington Avenue. While there are several sections of McAlpine Street that will need reconstruction or resurfacing before implementation, most of this route can be implemented with added shared lane markings and bicycle boulevard signage. This provides an improved main route through the City while the solution to Washington Avenue is being developed. It should also be noted that while McAlpine Street does not make the list for the top three in ease of implementation, it would be in the top five.

B. Ease of Implementation

These projects are ranked based on importance to the system, with a focus on projects that can be easily implemented as quickly and cost effectively as possible. These projects will likely include restriping and adding some signage but may have minor pavement repairs. This allows the extents of the pedestrian and bicycle network to extend as far as possible quickly while funding is being acquired for other projects that are more involved.

1. Blackshear Street and Piedmont Avenue On-Street Bicycle Lanes and Sidewalks

Blackshear Street and Piedmont Avenue are the most easily implemented project in the Plan. With 8-foot shoulders already painted out, all that is required is adding a buffer line 2 feet into the shoulder and marking it as a bicycle lane. This route also provides greater access for the residents living on the north side of the City. There are currently no sidewalks on Blackshear Street, so the pedestrian accommodations will require additional funding and time, but the bicycle facilities can be incorporated immediately.

2. La Salle Street Buffered Bicycle Lanes and Sidewalks

La Salle Street is the second most important route in the City. It is also one of the easiest to implement. The lack of parking and ample width make bicycle lanes very easy to place the entire length of La Salle Street as soon as the City restripes the roadway. Additionally, most of the street already has sidewalk, so implementing sidewalk to fill in the gaps should not be very difficult or cost prohibitive.

3. Brule Street and Neil Street Bicycle Boulevards

Brule Street and Neil Street are important connections for the park system as well as the school district. Both of these streets are proposed as bicycle boulevard routes, and both require very minimal pavement repair before implementation. Because of this, this route is a very easy to implement connection to the park system from downtown, that provides connections from the other primary routes through the City.

C. Anticipated Use

These projects do not look at the importance to the system as a whole, but do focus on comments received at the public meeting and various discussions with City staff and are ranked based on their anticipated use.

1. Brosig Avenue Bicycle Boulevard

Brosig Avenue is currently under development, and has a high anticipated use based on its connection from Washington Avenue to the Navasota Center, as well as Brule Elementary School. The connection from Brule Street to Neil Street along the river also adds to the anticipated use giving that neighborhood better access to the facilities on Brosig Avenue and increasing the connection to the park system along the river. Based on comments received at public meetings, the community is greatly in favor of this project.

2. Spur 515 Shared-Use Path

Pedestrians currently walk alongside the Spur 515 for access to the businesses near the intersection with TX 6. Based on this current use, an added pedestrian and bicycle facility will increase the safety of these existing trips, as well as draw new trips from those that deemed this route unsafe before. There is also a possibility of including this project as a part of the Spur 515 realignment project that is being considered.

3. FM 379 Shared-Use Path

Pedestrian facilities connecting FM 379 to Washington Avenue were requested in several comments at the public forum on the Pedestrian and Bicycle Proposed Routing Map. With this connection to a neighborhood with a larger number of households below 50 percent of the poverty level, it is likely that the pedestrian facilities would have a higher usage than some other connections in the City.

5.02 FUNDING OPPORTUNITIES

There are many grant opportunities that will fully or partially fund bike and pedestrian projects at the state and federal levels. While not exhaustive, the following options are a start for funding when looking at specific projects.

A. State Funding Opportunities

There are several funding opportunities that come from statewide government agencies. These would be applicable for sidewalk and pedestrian improvement projects, as well as shared-use path construction.

1. TxDOT Transportation Alternatives Set-Aside (TA) Call for Projects

The TA Call for Projects is a program setup by TxDOT for the funding of bicycle and pedestrian infrastructure. The grant is a two-step application process, and project sponsors are only allowed to submit up to three projects at a time. The TA Call for Projects focus on projects that reflect a high degree of community consensus, while also contributing to TxDOT’s safety, mobility, and connectivity goals. Projects are also encouraged to address bicycle and pedestrian connections into existing facilities as well as providing ADA-compliant facilities. Applications for the grant are due in March and June.

2. Recreational Trails Fund

The National Recreational Trails Fund provides grants funded federally by the FHWA but administered by the Texas Parks and Wildlife Department (TPWD). The reimbursable grants can be up to 80 percent of project cost with a maximum of $200,000 for non-motorized trail grants.

This grant would primarily need to be used on the creation of shared-use paths in the system. Applications for the grant are due every year on February 1.

B. Federal Funding Opportunities

There are also several funding opportunities at the federal level that come from the United States (US) Department of Transportation (DOT) and from the US Department of Agriculture.

1. Rebuilding American Infrastructure with Sustainability and Equity (RAISE) Grants

RAISE is the continuation of what used to be called Better Utilizing Investments to Leverage Development (BUILD) or Transportation Investment Generating Economic Recovery (TIGER) grants that are provided by the DOT. Projects for RAISE funding are evaluated based on merit criteria that include safety, environmental sustainability, quality of life, economic competitiveness, state of good repair, innovation, and partnership. The DOT prioritizes projects that demonstrate improvements to racial equity, reduce the impacts to climate change, and create good paying jobs. This description aligns with the Plan’s projects and should be considered as a possible source for funding. The program is highly competitive but has an equitable distribution between urban and rural areas. Applications are due in July.

2. Community Facilities Direct Loan and Grant Program

The Community Facilities Direct Loan and Grant Program is administered by the US Department of Agriculture Rural Development Office. The program provides both grants and low-interest loans for funding of essential community facilities in rural communities of less than 20,000 residents. Funds can be used to purchase, construct, or improve essential community facilities. These are not limited to transportation funding but would be ideal for funding along main routes through the city, particularly along Washington Avenue or La Salle Street.

SECTION 6
CONCLUSION

6.01 CONCLUSION

Based on the multifaceted prioritization of projects described in Section 5, the team identified the top five projects that should be pursued by the City to further the development for pedestrian and bicycle accommodations.

A. Top Priority Projects

The top priority projects from the previous section were all put through a metric and weighted based on route priority, importance to the system, ease of implementation, and anticipated use. Based on the results, these are the top three projects that will have the greatest impact of the pedestrian and bicycle system in Navasota.

1. La Salle Street Bicycle Lanes and Sidewalk Accommodation

   La Salle Street should be easily implemented for quick results and benefits to the pedestrian and bicycle users of the city. This route is the second most important to the network but should be able to be implemented quickly with little pushback from the residents due to the existing lack of parking on La Salle Street.

2. Washington Avenue Bicycle Lanes and Sidewalk Accommodation

   This is the most important connection for the pedestrian and bicycle network in the city. While more difficult to implement, the benefits gained from proper connections on Washington Avenue will be high, providing great accommodations for all sectors of the community.

3. McAlpine Street Bicycle Boulevard

   McAlpine Street offers a great alternative route to Washington Avenue. If these projects are pursued at the same time, McAlpine Street will be more easily implemented and provide benefits to routing during the Washington Avenue project.

4. Brosig Avenue Bicycle Boulevard

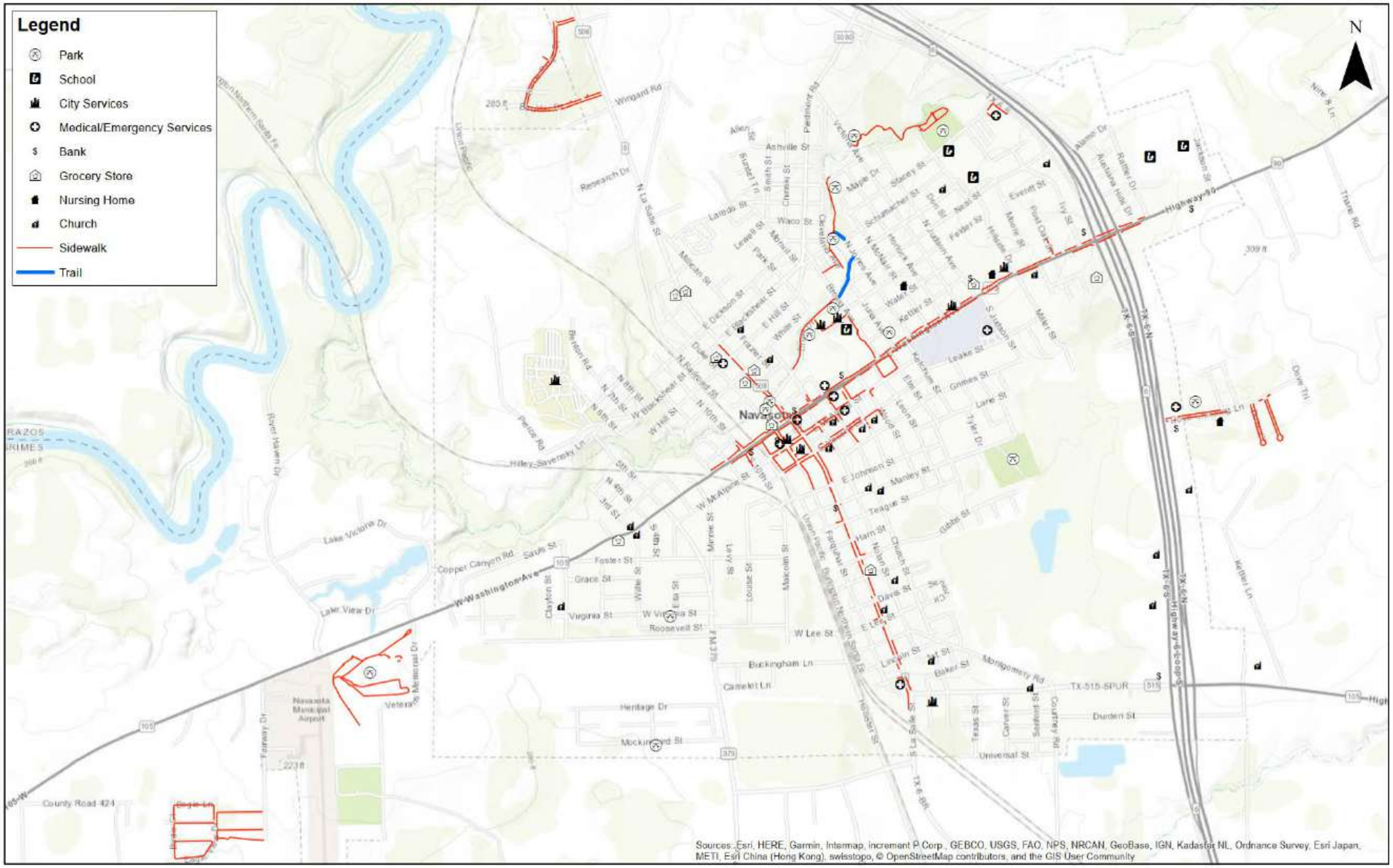
   Brosig Avenue is currently a project advanced by the City to add sidewalk along the west side of the roadway. Adding bicycle elements to this project would be easily accomplished with a few shared-use markings and some additional signs. This route is critical because of the access it provides to the school system, the park system, and the north side of the City.

5. Brule Street Bicycle Boulevard

   Brule Street offers a great connection to the school and park system by connecting the routes along the river. There is already sidewalk along this road for pedestrians, and the pavement is in good condition to implement bicycle accommodations without needing to repave the road. This is a simple project to implement that will add great benefit to pedestrians and bicycles for relatively low costs.

APPENDIX A
COMMUNITY DESTINATION LOCATION MAPS

Current Ped/Bike Facilities



STRAND ASSOCIATES®

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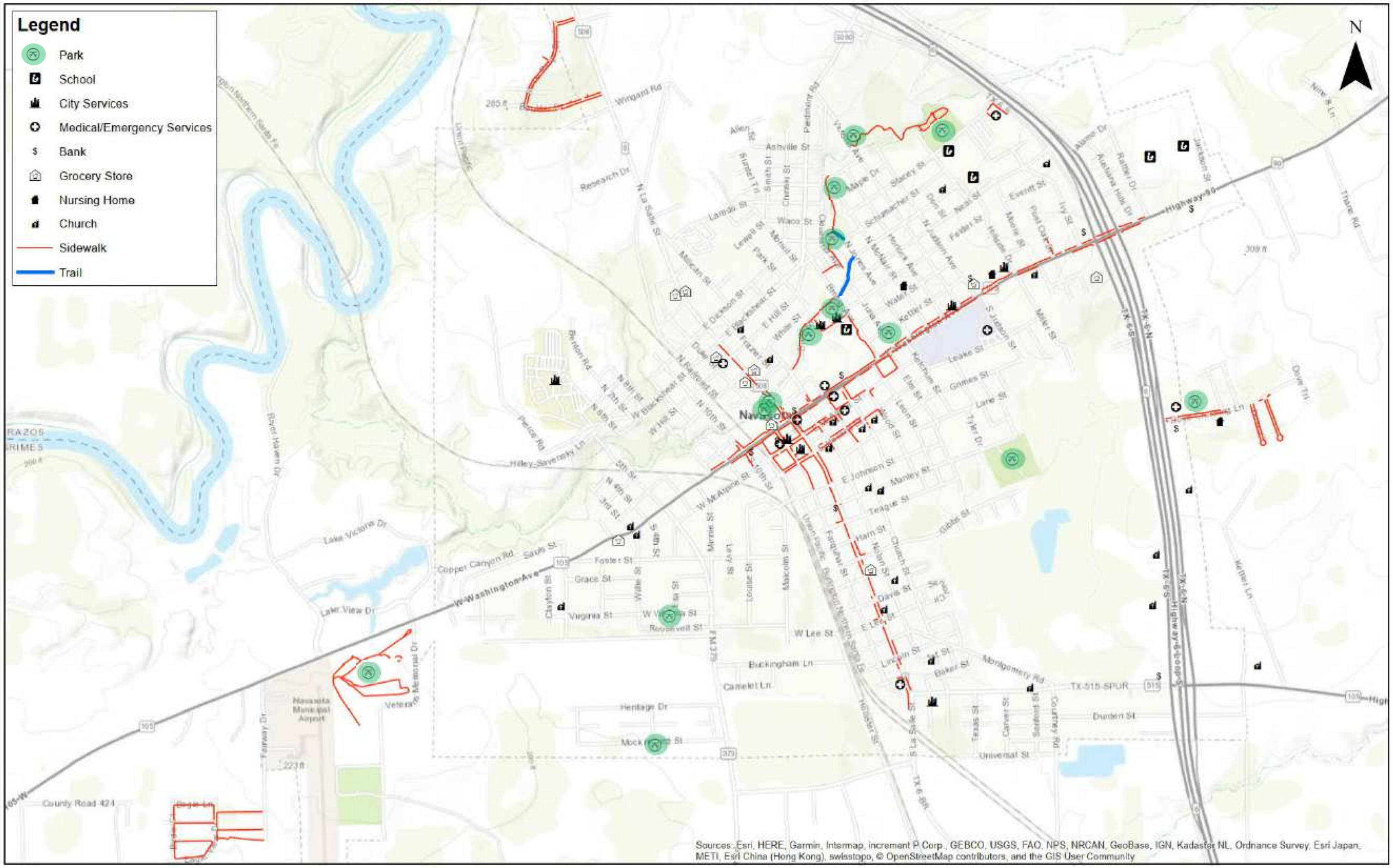
Current Ped/Bike Facilities



STRAND ASSOCIATES

Parks

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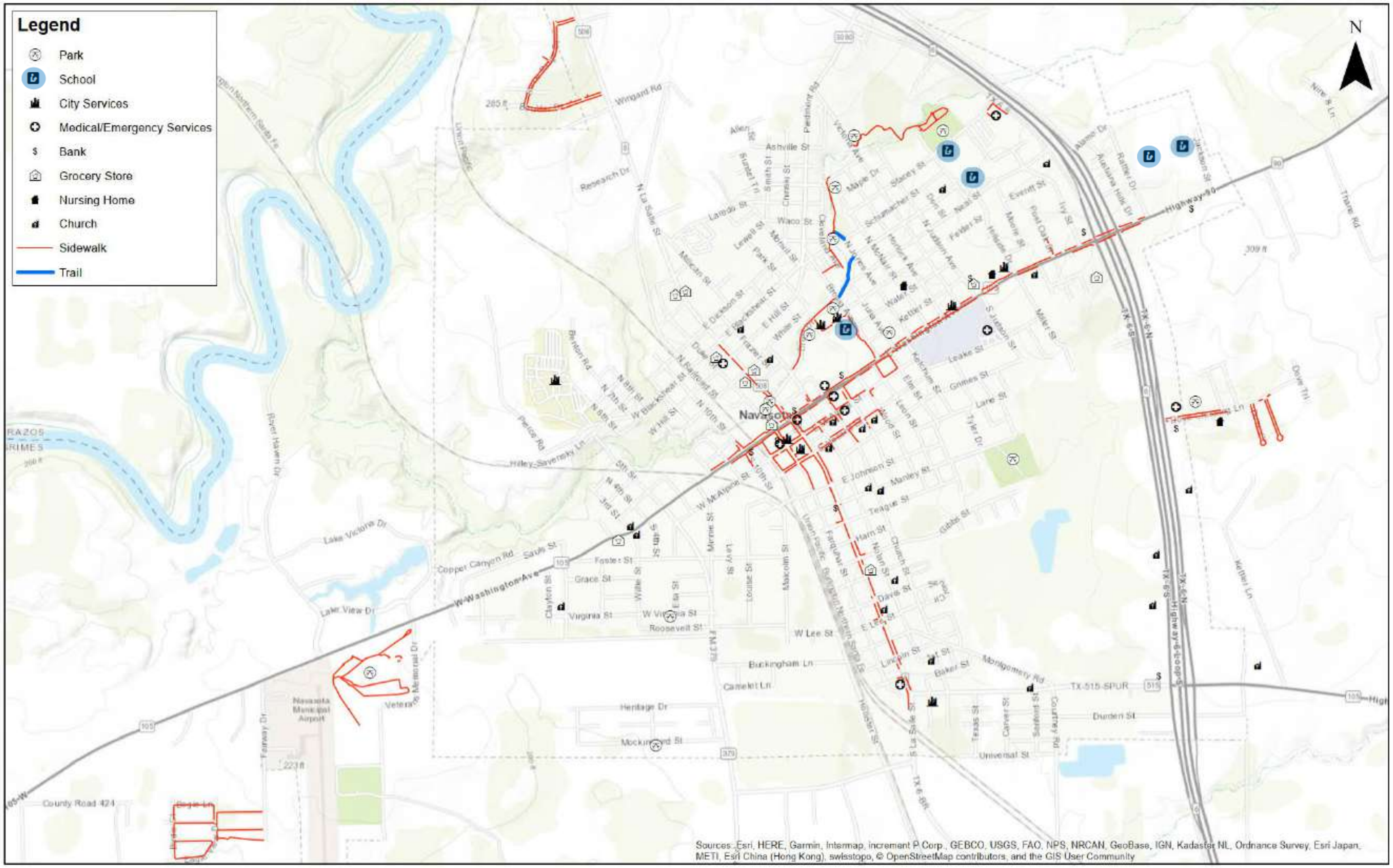
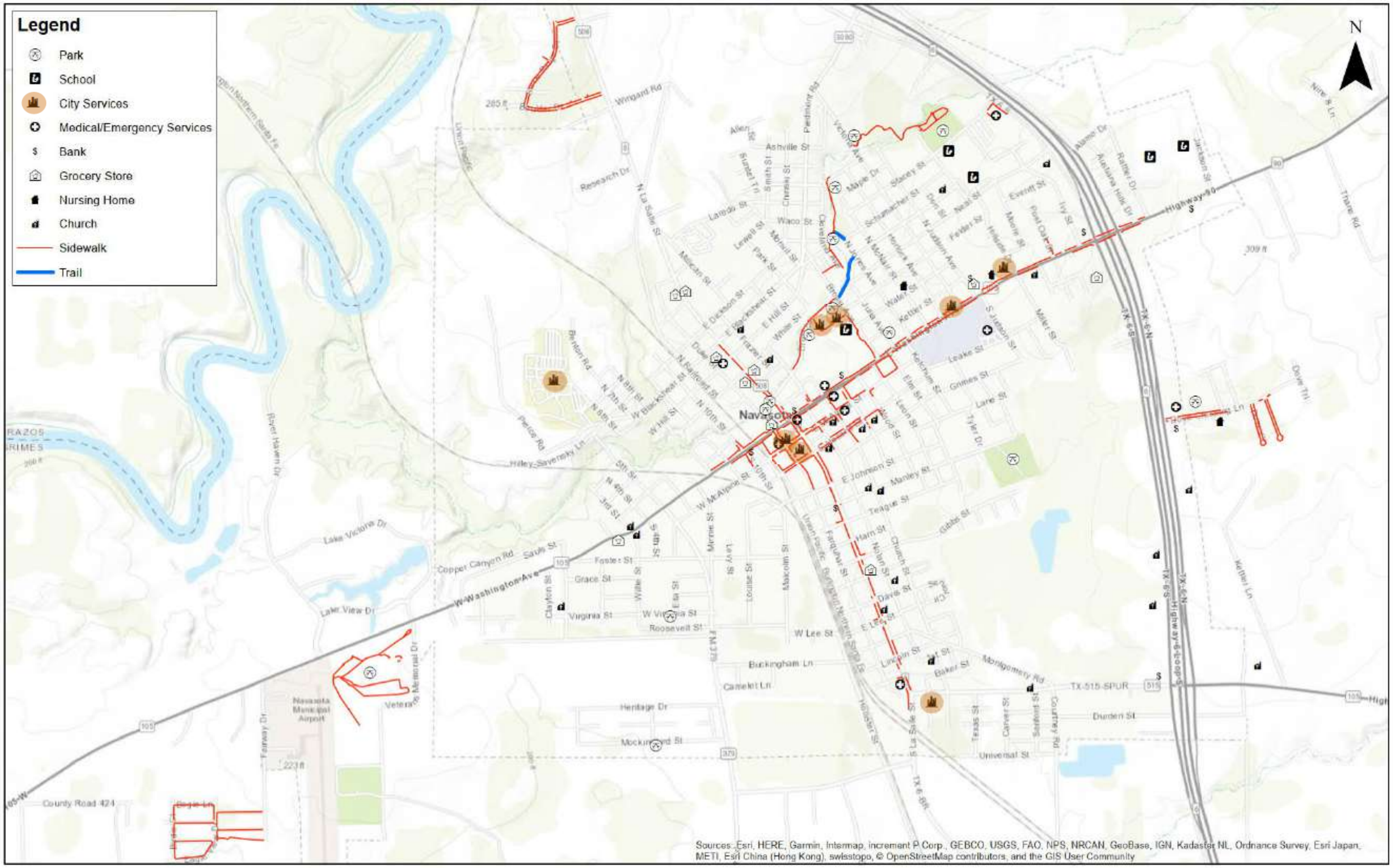
Current Ped/Bike Facilities



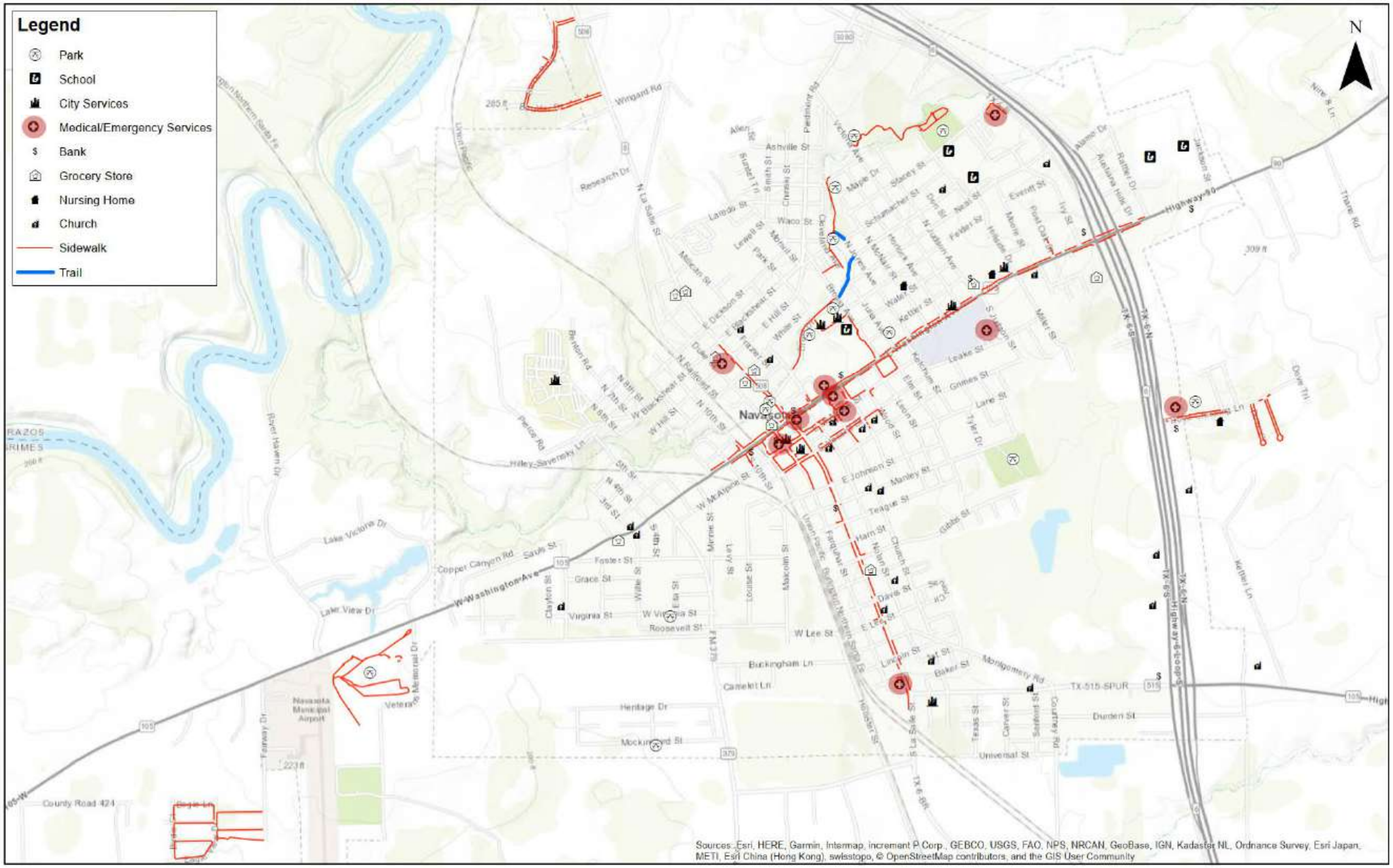
STRAND ASSOCIATES®

Schools

Current Ped/Bike Facilities



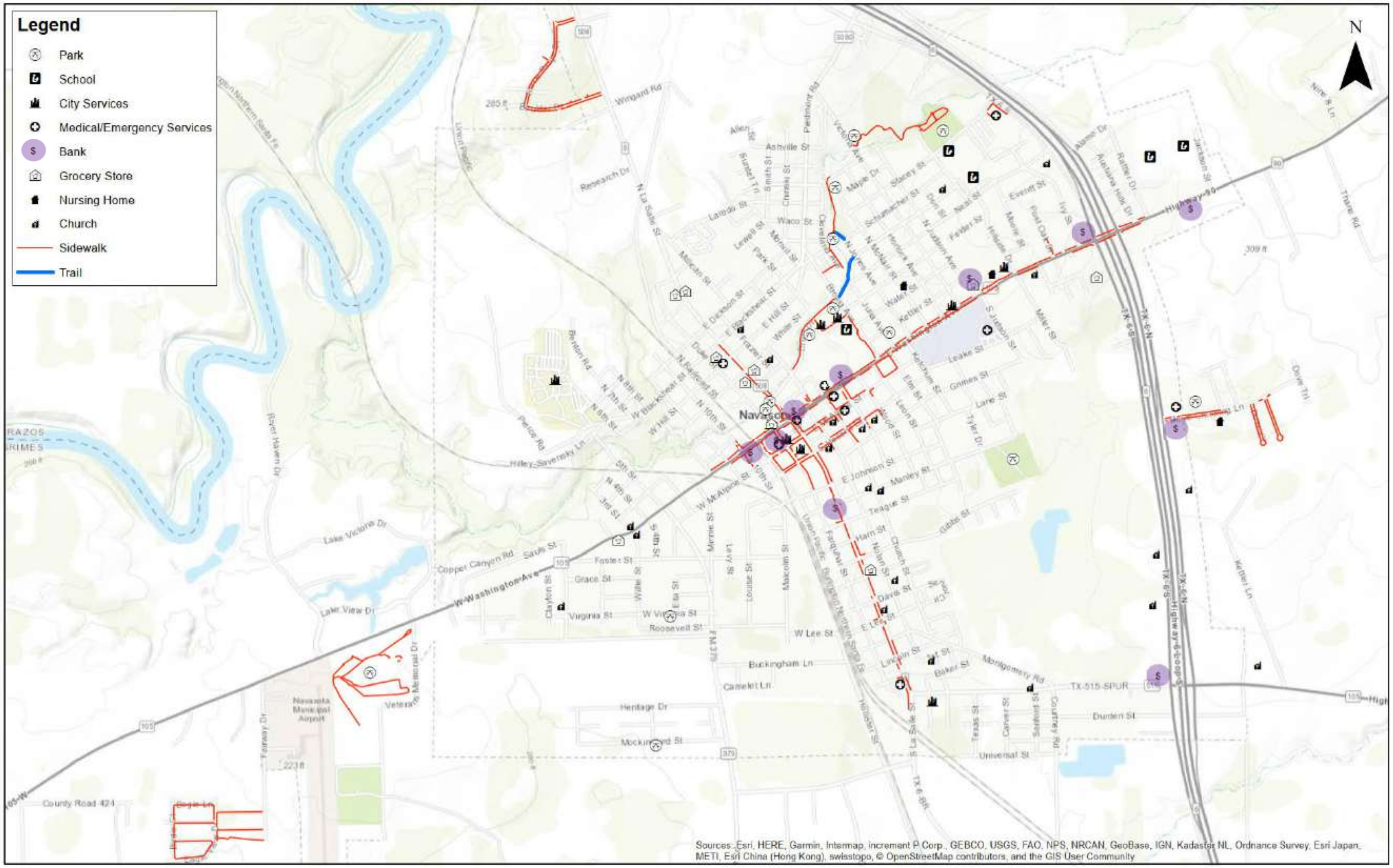
Current Ped/Bike Facilities



STRAND ASSOCIATES

Medical/Emergency Services

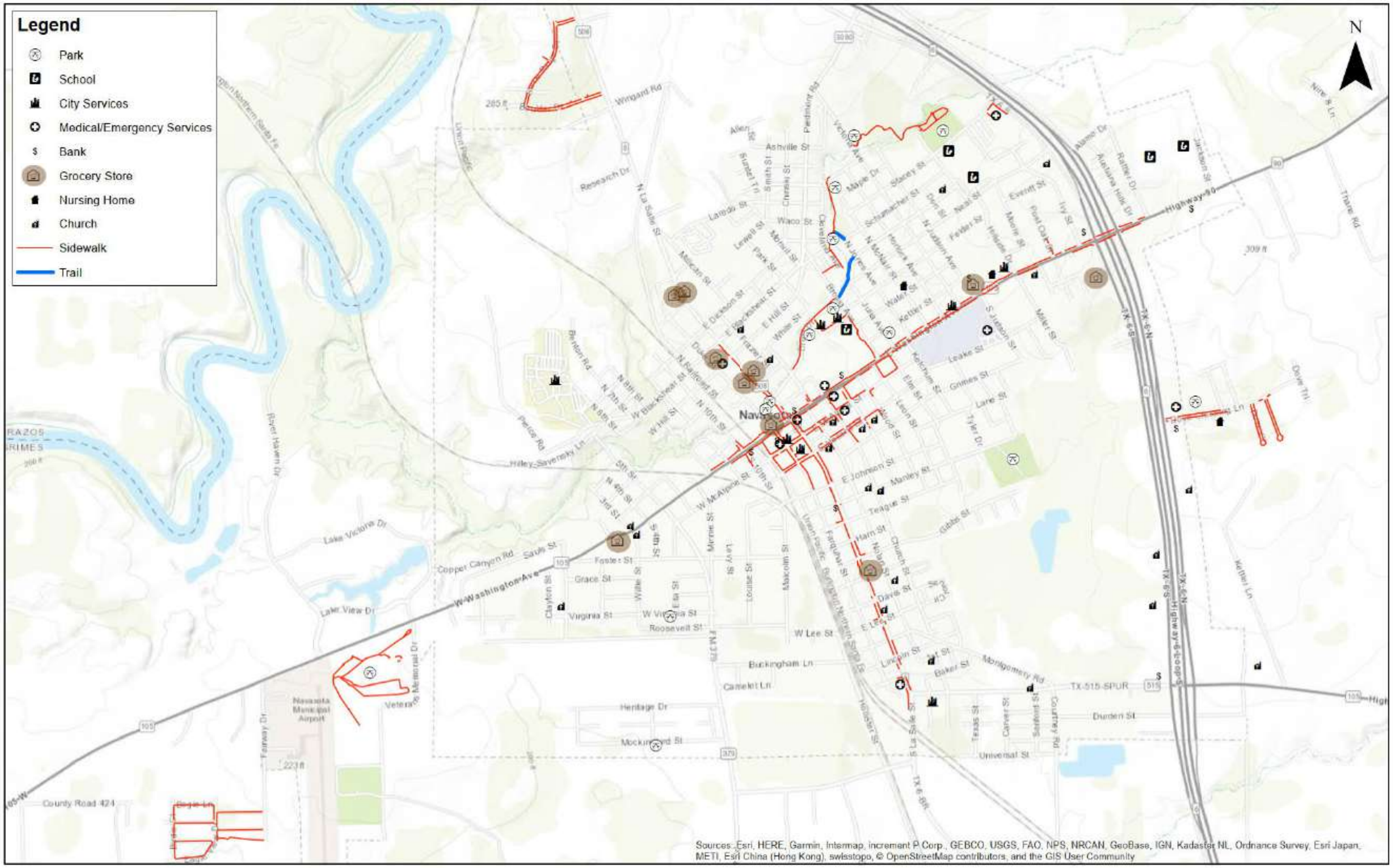
Current Ped/Bike Facilities



STRAND ASSOCIATES®

Banks

Current Ped/Bike Facilities



STRAND ASSOCIATES®

Grocery/Food Stores

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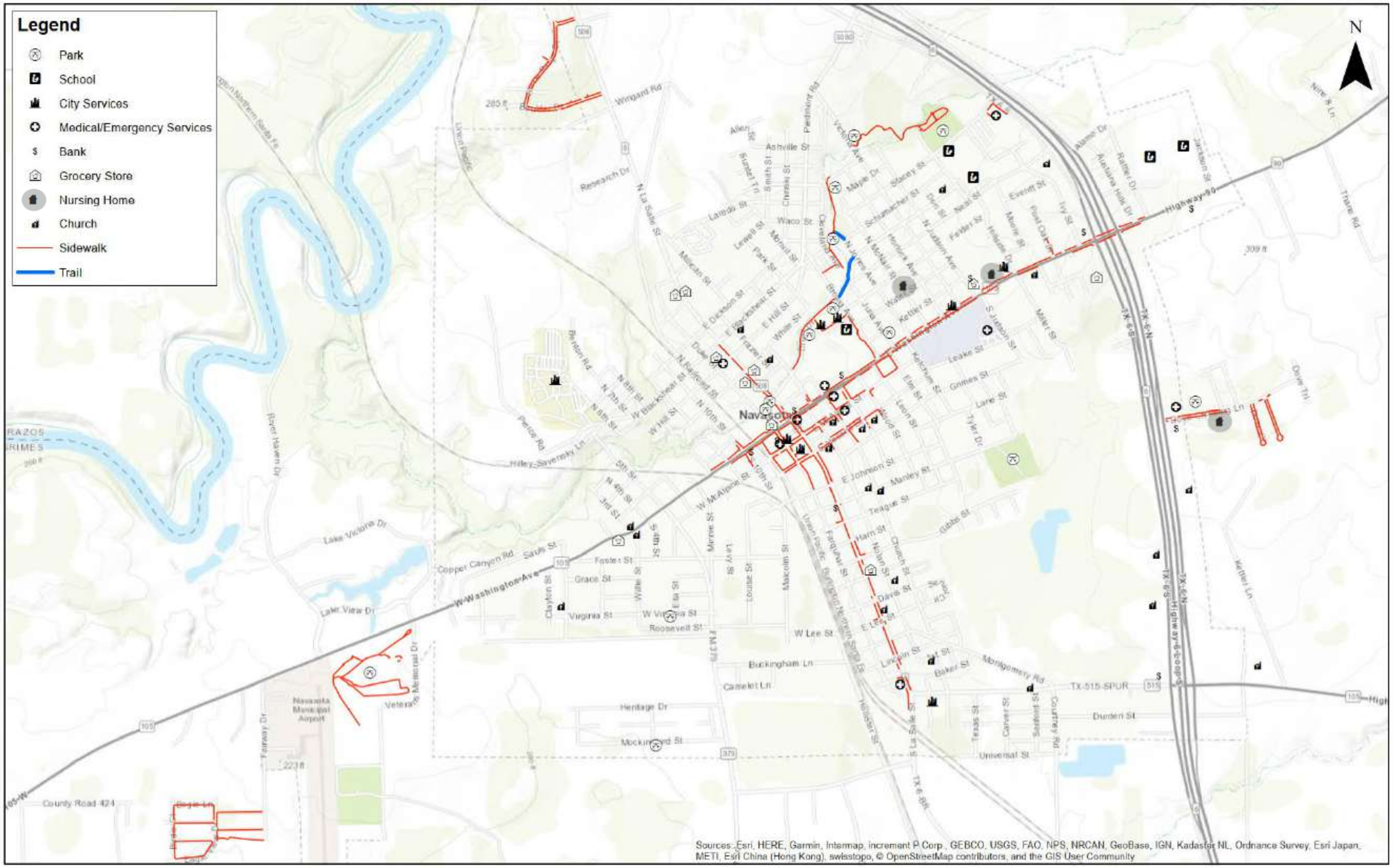
Current Ped/Bike Facilities



Nursing Homes/Care Facilities

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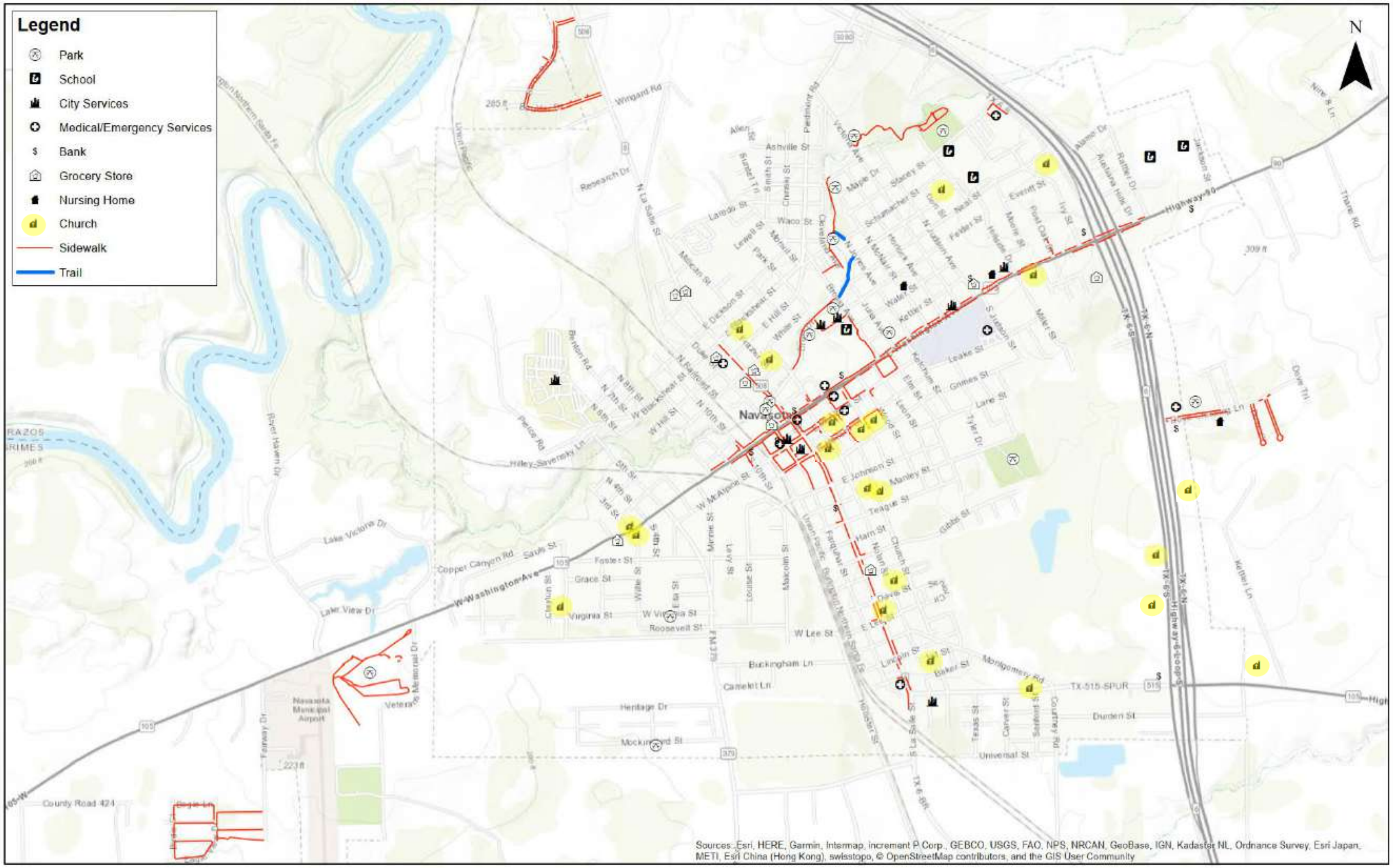
Current Ped/Bike Facilities



Churches

STRAND ASSOCIATES®

APPENDIX B
PUBLIC MEETING FEEDBACK

NAVASOTA PEDESTRIAN AND BICYCLE PLAN OPEN HOUSE

May 18, 2021 at City Hall, 5:30 to 7:00 PM

NAME	REPRESENTING	ADDRESS (Optional)	CITY & ZIPCODE (Optional)	E-MAIL (Optional)
Connie Clements	Examiner	300 Hillside	77868	You have it already
Joyce April		904 Holland	77868	
Mitch Bertone		904 Holland	77868	
[illegible]				
Yolanda Fultz		226 Hillside		
Bernie [illegible]		703 N. 10th	77868	
Deborah Richardson				
Tanya Walters			77868	
DAVID TULLOS				
Julie Horn			77868	
Geoff Horn	Self		77868	
MAX BRAND	Self			
[illegible]	Owner/Self		77868	
Sharon Mangum	Self			
[illegible]				
Matt Morse	Self		77868	

NAVASOTA PEDESTRIAN AND BICYCLE PLAN OPEN HOUSE

May 18, 2021 at City Hall, 5:30 to 7:00 PM

NAME	REPRESENTING	ADDRESS (Optional)	CITY & ZIPCODE (Optional)	E-MAIL (Optional)
Benjamin G. Miller	GLS		75901 Lufkin	
[illegible]		117 Hillside St	77868	nbmlisa@hotmail.com
Kelly Hajek	Strand		Brenham	
JARED ENGELKE	STRAND		BRENHAM	

PROJECT ROUTE:	COMENTS / SUGGESTIONS:
(For TxDOT Grant Purposes) HOME ZIP CODE: 77868 **OPTIONAL INFORMATION** NAME: Max Brand PHONE: 936-658-1523 EMAIL: emaxobrand@gmail.com	Do NOT Reduce PARKING on Hwy 105 WASHINGTON AVE. Side walks Are Needed.

DRAFT (07.20.2021)

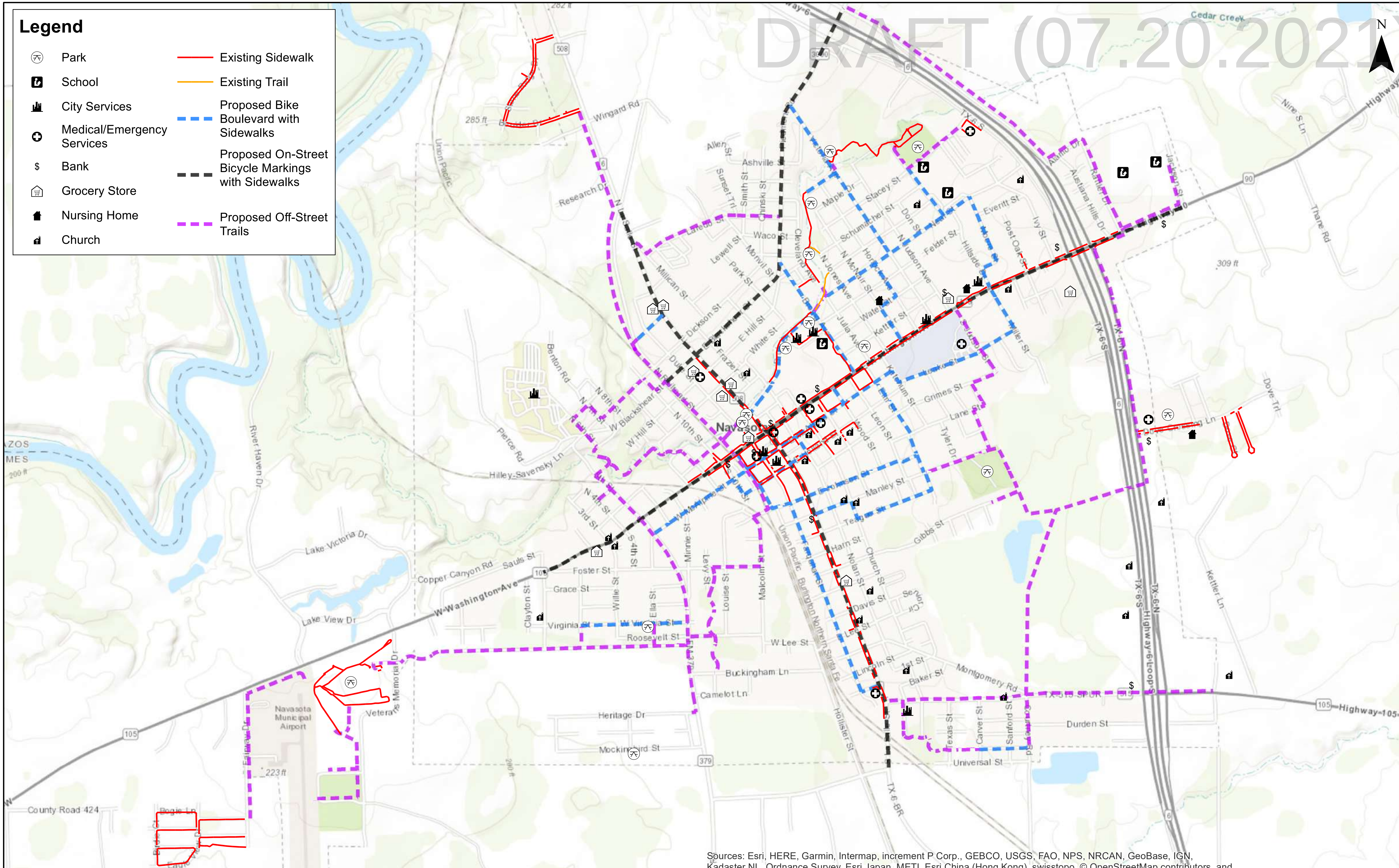
ONLINE SURVEY RESPONSES

Response ID	Email	Name	Please provide comments on the draft Goal and Objectives: Goal: Provide safe and convenient pedestrian and bicycle accommodations that connect Navasota neighborhoods to community destinations.	What priority would you consider PARKS when identifying important community features that a pedestrian/bicycle system should connect?	What priority would you consider SCHOOLS when identifying important community features that a pedestrian/bicycle system should connect?	What priority would you consider CITY SERVICES (City Hall, Navasota Center, etc.) when identifying important community features that a pedestrian/bicycle system should connect?	What priority would you consider MEDICAL/EMERGENCY services when identifying important community features that a pedestrian/bicycle system should connect?	What priority would you consider BANKS/ATMs when identifying important community features that a pedestrian/bicycle system should connect?	What priority would you consider GROCERY/FOOD STORES when identifying important community features that a pedestrian/bicycle system should connect?	What priority would you consider NURSING HOMES when identifying important community features that a pedestrian/bicycle system should connect?	What priority would you consider CHURCHES when identifying important community features that a pedestrian/bicycle system should connect?	Are there other destinations/community features you feel we should consider when planning pedestrian and bicycle connections? How would they rank among the priorities above?	Please provide any additional comments you wish related to pedestrians and bicycles in Navasota.	Please review the draft Pesetrian and Bicycle Routes map and add comments if you would like to.
1	anonymous		I am so excited about this plan! My family enjoys biking and walking over driving- especially because Navasota is small enough to easily make this a regular way of transportation. Having a safer way to do this will make this much more reasonable for us!	Medium	High	High	High	Medium	High	High	High			I wish the bike lane went past 6 to the schools.
2	anonymous		I share the pedestrian aspect of the goal. I share the objective of sidewalks connecting residents to schools, community facilities and businesses. Parents do not let their children walk or bike to school anymore. It's not the safe world I grew up in. The only people who would really use these citywide would be cycle clubs coming through town. I will say that in the lower income areas where they may not have a car, they might bike to the grocery store if it were available to them. As a driver, I'm nervous sharing the road with bicycles. I can't help but see increased accidents, even fatalities, with cyclists and cars on Washington Avenue. It's extremely difficult for sedans to back out when parked next to trucks and SUVs, even with a backup camera. You still have to pull out and run the risk of hitting someone. I think the bike ROUTES should encircle town such as on FM 3090 and Spur 515 and then have a shared streets like Church and Victoria to make their way into town. FM 3090 wraps around to connect with FM 379.	Medium	Low	Medium	Medium	Medium	High	Low	Low	The residents in the vicinity of FM 379 are more isolated from services but a sidewalks and bike routes on McAlpine eastbound from FM 379 could connect them to medical facilities, WIC and city services. Many of the dollar stores, health & human services offices are on LaSalle right off FM 3090.	This is not a safe world anymore. Parents don't let their kids walk or bike and it's a waste of resources in my area if you're doing it for the kids. Adults like to walk for their health so sidewalks are appreciated.	I don't want my three trees cut down for a sidewalk. I'm not opposed to street and bike sharing but not at the expense of parking. I think it's impossible to make an honest assessment of bike lanes on Washington until we have the Farquhar-Washington crosswalk constructed. It will require a median from LaSalle to Farquahar and new routing that we have to adapt to because of two streets now with prohibited turns.
3	anonymous			Medium	Low	High	High	Low	High	High	Low			
4	anonymous		DO NOT take away from on street vehicle parking for commerce/economic development (Washington Ave. primarily)	High	High	Medium	Medium	Low	Medium	Low	Low	Downtown center, open areas (but no more important than parks)	Need to be aware of width of trucks (LOADS) that would affect "trail" width; I think that in downtown, the bicycle travelers should be on same lane as motor vehicles. Cannot afford to take away any parking from downtown. Also, be aware of width of city streets.	Need to take into account any NEW park development that is needed (primarily West End)
6	anonymous			High	High	Low	Low	Low	Medium	Low	Low			
7	anonymous		Better use of taxpayer funds would be to first repair/re-pave the streets in Navasota rather than provide anything new.	High	High	Low	Low	Medium	Medium	Low	Medium			
8	anonymous		Cross Walks on Washington Street West from LaSalle. # 1 in front of Classic Rock Cafe # 2 at RR tracks near Rail and Rye	High	Medium	Medium	Medium	Medium	High	Medium	Medium	Clean up sidewalk next to Circle P Antiques		
9	anonymous			Medium	High	Medium	High	High	High	Medium	Medium			
10	anonymous		1. Connect walkers and cycles to different areas and businesses. 2. Looking forward to riding bikes around town.	High	High	High	High	Medium	Medium	Medium	High	The Recycling building. Rank - medium.	Looking forward to riding bikes around town.	The map looks good. I believe it will be a good start. Thanks for the proposal
11	anonymous			Medium	Medium	Low	Low	Low	Medium	Low	Low			
12	anonymous			High	Medium	Low	High	Medium	Medium	Low	Low	Please clean up the parking area next to RR tracts		
13	anonymous		Pavrd designated paths are great but our roads need so much work. Maybe combine the two?	High	High	Medium	High	Low	Low	Low	Medium		I'm not sure we have enough bikes to really have so much put into this. However, maybe if we encourage more bike friendly activities it could help.	
14	anonymous			High	High	Low	Medium	Low	Medium	Low	Low		Be mindful to not eliminate/sacrifice parking downtown just to make it more bike friendly. Bike lanes and racks could be added to alleys and places off Washington Ave.	Encourage the removal of the proposed On-Street Bicycle Markings with Sidewalk on Washington Ave.
15	anonymous			High	High	Low	Low	Low	Medium	Low	Low			
16	anonymous			High	High	Medium	High	Medium	Medium	Medium	Medium	US Post office		
17	anonymous		When possible I prefer the multi-use paths. (The city will need to change ordinances to allow bicycles on the paths.	High	High	High	High	Medium	High	Medium	High		This project is needed as the city needs better pedestrian and bicycle facilities.	

PUBLIC MEETING MAP COMMENTS

Comment Number	Comment
1	Would like a bicycle lane to the high school
2	Currently no sidewalks for citizens in low income areas. Would like sidewalk and path along FM 379 and from FM 379 to the north along Washington Avenue.
3	Would like a path along Rosevelt Street to take citizens to places located on the west side of August Horst Municapal Park without going via Washington Avenue.
4	A lot of people park along Hillside Street
5	Hillside street has narrow yards. Moore Street has wider yards and more space for routing sidewalk and bicycle boulevard.

APPENDIX C
PROPOSED ROUTING MAP



City of Navasota: Bike & Pedestrian Connections - Proposed Facilities Overview

APPENDIX D
COST ANALYSIS UNIT PRICE ASSUMPTIONS

APPENDIX D - ASSUMED COSTS AND UNIT PRICES

Initial Construction Cost

Concrete

	Item Description	Item Code	Unit	Quantity	Unit Price	Cost	Rounded Cost	Remarks
Required	7" Reinforced Concrete SUP	3606001	SY per mile	5867	$ 99.72	$ 585,024.00	$ 585,000.00	
	Flex Base Surface Area 8" Gravel	2476201	SY per mile	7040	$ 10.99	$ 77,369.60	$ 77,000.00	
	Pavement Marking	6666205	LF per mile	1320	$ 0.12	$ 158.40	$ -	
	Bicycle Route Signs		per mile	10	*	$ 4,798.00	$ 4,800.00	Assumes 10 per mile
					Subtotal	$ 667,350.00		
Optional	Induction & Infrared Bike/Ped Counter		per mile	1	*	$ 5,820.00	$ 5,800.00	
	High Pressure Sodium Light		per mile	53	*	$ 265,000.00	$ 265,000.00	Assumes Every 100 feet (53 per mile)
					Subtotal	$ 270,820.00		
* Item cost taken from the TxDOT Bicycle Tourism Trails Study, Tech Memo 3					Total	$ 938,170.00		

Asphalt

	Cost Description	Item Code	Unit	Quantity	Unit Price	Cost	Rounded Cost	Remarks
Required	2" HMA Surface	3406122	ton per mile	657	$ 85.52	$ 56,192.34	$ 56,000.00	
	2" HMA Base	3406239	ton per mile	657	$ 56.91	$ 37,393.66	$ 37,000.00	
	Primecoat AEP	3106005	Gal per mil	1760	$ 2.63	$ 4,628.80	$ 5,000.00	Assumes 0.3 gal/SY application rate
	Flex Base Surface Area 8" Gravel	2476201	SY per mile	7040	$ 10.99	$ 77,369.60	$ 77,000.00	
	Pavement Marking	6666205	LF per mile	1320	$ 0.12	$ 158.40	$ -	
	Bicycle Route Signs		per mile	10	*	$ 4,798.00	$ 4,800.00	Assumes 10 per mile
					Subtotal	$ 180,540.81		
Optional	Induction & Infrared Bike/Ped Counter		per mile	1	*	$ 5,820.00	$ 5,800.00	
	High Pressure Sodium Light		per mile	53	*	$ 265,000.00	$ 265,000.00	Assumes Every 100 feet (53 per mile)
					Subtotal	$ 270,820.00		
* Item cost taken from the TxDOT Bicycle Tourism Trails Study, Tech Memo 3					Total	$ 451,360.81		

Gravel

	Cost Description	Item Code	Unit	Quantity	Unit Price	Cost	Rounded Cost	Remarks
Required	Flex Base Surface Area 8" Gravel	2476201	SY per mile	7040	$ 10.99	$ 77,369.60	$ 77,000.00	
	Bicycle Route Signs		per mile	10	*	$ 4,798.00	$ 4,800.00	Assumes 10 per mile
					Subtotal	$ 82,167.60		
Optional	Induction & Infrared Bike/Ped Counter		per mile	1	*	$ 5,820.00	$ 5,800.00	
	High Pressure Sodium Light		per mile	53	*	$ 265,000.00	$ 265,000.00	Assumes Every 100 feet (53 per mile)
					Subtotal	$ 270,820.00		
* Item cost taken from the TxDOT Bicycle Tourism Trails Study, Tech Memo 3					Total	$ 352,987.60		

Maintenance Costs

Concrete

	Cost Description	Item Code	Unit	Quantity	Unit Price	Cost	Remarks
Routine Annual Maintenance	Grass Mowing Cleaning/Brushing Tree Trimming Vandalism Repair Litter Control		Per Mile			$ 5,000.00	Cost taken from Routine Maintenance cost listed in the TxDOT Tourism Trails Study, Technical Memorandum 3
Periodic Maintenance (every 5 years)	Crack Sealing Roadway Edging Re striping		Per Mile			$ 9,000.00	Cost taken from Periodic Maintenance cost listed in the TxDOT Tourism Trails Study, Technical Memorandum 3
					30 Year Cost	$ 204,000.00	

Asphalt

	Cost Description	Item Code	Unit	Quantity	Unit Price	Cost	Remarks
Routine Annual Maintenance	Grass Mowing Cleaning/Brushing Tree Trimming Vandalism Repair Litter Control		Per Mile			$ 5,000.00	Cost taken from Routine Maintenance cost listed in the TxDOT Tourism Trails Study, Technical Memorandum 3
Periodic Maintenance (every 5 years)	Crack Sealing Roadway Edging Re striping		Per Mile			$ 9,000.00	Cost taken from Periodic Maintenance cost listed in the TxDOT Tourism Trails Study, Technical Memorandum 3
One Time Cost (15 year resurface)	Milling	3546197	SY per mile	657	$ 0.95	$ 624.21	
	Resurface 2" HMA		Per MIle			$ 56,000.00	Taken from initial construction cost
	Primecoat AEP		Per MIle			$ 5,000.00	Taken from initial construction cost
	Pavement Marking		Per Mile			$ 158.40	Taken from initial construction cost
					30 Year Cost	$ 256,782.61	

Gravel

	Cost Description	Item Code	Unit	Quantity	Unit Price	Cost	Remarks
Routine Annual Maintenance	Grass Mowing Cleaning/Brushing Tree Trimming Vandalism Repair Litter Control		Per Mile			$ 5,000.00	Cost taken from Routine Maintenance cost listed in the TxDOT Tourism Trails Study, Technical Memorandum 3
	Spot Gravel		Per Mile			$ 1,000.00	Estimated based on gravel road maintenance
Periodic Maintenance (every 5 years)	Regravel 1" surface		SY per Mile			$ 9,671.20	Cost of 8" Gravel divided by 8
	Reblading	1506001	STA	52.8	$ 166.96	$ 8,815.49	
					30 Year Cost	$ 290,920.13	