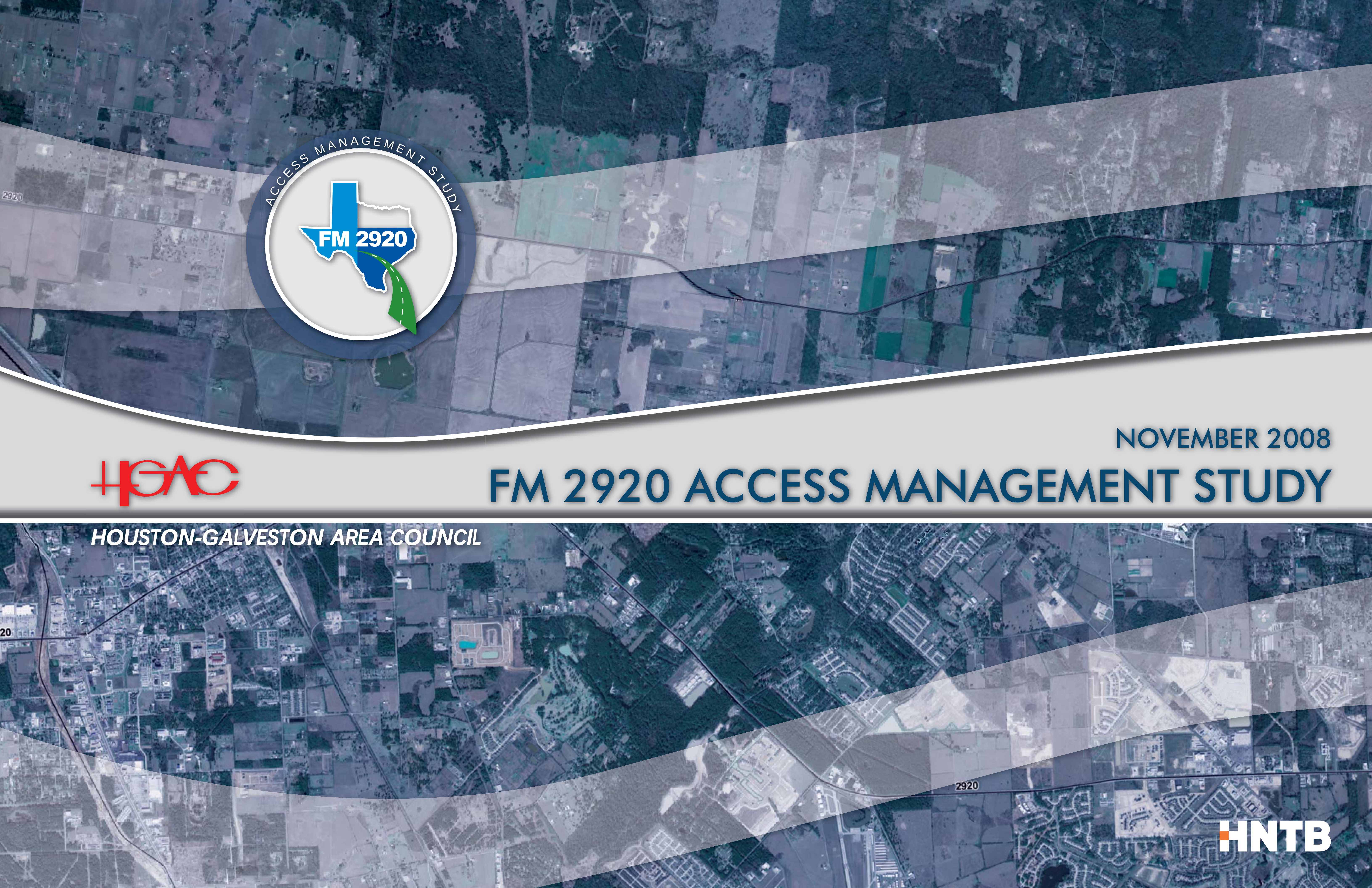

ACCESS MANAGEMENT STUDY
FM 2920

NOVEMBER 2008

FM 2920 ACCESS MANAGEMENT STUDY

H-GAC
HOUSTON-GALVESTON AREA COUNCIL

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Chapter 1: Introduction

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PURPOSE OF STUDY

The HNTB team was retained by H-GAC to identify access management improvement techniques for the FM 2920 corridor from Hempstead Road (west of US 290) to Lexington Road (east of Interstate 45).

ACCESS MANAGEMENT

The systematic control of the location, spacing, design, and operation of driveways, median openings, interchanges, and street connections to a roadway. The purpose is to provide vehicular access to land development in a manner that preserves the safety and efficiency of the transportation system. For additional information, including benefits and tools to accomplish access management, refer to Appendix A.
Source: Access Management Manual, TRB 2003

The study includes collection of sufficient information to measure, evaluate, and identify a range of viable short, medium, and long-term improvement concepts that will improve safety and mobility; reduce motorist delay; reduce crash rates; enhance land use; and preserve long-term property values along the corridor. These strategies will focus also on providing opportunities along some sections of the corridor for pedestrian connectivity as well as aesthetic and landscaping treatments, which will help stimulate economic vitality.

FM 2920 at IH 45

STUDY PROCESS

Public involvement is very important in an access management study. To ensure that the specific needs of the community were incorporated into the study recommendations, a steering committee comprised of the funding agencies and other affected agencies was formed to guide the technical and administrative aspects of the study. To obtain the community's input on critical issues and needs along the FM 2920 corridor, and to obtain feedback on the initial set of improvement alternatives, public meetings were conducted. Comments from the public meetings and steering committee were incorporated into the final recommended improvements.

STEERING COMMITTEE AGENCIES

Houston-Galveston Area Council
Greater Tomball Area Chamber of Commerce
Harris County
Houston Northwest Chamber of Commerce
North Houston Association
Texas Department of Transportation
City of Tomball
City of Waller

The following chart depicts a typical Access Management Study process and the time line needed for such a study. The process includes data collection, analysis of existing conditions, proposing recommendations with the infusion of public input through public meetings, stakeholder meetings, and steering committee oversight throughout the process.

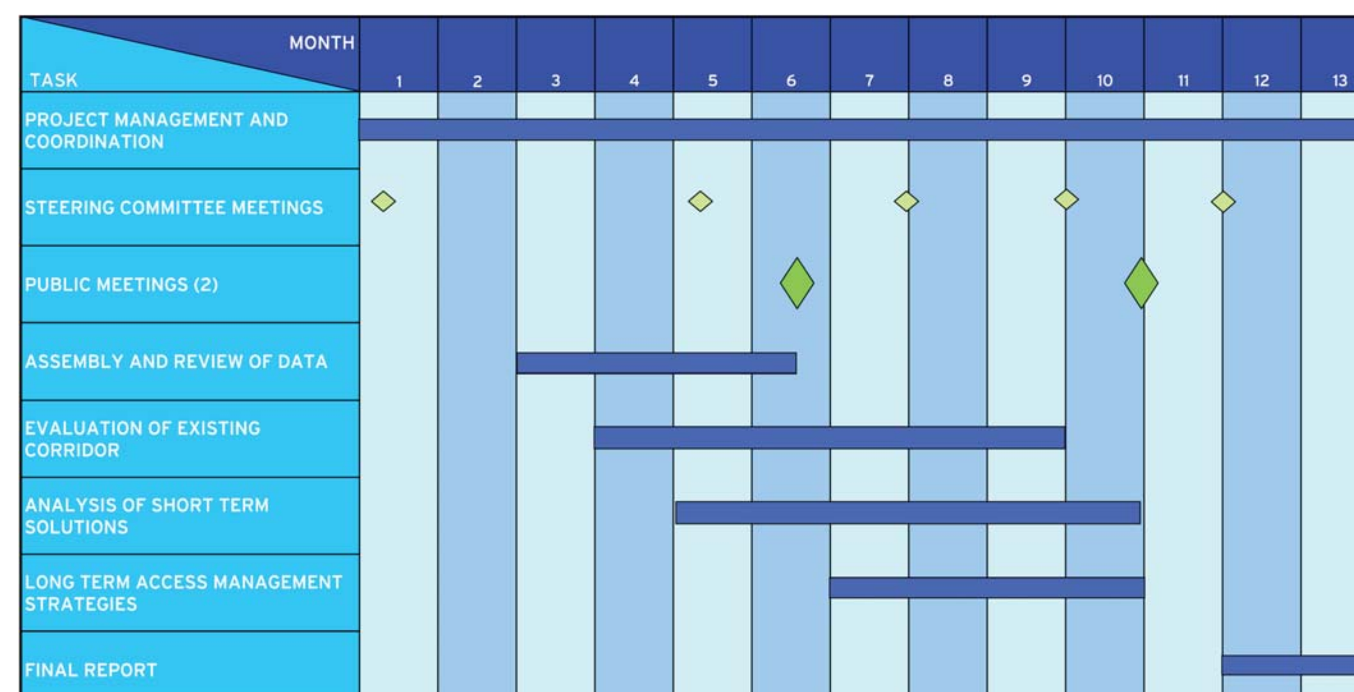


Figure 1.1 - Access Management Study Schedule

STUDY AREA

FM 2920 is a major east-west arterial traversing the city of Waller and the city of Tomball. The limits for this 32-mile study segment (Figure 1.2) are from Hempstead Road (west of US 290) to Lexington Road (east of Interstate 45). The right of way (ROW) along the corridor varies from 60 feet to 120 feet in width.

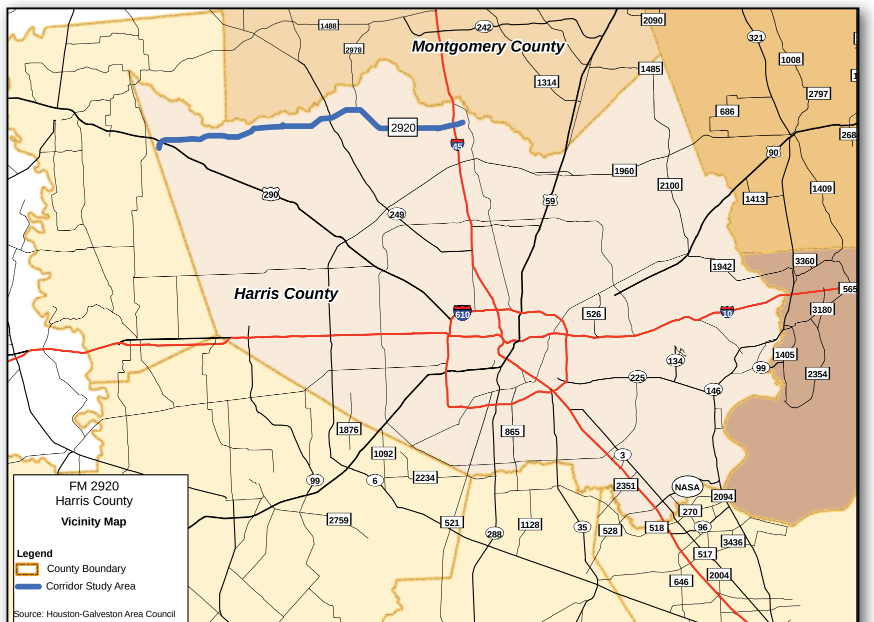


Figure 1.2 - Vicinity Map

PROJECT FACTS

Facility Type:	Farm-to-Market Road – Principal Arterial
Study Limits:	US 290 to Interstate 45
Facility Owner:	Texas Department of Transportation
Facility Maintenance:	Texas Department of Transportation and City of Tomball
Number of Lanes:	5 lanes (mainly east of SH 249); 2 lanes (mainly west of SH 249)
Right of Way:	60-120 feet (mainly east of SH 249); 100 feet (mainly west of SH 249)

Rapidly increasing commercial, retail, and residential development along FM 2920 between Interstate 45 and Tomball continues to cause motorist delay and frustration. Based on 2007 traffic counts, the 5-lane section of FM 2920 near Interstate 45 carries 58,800 vehicles per day, while the section near SH 249 and Tomball carries 29,900 vehicles per day. As we move further west, FM 2920 becomes a 2-lane rural arterial surrounded by widely-spaced rural developments and farmlands with volumes of 7,000 to 26,800 vehicles per day.

The study area passes through four H-GAC Regional Analysis Zones (RAZ), 117, 118, 120 and 122 (Figure 1.3). Based on H-GAC 2035 regional growth forecast, the projected population growth along FM 2920 is between 95% and 578%, with the largest percentage in the western half of the corridor (Table 1.1). On average, the corridor will experience 128% population growth. As a result of this growth, motorists will face more delays along FM 2920 due to anticipated commercial and residential development, along with associated infrastructure. Even more pronounced will be the problems in the Tomball Downtown area where the right-of-way narrows in some areas to 60 feet, with no medians or turning lanes at intersections. The parallel parking along a few blocks in the downtown area will create additional challenges and will continue to significantly impact the flow and safety of vehicular and pedestrian traffic.

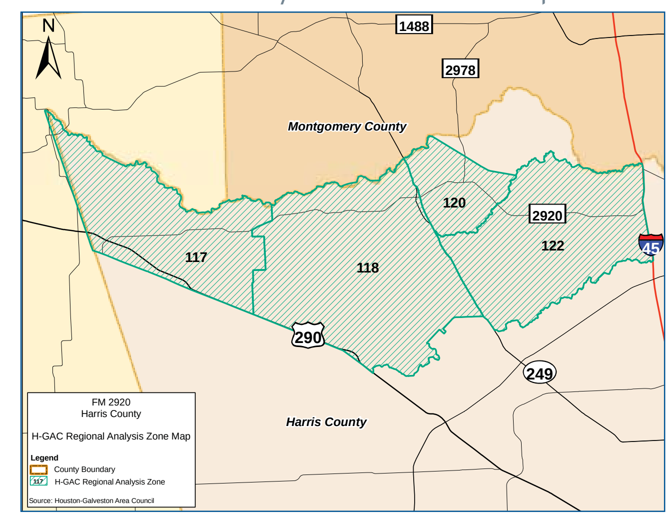


Figure 1.3 - H-GAC Regional Analysis Zone (RAZ) Map

Regional Analysis Zone ID	2005 Jobs	2035 Jobs	% Increase	2005 Population	2035 Population	% Increase
117	1,016	3,917	285.53%	6,292	42,675	578.24%
118	10,216	26,466	159.06%	60,663	140,665	131.88%
120	9,606	17,031	77.30%	12,158	31,157	156.27%
122	25,045	53,319	112.89%	105,022	205,433	95.61%
Total	45,883	100,733	120%	184,135	419,930	128%

Source: H-GAC

Table 1.1 - H-GAC 2035 Regional Growth Forecast by RAZ - FM 2920 Corridor

STUDY GOALS

The overall goal of the study is to develop a plan that identifies and addresses short-to medium-term solutions for implementation to improve mobility, reduce traffic delays, and improve safety. The goal is also to provide a long-range vision for the corridor, by developing access management guidelines along the corridor that complement the land use and urban planning in and around the study area. Implementation of the short, medium, and long-term solutions should result in reduced congestion, fewer crashes, and improved mobility and air quality.

SUMMARY OF STUDY GOALS

- Improve mobility / reduce delays along FM 2920
- Improve safety / decrease crash rates along corridor
- Provide for an open process with public and stakeholder involvement in the project's development
- Provide practical solutions that can be implemented in a timely manner

Chapter 2: Analysis of Existing Conditions

This chapter is focused on the existing conditions along the corridor. In order to properly assess the improvements needed along the corridor to improve safety and mobility. It is critical to take a closer look into the physical and the operational characteristics of the roadway.

The physical characteristics include the roadway itself, intersection geometry, driveways, signage, modal facilities, and planned facilities along the corridor.

The operational characteristics encompasses an evaluation on how the facility is functioning under existing conditions, identifying sections with high crash rates and applying the appropriate access management tools to improve the safety along those sections, identifying sections and intersections experiencing congestion and unreasonable delays.

A simulation model is used to quantify and document those aspects for the existing conditions; the same model is used to help quantify the benefits of the improvements.

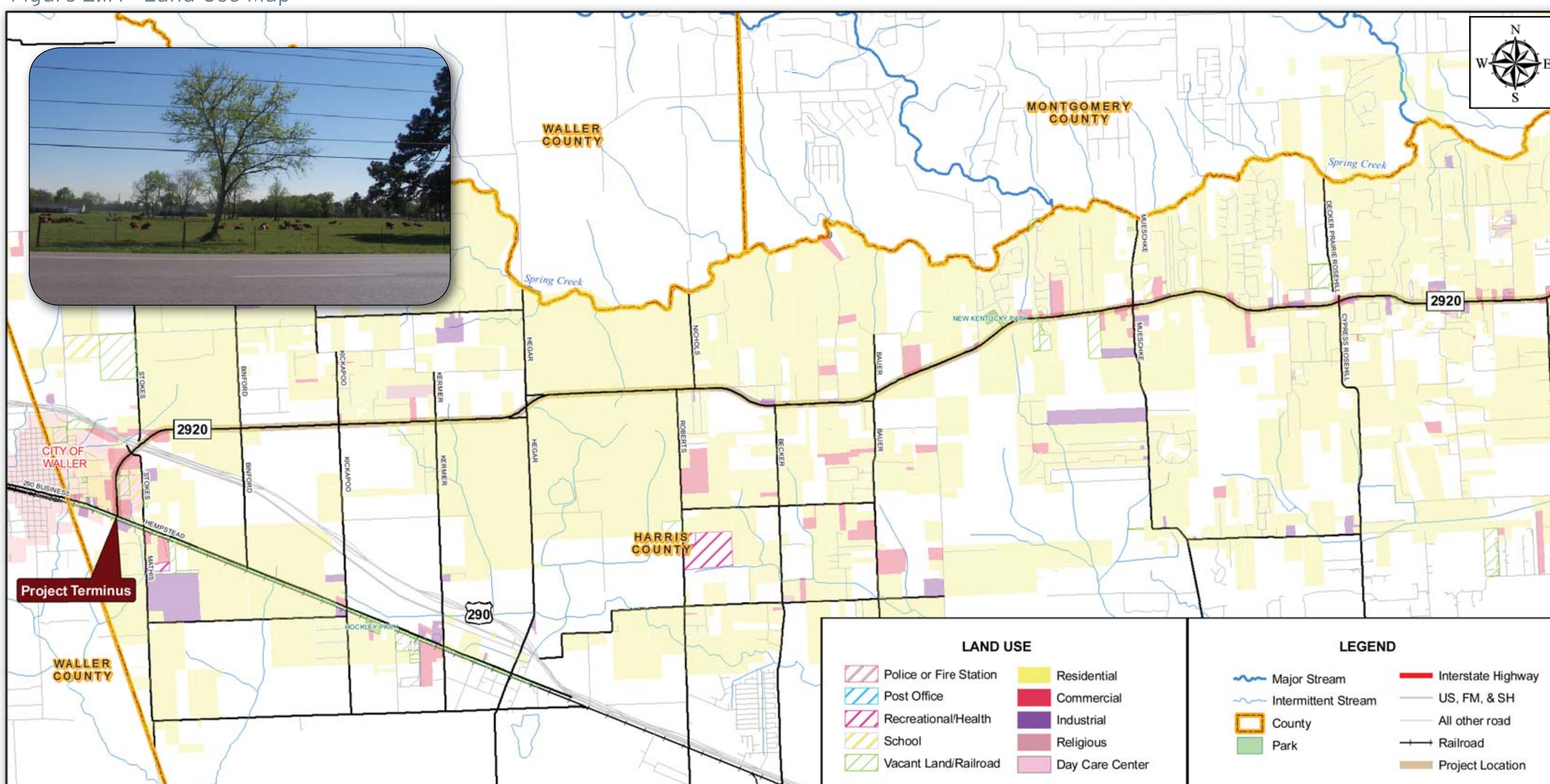
ROADWAY CHARACTERISTICS

LAND USE AND ZONING

FM 2920 is primarily an asphalt roadway with approximately 50 signalized intersections. Between Interstate 45 and SH 249, it is a five-lane rural section with a continuous, two way, left turn lane and shoulders with the exception of a 2-mile section through the city of Tomball. This section is urbanized with curb and gutter and has approximately 84 spaces of parallel on-street parking. Dedicated left turn lanes are designated at major intersections while access between intersections to and from driveways is facilitated by the continuous center left turn lane.

The five-lane section continues approximately 5 miles west of SH 249 where FM 2920 becomes a two-lane rural roadway with a 4 foot shoulder and open ditch drainage. The 2-lane section, primarily surrounded by farmland, continues to the end of the project limits (Hempstead Road).

Figure 2.1A - Land Use Map



The FM 2920 study area includes intersections with three major highway facilities: IH 45, SH 249, and US 290. Major intersecting thoroughfares include Spring Cypress Road, Rhodes Road, Kuykendahl Road, Stuebner-Airline Road, Hufsmith Kohrville Road (FM 2978), SH 249, Cypress Rose Hill Road, Telge Road, and Hempstead Road. Spring Cypress Road becomes a parallel east-west facility to the south of FM 2920 connecting IH 45 and US 290. The four major thoroughfares that provide important connections between Spring Cypress Road and FM 2920 are Kuykendahl Road, Hufsmith Kohrville Road (FM 2978), Stuebner Airline Road and Telge Road.

There is no other major thoroughfare running parallel to FM 2920 on the north that connects IH 45 and US 290. Overall, in the northwest Houston region, the closest two east-west major thoroughfares providing a direct link between IH 45 and US 290 are FM 1960, 6 miles to the south and FM 1488, 9 miles to the north of FM 2920.

In the study area, Kuykendahl Road and Stuebner Airline Road are the only north-south major thoroughfares that connect to FM 1960. Hufsmith Kohrville Road (FM 2978) terminates at SH 249. Major north-south roadways crossing FM 2920 west of SH 249 terminate at US 290 to the south.

The FM 2920 corridor provides access to a wide variety of commercial, recreational, and residential areas. The FM 2920 corridor is anchored by significant commercial development and large subdivisions on the eastern end between SH 249 to IH 45N. The corridor primarily is residential and farmland on the west with sporadic commercial properties from US 290 to SH 249.

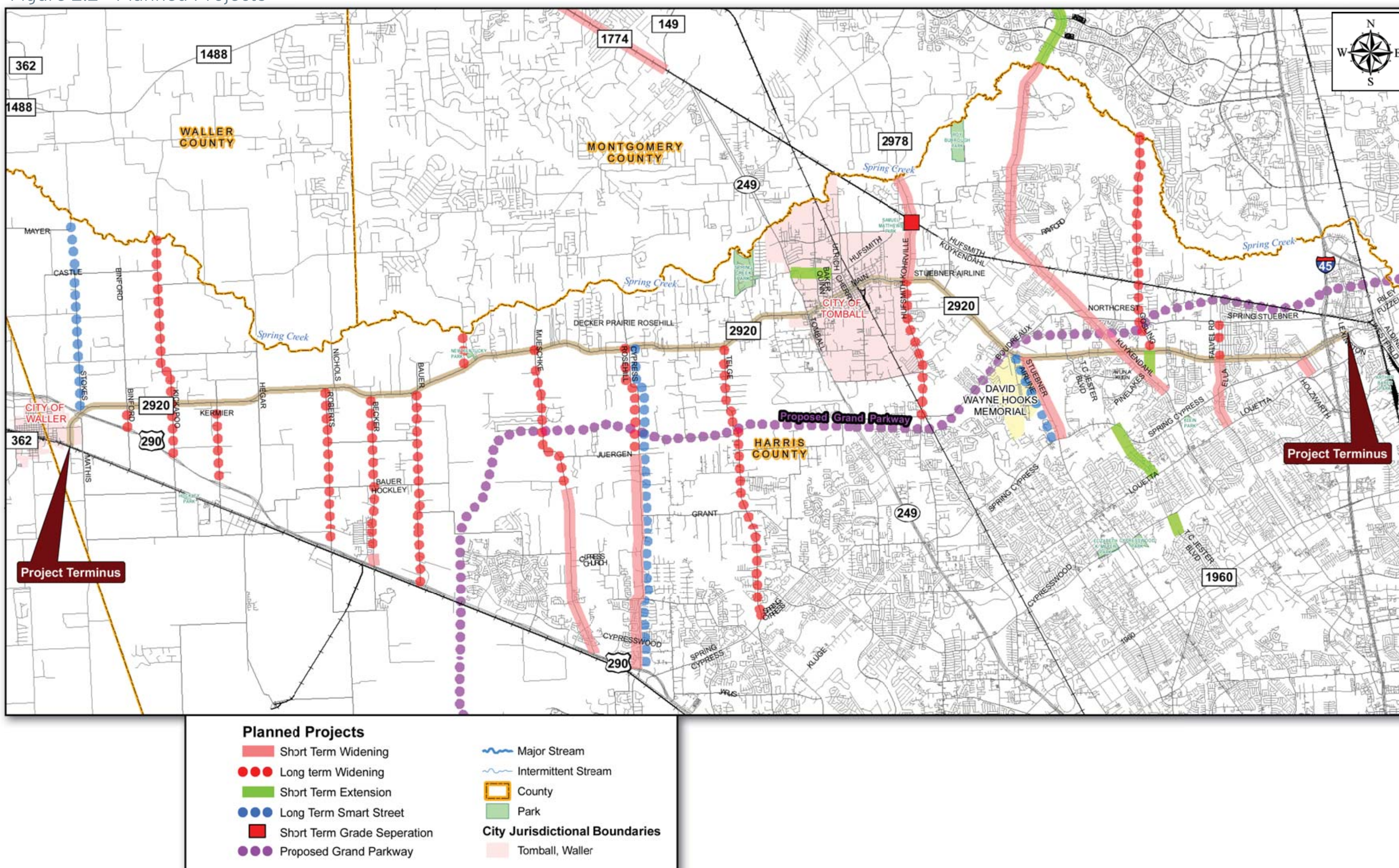
A comprehensive field study was performed to determine the roadway characteristics along the corridor (Appendix B).

Figure 2.1B - Land Use Map

PLANNED PROJECTS IN THE AREA

The planned projects in the area surrounding the FM 2920 Corridor are shown in Figure 2.2 below. The most significant planned project is the Grand Parkway, which is proposed as a toll facility. Between Boudreaux and Interstate 45(N), the Grand Parkway parallels FM 2920 to the north, which will help relieve some of the congestion along FM 2920 in this section. Most of the other planned projects are on north-south roadways. The projects shown in the exhibit below are categorized by type and schedule (as short or long-range). The projects are listed on the H-GAC 2035 Regional Transportation Plan (RTP), TxDOT unified transportation plan and from the Harris County Planning Department.

Figure 2.2 - Planned Projects



EXISTING TYPICAL SECTIONS AND RIGHT OF WAY (ROW)

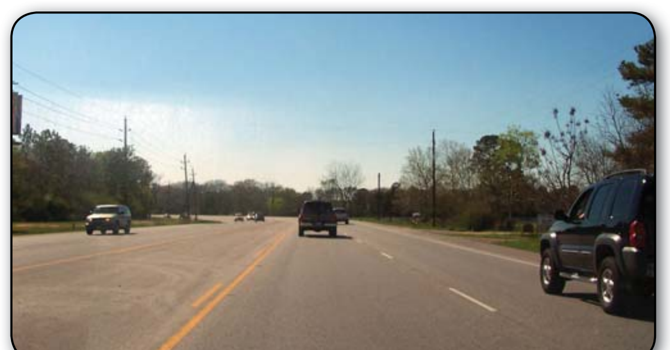
The typical roadway section for FM 2920 varies by pavement width, pavement type, and ROW width throughout the corridor. The typical section details are as follows:

SECTION 1
HEMPSTEAD ROAD TO CYPRESS ROSE HILL ROAD

- Two 12-foot Driving Lanes with Two 4-foot Shoulders
- 100 foot ROW Width
- Open Ditch Drainage

SECTION 2
CYPRESS ROSE HILL ROAD TO SH 249

- Four 12-foot Driving Lanes, One 14-foot Center Left Turn Lane, with 8-foot Shoulders
- 120-foot ROW Width
- Open Ditch / Curb & Gutter Drainage



SECTION 3
SH 249 TO PINE STREET

- Four 12-foot Driving Lanes, One 16-foot Center Left Turn Lane with No Shoulders
- Varies 60-foot to 100-foot ROW Width
- Curb & Gutter Drainage

SECTION 4
PINE STREET TO ELM STREET

- Four 12-foot Driving Lanes with Parallel On-Street Parking
- 100-foot ROW Width
- Curb & Gutter Drainage

SECTION 5
ELM STREET TO WILLOW STREET

- Four 12-foot Driving Lanes with No Shoulders
- 60-foot ROW Width
- Curb & Gutter Drainage

SECTION 6
WILLOW STREET TO INTERSTATE 45N

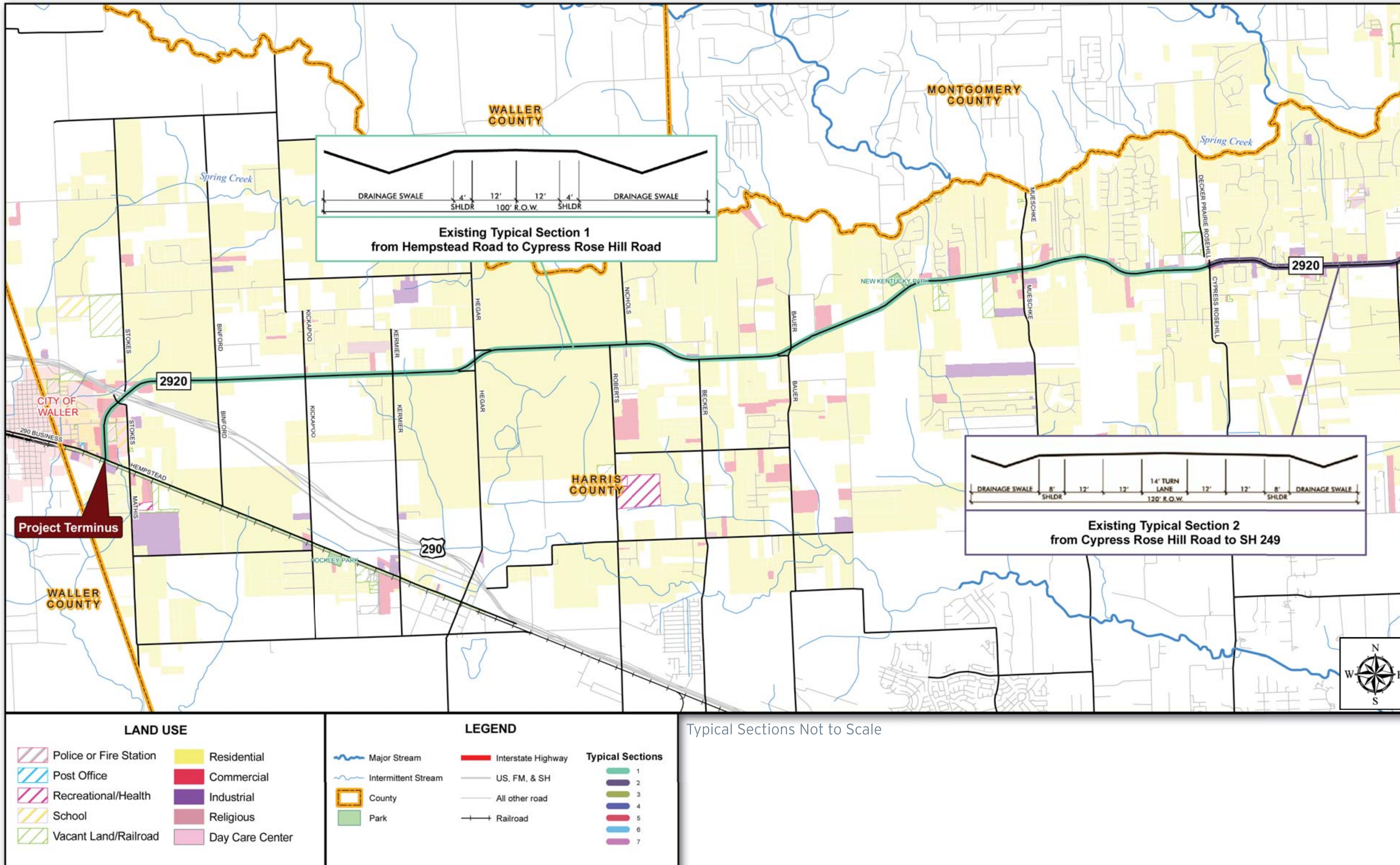
- Four 12-foot Driving Lanes, One 14-foot Center Left Turn Lane with 8-foot Shoulders
- 120-foot ROW Width
- Open Ditch Drainage

SECTION 7
INTERSTATE 45N TO LEXINGTON ROAD

- Four 12-foot Driving Lanes with No Shoulders
- Varies 80-foot to 120-foot ROW Width
- Open Ditch Drainage

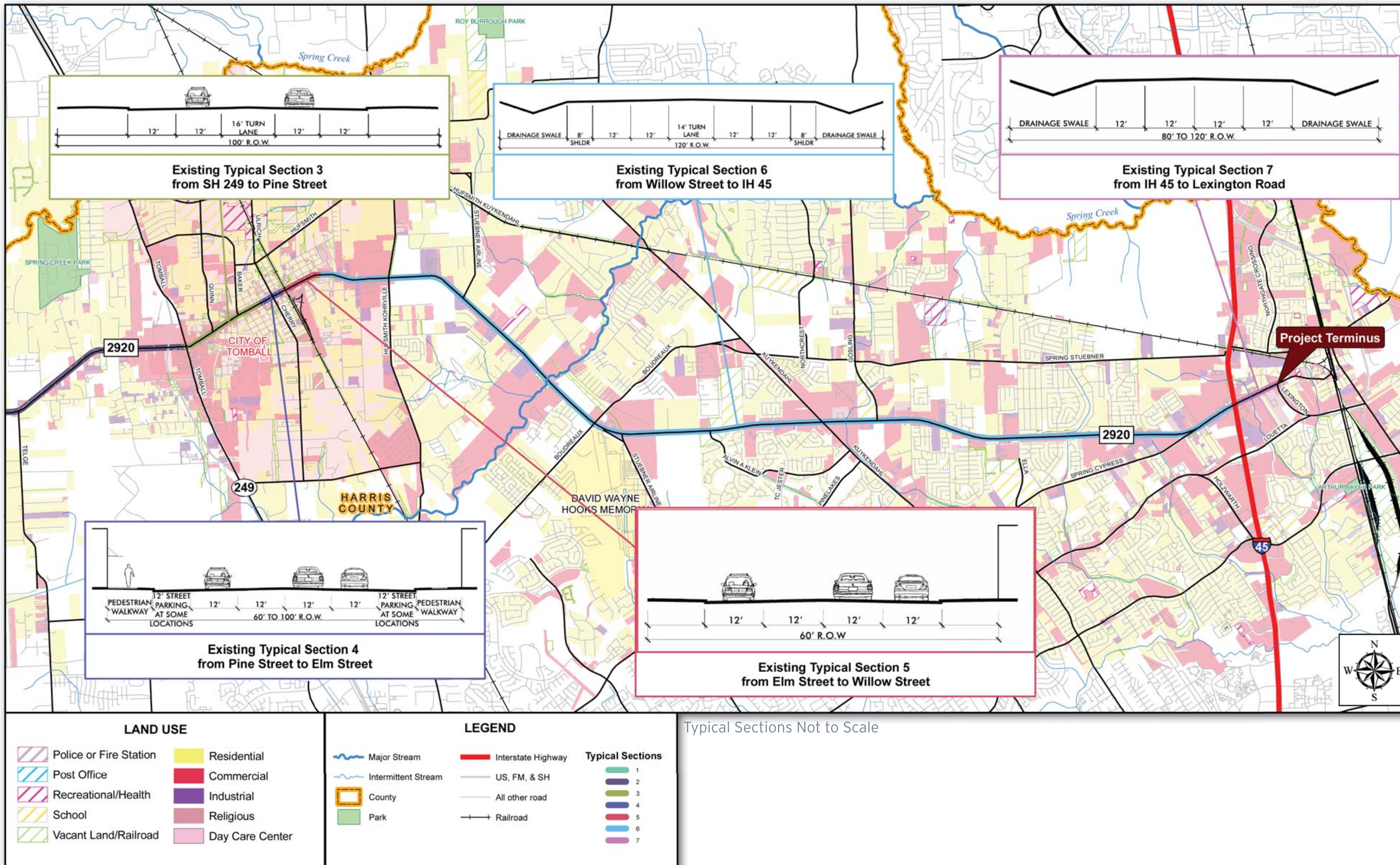
EXISTING TYPICAL SECTIONS AND ROW

Figure 2.3A - Existing Typical Sections



Typical Sections Not to Scale

Figure 2.3B - Existing Typical Sections



Typical Sections Not to Scale

DRIVEWAYS AND ACCESS

A comprehensive field investigation was conducted and aerial maps were reviewed along the entire length of the corridor, to identify the location of existing driveways along FM 2920. The study concluded that there are approximately 698 driveways within the study area, with 60% of those being located east of SH 249. Based on the roadway sections in Figure 2.5, driveway densities along the corridor vary from 11 to 57 driveways per mile.

Figure 2.4 -Driveway Density Chart

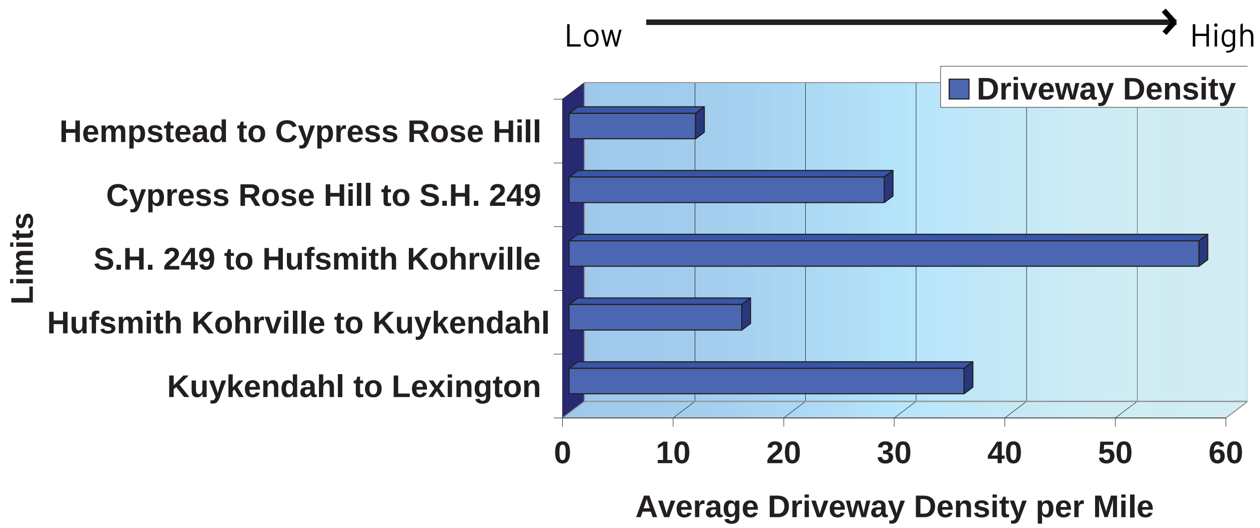


Figure 2.5 -Driveway Density

#	Segment	Distance (Miles)	Driveways EB	Driveways WB	Driveways Total	Driveway Density (Driveways/Mile)
1	Lexington Road to IH 45	0.56	16	22	38	68
2	IH 45 to Springwest Drive	0.64	19	16	35	55
3	Springwest Drive to Meadowhill Drive	1.39	20	21	41	29
4	Meadowhill Drive to Falvel Road	0.43	3	1	4	9
5	Falvel Road to Bridgestone Lane	0.57	14	8	22	39
6	Bridgestone Lane to Rhodes Road	0.71	8	9	17	24
7	Rhodes Road to Gosling Road	0.38	7	9	16	42
8	Gosling Road to Kuykendahl Road	0.61	8	8	16	26
	Lexington To Kuykendahl	**5.29**	**95**	**94**	**189**	**36**
9	Kuykendahl Road to T.C. Jester Boulevard	0.55	12	6	18	33
10	T.C. Jester Boulevard to Alvin A Klein Drive	0.7	2	5	7	10
11	Alvin A Klein Drive to Stuebner Airline Road	1.01	1	3	4	4
12	Stuebner Airline Road to Boudreaux Road	0.34	5	7	12	35
13	Boudreaux Road to Dowdell Road	0.67	0	1	1	1
14	Dowdell Road to Stuebner Airline Road North	1.39	14	16	30	22
15	Stuebner Airline Road North to Hufsmith Kohrville Rd.	0.91	4	11	15	16
	Kuykendahl Road to Hufsmith Kohrville	**5.57**	**38**	**49**	**87**	**16**
16	Hufsmith Kohrville Road to N Willow Street	0.81	11	18	29	36
17	N Willow Street to N Cherry Street	0.57	12	20	32	56
18	N Cherry Street to N Pine Street	0.14	1	1	2	14
19	N Pine Street to Baker Drive	0.33	16	18	34	103
20	Baker Drive to Holderrieth Blvd.	0.09	1	4	5	56
21	Holderrieth Blvd to Quinn Road/Ella Street	0.23	8	10	18	78
22	Quinn Road/Ella Street to Joe B St/ Buvinghausen St.	0.13	5	4	9	69
23	Joe B St/ Buvinghausen St to Tomball Parkway/ SH 249	0.21	4	10	14	67
	Hufsmith Kohrville to SH 249	**2.51**	**58**	**85**	**143**	**57**
24	Tomball Parkway/SH 249 to Tom Calvert Road	0.76	16	14	30	39
25	Tom Calvert Road to Park Road	0.51	9	8	17	33
26	Park Road to Telge Road	0.84	9	18	27	32
27	Telge Road to Lutheran Church Road	0.34	2	3	5	15
28	Lutheran Church Road to Cypress Rose Hill Road	1.83	23	20	43	23
	SH 249 to Cypress Rose Hill	**4.28**	**59**	**63**	**122**	**29**
29	Cypress Rose Hill Road to Sanders Cemetery RD/Mueschke Rd	2.22	28	30	58	26
30	Sanders Cemetery Road to US 290	10.67	32	51	83	8
31	US 290 to Old Waller Tomball Road	0.42	6	1	7	17
32	Old Waller Tomball Road to Hempstead Road	0.42	3	6	9	21
	Cypress Rose Hill to Hempstead Road	**13.73**	**69**	**88**	**157**	**11**
Total	**Lexington to Hempstead Road**	**31.38**	**319**	**379**	**698**	**22**

RAILROADS

There is one railroad crossing along the corridor. The crossing is in Tomball, east of Elm Street, and belongs to BNSF Houston Subdivision rail line (DOT crossing ID 597102T). Currently, there are approximately 10-15 train crossings daily with a maximum speed of 40 MPH. According to a recent Houston area freight rail study by TxDOT, a benefit / cost ratio analysis was conducted which did not recommend to grade separate the railroad crossing.

PEDESTRIAN AND BICYCLE INFRASTRUCTURE

FM 2920 is a designated bike route between US 290 and IH 45. It is identified also as a bike route in the Houston-Galveston Regional Bikeway Plan. (1)

DEFINITION OF A BICYCLE ROUTE SYSTEM

A system of bikeways designated by the jurisdiction having the authority with appropriate directional and informational route markers, with or without specific bicycle route numbers. Bike routes should establish a continuous routing, but may be a combination of any and all types of bikeways.
Source: American Association of State Highway Transportation Officials (AASHTO)

There are only a few signs along FM 2920 indicating its bike route designation along the shoulder.

The existing typical section between IH 45N and Willow Street in Tomball provides 8-foot shoulders, which are acceptable for bike use.

Between Willow Street and SH249, there are sections of FM 2920 with limited right of way (60 feet) or curb and gutter sections with a high density of driveways, neither of which are favorable for safe bike usage. Through the old downtown Tomball area, the parallel parking creates an added challenge to bike users. As for the section of FM 2920 between US 290 and Cypress Rose Hill, the existing typical section includes 4-foot shoulders which are not adequate for bike use.

As for pedestrian accommodations along FM 2920, they are limited to the section through the city of Tomball and the old downtown area in Tomball, where there is a curb and gutter section. The lack of continuous sidewalks outside the Tomball area is due to the nature of the rural typical section with shoulders and open ditches for drainage. No significant pedestrian traffic was observed outside the Tomball area. A traffic signal inventory identifying intersections with crosswalks and pedestrian signals is included in Appendix E.

(1) H-GAC 2035 Regional Bikeway Plan, September 2007

SIGNAGE

The roadway signage along FM 2920 provides suitable information and warnings to roadway users, but its ability to attract drivers attention is minimized by the volume of commercial signs along the corridor, particularly east of SH 249. Advanced signage is in place throughout most of the corridor; however, there are several locations where signs are placed too close to intersections and do not offer much advanced warning. There are no existing signs displaying block numbers, which have proven to aid roadway users in decision making. Upon review of the latest crash data, it was observed that most of the crashes that occurred within the study area were caused by failure to control speed, which could indicate a lack of sufficient advanced warning signage or devices.

TRAFFIC CHARACTERISTICS

CRASH DATA ANALYSIS

The latest available crash data for the study corridor was obtained from the Texas Department of Transportation (TxDOT) and Houston-Galveston Area Council (H-GAC). Though TxDOT provided crash data for the three-year period from 2004 through 2006, the department indicated that the data was preliminary and has not been certified. H-GAC provided crash data for the three-year period from 1999 – 2001. Crash data also was obtained from the city of Tomball (2004-2006) for the portion of FM 2920 within Tomball city limits and from the Harris County Sheriff's Office (2006) for the western and eastern portions of the study area. Summaries of reported crashes from all sources are provided in Appendix C.

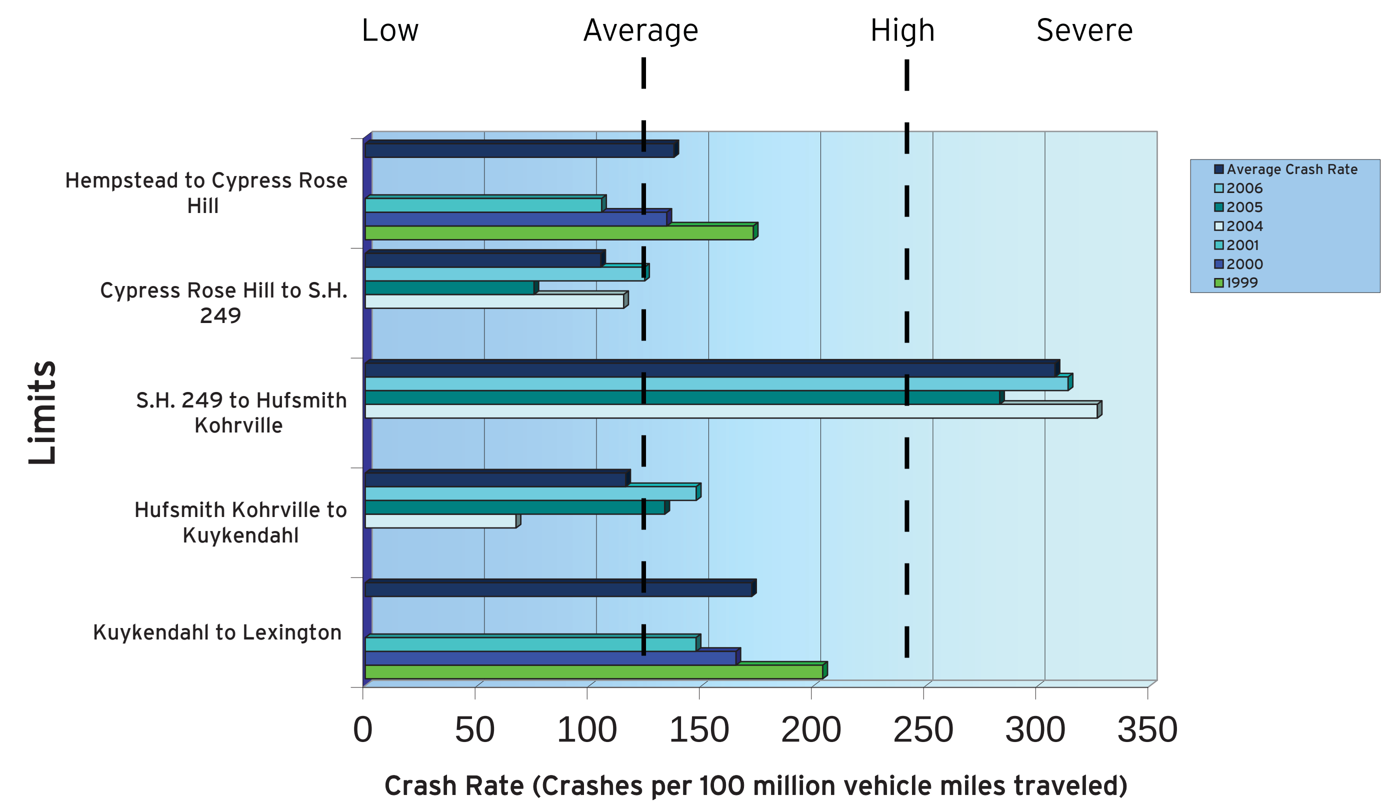
Based on the H-GAC data, the FM 2920 study corridor had crash rates higher than the statewide average of 125.7 crashes per 100 million vehicle miles traveled (MVMT) for the period 1999-2001. The section of FM 2920 within the city of Tomball had a crash rate of 266 crashes per 100 MVMT, which is more than double the statewide average. A section of roadway generally is considered to have a crash problem when the crash rate is more than double the statewide average.

Based on the 2004-2006 crash data provided by TxDOT on March 5th, 2008, sections of FM 2920 from Tomball Parkway to Cypress Rose Hill and from Huffsmith-Kohrville to Kuykendahl had crash rates higher than the statewide average of 125.7 for the year 2001. The section of FM 2920 within the Tomball city limits had a crash rate of 415 crashes per 100 MVMT, which is more than double the statewide average and indicative of a crash problem.

At the time TxDOT provided crash data for this project, statewide crash data was still being entered into their information system and as such, statewide average data for the 2004-2006 period were not available. Crash rates for this period were therefore compared to the most recent statewide crash rate available (2001).

Year 2004-2006 crash data for the study area was obtained from the city of Tomball in August 2007. Based on this data, crash rates were computed and compared to the statewide average crash rate from 2001 (the latest available year). This data showed that the portion of FM 2920 from Cypress Rose Hill Road to SH 249 had a crash rate less than the statewide average rate, while the section from SH 249 to Hufsmith Kohrville Road had just under twice the statewide average rate of crashes (Figure 2.6).

Figure 2.6 -Summary of FM 2920 Study Area Crash Rates from Various Sources.

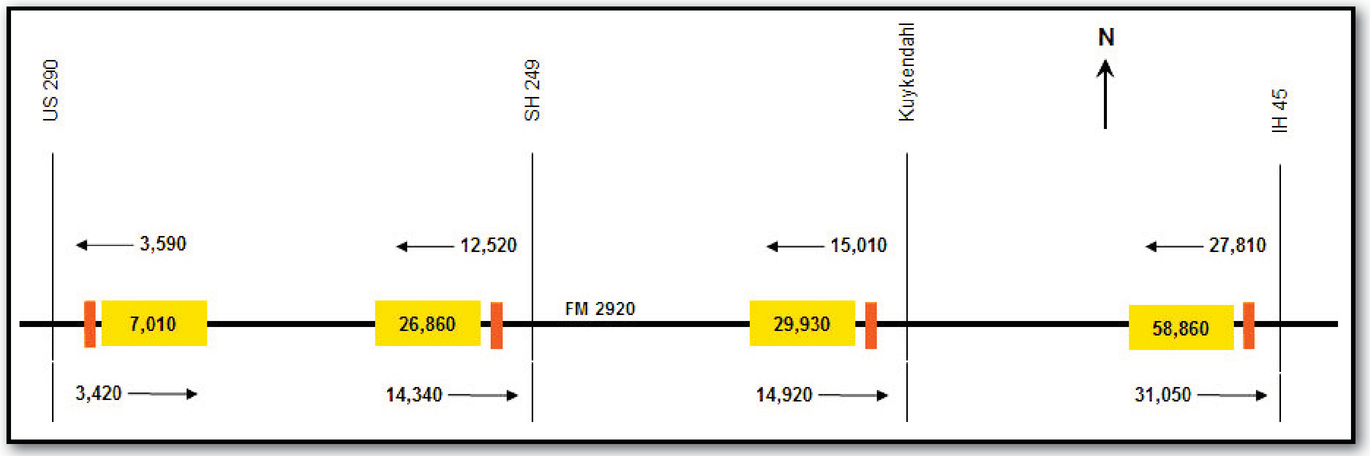


Average crash rates from data obtained from H-GAC, Harris County Sheriff's office, and the city of Tomball, are included in Appendix D. The appendix also includes computations of crash rates and more detailed analysis (e.g., intersection versus non-intersection related crashes, etc.).

DAILY TRAFFIC VOLUMES

Twenty-four hour traffic volume counts were conducted at four locations along the FM 2920 corridor for both directions of travel. These counts were conducted simultaneously, e.g., the same 24-hour period at all locations in September 2007. Figure 2.7 identifies the locations of the 24-hour traffic counts and summarizes the volume of traffic recorded at each. Details of these traffic counts are provided in Appendix D.

Figure 2.7 - Existing Average Daily Traffic Volume with Directional Distribution.

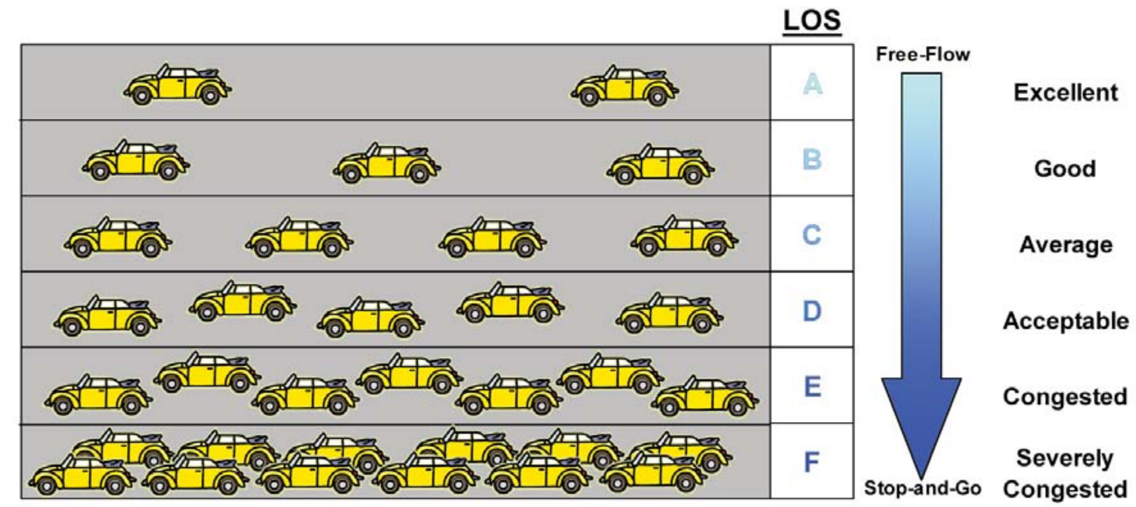


As shown in Figure 2.7, traffic volumes along FM 2920 range from 7,000 vehicles per day (VPD) at the western end of the study area near US 290 to 58,900 VPD at the eastern end near IH 45. Directional distribution over the 24-hour period is approximately 50% each direction, eastbound and westbound, along the FM 2920 study corridor.

MEASURES OF EFFECTIVENESS – LEVEL OF SERVICE (LOS)

Level of Service (LOS) is a qualitative measure of traffic operations on a roadway. LOS provides a performance index of traffic flow in terms of travel time, maneuverability, interruptions, congestion, convenience, and safety. LOS are given six letter designations from A through F, with LOS A representing the best operating conditions (light traffic with minimal delay) and LOS F representing the worst (very heavy traffic with long delays). In urban areas, LOS D is generally considered to be the limit of acceptable traffic operating conditions. These LOS classifications are illustrated in Figure 2.8.

Figure 2.8 - Level of Service (LOS) Illustration.



VOLUME-CAPACITY RATIOS AND CORRIDOR LOS

The ratio of traffic volume to available capacity (v/c ratio) is a measure of how well a section of roadway accommodates traffic volumes based on geometric design and operational features. The relationship between 24-hour v/c ratios and LOS is summarized in Table 2.1.

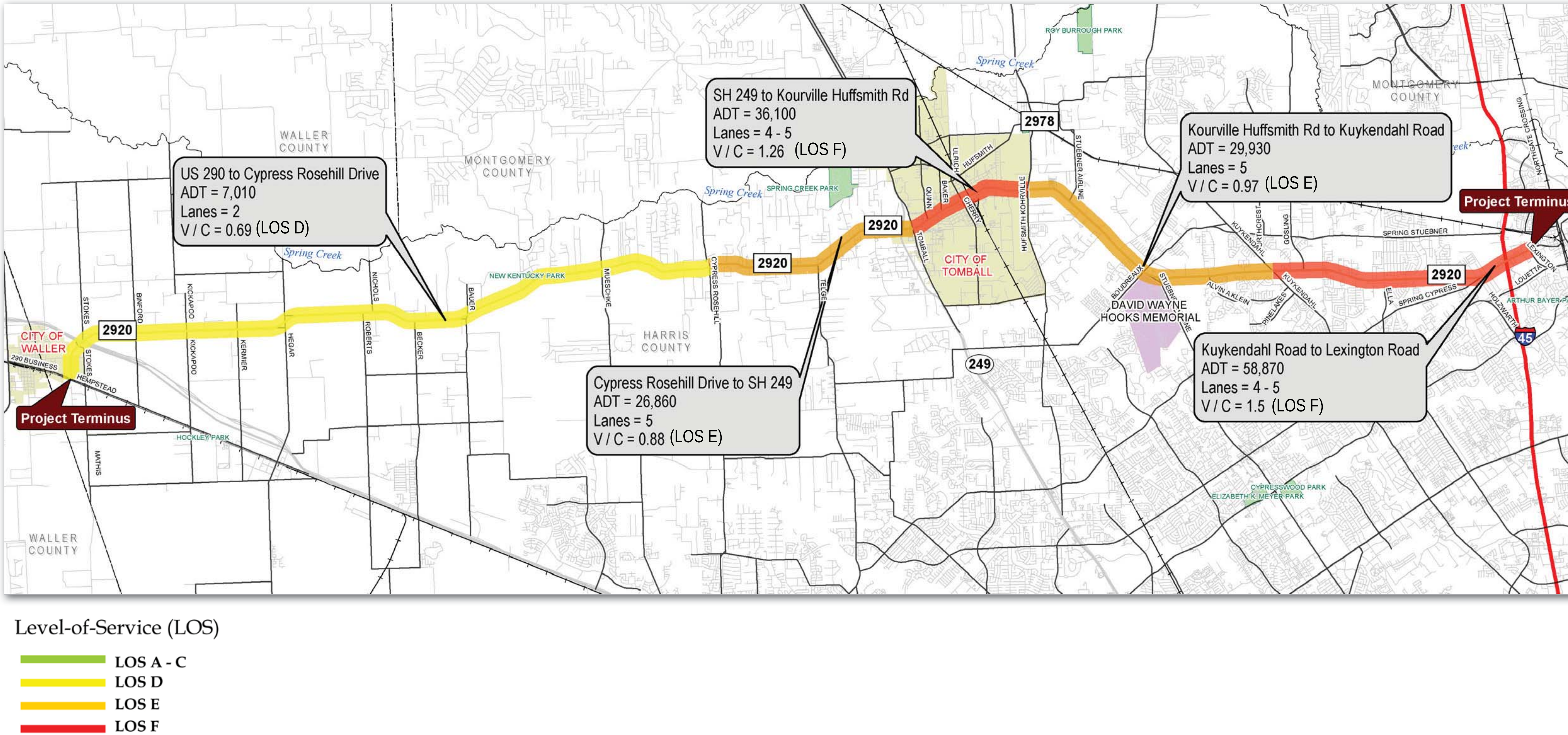
Existing 24-hour data collected, was compared with roadway capacity for various sections of FM 2920 to compute v/c ratios and determine LOS. The results are summarized in Figure 2.9.

Table 2.1 - 24-Hour V/C Ratios Related to LOS

LOS	Maximum Volume-to-Capacity Ratio
A	0.30
B	0.47
C	0.65
D	0.80
E	1.00
F	> 1.00

As shown in Figure 2.9, the western section of FM 2920 between US 290 and Cypress Rose Hill Drive currently operates at LOS D, which is considered acceptable in an urban area. The daily traffic volume on this section is approximately 7,000 VPD and this section of FM 2920 is a two-lane facility.

Figure 2.9 -Existing v/c Ratios and Corridor LOS in the Study Corridor



The section between Cypress Rose Hill Drive and SH 249 has an estimated 26,900 VPD with an unacceptable LOS E. This section of FM 2920 is a four-lane facility with a two-way center left-turn lane.

Within the city of Tomball, from SH 249 to Hufsmith Kohrville Road, the daily traffic volumes are 36,100 VPD with a failing LOS F. The roadway cross-section varies from four to five lanes. East of the city of Tomball, between Hufsmith Kohrville and Kuykendahl Road, traffic volumes are an estimated 29,900 VPD and traffic operates at an unacceptable LOS E. This section of FM 2920 is a four-lane facility with a two-way center left-turn lane. The easternmost section of the FM 2920 study corridor between Kuykendahl Road and Lexington Road currently operates at a failing LOS F with traffic volumes estimated at 58,900 VPD. The roadway cross-section varies from four to five lanes.

Overall, a little more than a third of the FM 2920 study corridor is operating at an acceptable LOS (the western portion of the corridor). The section between the city of Tomball and Interstate 45 is experiencing unacceptable LOS between E and F. Improvements are needed along the FM 2920 study corridor to improve mobility and safety.

TRAFFIC SIGNAL INVENTORY

To determine the improvements needed to the traffic signals and intersection geometry, a complete inventory of all signalized intersections was conducted. Field inventories were conducted to collect information including: signal type (mast arm or span wire), controller and cabinet type, detection type, communication system, pedestrian signals, crosswalks, illumination, number of lanes on each approach and other data. The traffic signal data is included in Appendix E.

TRAFFIC SIMULATION ANALYSIS

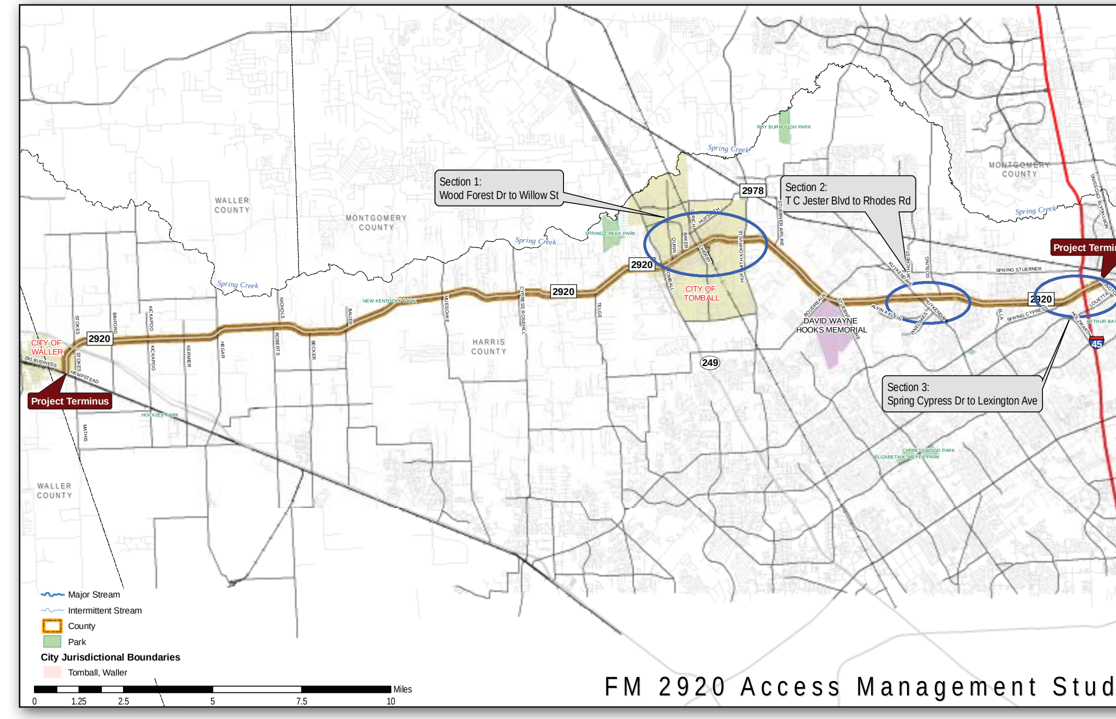
STUDY SECTIONS

For the purpose of conducting detailed traffic analyses, three separate study sections were selected. Each of these sections was modeled in VISSIM, a traffic Micro-simulation software tool. The models were utilized in conducting A.M. and P.M. peak hour analyses and corridor evaluation based on various Measures of Effectiveness (MOEs).

The three FM 2920 sections modeled are identified in Figure 2.10, their limits are as follows:

Section 1: FM 2920 from Wood Forest Drive to Willow Street.
Section 2: FM 2920 from TC Jester Boulevard to Rhodes Road.
Section 3: FM 2920 from Spring Cypress Drive to Lexington Avenue.

Figure 2.10 -FM 2920 Divided into Three Sections for Detailed Traffic Analysis



INTERSECTION TURNING MOVEMENT COUNTS

In addition to considering 24-hour traffic volumes along a particular roadway location, it is important to determine turning percentages during AM and PM peak hours. Peak hour turning movement counts were conducted for all signalized intersections within the three areas for which traffic operations were conducted. Turning movement counts also were conducted at major unsignalized intersections and driveways. These counts were conducted to facilitate the quantification of traffic volume re-routing due to potential improvement alternatives such as raised medians and driveway closures. Cumulatively, the turning movement counts provide a better understanding of traffic patterns along the FM 2920 study corridor. Details of turning movement count data are provided in Appendix D. All turning volume counts were conducted on a typical weekday in September and October 2007.

AVERAGE TRAVEL SPEED

Average travel speed provides a measure of the level of congestion along a corridor. Travel time runs were conducted along the FM 2920 study corridor during peak hours on a typical weekday in December 2007 using the average car method. Average travel speed for the three FM 2920 study sections are summarized in Appendix F.

Generally, average travel speeds were higher during the A.M. peak hour compared to the P.M. peak hour. Also, as would be expected, travel speed is higher in the non-peak direction. For example, in Section 3, travel speed was higher in the westbound direction during the A.M. peak hour and higher in the eastbound direction during the P.M. peak hour.

Details of the travel time data obtained from field survey and additional analysis of the data are presented in Appendix F.

INTERSECTION LOS

Intersection LOS relates to the average delay experienced by drivers as a result of traffic control, as summarized in Table 2.2. Signalized intersection analysis was conducted using the simulation modeling software VISSIM. The model details and procedures are described in the following sections. VISSIM simulation output includes average delays and turning volumes at each intersection over a time period. The A.M. and P.M. peak hour data by intersection are extracted from the model runs and post processed using Highway Capacity Manual methodologies to compute average control delay per vehicle. As shown in Table 2.2 , the relationship between LOS and average control delays were used to assign A.M. and P.M. peak hour LOS to every study intersection. Existing conditions A.M. and P.M. peak hour LOS analysis results are listed in Appendix F.

Table 2.2 - Intersection Level of Service (LOS) Criteria

LEVEL OF SERVICE	SIGNALIZED INTERSECTIONS	UNSIGNALIZED INTERSECTIONS	DESCRIPTION
(LOS)	AVERAGE CONTROL DELAY (SEC/VEH)	AVERAGE CONTROL DELAY (SEC/VEH)	
A	0 - 10	0 - 10	Very low vehicle delays, free traffic flow, signal progression extremely favorable, most vehicles arrive during given signal phase.
B	> 10 - 20	> 10 - 15	Good traffic flow, good signal progression, more vehicles stop and experience higher delays than for LOS A.
C	> 20 - 35	> 15 - 25	Stable traffic flow, fair signal progression, significant number of vehicles stop at signals.
D	>35 - 55	>25 - 35	Noticeable traffic congestion, longer delays and unfavorable signal progression, many vehicles stop at signals.
E	> 55 - 80	> 35 - 50	Unstable traffic flow, poor signal progression, significant congestion, traffic near roadway capacity, frequent traffic signal cycle failures.
F	> 80	> 50	Unacceptable delay, extremely unstable flow, heavy congestion, traffic exceeds roadway capacity, stop-and-go conditions.

Source: Highway Capacity Manual, Transportation Research Board, 2000

Under existing peak hour conditions, although many intersections were found to be operating at acceptable LOS, the following intersections were operating at a failing LOS:

1. FM 2920 and IH 45 (both A.M. and P.M. peak hours)
2. FM 2920 and Kuykendahl Road (both A.M. and P.M. peak hours)
3. FM 2920 and SH 249 (P.M. peak hour)

TRAFFIC SIMULATION ANALYSIS

Traffic simulation models were developed using VISSIM (version 4.30-05), a time step and behavior based simulation tool for analyzing microscopic traffic operations. Three separate models were built to represent each of the three study sections. For each study section, a separate model was built to represent the existing A.M. and P.M. peak hour volumes.

Aerial images were imported to VISSIM to code the existing roadway network, which included all signalized intersections as well as major unsignalized intersections and driveways. Other inputs for the VISSIM models included vehicle speed profiles, vehicle types/characteristics, traffic compositions, lane geometries, traffic volumes, routing decisions, and signal control timing.

Appendix F contains details of the various inputs, assumptions, and parameters considered for the development of the VISSIM models as well as details of model calibration, MOEs, and results of the analysis of short-range improvements. Figure 2.10 is a screen shot from the VISSIM simulation model.

Figure 2.10: VISSIM Model - Screen Capture from Existing PM Peak Simulation – Intersection of FM 2920 and IH 45

EXISTING POLICIES AND PRACTICES

Since FM 2920 is owned and maintained by TxDOT, properties abutting FM 2920 have to obtain a driveway permit in order to tie into the roadway or to revise any existing driveway utilizing the TxDOT 'Regulations for Access Driveways to State Highways'. Land use and platting approval, which controls the configuration and intensity of development along the corridor, are vetted with the county or the municipalities. The State, the county, and the municipalities do not necessarily have a coordinated approach to approve access and platting for proposed developments along the corridor.

TxDOT Access Management Manual, revised in June 2004, is the document used and referenced for issues related to access along FM 2920. The manual provides guidance for access location determination including procedures for TxDOT, City of Tomball, City of Waller, and Harris County to be granted permitting authority to the state highway system.

Chapter 3: Public Involvement

GOALS OF PUBLIC INVOLVEMENT
PUBLIC INVOLVEMENT PLAN
STEERING COMMITTEE
PUBLIC MEETINGS

GOALS OF PUBLIC INVOLVEMENT

To ensure a comprehensive public involvement program that addresses the unique aspects of the FM 2920 project, the study team adhered to four guiding principles:

1. Identify and involve all stakeholders in the study process
2. Be proactive
3. Bring diverse interests to the table
4. Build consensus

Using these four principles, the HNTB team established public involvement goals to guide the public involvement process and to ensure the activities had purpose. The public involvement goals for the FM 2920 Access Management Study are as follows:

1. Increase the level of awareness about the traffic issues and problems
2. Provide opportunities for businesses, residents and other constituencies with interest in the corridor to provide input into the study process
3. Provide a mechanism for relaying study findings and recommendations to the public
4. Provide a method for incorporating input into the recommendations

PUBLIC INVOLVEMENT PLAN

Public involvement is a fundamental part of any access management study. For the FM 2920 project, efforts were made to maximize participation. A contracting steering committee was formed, two series of public meetings were held (with meetings at two locations for each series to maximize attendance) and several stakeholder meetings were conducted. In addition, a website was developed under the address www.FM2920mobility.com to keep those interested abreast of current project progress. The study team participated in several small group presentations to update members of the North Houston Association, the Greater Tomball Area Chamber of Commerce, and the Downtown Tomball Association.

STEERING COMMITTEE

The Steering Committee was comprised of the Houston-Galveston Area Council, Texas Department of Transportation, City of Tomball, City of Waller, Harris County, Houston Northwest Chamber of Commerce and the Greater Tomball Area Chamber of Commerce. The purpose of the Steering Committee was to guide and direct the technical aspects of the study throughout the various stages of development.

PUBLIC MEETINGS

Two series of public meetings were held as part of the FM 2920 Access Management Study. The first series of meetings presented the goals and objectives of the study, the existing conditions, educational material on access management, and data collected along the corridor. Input from the public was solicited through a questionnaire to help guide the development of solutions and to better understand public perception regarding trouble spots along the corridor.

The second and final series of meetings were conducted to solicit public input on the proposed recommendations. Input from the public was solicited through a comment form to obtain feedback on the recommendations and assess the public's level of satisfaction with the study recommendations.

FIRST SERIES OF MEETINGS

SECOND SERIES OF MEETINGS

Two meetings were held for each series of meetings. The meetings were held at Krimmel Intermediate School and at Lone Star College to provide flexibility and encourage greater participation along the corridor. The table on the following page summarizes the meetings details:

Table 3.1 - Attendance Summary

	Date	Location	Number of Attendees	Number of Comments
First Series of Public Meetings	November 14, 2007	Lone Star College in Tomball	39	80
	November 15, 2007	Krimmel Intermediate School	40	
Second Series of Public Meetings	March 26, 2008	Krimmel Intermediate School	49	54
	March 27, 2008	Lone Star College in Tomball	25	

For both series of meetings, the questionnaires and comment forms were compiled and tabulated. A summary report was prepared and submitted to the Steering Committee, before being posted on the website. The summary report is included in Appendix H. For the second series of meetings a response document was included to summarize revisions to the proposed recommendations as a result of public input. Excerpts from both series of meetings are included below.

EXCERPTS FROM FIRST SERIES OF PUBLIC MEETINGS

The Public's top three priorities for the FM 2920 corridor:

1. Improve mobility
2. Improve public safety
3. Improve intersections

Figure 3.1 - Need Pedestrian / Bicycle Friendly Areas

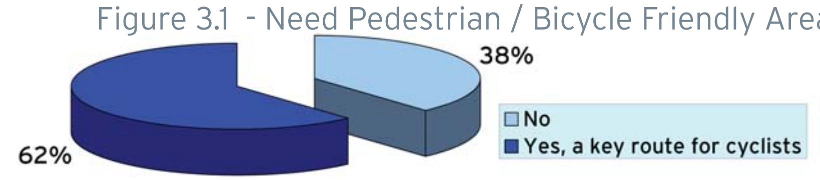
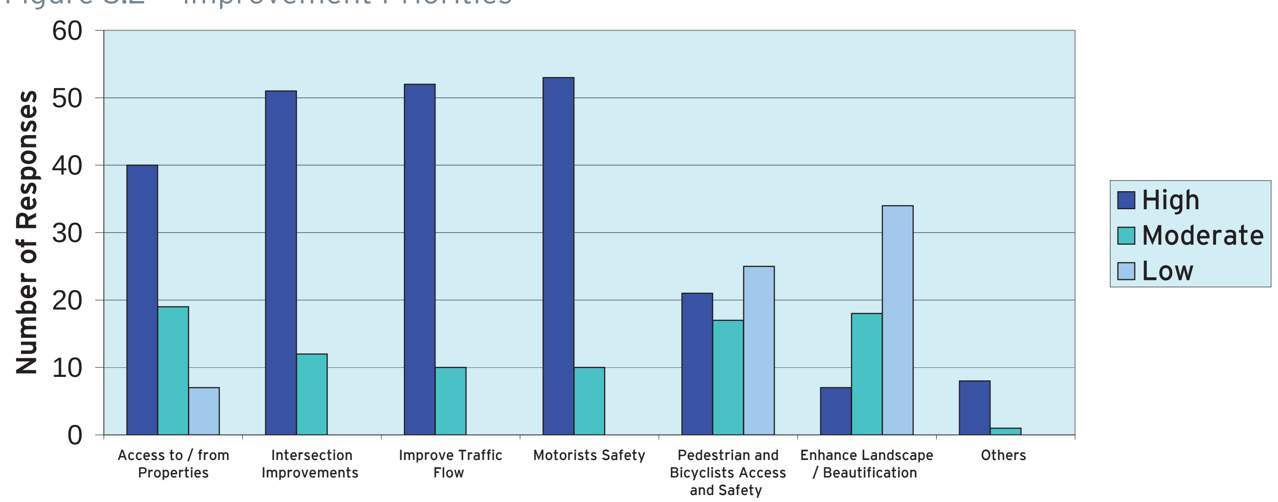


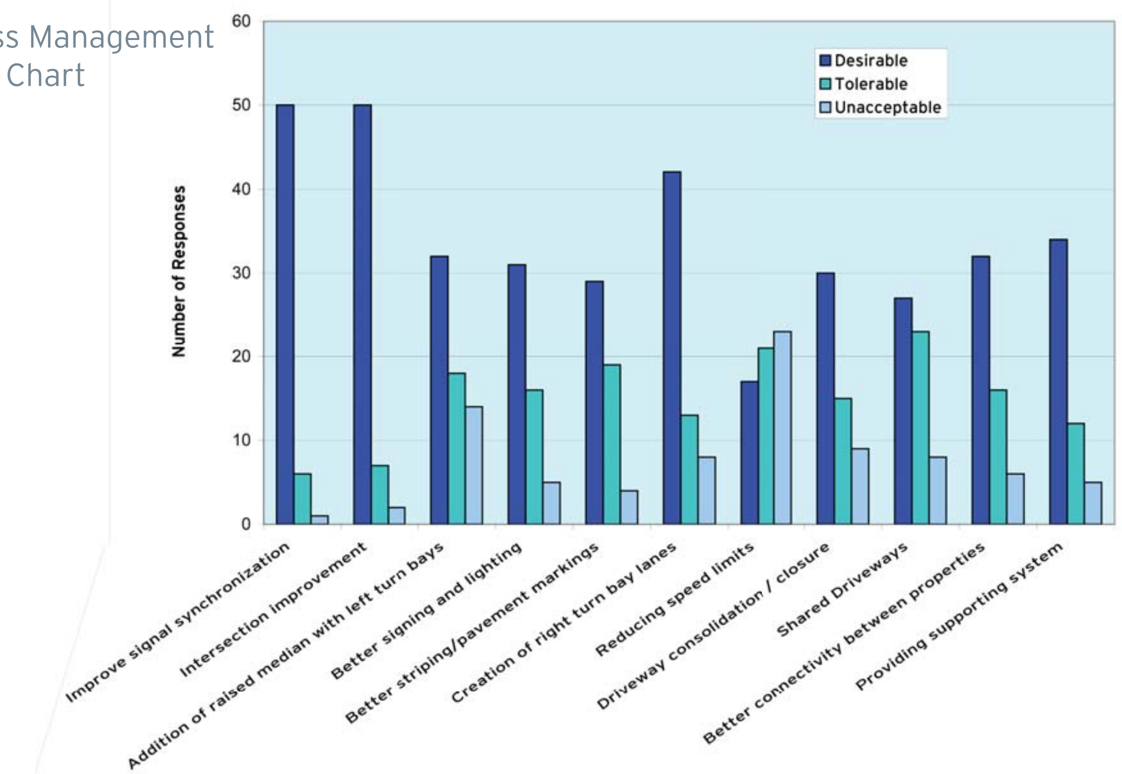
Figure 3.2 - Improvement Priorities



PRIORITIES OF ACCESS MANAGEMENT TOOLS

1. Signal synchronization – the majority of respondents supported better signal synchronization.
2. Intersection geometry – the majority of respondents supported improving intersections and adding left-turn and right-turn bay lanes at intersections.
3. Pedestrian / bicycle improvements – there is support for improvements to pedestrian / bicycle facilities.

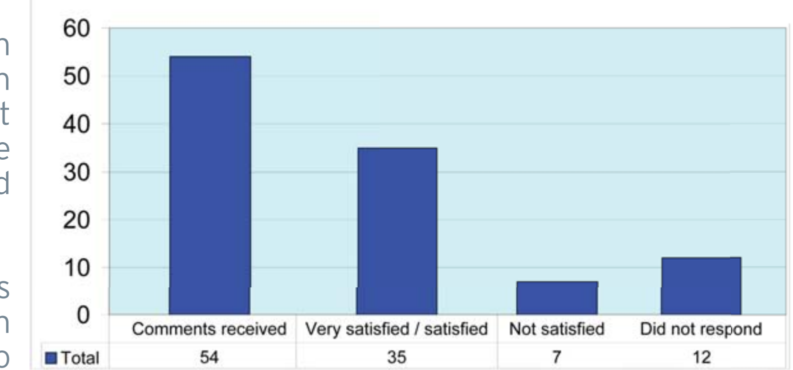
Figure 3.3 - Access Management Tools Chart



EXCERPTS FROM SECOND SERIES OF PUBLIC MEETINGS

The majority questionnaire respondents were satisfied with the recommendations.

Figure 3.4 - Level of Satisfaction with Study Recommendations



Concerns were raised in the downtown Tomball area regarding the elimination of on-street parking for the adjacent businesses and the ability to balance economic development with safety and mobility.

As a result of the public input, H-GAC has commissioned a separate Downtown Urban Design Plan study (Livable Centers) to develop urban design solutions for mobility, connectivity, access, community character, and quality of life concerns of the Downtown Tomball businesses. This Livable Centers study will support and complement the recommendations of the access management study; focusing on a masterplan for parking, streetscape, pedestrian linkages, and civic plaza open spaces. Additional design recommendations will include land use, architectural façade treatment, way-finding, utilities, and infill development, all focus on creating and reflecting a true "sense of place" and creating a destination area for downtown Tomball. Additional public involvement opportunities including an advisory committee and community visioning workshops will be provided for Downtown Tomball property owners and other interested parties. Participation from the public, as well as the city of Tomball, will be an essential component of the livable centers study.

Chapter 4: Recommended Improvements and Implementation Strategies

RECOMMENDATIONS
SIGNALIZED INTERSECTION IMPROVEMENTS
NON-SIGNALIZED INTERSECTION IMPROVEMENTS
ROADWAY IMPROVEMENTS
DOWNTOWN TOMBALL AREA IMPROVEMENTS
BICYCLE ROUTE IMPROVEMENTS
TRAFFIC MODEL WITH RECOMMENDED IMPROVEMENTS
IMPLEMENTATION CONSIDERATIONS FOR SHORT-TO MEDIUM-RANGE IMPROVEMENTS
IMPLEMENTATION CONSIDERATIONS FOR LONG-RANGE IMPROVEMENTS
IMPLEMENTATION AND COST SUMMARY
RECOMMENDED IMPROVEMENTS

RECOMMENDATIONS

Selection of the recommended improvements is a process that begins with evaluation of the existing conditions, public input, and traffic modeling of before and after conditions to ensure that the selected improvements meet the project goals of improving mobility and safety and can be implemented in a timely manner.

RECOMMENDED IMPROVEMENT PROCESS

- Evaluation of existing conditions
- Public input
- Determine list of improvements
- Evaluate before and after conditions
- Revise based on additional public input

Public input on trouble spots and improvement priorities from the first public meeting was reviewed and investigated before a preliminary recommendations set was developed. The existing traffic model that was developed and calibrated was then updated with the preliminary set of improvement recommendations to evaluate their benefits. Based on public input received, as well as input from the steering committee, and other small group meetings, some of the improvements were modified, which resulted in the final set of recommendations included in this chapter.

The recommended improvements were classified into one of three phases for implementation – short, medium, and long-range. Generally, improvements that are contained within the existing right-of-way and can be constructed easily are recommended for short-range implementation. Improvements that involve more extensive engineering, require acquisition of right of way or require coordination and investment by others are recommended for medium, or long-range implementation. While cost is certainly a factor for programming of the improvements by each agency, the phasing was recommended primarily based on the need or urgency for the improvement. Funding may not be available for implementation of all the short-range improvements at one time and additional prioritization may be necessary.

The FM 2920 corridor is generally the responsibility of TxDOT. Most of the cross streets fall under Harris County's jurisdiction is with the exception of streets in the cities of Waller and Tomball.

The improvements recommended for the FM 2920 corridor are listed in five categories below. Locations for specific improvements are shown on the aerial layout sheets. Certain improvements are general recommendations for implementation along the entire corridor and may not be shown on the aerial layouts.

RECOMMENDED IMPROVEMENT CATEGORIES

- Signalized intersection improvements
- Non-signalized intersection improvements
- Roadway improvements
- Tomball downtown area improvements
- Bicycle route improvements

SIGNALIZED INTERSECTION IMPROVEMENTS

TRAFFIC SIGNALS

- Update traffic signal controllers with capabilities for appropriate vehicle detectors to improve efficiency of signal timing
- Connect signals with fiber optic cable to facilitate signal synchronization and provide for vehicle progression through multiple signals without stopping
- Add back plates to signal heads
- Add dedicated left turn signal heads for new left turn lanes
- Convert any older small signal heads to 12-inch signal heads
- Add advance warning signs at high crash intersections
- Add pedestrian crosswalks and crossing signals where appropriate

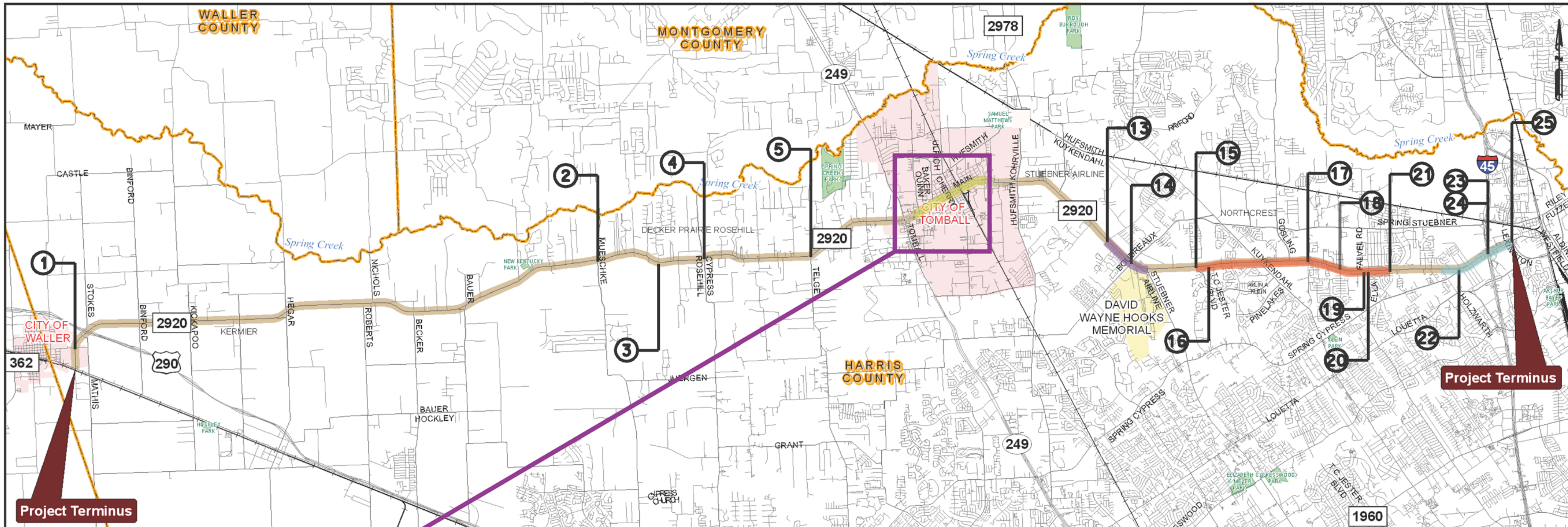
The specific traffic signal improvements recommended at each location are shown on Figure 4.1, with additional detail provided in the Traffic Signal Cost Detail Table in Appendix G. Note that additional pedestrian facilities for schools were not included as they are required when new schools are constructed.

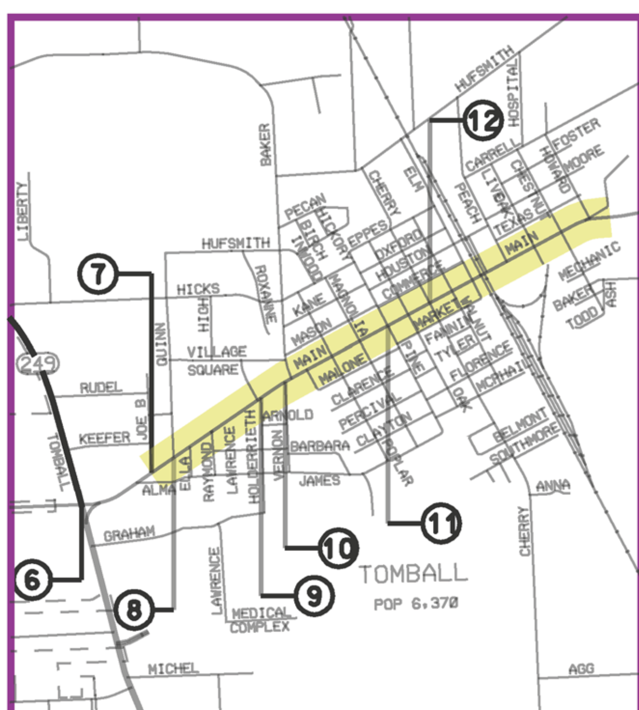
INTERSECTION GEOMETRY

- Add left or right turn lanes to FM 2920 and/or cross street*
- Close or relocate driveways near intersections to improve traffic operations
- Add raised medians to eliminate conflicts with high volume turning movements
- Increase turning radii to reduce delays caused by turning vehicles

* Turn lanes - although recommended, a more detailed study will be required to address right of way, utility, and other impacts and to identify when the turn lanes should be implemented.

Figure 4.1 - Traffic Signal Improvements





Street No.	Street Name	Upgrade Controller	Reconstruct Signal	Back Plates	Add Detection	Add Left Turn Lane Head	Pedestrian Improvements
1	Waller Tomball Road	●			●	●	
2	Sanders Cemetry Road/Mueschke Road		●				
3	Rosewood Trail		●				
4	Cypress Rose Hill Road		●				
5	Telge Road	●		●			
6	SH 249 Old	●		●			
7	Joe B Street/ Buvinghausen Street		●				
8	Quinn Road/ Ella Street	●			●		
9	Holderrieth Boulevard	●		●	●	●	
10	Vernon Avenue		●			●	●
11	Pine Street		●			●	●
12	Cherry Street	●	●	●	●	●	●
13	Dowdell Road				●		

Table title: FM 2920 Recommended Traffic Signal Improvements

Street No.	Street Name	Upgrade Controller	Reconstruct Signal	Back Plates	Add Detection	Add Left Turn Lane Head	Pedestrian Improvements
14	Boudreaux Road			●		●	
15	Alvin A Klien Boulevard	●				●	
16	Krimmel School New Intersection						●
17	Rhodes Road					●	
18	Bridgestone Lane	●		●			
19	Fire Station # 75	●	●	●			
20	Falvel Road/Ella Boulevard					●	
21	Meadow Hill Drive	●		●			
22	Springwest Drive	●		●			
23	IH 45 Southbound Frontage Road	●		●			
24	IH 45 Northbound Frontage Road	●		●			
25	Lexington Road	●		●	●		●

Table title: FM 2920 Recommended Traffic Signal Improvements (cont'd)

Synchronization Subsystems

Subsystem	Limits
D	Joe B Street/ Buvinghausen Street to Concordian/N. Willow Street
C	Dowdell Road to Stuebner Airline Road - East
B	Alvin A Klien Boulevard to Meadow Hill Drive
A	Hanover Woods Drive to Lexington Road

NON-SIGNALIZED INTERSECTION IMPROVEMENTS

- Conduct traffic signal warrant studies as needed due to development and changes in traffic volumes and patterns
- Add left or right turn lanes to FM 2920 and/or cross street
- Close or relocate driveways near intersections to improve traffic operations
- Addition of advance warning signs at high crash intersections

ROADWAY IMPROVEMENTS

- Provide 8-foot shoulders along FM 2920 where the right of way is 100 to 120-feet wide
- Add a continuous two way left turn lane (TWLTL) on the 2-lane roadway section
- Realign cross streets to eliminate offset intersections
- Add pavement markings for left turn lanes, pedestrian crosswalks, bike route, school zones, and rail road crossings
- Improve safety control measures at railroad crossings and add longitudinal channelizers
- Install rumble strips across traffic lanes in advance of high accident locations
- Install warning signs in advance of sharp roadway curves
- Install depressed shoulder texturing adjacent to the outside lane edge and textured centerline striping for the 2-lane roadway to help keep vehicles within the travel lane and off the shoulders
- Add block numbering on street signs at intersections
- Recommend speed study for the corridor and revision of the speed limits as necessary

Some advance signing and rumble strip improvements along the corridor are shown on Figure 4.2.

Figure 4.2 - Signing and Rumble Strips

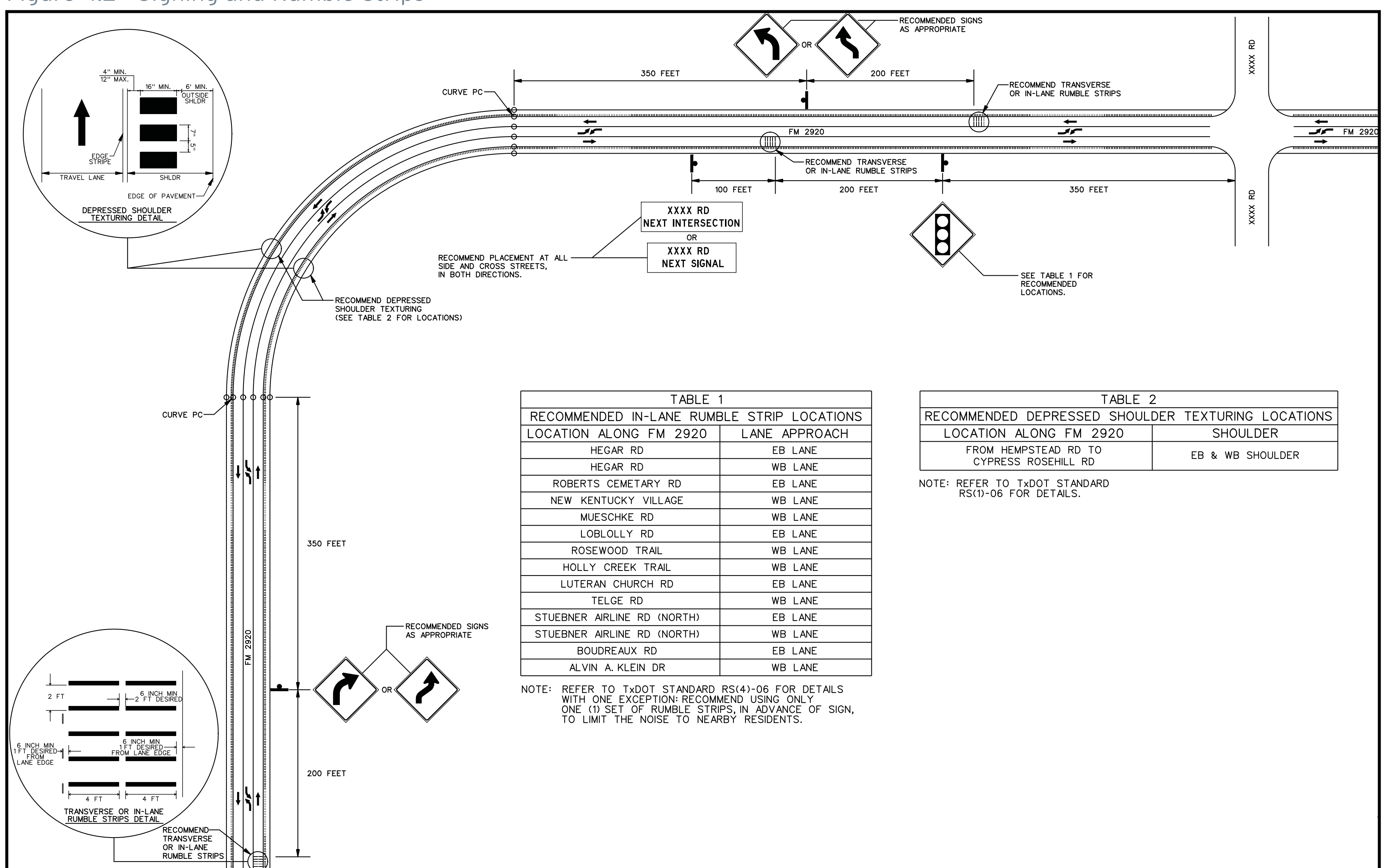


TABLE 1 RECOMMENDED IN-LANE RUMBLE STRIP LOCATIONS	
LOCATION ALONG FM 2920	LANE APPROACH
HEGAR RD	EB LANE
HEGAR RD	WB LANE
ROBERTS CEMETARY RD	EB LANE
NEW KENTUCKY VILLAGE	WB LANE
MUESCHKE RD	WB LANE
LOBLOLLY RD	EB LANE
ROSEWOOD TRAIL	WB LANE
HOLLY CREEK TRAIL	WB LANE
LUTERAN CHURCH RD	EB LANE
TELGE RD	WB LANE
STUEBNER AIRLINE RD (NORTH)	EB LANE
STUEBNER AIRLINE RD (NORTH)	WB LANE
BOUDREAUX RD	EB LANE
ALVIN A. KLEIN DR	WB LANE

NOTE: REFER TO TxDOT STANDARD RS(4)-06 FOR DETAILS WITH ONE EXCEPTION: RECOMMEND USING ONLY ONE (1) SET OF RUMBLE STRIPS, IN ADVANCE OF SIGN, TO LIMIT THE NOISE TO NEARBY RESIDENTS.

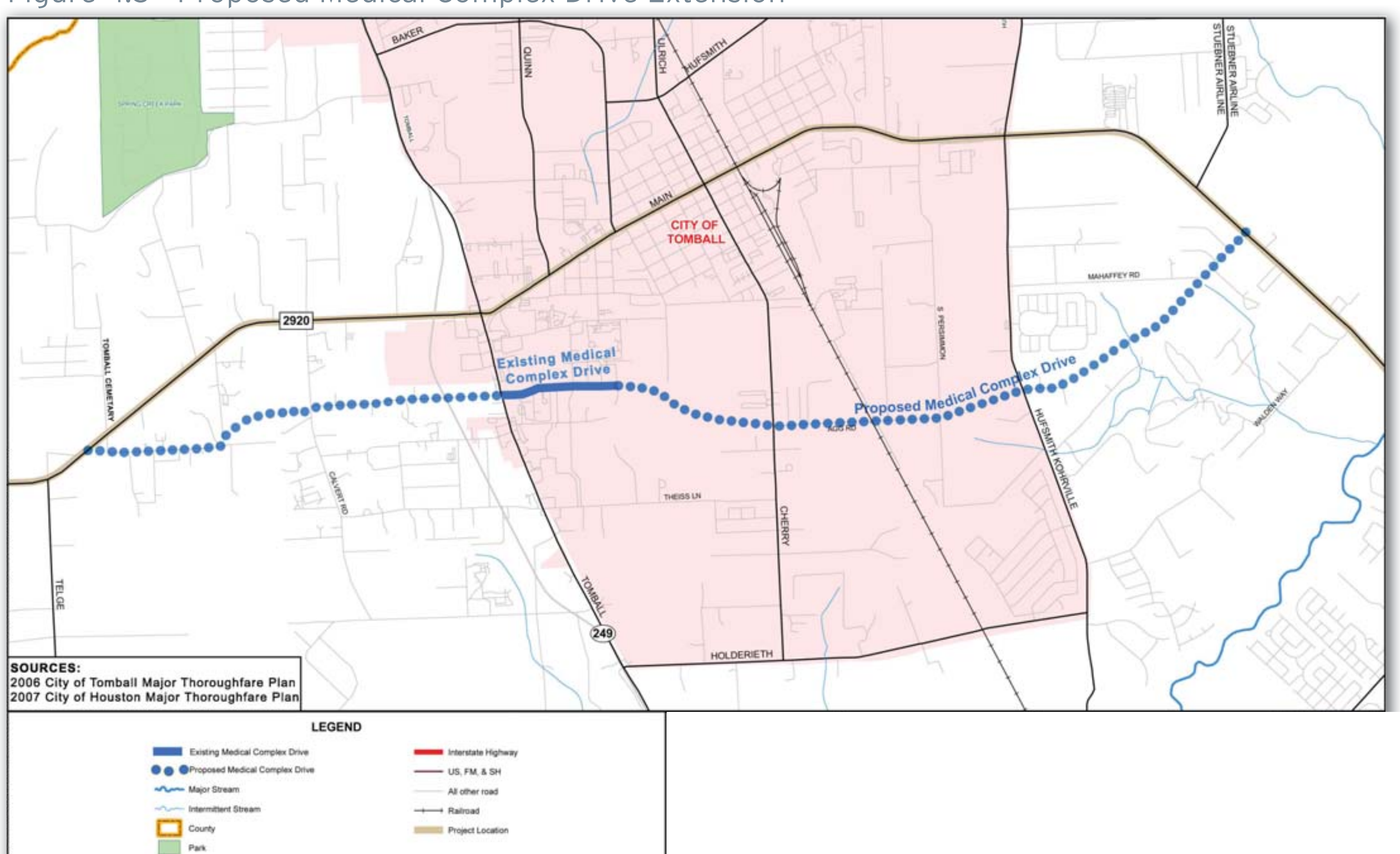
TABLE 2 RECOMMENDED DEPRESSED SHOULDER TEXTURING LOCATIONS	
LOCATION ALONG FM 2920	SHOULDER
FROM HEMPSTEAD RD TO CYPRESS ROSEHILL RD	EB & WB SHOULDER

NOTE: REFER TO TxDOT STANDARD RS(1)-06 FOR DETAILS.

DOWNTOWN TOMBALL AREA IMPROVEMENTS

- Remove FM 2920 on-street parking and provide off-street parking lots on adjacent streets with adequate signage along FM 2920
- Add a wayfinding map for businesses in the downtown area at kiosks in the off-street parking lots
- Introduce a raised median along FM 2920 with pedestrian refuge
- Provide channelized left turn lanes at select locations
- Consolidate driveways
- Widen and improve sidewalks (ADA requirements may be necessary)
- Provide an alternate bike route off FM 2920 through Tomball
- Update and synchronize traffic signals
- Improve street signing and provide block numbering
- Realign cross streets to eliminate offset intersections
- Add innovative pavement markings for railroad and pedestrian crossings
- Improve parallel east-west facilities, including extending Medical Complex both east and west to provide connections to FM 2920 along with a grade separation at SH 249 and the railroad track, see Figure 4.3

Figure 4.3 - Proposed Medical Complex Drive Extension



It should be noted that a separate Livable Centers study (Tomball Downtown Urban Design Plan) is being developed to evaluate the Downtown Tomball area in more detail. This study will include extensive public involvement opportunities through interactive workshops to help develop consensus on a plan for the downtown area. The goal of the Downtown Urban Design Plan is to create recommendations and implementation strategies for urban planning initiatives focusing in the following categories:

1. Parking Masterplan for on and off-street public parking to create development, access, and pedestrian connectivity.
2. Pedestrian Linkage and Streetscape Masterplan to develop pedestrian and streetscape facilities that work cohesively with development access and loading, parking and street circulation access, and public open space connectivity.
3. Depot Site Open Space / Plaza Masterplan for civic depot open space / plaza as a community focal point, providing overall downtown connectivity and to cultural, residential, and commercial uses.

Additional urban design guideline and framework recommendations also will include the following:

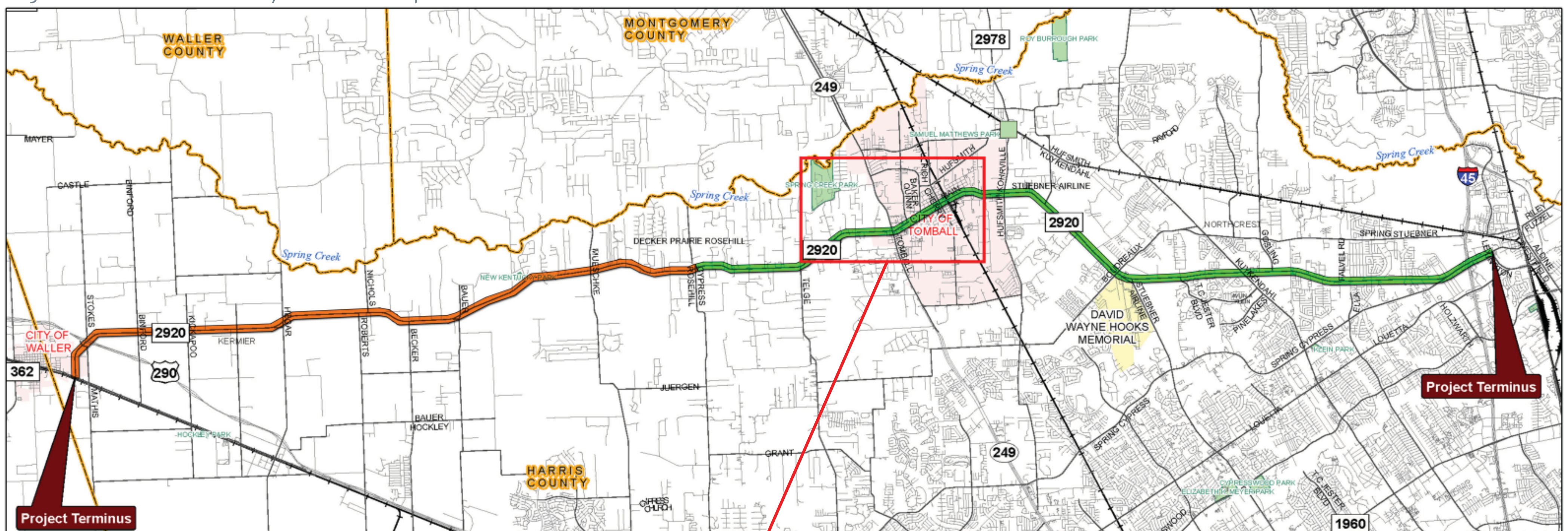
- Wayfinding signage design location
- Utility infrastructure analysis and design
- Architectural façade, form, character, and recommendations
- Identified infill development
- Context for downtown land use adjacency and transitionary use
- Landscape design for street median and edge plantings, landscape buffering, and screening

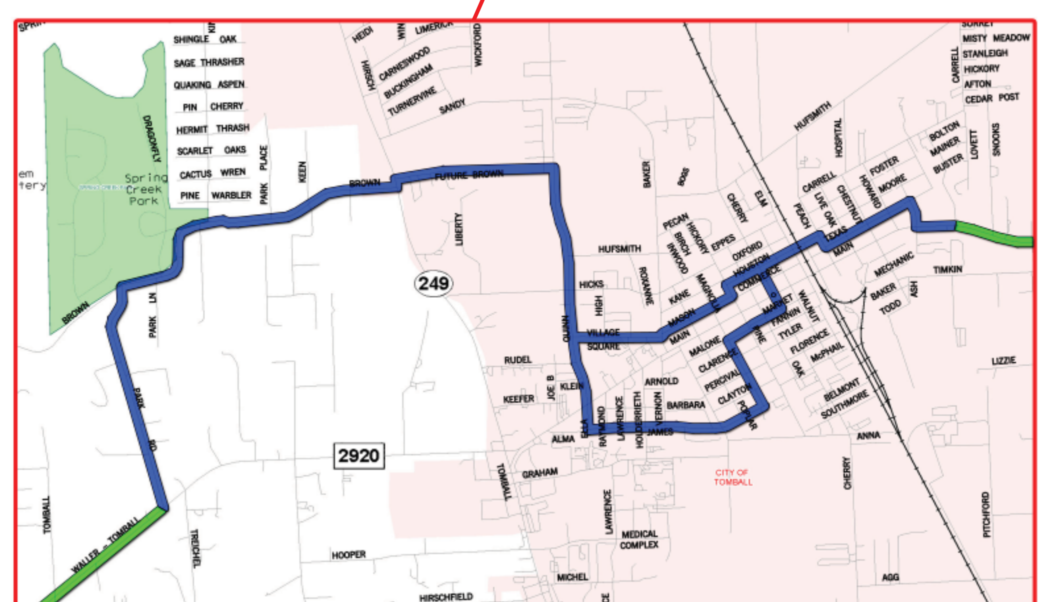
BICYCLE ROUTE IMPROVEMENTS

FM 2920 is a designated bike route for the entire project length. Currently, FM 2920 has an existing 8-foot shoulder from west of SH 249 to IH 45N with the exception of the section through the city of Tomball. Figure 4.4 shows a recommended bicycle route modification to allow for a continuous facility along the corridor with some detours through the city of Tomball due to restrictive right of way in this section of FM 2920 and the high density of driveways and intersections.

The bicycle route modification also creates more opportunity for connectivity between community and neighborhood assets back to the central spine of the designated FM 2920 bicycle route, further creating greater connectivity opportunities along its adjacent communities. The Livable Centers study for downtown Tomball will integrate these recommendations in the urban design plan.

Figure 4.4 - FM 2920 Bicycle Route improvements





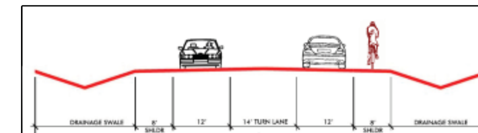
LEGEND

- Existing Bike Route
- Recommended Improvements to Bike Route: Add 8 ft Shoulders on FM 2920
- Recommended Improvements to Bike Route: Street Improvements to be Determined by the City of Tomball

Note:

Bicycle Route System - A system of bikeways designated by the jurisdiction having authority with appropriate directional and informational route markers, with or without specific route numbers. Bike routes should establish a continuous routing, but may be a combination of any and all types of bikeways.

For all roadways where bicycle travel is permitted, planning and design should consider provisions for bicycling



FM 2920 RECOMMENDED TYPICAL SECTION

TRAFFIC MODEL WITH RECOMMENDED IMPROVEMENTS

As discussed previously, the recommended improvements were added to the existing traffic model to analyze the impact of the benefits. The results for two key measures of effectiveness, travel time and average delay, are summarized in Figures 4.5 thru 4.8. For additional details, refer to the appendix F.

TRAVEL TIME

Is the average travel time, in seconds, for vehicles to traverse the section modeled, under the given roadway geometric, traffic volume, and traffic control conditions

Figure 4.5 - Travel Time (Minutes) - A.M. Traffic

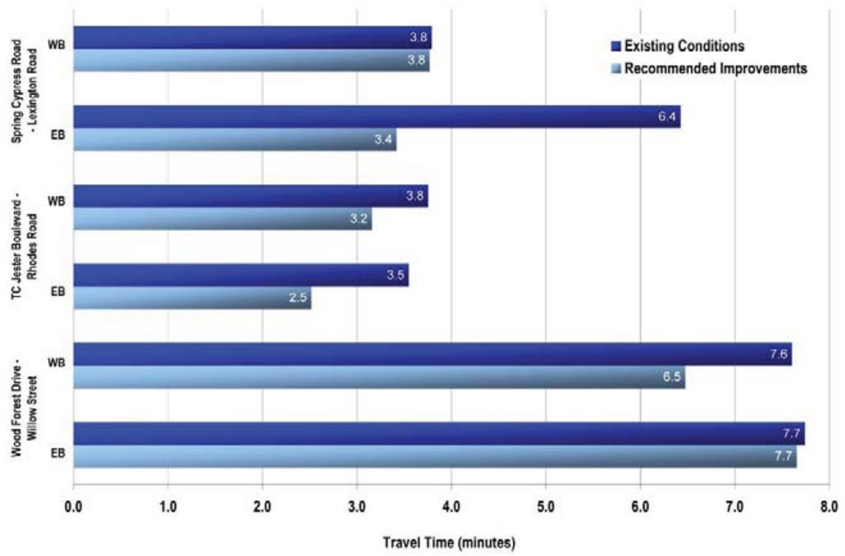
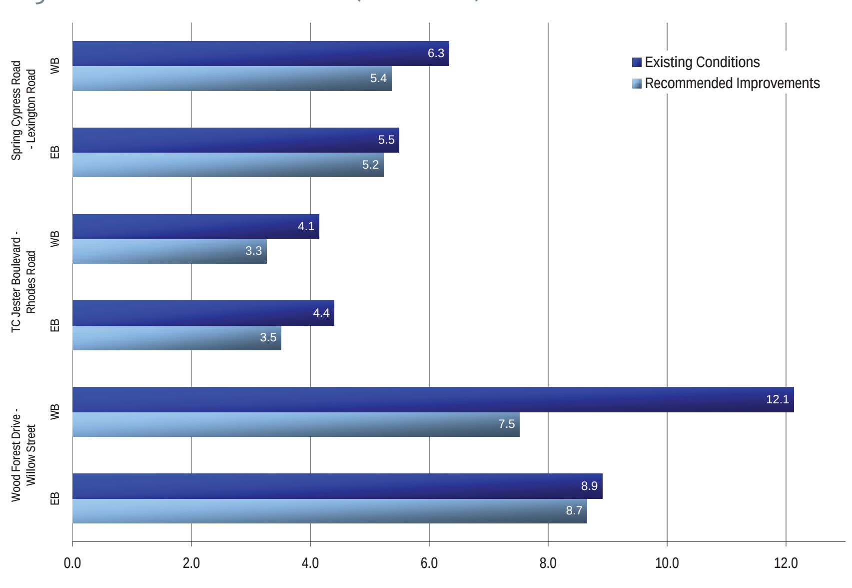


Figure 4.6 - Travel Time (Minutes) - P.M. Traffic



AVERAGE DELAY

Is the difference in seconds between ideal travel time for the section and the actual travel time under the given roadway geometric, traffic volume, and traffic control conditions

Figure 4.7 - Average Delay Per Vehicle (Seconds) - A.M. Traffic

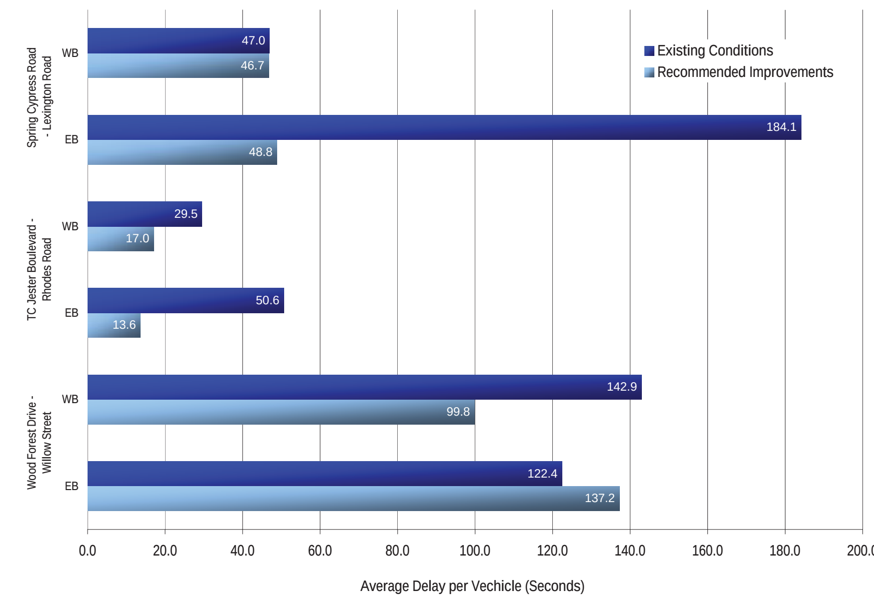
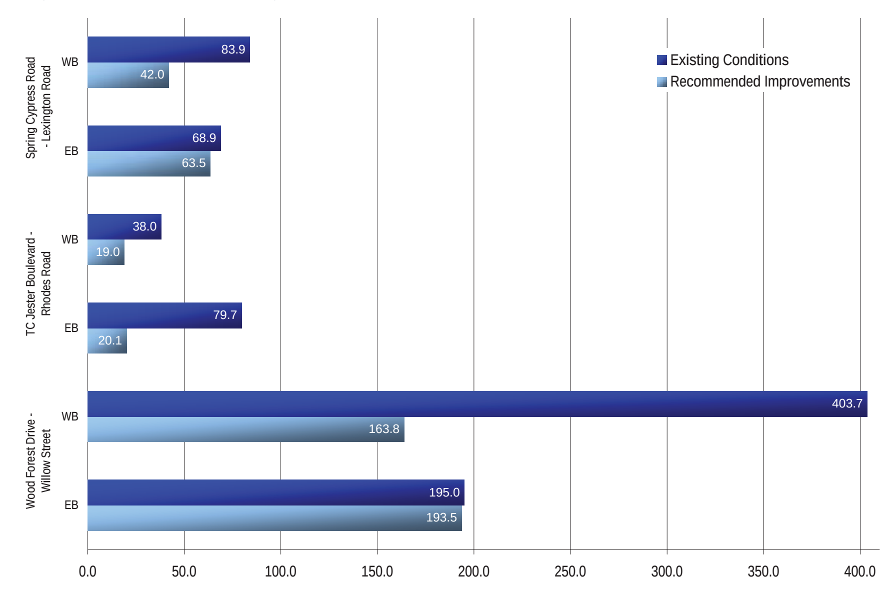


Figure 4.8 - Average Delay Per Vehicle (Seconds) - P.M. Traffic



TRAFFIC MODEL WITH RECOMMENDED IMPROVEMENTS (CONT.)

TRAVEL TIME SAVINGS

Travel time is an integral component of transportation cost, and therefore an assessment of potential savings in travel time is useful in the evaluation of transportation improvements. The value of travel time includes costs to consumers of personal (unpaid) time spent on travel, and costs to businesses of paid employee time spent in travel. In order to estimate potential travel time savings for transportation improvements, a monetary value is placed on the amount of time saved.

According to Texas Transportation Institute (2005) the value of time based on congestion is $14.60 per person-hour for autos and $77.10 per person-hour for trucks. Using the Consumer Price Index (CPI) to adjust for inflation and assuming an average vehicle occupancy of 1.2 persons, the value of time per auto is equivalent to $18.57 per hour (2007$). The equivalent 2007$ value for trucks is $81.73. Based on traffic simulation models developed for selected sections of the FM 2920 corridor, the recommended improvements would result in approximately 36.1 hours in vehicle hours traveled (VHT) savings during the weekday AM peak hour and 32.3 hours in VHT savings during the weekday PM peak hour. Projected VHT savings for the entire study limits of the FM 2920 corridor are approximately 213 hours for the AM peak hour and 192.5 hours for the PM peak hour. Assuming 260 weekdays a year, the annual peak hour travel time savings due to the recommended improvements are estimated at approximately $1.38 million for the AM peak hour and $1.25 million for the PM peak hour.

CRASH COST SAVINGS

Crash costs refer to the economic value of damages or losses caused by collisions. Crash savings are calculated based on average crash rates, which vary by class and type of facility. Subsequently, divided and undivided roadway facilities have different crash rates. According to the NCHRP publication "Impacts of Access Management Techniques" suburban facilities with raised medians have 16% lower crash rates than roadways with continuous left turn lanes. According to the TRB Access Management Manual, the addition of a two-way left-turn lane to an undivided roadway facility is projected to result in a 35 % reduction in crashes. To illustrate the impact of reducing crashes the monetary costs per crash type (fatal, serious injury, other injury and property damage) were used, as reported by the National Safety Council, shown in Table 4.1. Using these monetary values, the three year FM 2920 crash history for 2004 – 2006, and the estimated 16% reduction in crashes due to the presence of raised medians and 35 % reduction due to addition of two way left turn lane, the average annual crash savings resulting from the FM 2920 corridor improvements were estimated at $12.51 million.

Table 4.1 - Crash Cost by Severity

Crash Type	Cost
Death	$4,120,000
Incapacitating injury	$207,133
Non-incapacitating evident injury	$51,912
Possible injury	$25,132
No injury	$2,266

Source: Estimating the Costs of Unintentional Injuries, National Safety Council, 2006, adjusted to 2007 Dollars

AIR QUALITY

Air Pollution Costs refers to motor vehicle air pollutant (called mobile emissions) damages, including human health, ecological and esthetic degradation. The term "emissions" generally refers to gases and particles introduced into the air. The United States Environmental Protection Agency (EPA) describes air pollution as the contamination of air by the discharge of harmful substances, which include Volatile Organic Compounds (VOC), carbon monoxide (CO) and nitrogen oxides (NOx). The concentration of these air pollutants is related to traffic congestion. Lower speeds associated with traffic congestion tend to result in higher levels of pollutants. The recommended improvements from FM 2920 are designed to improve safety and reduce delay along the corridor. The reduction in congestion as a result of implementing these recommendations is projected to result in an eleven percent reduction in VOC, CO, and NOx levels.

ACCESS MANAGEMENT BENEFITS ON FM 2920

- Annual Travel Time Savings $2.6 million
- Annual Crash Cost Savings $12.5 million

IMPLEMENTATION CONSIDERATIONS FOR SHORT AND MEDIUM-RANGE IMPROVEMENTS

This study recommends adding 8-foot shoulders and a continuous two way left turn lane to the 2-lane section from US 290 to Cypress Rosehill Road. The additional lane will improve safety for left turning vehicles onto signalized and unsignalized side streets and driveways while the wider shoulder will improve safety for bicyclists along this section of FM 2920.

Based on safety and cost considerations, the TWLTL and shoulder additions at intersections and the addition of rumble grooves along the centerline are recommended for short-range implementation, while the TWLTL and shoulder additions between intersections are recommended for medium-range implementation. With implementation tied closely to funding availability, there is a possibility that implementation of the medium-range improvements may be delayed. Since future conditions and development patterns along the corridor may vary from the assumptions and projections used at this time, this study recommends the re-evaluation of the medium-range improvements prior to implementation to determine whether it is more beneficial to widen to a four-lane section with raised median or a five-lane section, versus the currently recommended three-lane section. Safety should also be considered in the future re-evaluation. While the buffer between opposing lanes provided by a TWLTL is safer than an undivided two-lane facility, as traffic and development increase over time, safety decreases, creating the need to limit conflict points with a raised median.

IMPLEMENTATION CONSIDERATIONS FOR LONG-RANGE IMPROVEMENTS

Due to the narrow right of way along FM 2920 through downtown Tomball, it is recommended that a parallel roadway be developed to relieve FM 2920 in this segment. Although not directly within the FM 2920 corridor, this study supports the Major Thoroughfare Plans for the cities of Tomball and Houston to extend Medical Complex both east and west to FM 2920 (figure 4.3). This will significantly improve local traffic circulation especially within the city of Tomball and should alleviate congestion along FM 2920 providing an alternate parallel route.

FM 2920 is a designated bike route; however, the restricted width through segments of FM 2920 in Tomball presents a significant safety issue for bicyclists. It is recommended to move the bike route off FM 2920 onto city streets in this segment. Although a preliminary route was developed during this study (figure 4.4), the bike route should be investigated in greater detail during the Livable Center study. In the future, once Medical Complex is extended to FM 2920, this facility should be considered as a more direct bike route alternative through Tomball.

The Grand Parkway also may relieve traffic on FM 2920 east of Boudreaux. This project is planned to cross FM 2920 near Boudreaux Road, then parallel FM 2920 to the north. This should help relieve the severely congested eastern section of the FM 2920 corridor up to IH 45.

Access management is an effective tool that can be used to improve safety and mobility prior to the significant investment involved with adding capacity; however, to address the significant growth recently experienced along the FM 2920 corridor, the study recommends that widening studies be conducted to determine future capacity needs. The traffic analysis of existing conditions shows poor LOS of service on the section of FM 2920 east of SH 249. The future planned parallel routes and other study recommendations will improve mobility and LOS for a period of time. To help determine when widening studies should be undertaken along FM 2920, Table 4.2 below was prepared to summarize the current number of lanes and LOS and the years in which the LOS will deteriorate beyond capacity (LOS E). This table takes into account future traffic projections based on the H-GAC regional travel demand model, which includes all planned projects in the Regional Transportation Plan (RTP). Note that the Grand Parkway is in the RTP. Medical Complex Drive is included only in the Major Thoroughfare Plan, not the RTP. Various scenarios for added capacity were modeled to show when the expanded facility exceeds capacity (LOS E). These are shown in Table 4.3.

Table 4.2 - Existing (2007) Traffic Conditions

FM 2920 Sections		Number of	LOS	Year in which	
From	To	Lanes		LOS > D*	LOS > E**
US 290	Cypress Rose Hill Drive	2	C	2012	2027
Cypress Rose Hill Drive	SH 249	5	E	-	2010
SH 249	Hufsmith Kohrville Road	4-5	F	-	-
Hufsmith Kohrville Road	Kuykendahl Road	5	E	-	2009
Kuykendahl Road	IH 45	5	F	-	-
IH 45	Lexington Road	4	F	-	-

* Year in which Level of Service projected to exceed acceptable level (LOS D)
** Year in which Level of Service projected to exceed capacity (LOS E)

Table 4.3 - Future Capacity Needs

FM 2920 Sections		Number of	Year in which	
From	To	Lanes	LOS > D*	LOS > E**
US 290	Cypress Rose Hill Drive	3	2015	2031
		4	> 2035	> 2035
Cypress Rose Hill Drive	SH 249	6	2013	2023
		8	2027	> 2035
SH 249	Hufsmith Kohrville Road	6	2011	2021
		8	2024	2033
Hufsmith Kohrville Road	Kuykendahl Road	6	2015	2034
		8	> 2035	> 2035
Kuykendahl Road	IH 45	6	2007	2010
		8	2021	> 2035
IH 45	Lexington Road	5	2009	2020
		6	2022	2033

* Year in which Level of Service projected to exceed acceptable level (LOS D)
** Year in which Level of Service projected to exceed capacity (LOS E)

IMPLEMENTATION AND COST SUMMARY

A summary of the number, type, and jurisdictional agency responsible for the recommended improvements, grouped by implementation phase, are presented in Tables 4.4, 4.5 and 4.6 below. The costs for the recommended improvements by implementation phase and agency are presented in Table 4.7. A more detailed cost estimate for each improvement type is included in Appendix G. Following the cost estimates are the aerial layout sheets showing locations for specific improvements.

Table 4.4 - Short-Range Improvements

		SHORT RANGE																							
		Improvements Along FM 2920 by TxDOT																				Improvements by Harris County			
				Add Signs																					
Segment		Traffic Signal Improvements	Traffic Signal Synchronization	Street Name / Block Number	Next Intersection / Signal	Curve Warning	Add In-Lane Rumble Strips	Add Shoulder Texturing (Both Shoulders)	Add Centerline Texturing	Add Left Turn Lane on FM 2920	Add Right Turn Lane on FM 2920	Widen Shoulders to 8' at Intersections (2100 LF on Both Sides)	Widen Roadway from 2-Lane to 5-Lane	Restripe For New Lane Configuration (FM 2920 / IH45 Intersection)	Add Raised Median / Channelization (Concrete)	Add Raised Median / Channelization (Ready for Landscaping)	Widen Sidewalks	Minor Driveway Modification	Reduce Driveway Width	Improve Railroad Crossing Control Device	Rehabilitate Pavement (Pine St to Elm St)	Add Raised Median / Channelization (Concrete)	Add Left Turn Lane on Cross Street	Add Right Turn Lane on FM 2920 (Spring Cypress Rd)	Reduce Driveway Width
1	Hempstead Rd to Cypress Rose Hill Rd			10	46	6	7	13.8 MI	13.8 MI	30	24	16.5 INT	0.28 MI		888 SF										
2	Cypress Rose Hill Rd to SH 249 Business			9	17	2	3				2														
3	SH 249 Business to Huffsmith-Kohrville Rd			9	27						0				15712 SF	3800 SF	25276 SF	1	5	1	1				
4	Huffsmith-Kohrville Rd to Kuykendahl Rd			9	13	1	4				8				2746 SF										
5	Kuykendahl Rd to Lexington Rd			12	30		1				4			1	17610 SF				2			8869 SF	1	1	6
Total	**Hempstead Rd to Lexington Rd**	**1 LS**	**1 LS**	**49**	**133**	**9**	**15**	**13.8**	**13.8**	**30**	**38**	**16.5**	**0.28**	**1**	**36956**	**3800**	**25276**	**1**	**7**	**1**	**1**	**8869**	**1**	**1**	**6**

Table 4.5 - Medium-Range Improvements

		MEDIUM RANGE												
		Improvements Along FM 2920 by TxDOT				Improvements by Harris County							Improvements by City	
Segment		Add Continuous Left Turn Lane and 8' Shldrs between Intersections	Widen One Additional WB Lane	Driveway Closure	Consolidate Driveways	Widen Roadway from 2-Lane to 5-Lane	Widen Roadway from 2-Lane to 4-Lane	Add Left Turn Lane on Cross Street	Add Right Turn Lane on Cross Street	Add Left Turn Lane on FM 2920 (Spring Cypress Rd)	Add Raised Median / Channelization (Concrete)	Driveway Closure	Add Left Turn Lane on Cross Street	Improve Right Turn Radius
1	Hempstead Rd to Cypress Rose Hill Rd	6.3 MI						21	1				2	
2	Cypress Rose Hill Rd to SH 249 Business							2						
3	SH 249 Business to Huffsmith-Kohrville Rd			15										1
4	Huffsmith-Kohrville Rd to Kuykendahl Rd			5		0.2 MI		4						
5	Kuykendahl Rd to Lexington Rd		0.67 MI	10	1		0.9 MI	3		1	2185 SF	4		
Total	**Hempstead Rd to Lexington Rd**	**6.3**	**0.67**	**30**	**1**	**0.2**	**0.9**	**30**	**1**	**1**	**2185**	**4**	**2**	**1**

Table 4.6 - Long-Range Improvements

		LONG RANGE					
Improvements by		Harris County				City of Tomball	
Segment		Widen Roadway from 4-Lane to 6-Lane	Realign Nichols Rd.	Realign Kobs Rd.	Realign Foster Rd.	Realign Alma St.	Realign Baker Dr.
1	Hempstead Rd to Cypress Rose Hill Rd		1				
2	Cypress Rose Hill Rd to SH 249 Business			1			
3	SH 249 Business to Huffsmith-Kohrville Rd					1	1
4	Huffsmith-Kohrville Rd to Kuykendahl Rd						
5	Kuykendahl Rd to Lexington Rd	0.47 MI			1		
Total	**Hempstead Rd to Lexington Rd**	**0.47**	**1**	**1**	**1**	**1**	**1**

Table 4.7 - Cost Estimate

FM 2920 Access Management Study Preliminary Cost Estimate																		
Primary Funding Source		TxDOT				Harris County				City of Waller				City of Tomball				TOTALS (In Millions)
	Improvement	Number	Unit	Unit Cost	Cost	Number	Unit	Unit Cost	Cost	Number	Unit	Unit Cost	Cost	Number	Unit	Unit Cost	Cost	
Short Range	Traffic Signal Improvements	1 LS	LS	$ 2,829,400	$ 2,829,400													
	Traffic Signal Synchronization	1 LS	LS	$ 150,000	$ 150,000													
	Street Name / Block Number	49	INT	$ 1,900	$ 93,100													
	Next Intersection / Signal	133	INT	$ 2,000	$ 266,000													
	Curve Warning	9	EA	$ 1,000	$ 9,000													
	Add In-Lane Rumble Strips	15	EA	$ 1,100	$ 16,500													
	Add Shoulder Texturing (Both Shoulders)	13.8	MI	$ 2,700	$ 37,260													
	Add Centerline Texturing	13.8	MI	$ 1,400	$ 19,320													
	Add Left Turn Lane on FM 2920	30	EA	$ 311,500	$ 9,345,000													
	Add Right Turn Lane on FM 2920	38	EA	$ 77,800	$ 2,956,400	1	EA	$ 77,800	$ 77,800									
	Widen Shoulders to 8' at Intersections (2100 LF on Both Sides)	16.5	INT	$ 349,200	$ 5,761,800													
	Widen Roadway from 2-Lane to 5-Lane	0.28	MI	$ 2,420,600	$ 677,768													
	Restripe For New Lane Configuration (FM 2920 / IH45 Intersection)	1	EA	$ 21,500	$ 21,500													
	Add Raised Median / Channelization (Concrete)	36956	SF	$ 10	$ 369,560	8869	SF	$ 10	$ 88,690									
	Add Raised Median / Channelization (Ready for Landscaping)	3800	SF	$ 22	$ 83,600													
	Widen Sidewalks	25276	SF	$ 8	$ 202,208													
	Minor Driveway Modification	1	EA	$ 7,100	$ 7,100													
	Reduce Driveway Width	7	EA	$ 5,200	$ 36,400	6	EA	$ 5,200	$ 31,200									
	Improve Railroad Crossing Control Device	1	LS	$ 150,000	$ 150,000													
	Rehabilitate Pavement (Pine St to Elm St)	1	LS	$ 191,000	$ 191,000													
	Add Left Turn Lane on Cross Street					1	EA	$ 94,200	$ 94,200									
	Add Off Street Parking													1	LS	TBD	TBD	
	TOTAL FOR SHORT RANGE IMPROVEMENTS				$ 23,222,916				$ 291,890				$ -				$ -	$ 23.51
Medium Range	Add Left Turn Lane on FM 2920 (Spring Cypress Rd)					1	EA	$ 311,500	$ 311,500									
	Add Continuous Left Turn Lane and 8' Shldrs between Intersections	6.3	MI	$ 2,032,300	$ 12,803,490													
	Widen One Additional WB Lane	0.67	MI	$ 1,125,500	$ 754,085													
	Widen Roadway from 2-Lane to 5-Lane					0.2	MI	TBD	TBD									
	Widen Roadway from 2-Lane to 4-Lane					0.9	MI	TBD	TBD									
	Add Raised Median/Channelization (Concrete)					2185	SF	$ 10	$ 21,850									
	Driveway Closure	30	EA	$ 5,000	$ 150,000	4	EA	$ 5,000	$ 20,000									
	Consolidate Driveways	1	EA	$ 7,400	$ 7,400													
	Bike Route	1	LS	TBD	TBD													
	Add Bike Route Signs	20	EA	$ 800	$ 16,000									15	EA	$ 800	$ 12,000	
	Add Left Turn Lane on Cross Street					30	EA	$ 94,200	$ 2,826,000	2	EA	$ 94,200	$ 188,400					
	Add Right Turn Lane on Cross Street					1	EA	$ 77,800	$ 77,800									
	Improve Right Turn Radius													1	EA	$ 6,400	$ 6,400	
	TOTAL FOR MEDIUM RANGE IMPROVEMENTS				$ 13,730,975				$ 3,257,150				$ 188,400				$ 18,400	$ 17.19
Long Range	Widen FM 2920 from 5-Lane to 6-Lane (From Boudreaux Rd to IH 45)	1	LS	TBD	TBD													
	Widen FM 2920 from 4-Lane to 6-Lane (From IH 45 to Lexington Rd)					0.47	MI	TBD	TBD									
	Realign Nichols Rd.					1	EA	$ 560,100	$ 560,100									
	Realign Kobs Rd.					1	EA	$ 244,700	$ 244,700									
	Realign Alma St.													1	EA	$ 244,700	$ 244,700	
	Realign Baker Dr.													1	EA	$ 244,700	$ 244,700	
	Realign Foster Rd.					1	EA	$ 244,700	$ 244,700									
	Construct Medical Complex Drive (FM 2920W to FM 2920E)													1	LS	TBD	TBD	
	TOTAL FOR LONG RANGE IMPROVEMENTS				$ -				$ 1,049,500				$ -				$ 489,400	$ 1.54
	GRAND TOTAL				$ 36,953,891				$ 4,598,540				$ 188,400				$ 507,800	$ 42.25

RECOMMENDED IMPROVEMENTS

LEGEND

- Residential
- Commercial
- Industrial
- Religious
- Day Care Center
- School
- Police or Fire Station
- Post Office
- Recreational / Health
- Vacant Land / Railroad
- County Boundary
- City Boundary

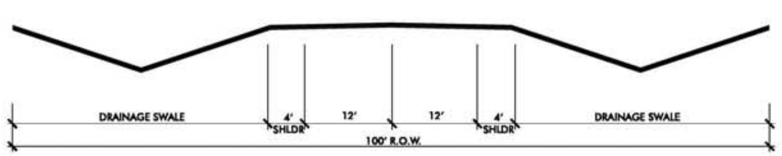
IMPROVEMENT LEGEND

County
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

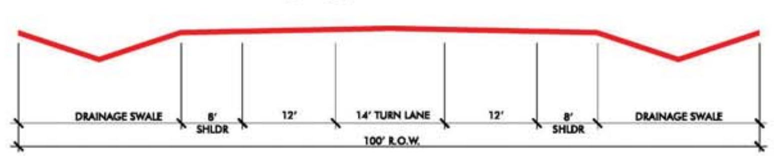
TxDOT
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

City
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

Existing Signal



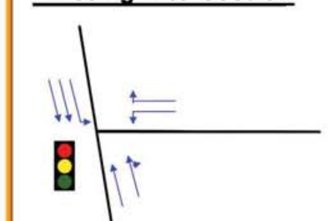
Existing Typical Cross-Section



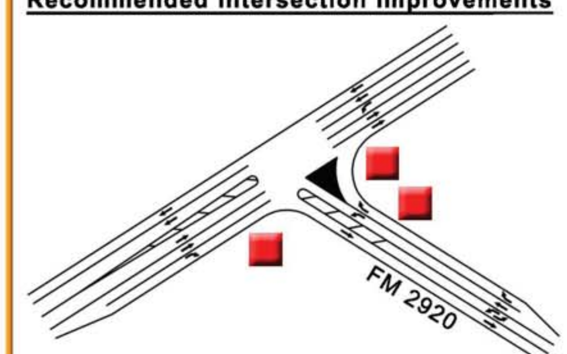
Proposed Typical Cross-Section

INTERSECTION OF FM 2920 AND HEMPSTEAD RD.

Existing Intersection



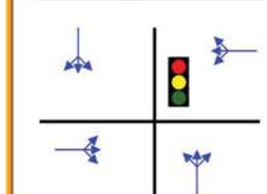
Recommended Intersection Improvements



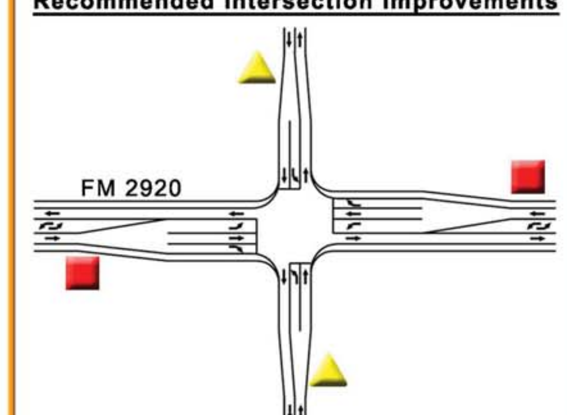
- Addition of right turn lane on West bound Hempstead
- Addition of right turn lane on South bound FM 2920
- Raised triangular median

INTERSECTION OF FM 2920 AND WALLER TOMBALL RD.

Existing Intersection



Recommended Intersection Improvements



- Addition of right and left turn lanes to North and South bound FM 2920
- Addition of left turn lane to East and West bound Waller Tomball Rd.

RECOMMENDED IMPROVEMENTS

LEGEND

- Residential
- Commercial
- Industrial
- Religious
- Day Care Center
- School
- Police or Fire Station
- Post Office
- Recreational / Health
- Vacant Land / Railroad
- County Boundary
- City Boundary

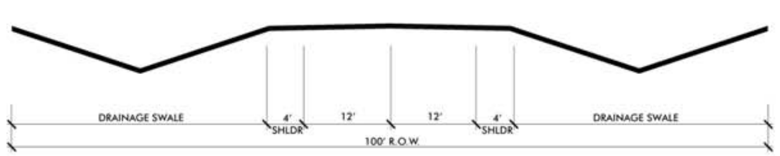
IMPROVEMENT LEGEND

County
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

TxDOT
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

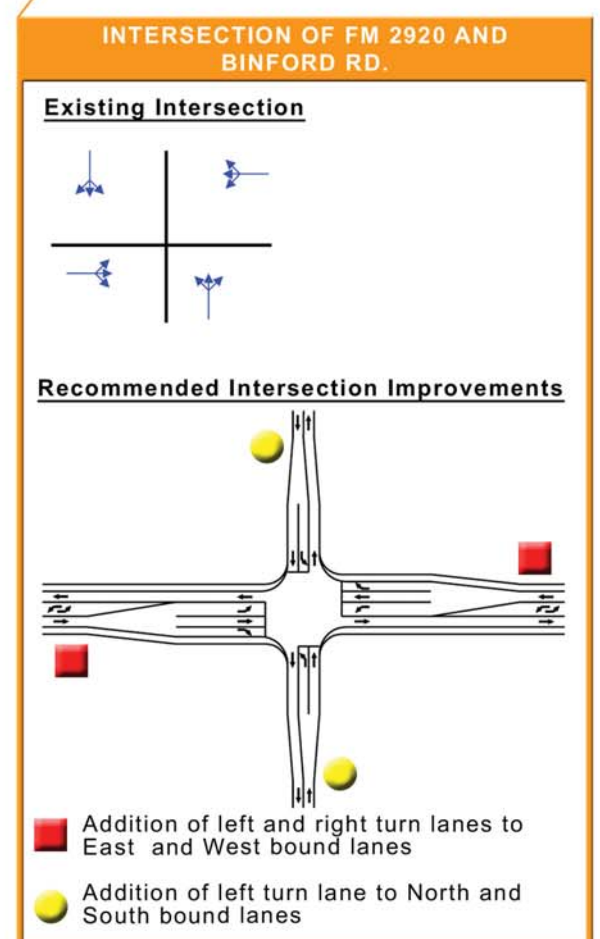
City
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

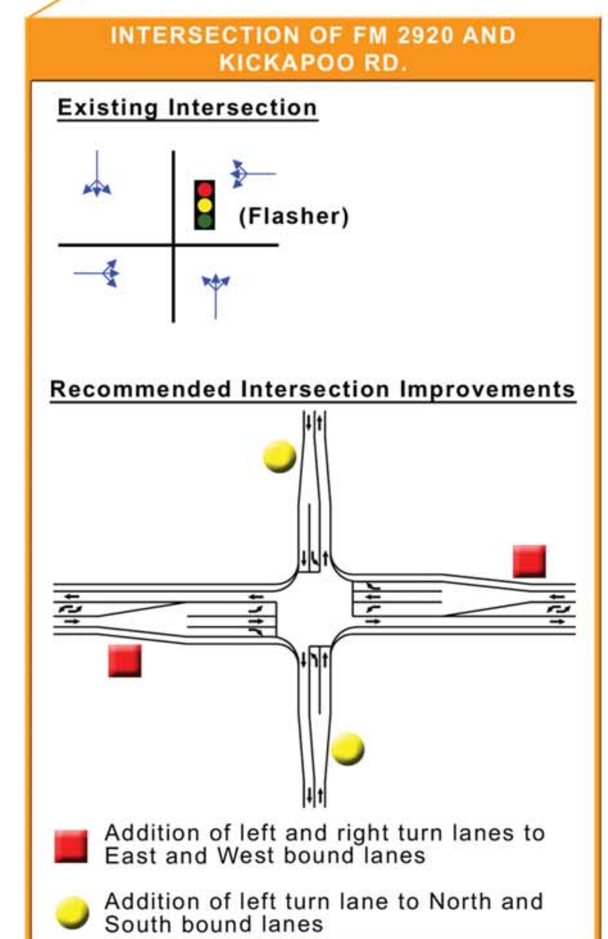
- Existing Signal



Existing Typical Cross-Section

Proposed Typical Cross-Section





RECOMMENDED IMPROVEMENTS

LEGEND

- Residential
- Commercial
- Industrial
- Religious
- Day Care Center
- School
- Police or Fire Station
- Post Office
- Recreational / Health
- Vacant Land / Railroad
- County Boundary
- City Boundary

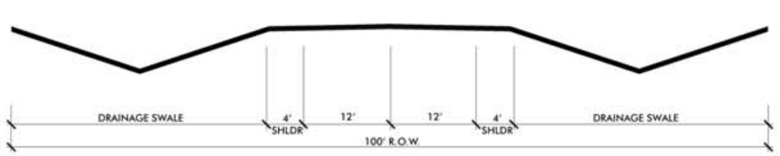
IMPROVEMENT LEGEND

County
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

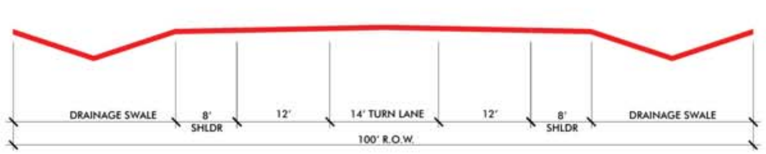
TxDOT
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

City
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

Existing Signal



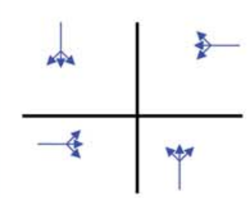
Existing Typical Cross-Section



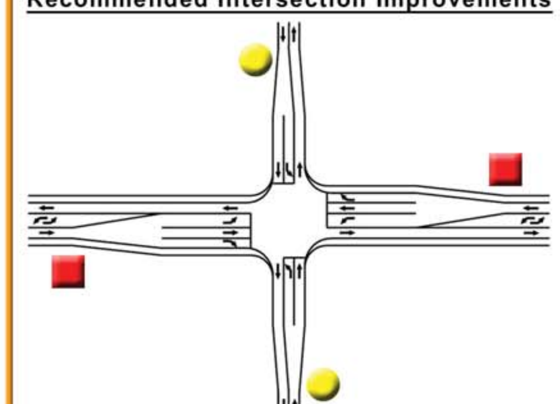
Proposed Typical Cross-Section

INTERSECTION OF FM 2920 AND KERMIER ROAD

Existing Intersection



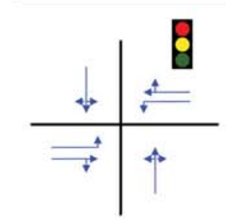
Recommended Intersection Improvements



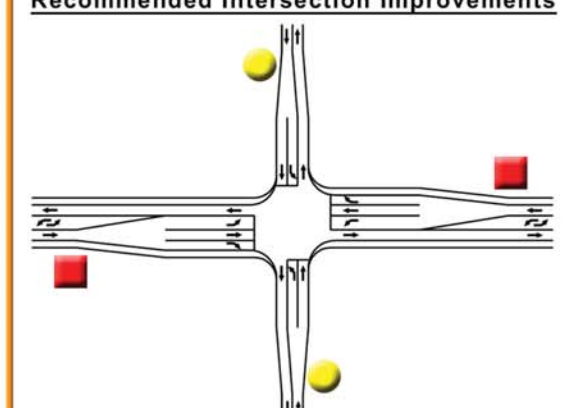
- Addition of left and right turn lanes to East and West bound lanes
- Addition of left turn lane to North and South bound lanes

INTERSECTION OF FM 2920 AND HEGAR ROAD

Existing Intersection

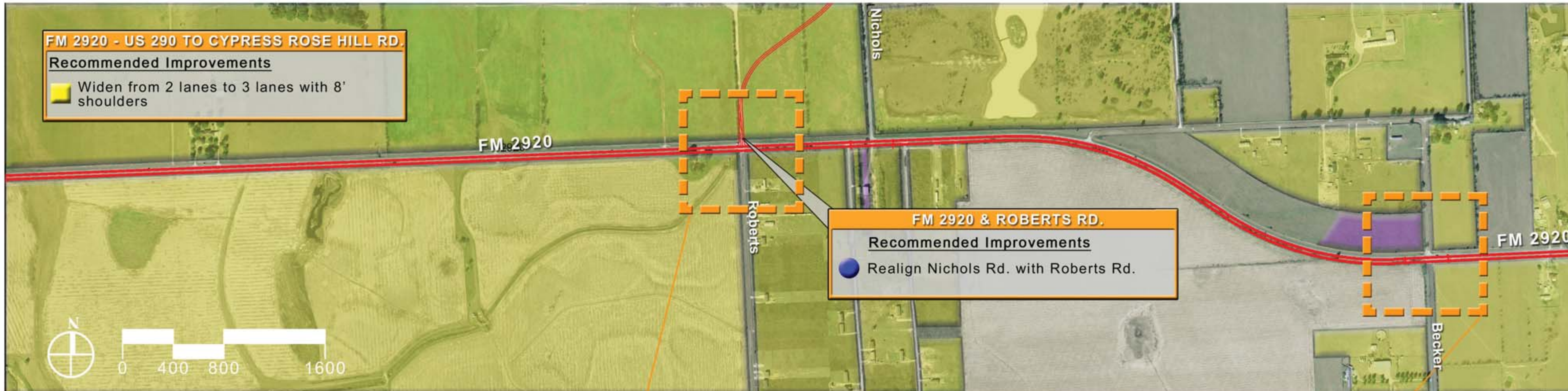


Recommended Intersection Improvements



- Addition of right turn lane to East and West bound lanes
- Addition of left turn lane to North and South bound lanes

RECOMMENDED IMPROVEMENTS



LEGEND

- Residential
- Commercial
- Industrial
- Religious
- Day Care Center
- School
- Police or Fire Station
- Post Office
- Recreational / Health
- Vacant Land / Railroad
- County Boundary
- City Boundary

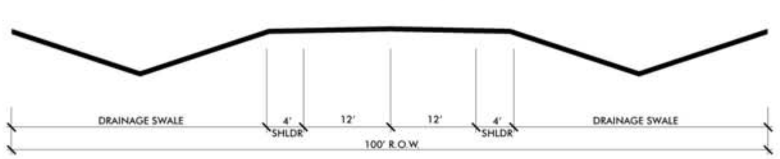
IMPROVEMENT LEGEND

County
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

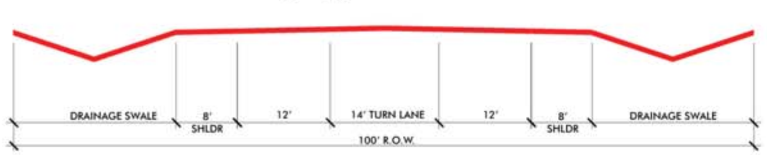
TxDOT
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

City
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

- Existing Signal



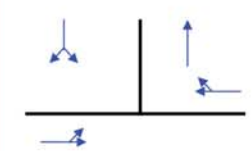
Existing Typical Cross-Section



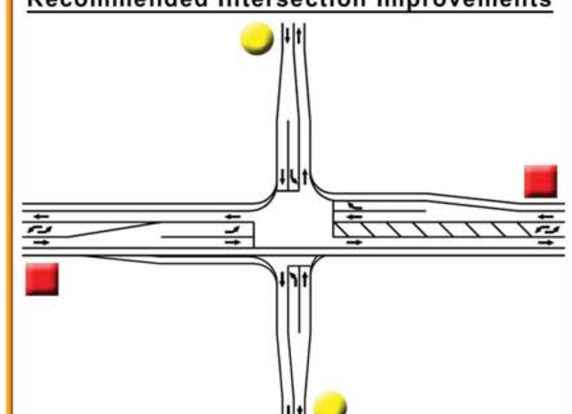
Proposed Typical Cross-Section

INTERSECTION OF FM 2920 AND NICHOLS RD.

Existing Intersection



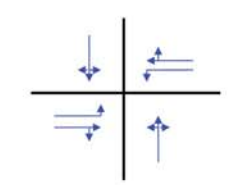
Recommended Intersection Improvements



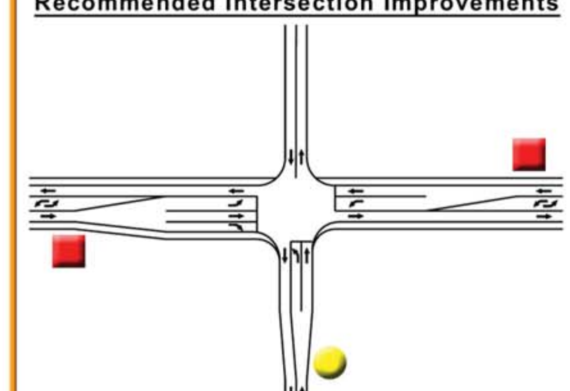
- Addition of left turn lane to West bound lane and right turn lane to East bound lane
- Addition of left turn lane to South bound lane
- Addition of left turn lane to North bound lane

INTERSECTION OF FM 2920 AND BECKER RD.

Existing Intersection



Recommended Intersection Improvements



- Addition of left and right turn lane to East bound lane, left turn lane to West bound lane
- Addition of left turn lane to North bound lane

RECOMMENDED IMPROVEMENTS

LEGEND

- Residential
- Commercial
- Industrial
- Religious
- Day Care Center
- School
- Police or Fire Station
- Post Office
- Recreational / Health
- Vacant Land / Railroad
- County Boundary
- City Boundary

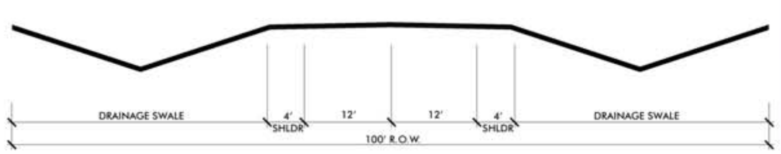
IMPROVEMENT LEGEND

County
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

TxDOT
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

City
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

Existing Signal

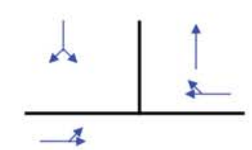


Existing Typical Cross-Section

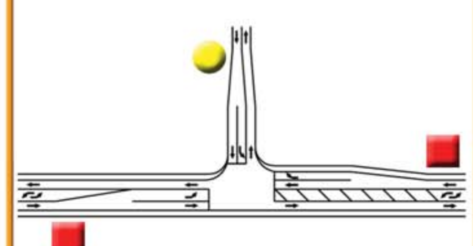
Proposed Typical Cross-Section

INTERSECTION OF FM 2920 AND HUNTERS CREEK WAY

Existing Intersection



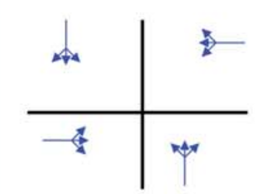
Recommended Intersection Improvements



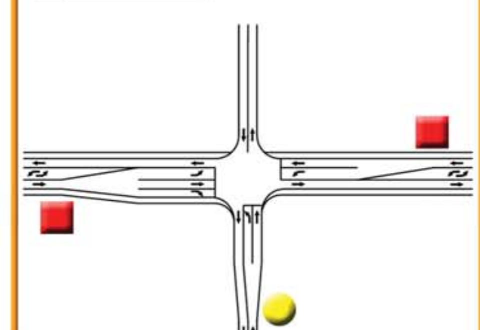
- Addition of left turn lane to East bound lane and right turn lane to West bound lane
- Addition of left turn lane to South bound lane

INTERSECTION OF FM 2920 AND BAUER RD.

Existing Intersection



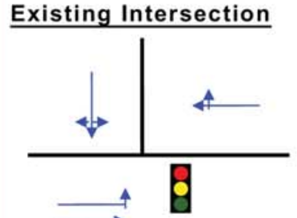
Recommended Intersection Improvements



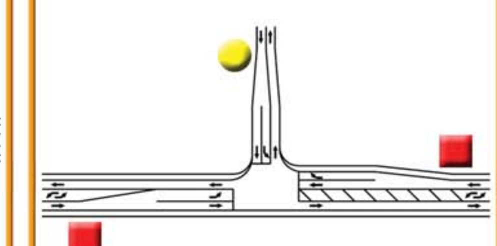
- Addition of left and right turn lane to East bound lane, left turn lane to West bound lane
- Addition of left turn lane to North bound lane

INTERSECTION OF FM 2920 AND ROBERTS CEMETERY RD.

Existing Intersection



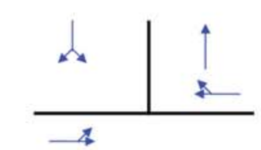
Recommended Intersection Improvements



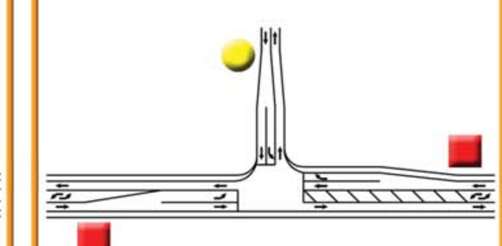
- Addition of left turn lane to East bound lane and right turn lane to West bound lane
- Addition of left turn lane to South bound lane

INTERSECTION OF FM 2920 AND NEW KENTUCKY VILLAGE

Existing Intersection



Recommended Intersection Improvements



- Addition of left turn lane to East bound lane and right turn lane to West bound lane
- Addition of left turn lane to South bound lane

RECOMMENDED IMPROVEMENTS

LEGEND

- Residential
- Commercial
- Industrial
- Religious
- Day Care Center
- School
- Police or Fire Station
- Post Office
- Recreational / Health
- Vacant Land / Railroad
- County Boundary
- City Boundary

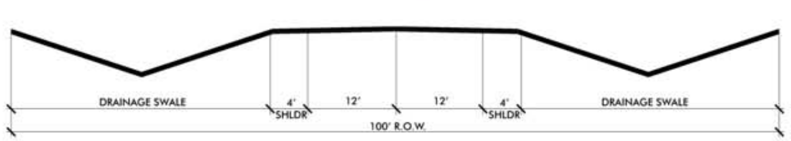
IMPROVEMENT LEGEND

County
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

TxDOT
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

City
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

- Existing Signal

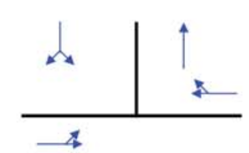


Existing Typical Cross-Section

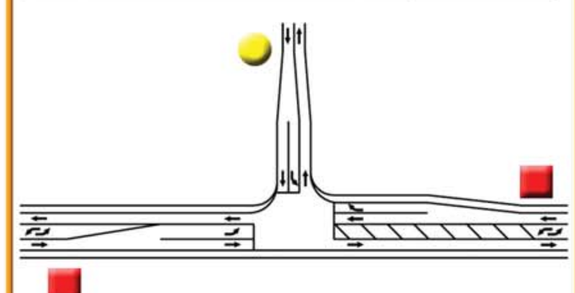
Proposed Typical Cross-Section

INTERSECTION OF FM 2920 AND THREE PINES DR.

Existing Intersection



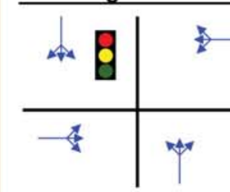
Recommended Intersection Improvements



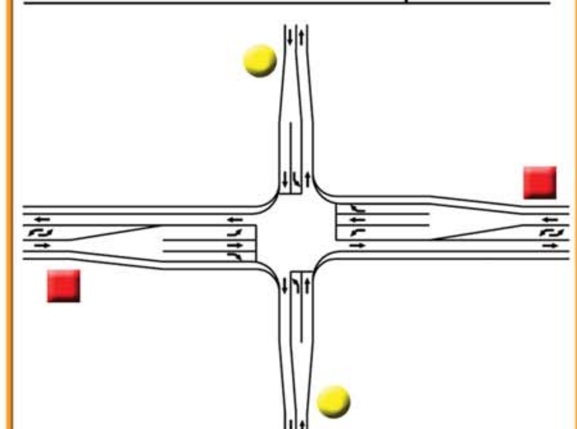
- Addition of left turn lane to East bound lane, right turn lane to West bound lane
- Addition of left turn lane to South bound lane

INTERSECTION OF FM 2920 AND MUESCHKE RD.

Existing Intersection



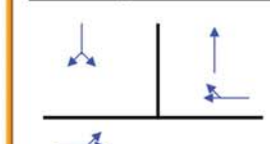
Recommended Intersection Improvements



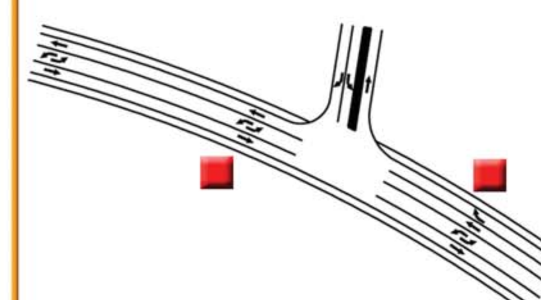
- Addition of left and right turn lanes to East and West bound lanes
- Addition of left turn lanes to North and South bound lanes

INTERSECTION OF FM 2920 AND LOBLOLLY RD.

Existing Intersection



Recommended Intersection Improvements



- Addition of left turn lane to East bound lane and right turn lane to West bound lane
- Improved turning radius on West Bound Lane

RECOMMENDED IMPROVEMENTS

LEGEND

- Residential
- Commercial
- Industrial
- Religious
- Day Care Center
- School
- Police or Fire Station
- Post Office
- Recreational / Health
- Vacant Land / Railroad
- County Boundary
- City Boundary

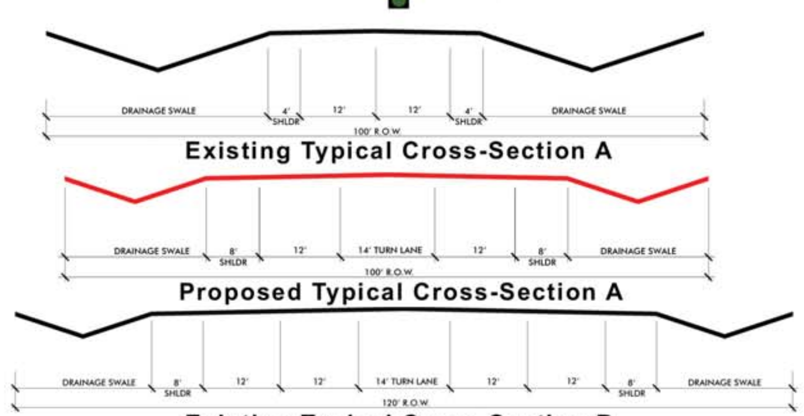
IMPROVEMENT LEGEND

County
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

TxDOT
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

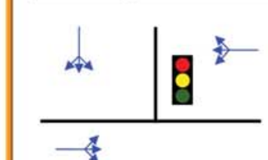
City
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

Existing Signal

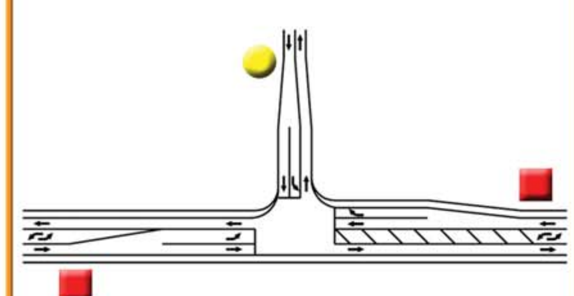


INTERSECTION OF FM 2920 AND ROSEWOOD TR.

Existing Intersection



Recommended Intersection Improvements

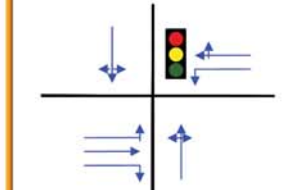


Addition of left turn lane to East bound lane and right turn lane to West bound lane

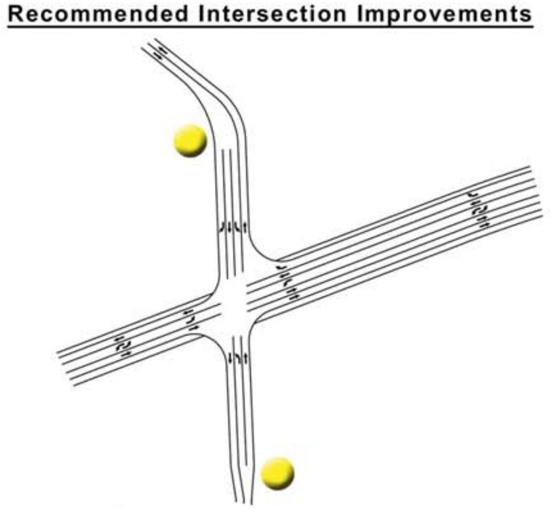
Addition of left turn lane to South bound lane

INTERSECTION OF FM 2920 AND CYPRESS ROSE HILL RD.

Existing Intersection



Recommended Intersection Improvements



Addition of left turn lanes to North and South bound lanes and right turn lane to South bound lane

RECOMMENDED IMPROVEMENTS

LEGEND

- Residential
- Commercial
- Industrial
- Religious
- Day Care Center
- School
- Police or Fire Station
- Post Office
- Recreational / Health
- Vacant Land / Railroad
- County Boundary
- City Boundary

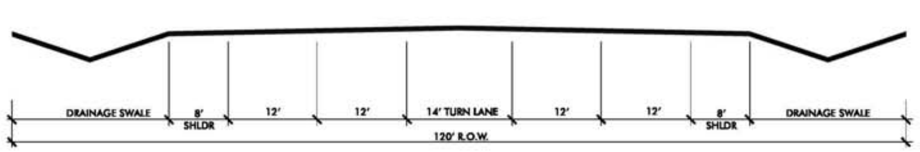
IMPROVEMENT LEGEND

County
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

TxDOT
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

City
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

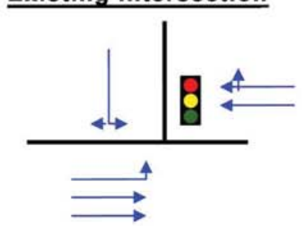
- Existing Signal



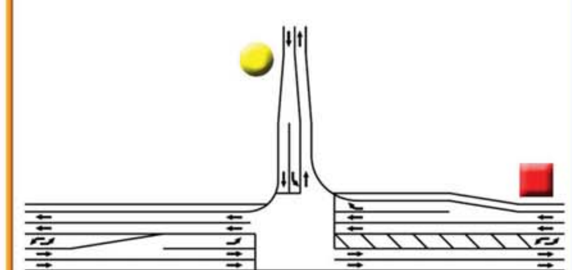
Existing Typical Cross-Section

INTERSECTION OF FM 2920 AND LUTHERAN CHURCH RD.

Existing Intersection



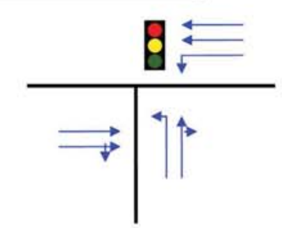
Recommended Intersection Improvements



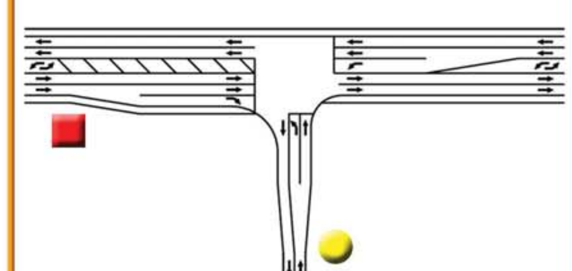
- Addition of right turn lane to West bound lane
- Addition of left turn lane to South bound lane

INTERSECTION OF FM 2920 AND TELGE RD.

Existing Intersection

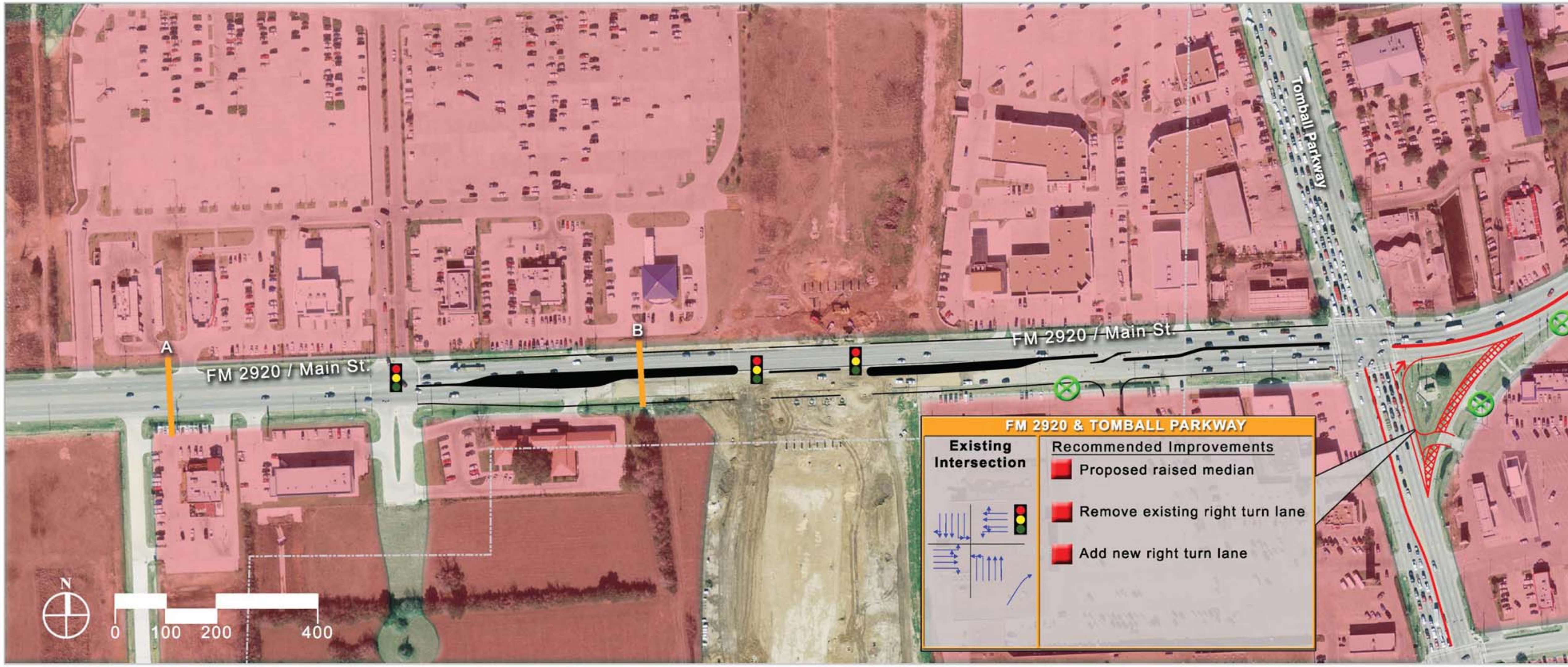


Recommended Intersection Improvements



- Addition of right turn lane to East bound lane
- Addition of left turn lane to North bound lane

RECOMMENDED IMPROVEMENTS



LEGEND

- Residential
- Commercial
- Industrial
- Religious
- Day Care Center
- School
- Police or Fire Station
- Post Office
- Recreational / Health
- Vacant Land / Railroad
- County Boundary
- City Boundary

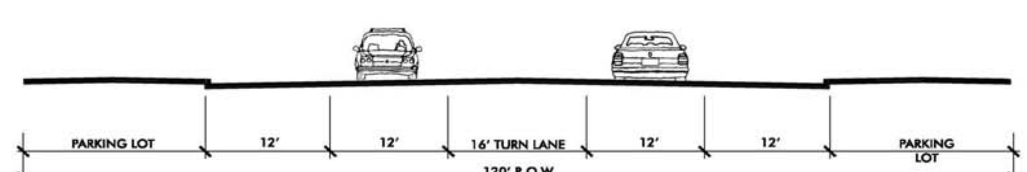
IMPROVEMENT LEGEND

County
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

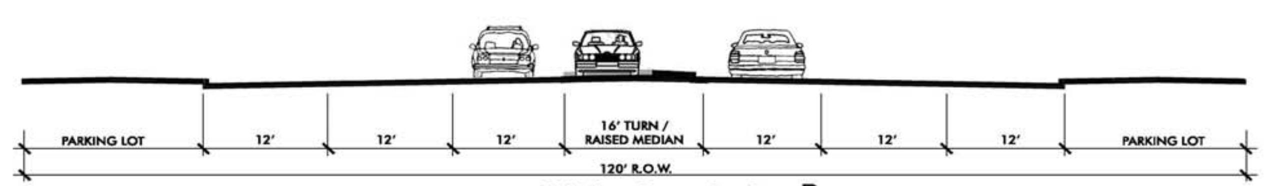
TxDOT
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

City
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

- Existing Signal
- Driveway Closure

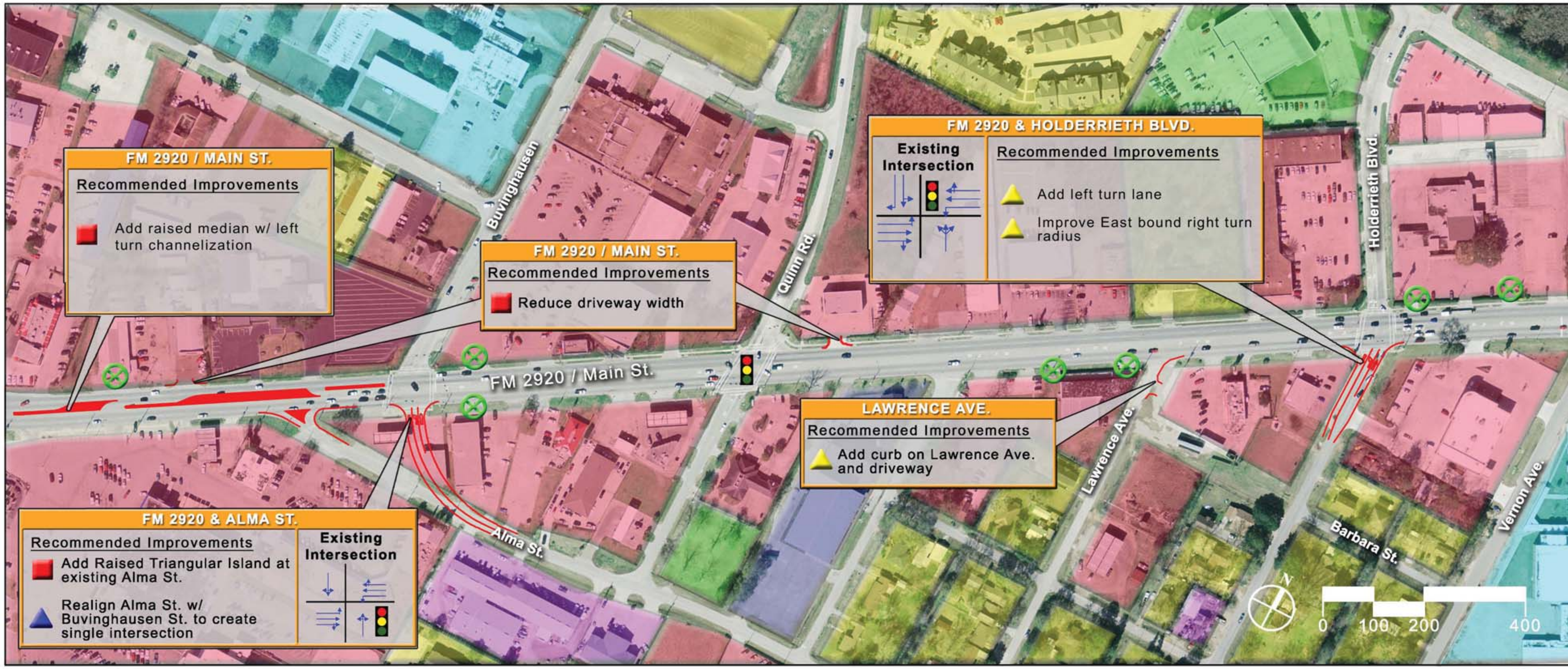


Existing Cross-Section A



Existing Cross-Section B

RECOMMENDED IMPROVEMENTS



LEGEND

- Residential
- Commercial
- Industrial
- Religious
- Day Care Center
- School
- Police or Fire Station
- Post Office
- Recreational / Health
- Vacant Land / Railroad
- County Boundary
- City Boundary

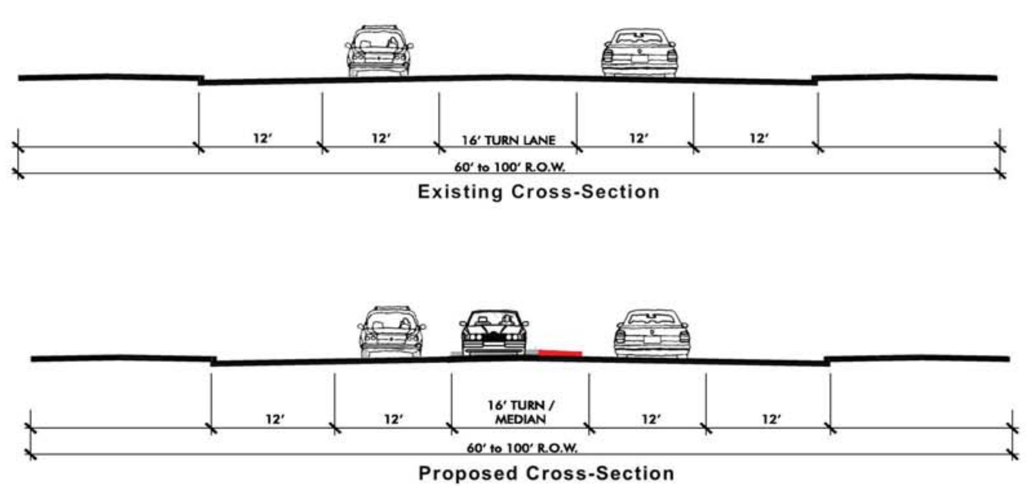
IMPROVEMENT LEGEND

County
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

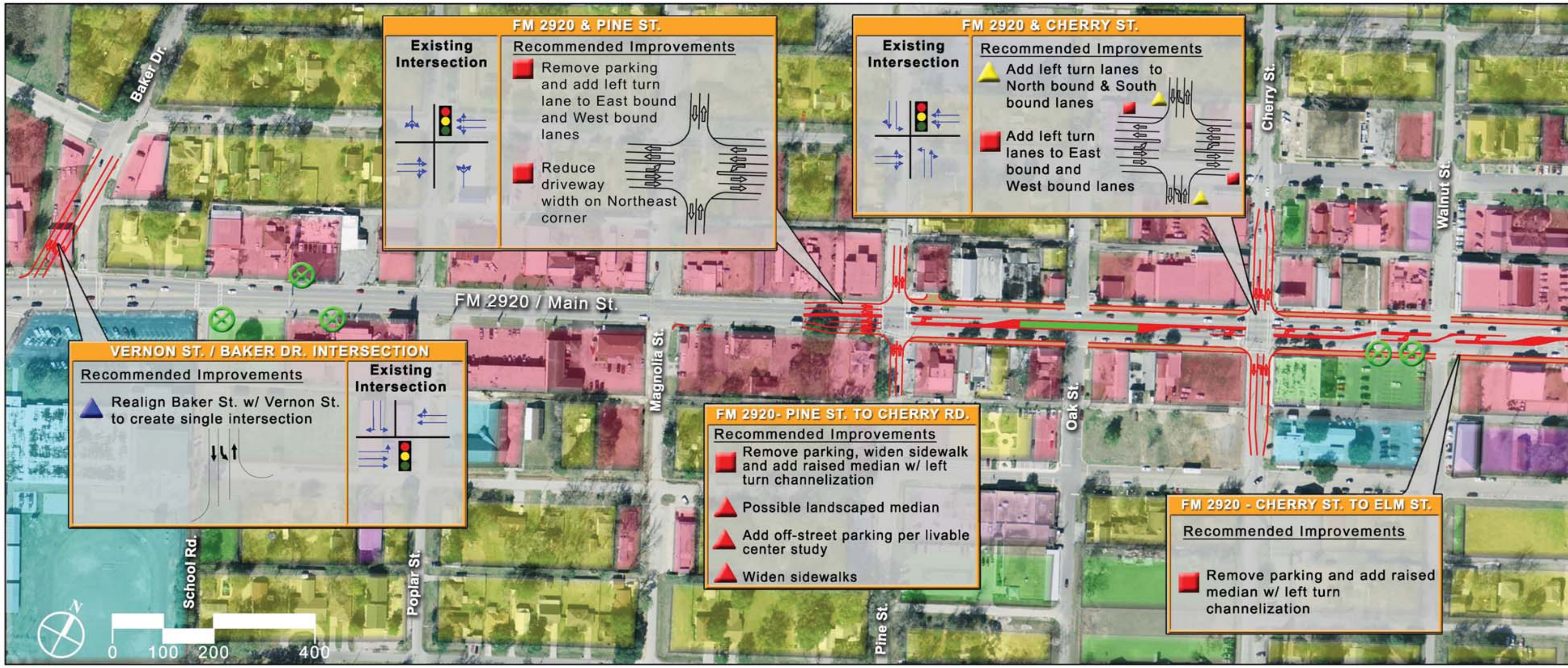
TxDOT
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

City
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

- Existing Signal
- Driveway Closure



RECOMMENDED IMPROVEMENTS



LEGEND

- Residential
- Commercial
- Industrial
- Religious
- Day Care Center
- School
- Police or Fire Station
- Post Office
- Recreational / Health
- Vacant Land / Railroad
- County Boundary
- City Boundary

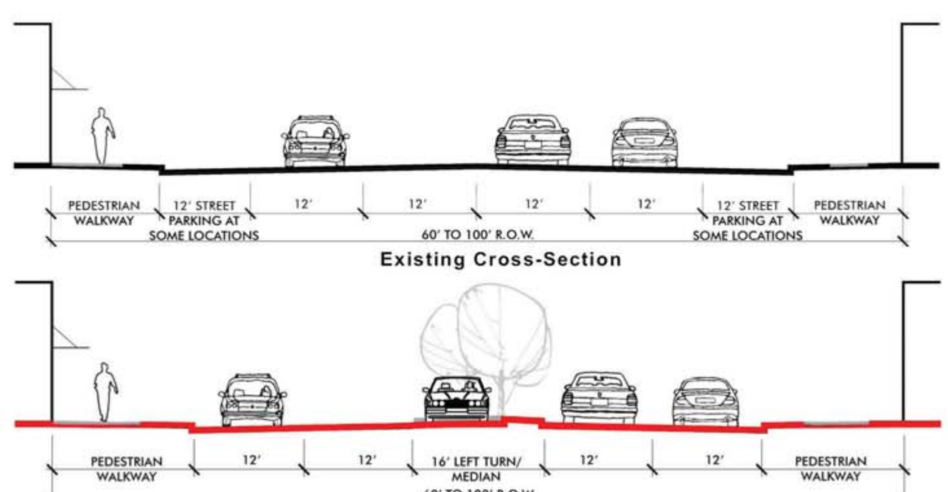
IMPROVEMENT LEGEND

County
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

TxDOT
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

City
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

- Existing Signal
- Driveway Closure



Existing Cross-Section

Proposed Cross-Section

RECOMMENDED IMPROVEMENTS

LEGEND

- Residential
- Commercial
- Industrial
- Religious
- Day Care Center
- School
- Police or Fire Station
- Post Office
- Recreational / Health
- Vacant Land / Railroad
- County Boundary
- City Boundary

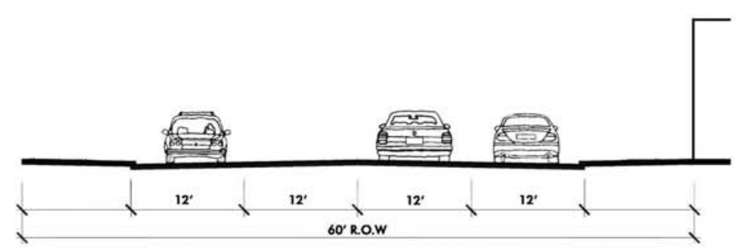
IMPROVEMENT LEGEND

County
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

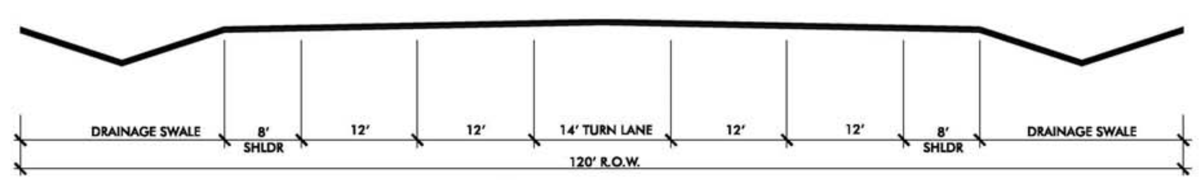
TxDOT
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

City
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

- Existing Signal
- Driveway Closure



Existing Typical Cross-Section A



Existing Typical Cross-Section B

RECOMMENDED IMPROVEMENTS

LEGEND

- Residential
- Commercial
- Industrial
- Religious
- Day Care Center
- School
- Police or Fire Station
- Post Office
- Recreational / Health
- Vacant Land / Railroad
- County Boundary
- City Boundary

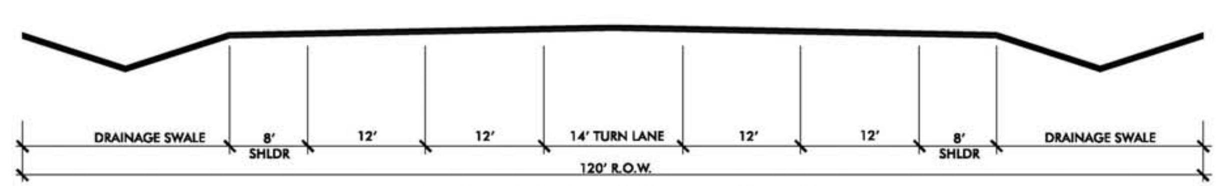
IMPROVEMENT LEGEND

County
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

TxDOT
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

City
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

- Existing Signal
- Driveway Closure



Existing Typical Cross-Section

RECOMMENDED IMPROVEMENTS

LEGEND

- Residential
- Commercial
- Industrial
- Religious
- Day Care Center
- School
- Police or Fire Station
- Post Office
- Recreational / Health
- Vacant Land / Railroad
- County Boundary
- City Boundary

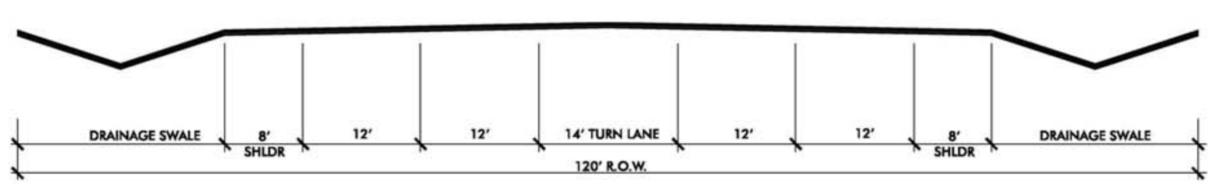
IMPROVEMENT LEGEND

County
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

TxDOT
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

City
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

- Existing Signal
- Driveway Closure



Existing Typical Cross-Section

RECOMMENDED IMPROVEMENTS

LEGEND

- Residential
- Commercial
- Industrial
- Religious
- Day Care Center
- School
- Police or Fire Station
- Post Office
- Recreational / Health
- Vacant Land / Railroad
- County Boundary
- City Boundary

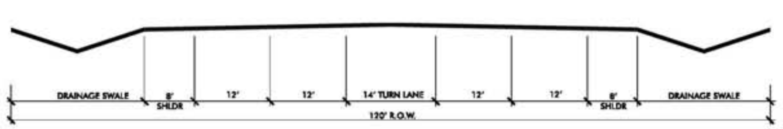
IMPROVEMENT LEGEND

County
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

TxDOT
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

City
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

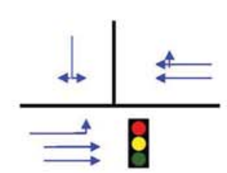
- Existing Signal
- Driveway Closure



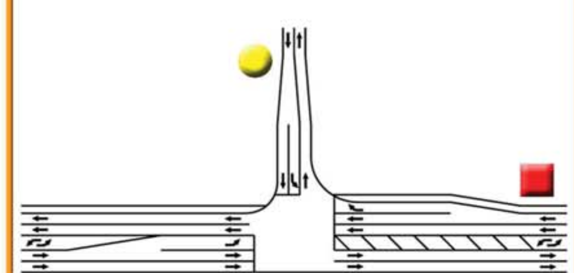
Existing Typical Cross-Section

INTERSECTION OF FM 2920 AND DOWDELL RD.

Existing Intersection



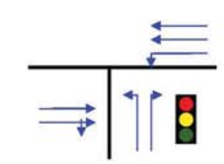
Recommended Intersection Improvements



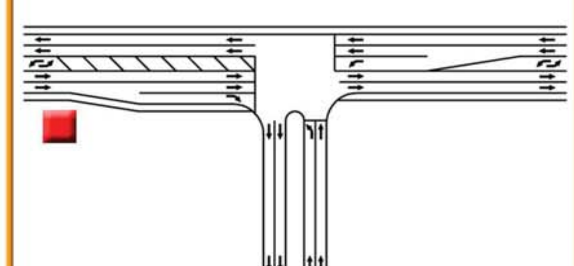
- Addition of right turn lane to West bound lanes
- Addition of left turn lane to South bound lanes

INTERSECTION OF FM 2920 AND INVERNESS CROSSING BLVD.

Existing Intersection



Recommended Intersection Improvements



- Addition of right turn lane to East bound lanes

RECOMMENDED IMPROVEMENTS

LEGEND

- Residential
- Commercial
- Industrial
- Religious
- Day Care Center
- School
- Police or Fire Station
- Post Office
- Recreational / Health
- Vacant Land / Railroad
- County Boundary
- City Boundary

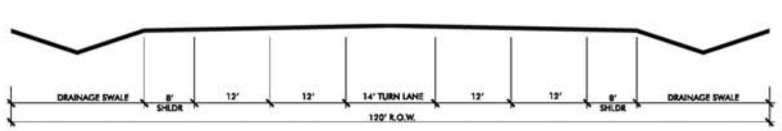
IMPROVEMENT LEGEND

County
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

TxDOT
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

City
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

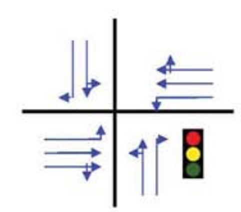
- Existing Signal



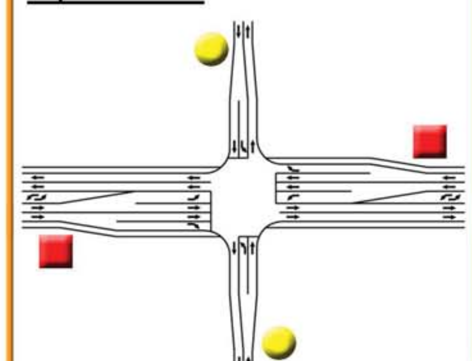
Existing Typical Cross-Section

INTERSECTION OF FM 2920 AND BOUDREAUX RD.

Existing Intersection



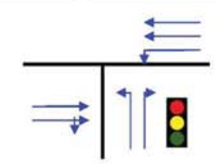
Recommended Intersection Improvements



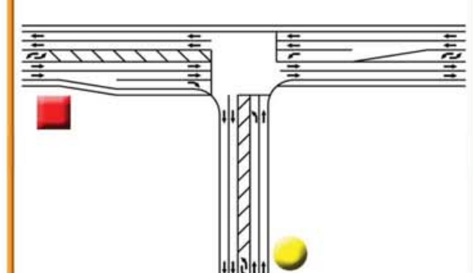
- Addition of right turn lanes to East and West bound lanes
- Addition of left turn lanes to North and South bound lanes

INTERSECTION OF FM 2920 AND STUEBNER AIRLINE RD.

Existing Intersection



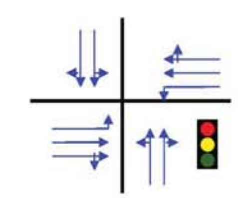
Recommended Intersection Improvements



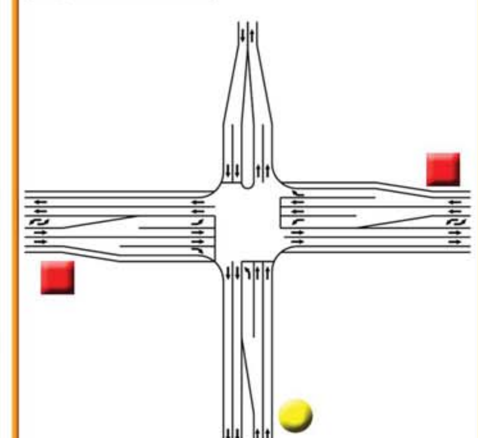
- Addition of right turn lane to East bound lanes
- Widen from 3 lanes to 5 lanes, currently under design

INTERSECTION OF FM 2920 AND ALVIN A. KLEIN DR.

Existing Intersection



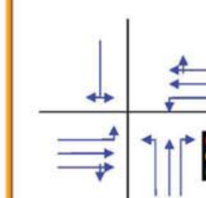
Recommended Intersection Improvements



- Addition of right turn lanes to West and East bound lanes
- Addition of left turn lane to North bound lane

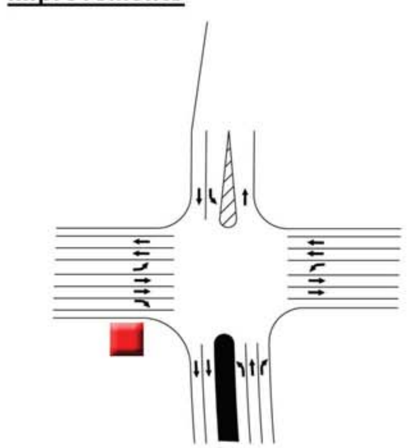
INTERSECTION OF FM 2920 AND TC JESTER BLVD.

Existing Intersection



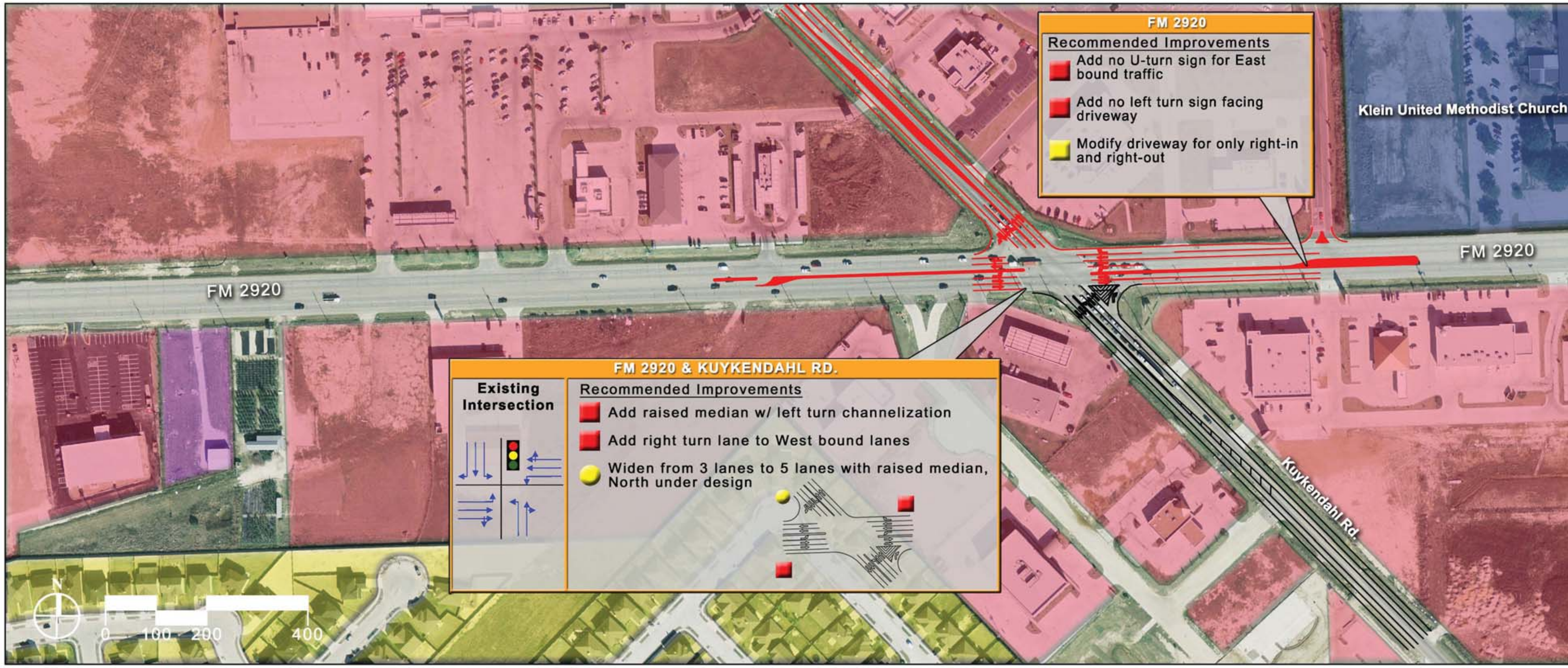
*Construction recently completed

Recommended Intersection Improvements



- Addition of right turn lane to East bound lanes

RECOMMENDED IMPROVEMENTS



LEGEND

- Residential
- Commercial
- Industrial
- Religious
- Day Care Center
- School
- Police or Fire Station
- Post Office
- Recreational / Health
- Vacant Land / Railroad
- County Boundary
- City Boundary

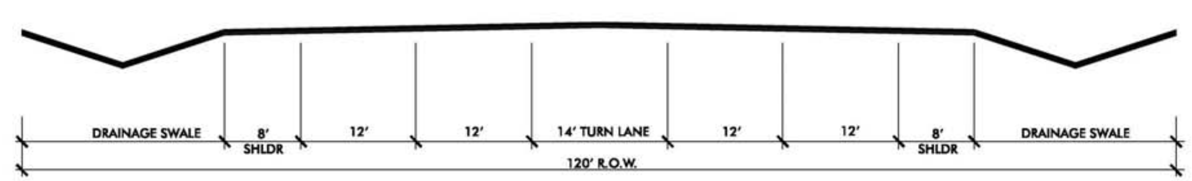
IMPROVEMENT LEGEND

County
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

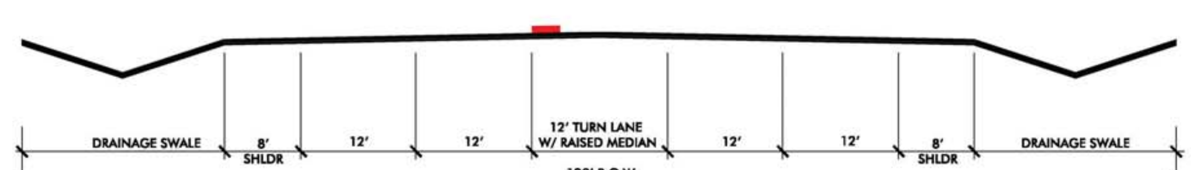
TxDOT
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

City
- Short Term Improvement
- Medium Term Improvement
- Long Term Improvement

- Existing Signal



Existing Typical Cross-Section



Proposed Typical Cross-Section

RECOMMENDED IMPROVEMENTS

LEGEND

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- Commercial
- Industrial
- Religious
- Day Care Center
- School
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IMPROVEMENT LEGEND

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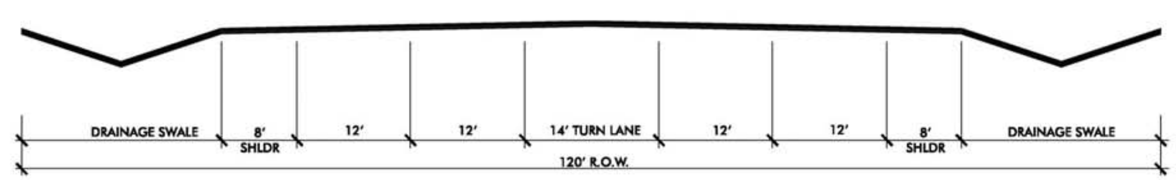
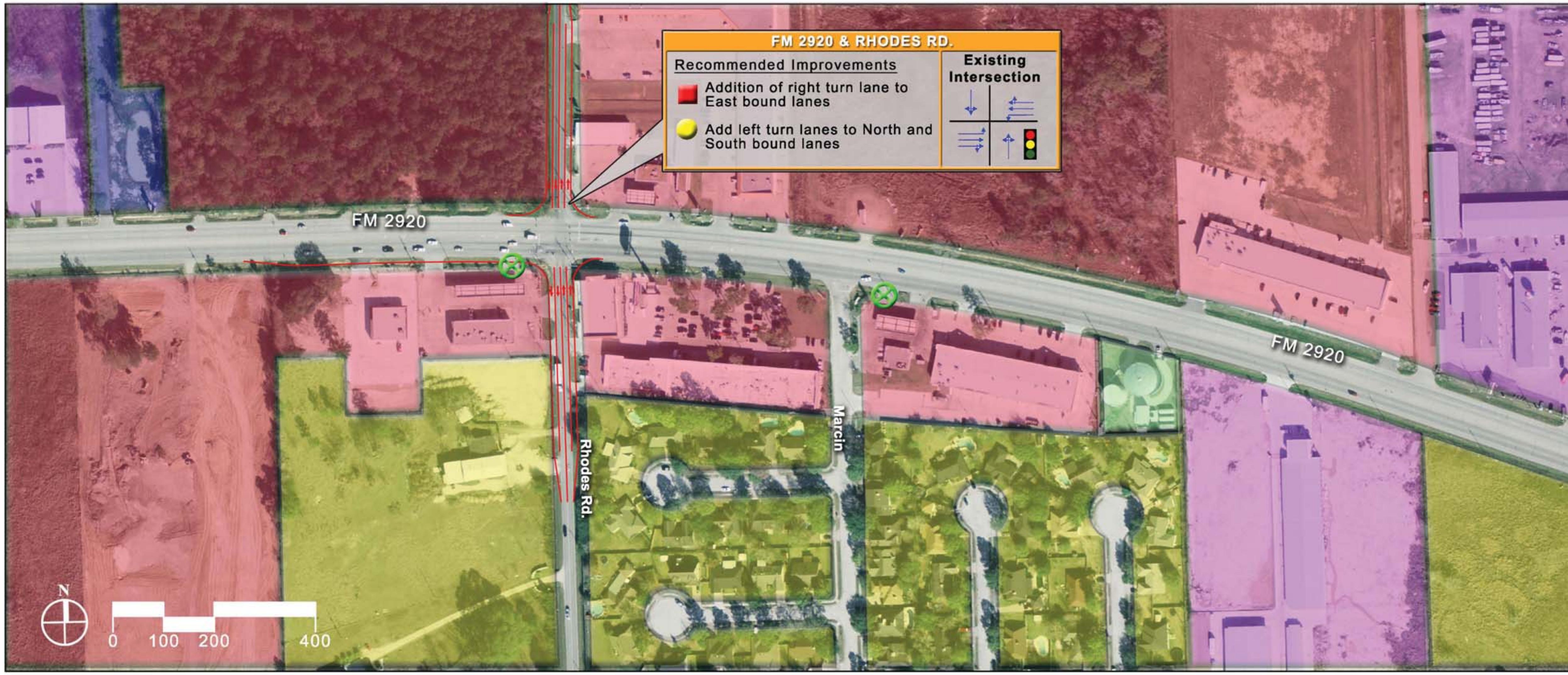


Existing Typical Cross-Section

RECOMMENDED IMPROVEMENTS



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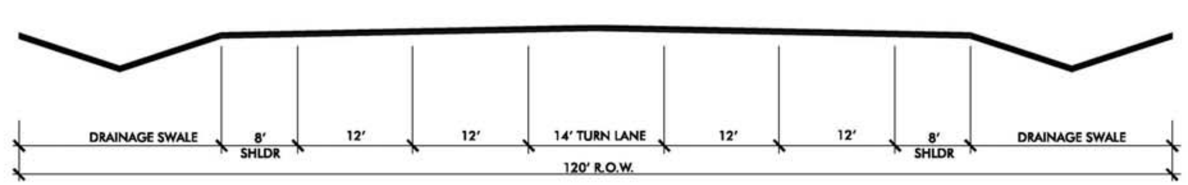
- Long Term Improvement

- Existing Signal
- Driveway Closure



Existing Typical Cross-Section

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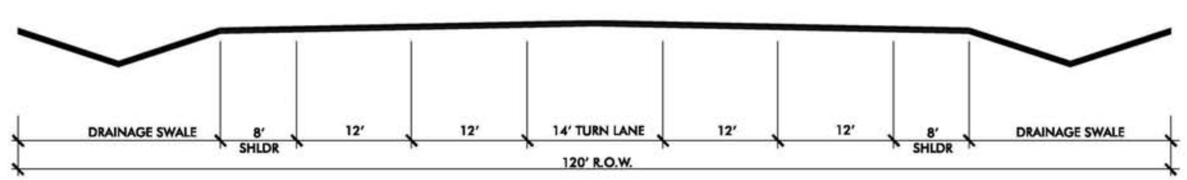
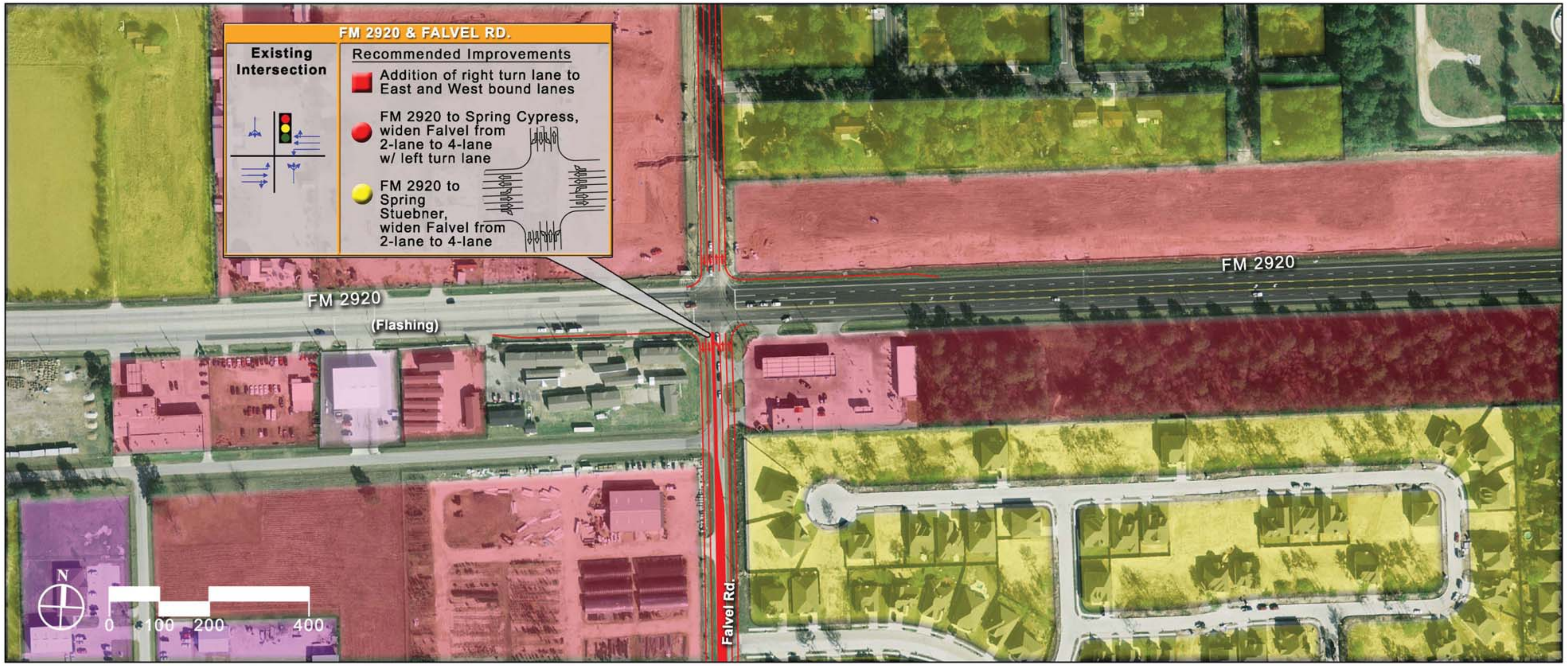


Existing Typical Cross-Section

RECOMMENDED IMPROVEMENTS



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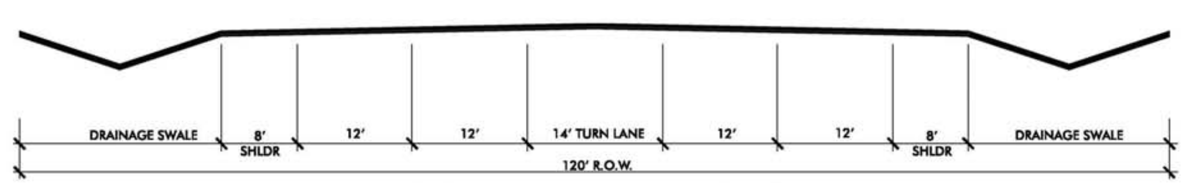

Existing Typical Cross-Section

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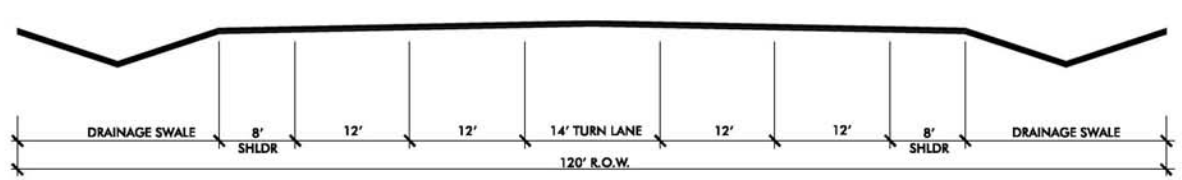

Existing Typical Cross-Section

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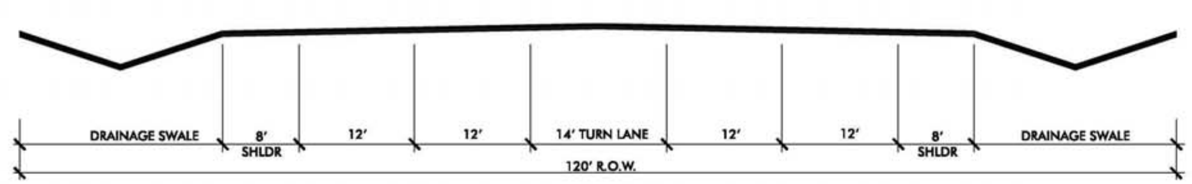

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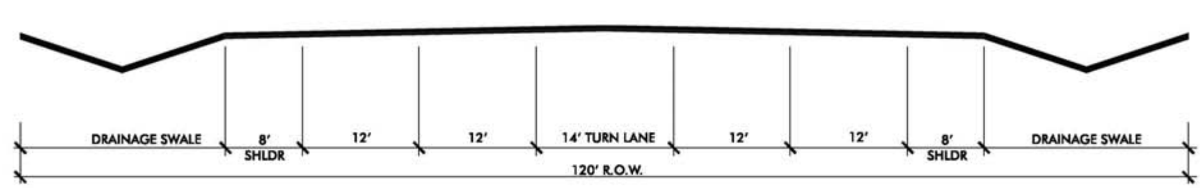

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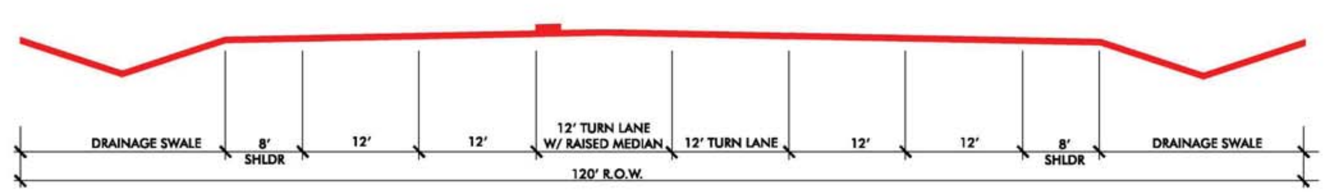
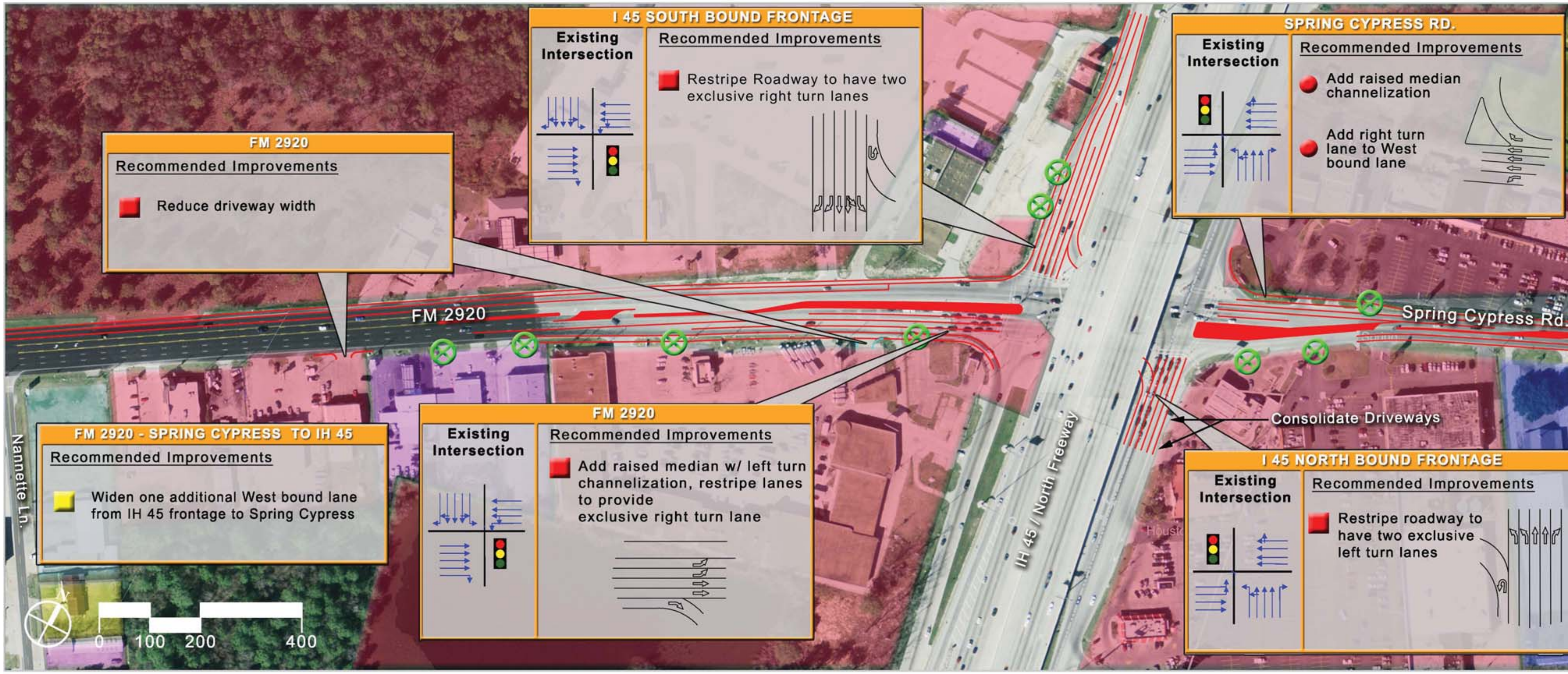
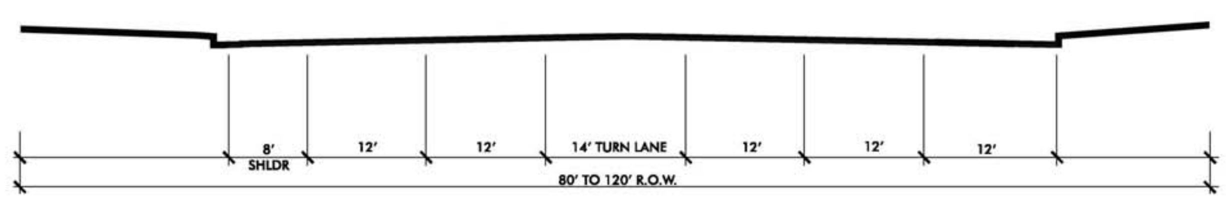


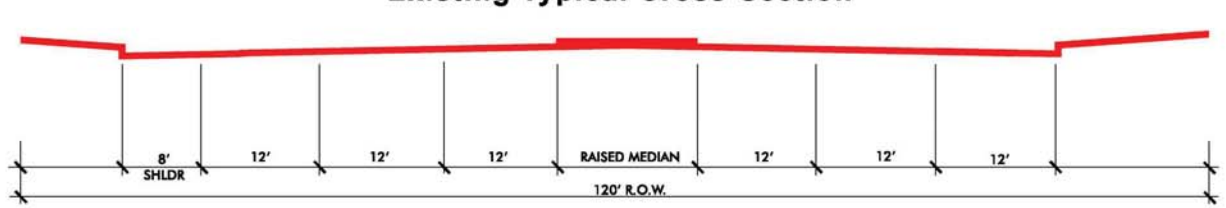
Proposed Typical Cross-Section

RECOMMENDED IMPROVEMENTS



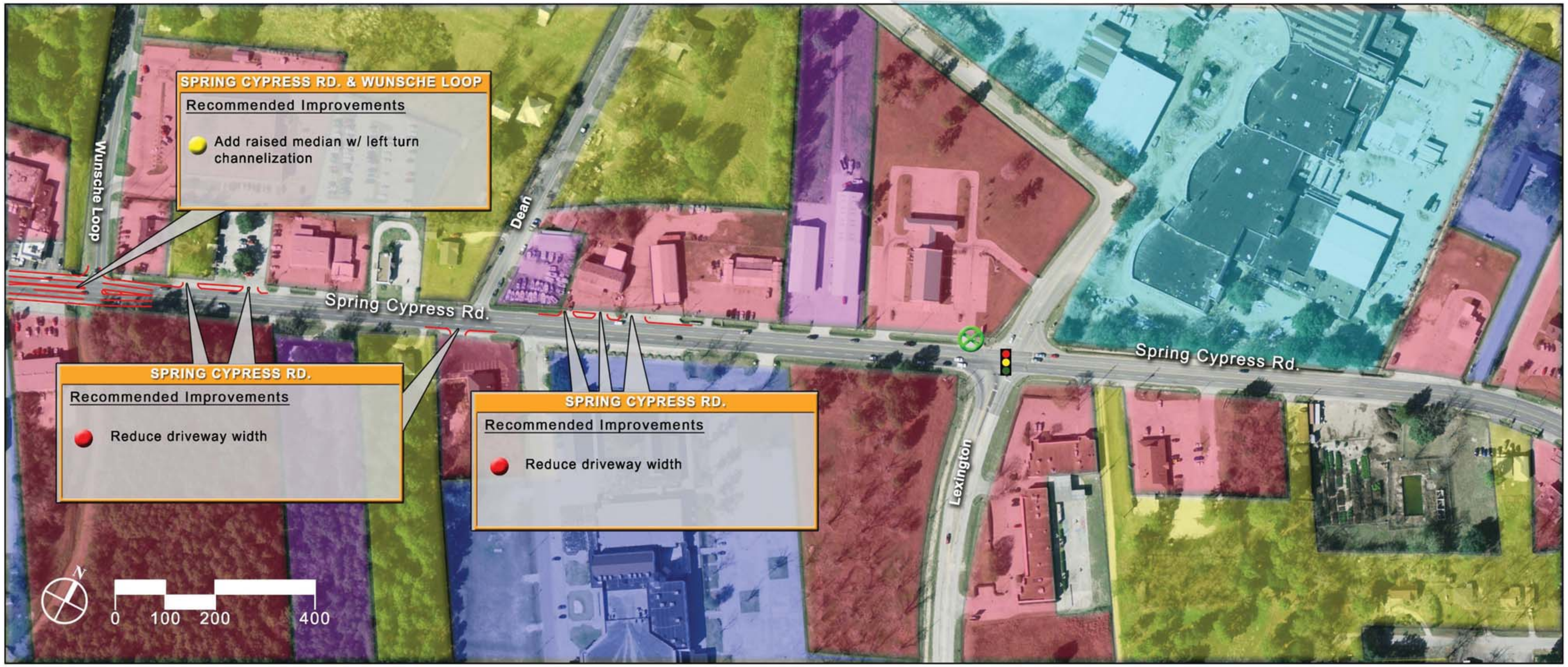


Existing Typical Cross-Section



Proposed Typical Cross-Section

RECOMMENDED IMPROVEMENTS



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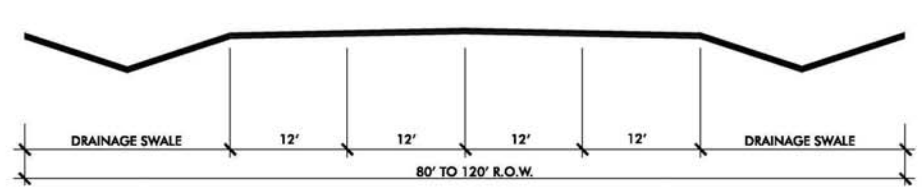


Existing Typical Cross-Section

Chapter 5: Future Corridor Needs

ISSUES REGARDING ACCESS MANAGEMENT
ACCESS MANAGEMENT IMPLEMENTATION AND STRATEGIES
STRATEGIES FOR FUTURE DEVELOPMENT

ISSUES REGARDING ACCESS MANAGEMENT

The following issues have been discussed in previous access management studies in this region. Great progress has occurred since the first access management study in April 2002. More systematic strategies could be applied to various corridors to coordinate the access needs of adjacent land uses with the function of the transportation system. The following is a reiteration of some of the issues related to access management in the region:

1. **Property owner and developer needs versus public needs –** In many instances the need to provide a safe roadway often conflicts with the developers desire to have unlimited and convenient access. In our area, the developers are not held accountable to ensure that their development does not adversely impact traffic in the area and that their needs do not adversely impact public needs.

2. **Agency obligation to provide access –** Agencies have to provide access to any platted parcel of land. Usually the land use and platting power to control the configuration and the intensity of development are vetted with either the city or the county. The State needs strong support and cooperation from the city and the county to ensure that access management is an integral part of the process.

3. **Intergovernmental Coordination –** Inter-agency support and improved communication are critical in carrying out a successful access management program. The city, State, and county must work together and establish unified criteria to preserve the integrity of the roadway system. Internally, the agencies need to resolve how to review and approve developer and property owner requests for development. A brief brochure or hand out outlining procedures for plat reviews that includes a contact person could become an effective tool for distributing the access management requirements and related information.

4. **Driveway permitting and design requirements –** The permitting processes of the various agencies should be examined and modified to address the requirements for a wider range of site uses or redevelopment. Monitoring these permits could ensure that the original permit conditions and previous agreements with developers and property owners are applicable. The driveway design and specifications should be reviewed periodically and additions or clarifications should be included to respond to frequently occurring access issues.

ACCESS MANAGEMENT IMPLEMENTATION AND STRATEGIES

WHAT CAN BE DONE?

This plan goes beyond the traditional roadway improvement to address land development and access management considerations along the FM 2920 corridor. This document is a versatile planning tool to prevent future access problems and to provide solutions for existing problems. It should be implemented through a combination of regulations, inter-agency or public-private agreements, and roadway improvement projects.

The study will establish guidelines based on the TxDOT approved Access Management Manual and TRB Access Management Manual. These guidelines should be implemented by various agencies (TxDOT, Harris County, City of Tomball and City of Waller) when reviewing permit applications for platting and access. This is a very effective tool that utilizes the permitting process and the review of developments and plats to ensure that good access management tools are implemented throughout the area on new development and redevelopment.

ACCESS MANAGEMENT GUIDELINES

Access management policies and guidelines should follow three basic rules:

- Be straight forward
- Be coordinated
- Be consistently applied

FM 2920 Proposed Access Management Guidelines for new development along the corridor (figure 5.1) will address the following:

- Functional areas near intersections
- Driveway spacing
- Driveway geometry
- Traffic Impact Study

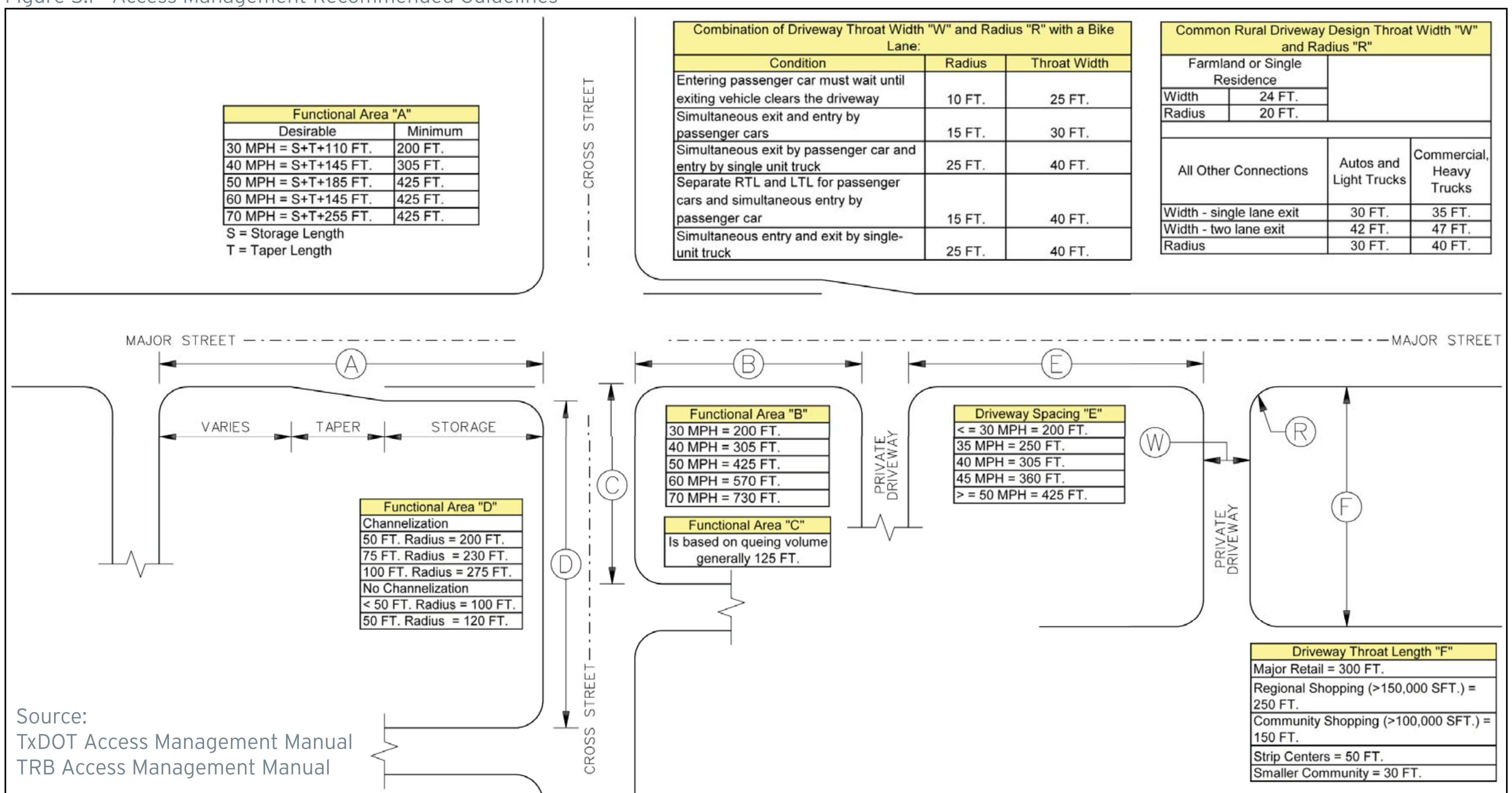
ADDITIONAL ACCESS MANAGEMENT STRATEGIES FOR THE FM 2920 CORRIDOR

Some key strategies for FM 2920 corridor to be considered:

- Establishment of a corridor management district (District) that works closely with property owners and developers to coordinate access management and corridor issues with various agencies, helping prevent further degradation of safety and capacity along the corridor. The District becomes the focal group that creates a link between the community along the corridor and the various agencies. The District also will help identify public private partnership initiatives, apply for grants, and create opportunities to support the economic development / redevelopment along the corridor.

- Create a connected supporting street system; e.g. side streets, parallel roads, interparcel circulation system to support planned development, and to help alleviate congestion on major roadways.
- Minimize the number of signals along FM 2920 to maintain efficient traffic flow. Traffic signals are needed at high-volume intersections; however, consideration for future signals includes whether the location meets signal warrant requirements based on the Manual on Uniform Traffic Control Devices, and whether the signal is consistent with access spacing criteria and preserves the efficiency of traffic flow. The key is to have a long and uniform spacing of traffic signals. This will improve the ability to coordinate signals and reduce delays along the corridor.
- Work closely with property owners and developers along the corridor to promote shared use driveways, reconstruction of substandard driveways, or relocation of driveways as well as interparcel connections during the redevelopment or expansion of an existing development.
- Regulate access to out-parcels and require internalized access to out-parcels via the shared circulation system of the development.
- Require major new developments along FM 2920 to conduct traffic impact studies, including methods to mitigate adverse impacts on FM 2920 traffic and operation.
- Promote multimodal facilities to support alternatives to vehicular use such as transit connection, park and ride facilities, and pedestrian and bicycle facilities, etc.
- Promote mixed use development and redevelopment along the corridor to create livable centers where people can work, play, and live within a walking distance and create an environment that is less dependent on vehicular use.

Figure 5.1 - Access Management Recommended Guidelines



STRATEGIES FOR FUTURE DEVELOPMENT

Both urban planning for future development and planning for transportation design are intrinsically connected. Land use, development type and pattern, building orientation, parking configuration and access collectively contribute to the development framework for creating efficient safe access to and within transportation systems and facilities.

The mobility needs, issues, and concerns for FM 2920 are not unlike many corridors and growing communities in suburban Houston and suburban America alike. Proactive approaches to developing and designing "Smart Growth" initiatives are essential to the success of both solving the transportations solutions and ensuring the success and quality of life aspect of development in rapid growing and redeveloping suburban and urban communities.

Establishing a cohesive hierarchical network or transit, street, streetscape, sidewalk, walkways, trails and open natural systems within development patterns that offer mixed-use density redistributed within in town centers and along commercial corridors will elevate the problematic growing demand of arterial volume of the traditional "commuting" patterns between urban cores and outer ring suburbia. In addition, responding to long-range planning of multi-modal forms of transportation and creating development and land uses that are "transit-oriented" will ensure the demand and success of alternative transportation needs in conjunction with the increasing demand for quality of life and environmental concerns.

H-GAC has developed a plan to bring together land use and transportation through a three-pronged coordination strategy that employs the creation of bicycle and pedestrian friendly Centers, establishment of better Connections between the centers, and designs based on the Context of the surrounding land uses. In addition to enhancing mobility choices, this 3C's strategy is expected to produce economic, environmental, and "quality of place" benefits for the region.

LIVABLE CENTERS

H-GAC has taken several steps towards implementing the 3C's program. A "Livable Centers" project category has been created in the TIP and RTP, and sponsors have proposed both planning and implementation of Livable Centers projects. Centers are places with a concentration of workplaces, shopping, entertainment, and/or housing. Clustering these activities creates opportunities for walking, bicycling, and transit trips, thus reducing the need for car travel. Depending on the concentration of activities and the pedestrian environment, internal car trips, within a center, could be reduced from 5% to 55%. The goal of the Livable Centers strategy is to improve access while reducing the need for single-occupant vehicles. Through a concentration and a mix of land uses, Livable Centers allow for greater accessibility by a variety of transportation modes, including walking, bicycling, and transit.

Source: H-GAC

3C'S, CENTERS, CONNECTIONS, CONTEXT

New Investment Opportunities

Most development in our region today is vehicle oriented. Transportation investments and market forces have created a cycle of automobile-dependency, where the mobility demands of growth are primarily met by roads and parking lots.

Mixed use centers are places where people can live, work and play without using their vehicles.

People increasingly want more choices in how they travel between where they live, work, and play. This trend presents a tremendous opportunity for new types of transportation investments that can reduce the growth of vehicle travel, while producing added economic and environmental benefits.

3Cs PROGRAM

CENTERS · *Safe Walkable Places*

Centers are places with concentrations of jobs, shopping, entertainment, public buildings, recreation, housing or all of these together. Well-designed Centers provide safe opportunities to walk, bike, utilize transit and "Park Once."

CONNECTIONS · *Convenient Choices*

Providing better auto, transit and pedestrian/bicyclist connections between Centers and neighborhoods gives residents, workers and visitors an alternative to congested thoroughfares.

CONTEXT · *Collaborative Solutions*

Early collaboration between stakeholders can produce street designs that meet all user needs and provide lasting community benefits.

KEY STRATEGIES

CENTERS

- *Reinvest in existing downtowns and other already walkable centers and neighborhoods.*
- *Promote development of live, work and play opportunities near transit.*
- *Encourage Town and Village Center designs in new development.*
- *Provide a safe, convenient walking environment.*

CONNECTIONS

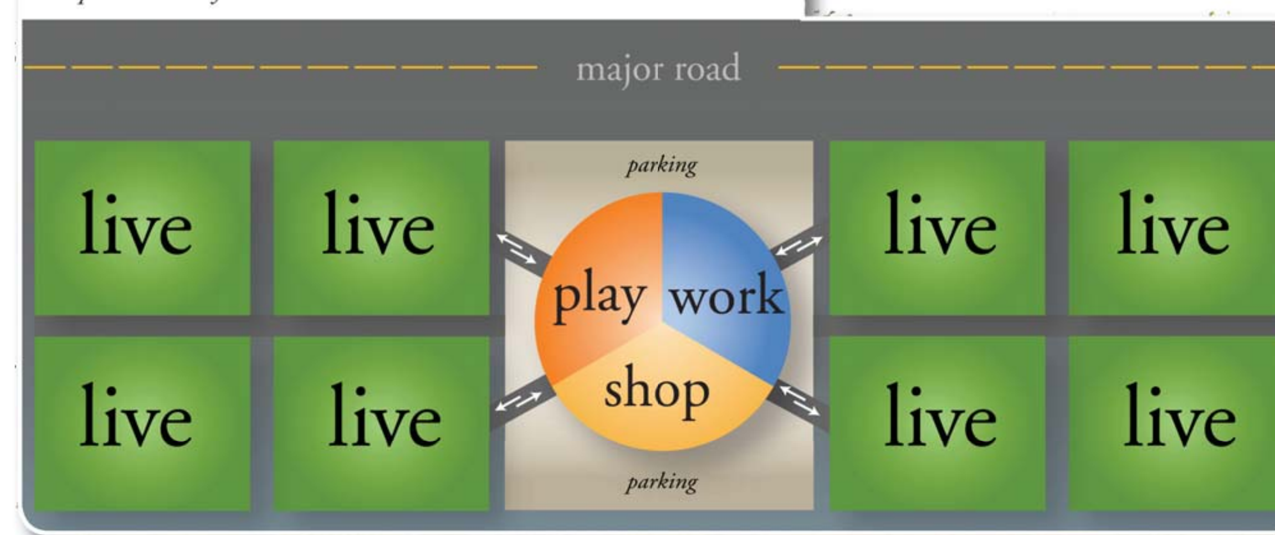
- *Establish excellent transit Connections between Centers.*
- *Provide safe pedestrian/bicyclist access to Centers.*
- *Design local streets networks to give people alternatives to congested thoroughfares.*

CONTEXT

- *Develop "Complete Streets" that are safe, have transit options, sidewalks, bikeways and landscaping appropriate for the surrounding land uses.*

3Cs APPROACH

A mix of destinations are clustered and can be accessed by vehicle, transit or pedestrian/bicyclist.



Source: H-GAC

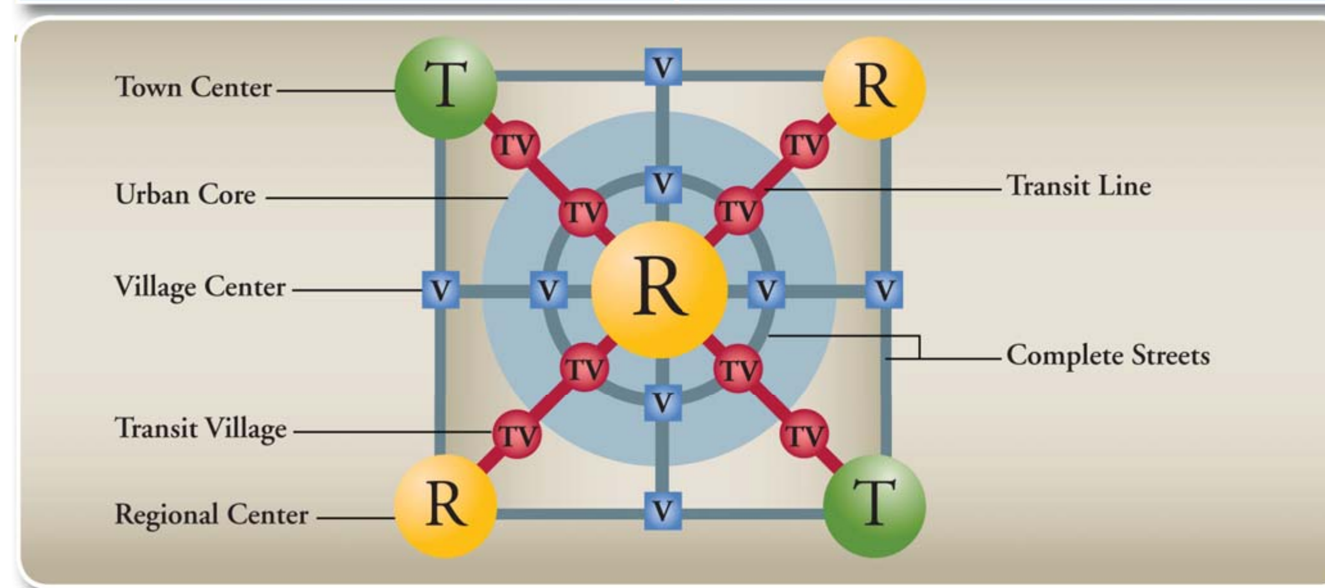
3C'S PROGRAM POTENTIAL

- Reduce Roadway Congestion
- Improve Roadway Safety
- Create Economic Advantages
- Produce Environmental Benefits
- Create Quality Places

HOW H-GAC CAN HELP

- Coordinate transit and roadway planning to ensure that existing and planned Centers are well connected to the region's multi-modal transportation network
- Promote roadway designs appropriate for the context of the surrounding community to ensure safe, convenient travel choices for all user modes
- Promote coordination of local transportation improvements and private sector development
- Help fund local planning studies to assist in the development of Centers
- Provide funding support for internal street connections and pedestrian facilities

TYPES OF CENTERS	VEHICLE TRIP REDUCTIONS
URBAN CORE High-density residential areas with mixed land uses and frequent intersections.	**5-20%** depending upon the concentration of activities, quality pedestrian environment and level of transit service.
REGIONAL CENTER Areas of concentrated employment or other major trip generators.	**Up to 40%** of workday vehicle trips. **Up to 55%** in highly concentrated areas with an outstanding pedestrian environment.
TOWN CENTER Concentration of housing, retail/office and civic destinations within half-mile radius of community gathering place with a good pedestrian network.	**5-7%** of home-based "live, work, play" pedestrian trips. **Up to 10%** with outstanding pedestrian environment.
TRANSIT VILLAGE High-density housing, retail and other destinations concentrated within a quarter mile to half mile and with good pedestrian access to a high volume transit facility.	**Up to 20%** with increased transit sharing of home-based work and other trips and increased pedestrian sharing of non-work trips.
VILLAGE CENTER Clustered neighborhood retail and services with good connections to surrounding neighborhoods.	**Up to 6%** of some home-based, non-work, pedestrian/bicyclist trips with reduced traffic on major roads. **Up to 7%** with good bicycle access.



Source: H-GAC

Appendix