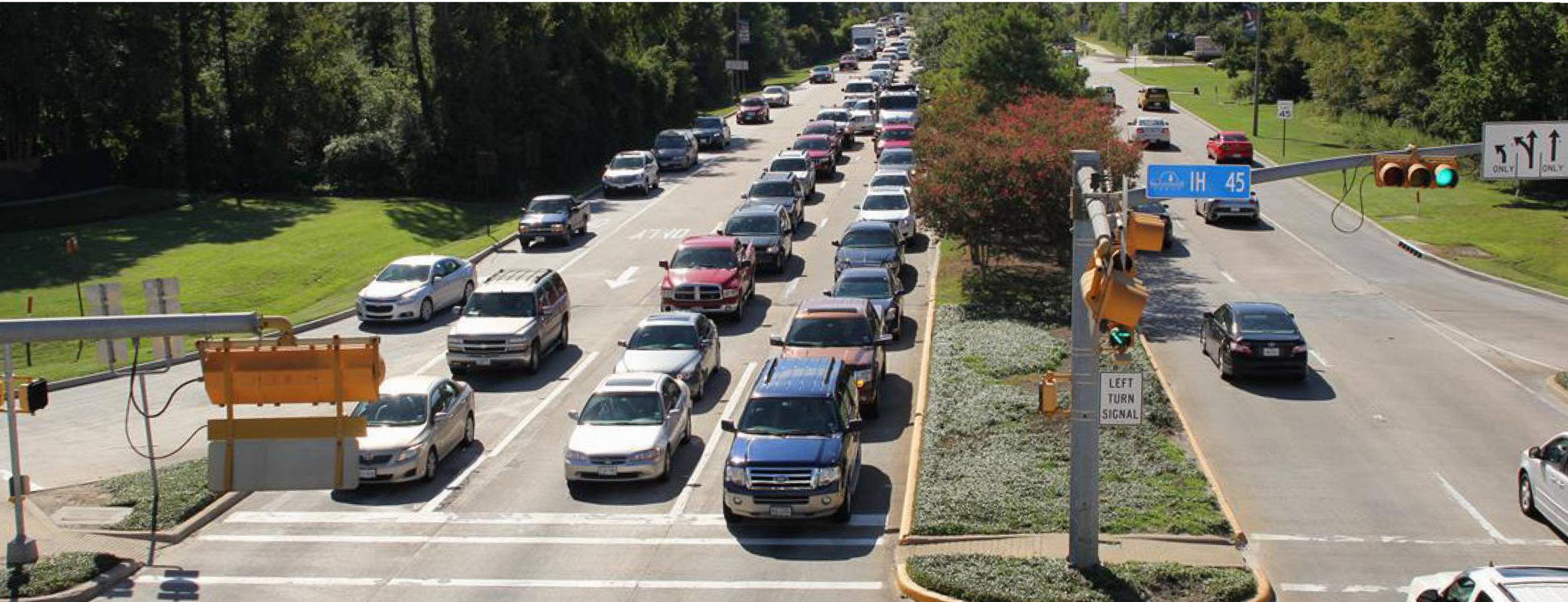


# SOUTH COUNTY MOBILITY

options | priorities



SEPTEMBER 2015



Research Forest Drive at IH 45

SOUTH COUNTY  
**MOBILITY**

options | priorities



SEPTEMBER 2015



# ACKNOWLEDGEMENTS

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### COMMISSIONERS COURT (2013):

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The Woodlands, Texas

# EXECUTIVE SUMMARY

# EXECUTIVE SUMMARY

## PROJECT BACKGROUND

South Montgomery County is a rapidly-growing part of the greater Houston-Galveston region both in terms of population and employment. In order to coordinate transportation planning efforts undertaken by local agencies to accommodate this growth, elected officials asked the Houston-Galveston Area Council (H-GAC) to establish a partnership with Montgomery County Precinct 3, The Woodlands Township, the City of Shenandoah, Oak Ridge North, The Woodlands Road Utility District #1 and Texas Department of Public Transportation (TxDOT) to collectively examine current and future mobility needs.

## PROJECT PURPOSE

The purpose of the South County Mobility Plan (SCMP) was to perform a sub-regional mobility study that would result in actionable recommendations to improve mobility and access to jobs, homes, and services in the study area (**Figure E1**). The report analyzes current and future conditions (e.g., population, employment, other relevant demographics, roadway network, and economic development), and identifies existing traffic bottlenecks and roadway facilities with high congestion levels and/or potentially unsafe conditions. Unsafe conditions include roadways with design deficiencies or deteriorated physical condition, inadequate capacity, and outdated traffic control and management systems.

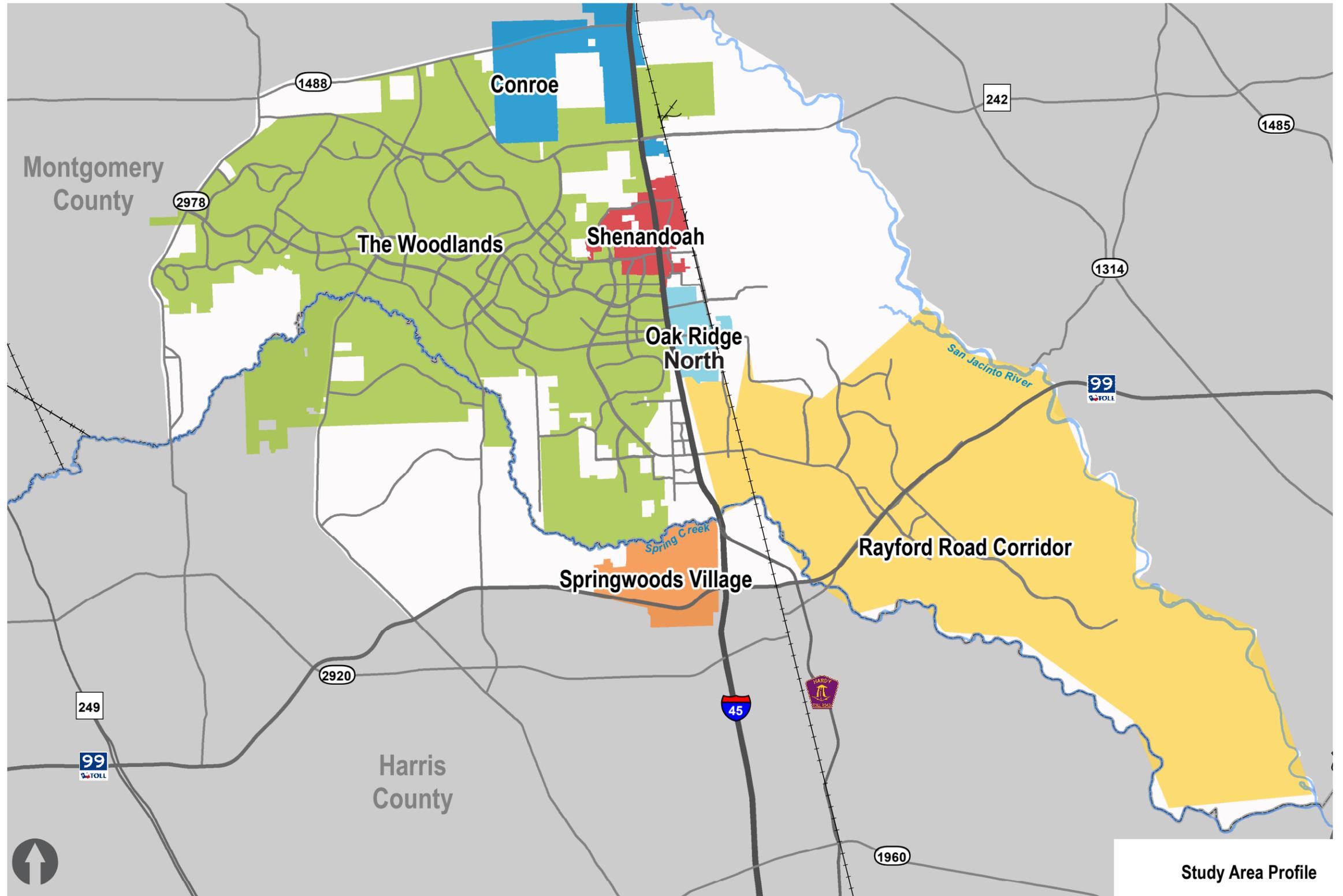


Figure E1: Study Area Profile

# EXECUTIVE SUMMARY

## THE VISION

Representatives from each of this study's participating agencies wanted to develop a transportation system that would accommodate existing and future mobility needs of all people and goods traveling within and through the area. These representatives formed a steering committee, which developed the following SCMP vision statement:

*"The vision of the South Montgomery County Mobility Plan is to protect and enhance the economic competitiveness and quality of life of the growing South Montgomery County area by designing a safe, efficient, interconnected, and cost-effective roadway network that recognizes the needs of all users: those traveling by autos, trucks and commercial vehicles, cyclists and pedestrians."*

The study's vision was delineated by specific goals, objectives, and performance measures.

## GOAL

### **Maximize Mobility:**

Develop innovative approaches to manage and improve transportation facilities throughout, minimize delays and selectively increase roadway capacity on the transportation network.

### **Quality of Life:**

Reflect the participating communities' priorities on protecting quality of life and the natural environment through appropriate use of design concepts and mitigation techniques.

### **Project Consensus:**

Strengthen partnerships between local governments, TxDOT, other transportation agencies and the private sector by identifying projects with significant consensus in the South Montgomery County/North Harris County area.

### **Economic Vitality:**

Support continued economic vitality by managing congestion, improving travel reliability and safety.

## OBJECTIVE

- Develop innovative approaches to make the network more efficient
- Preserve Right-of-Way
- Balance between transportation and the natural environment
- Fiscal soundness
- Community support
- Strengthen partnerships
- Manage congestion
- Improve reliability
- Improve safety

Within this framework, the South County Mobility Plan identified the following areas of concern:

- Mobility
  - Lack of north-south and east-west connectivity
  - Incomplete roadway network
  - Traffic signal operations and management
- Safety
  - Crash hotspots
  - Roadway signage and lighting
  - Existing and Future Developments
  - ExxonMobil/Springwoods Village
  - East side residential and commercial
  - West side office and commercial
- Other
  - Connections to Grand Parkway
  - Coordination with Union Pacific on future grade separations at railroad crossings
  - Core bicycle plan for study area including the Spring Creek Greenway



Market Street is a major shopping destination in The Woodlands Township.

# EXECUTIVE SUMMARY

## ANALYSIS

The study involved an extensive traffic data collection effort, roadway and intersection analyses, a thorough inventory and assessment of the roads in Precinct 3, a series of steering committee meetings and a public involvement program.



**TRAFFIC CAPACITY**  
 Traffic capacity analyses based on daily traffic volumes were performed for the major roadways in the study area and were validated with their corresponding average travel speed. The criterion was based on the generalized capacity analysis tables and average speeds located in the 2010 Highway Capacity Manual.

**INTERSECTION LEVEL OF SERVICE**  
 Intersection level of service analyses were performed using Synchro/SimTraffic (version 8) using peak period-turning movement counts. Model inputs included traffic volumes, lane geometry, posted speed limits, traffic signal control timing plans, and vehicle/driver parameters. Average speed analyses and helicopter videos were conducted along the major arterial streets during the morning and afternoon peak hours. Intersection capacity analyses were conducted at the major intersections.

**TRAFFIC FORECAST**  
 The traffic forecast for the South Montgomery County area shows a significant traffic growth for the short term period (0-5 years) period as well as for the long term period (5-25 years). This growth in traffic is occurring as a result of increases in population and employment.

**AVERAGE SPEED**  
 Average speeds were determined using Bluetooth devices capable of capturing Bluetooth signals from vehicles and their operators, which measure the time, in seconds, a vehicle takes to travel from one station to the next.

**TABLE E1: DEMOGRAPHIC AND REAL ESTATE VALUATION PROJECTIONS**

Design Year	Household Population Increase from 2013	Employment Increase from 2013	Residential Real Estate Valuation Increase from 2013	Commercial and Other Non-Residential Valuation Increase from 2013	Traffic Increase from 2013
2018	7%	26%	\$11.1 Billion	\$3.6 Billion	22% to 84%
2040	74%	84%	\$22.6 Billion	\$5.2 Billion	44% to 94%

Table E1 shows anticipated study area household population and employment growth, projected real estate valuation, and projected traffic increase for both design years relative to year 2013 conditions. The projected growth in household population and employment in the study area will generate future tax revenues to help pay for transportation facility improvements.

# EXECUTIVE SUMMARY

## PUBLIC INVOLVEMENT

The SCMP team customized a robust public involvement program that described the unique character of the area and needs of the residents, businesses, and employees who face daily mobility challenges. Two public meetings, a business open house, a project website, and several stakeholder presentations allowed members of the community to participate and express their concerns on mobility issues.

The study partners maintained continuous communications during the decision-making process. In addition to this, the SCMP team used a variety of public involvement techniques by eliciting public opinion and encouraging community participation.

A comment card was distributed at the first public meeting held February 27, 2014 at Oak Ridge Baptist Church along with a project website to deliver feedback to the study team. Comments received from the public meetings, comment cards and the study's website indicated that the community was most concerned about congestion on the following roadways:

- Rayford/Sawdust (381 comments)
- Kuykendahl Road (243 comments)
- Robinson Road (203 comments)
- Hanna Road (143 comments)
- Woodlands Parkway (68 comments)
- Riley Fuzzell (65 comments)
- IH 45 (57 comments)

A second public meeting was held on September 25, 2014 at Shenandoah's Municipal Complex. At this meeting, the findings of the study and the proposed recommendations were presented. Approximately 120 people attended this meeting which included an open house, two presentations, as well as a robust question and answer session.

## FINDINGS

Inadequate transportation facilities and services in the SCMP study area threaten the quality of life enjoyed by current residents as well as its continued economic growth. The projected growth is due to new developments occurring both within and outside the study area. New developments in the study area include: ExxonMobil campus, Springwoods Village, The Woodlands Town Center and Hughes Landing, Oak Ridge North Industrial Park, Shenandoah's large commercial developments, and multiple new residential developments primarily on the east side of IH 45.

With the upcoming opening of Grand Parkway, there is a critical need for parallel facilities to IH 45 and alternative commute options. This includes improvement of the existing north-south facilities as well as the construction of new north-south facilities parallel to IH 45 in the near term in order to fully take advantage of the new capacity and connectivity provided by the Grand Parkway.

Another critical mobility shortcoming is the lack of transportation facilities to provide proper traffic circulation for the office and commercial developments in the area. The existing interchanges along IH 45 at Woodlands Parkway/Robinson Road and Lake Woodlands Drive are rural designs that have become obsolete as the area has developed. Mobility would also be enhanced by providing two additional grade separations along IH 45: one between Research Forest and Lake Woodlands Drive, and another between Woodlands Parkway and Rayford-Sawdust Roads to provide traffic circulation across IH 45 as well as u-turns to serve businesses along the frontage roads.

A third pressing issue is the lack of a grid network of arterial streets on the east side of IH 45 to distribute the traffic trying to access IH 45 and Hardy Toll Road via Rayford Road. Providing a grade separation at the Union Pacific railroad tracks will be a critical element to reliable east-west travel as well.

A fourth mobility issue regards the natural and man-made barriers in the area, which prevent traffic from moving more freely across Spring Creek in the north/south direction and the Union Pacific Railroad in the east-west direction. These barriers prevent mobility, not only for vehicles, but also for pedestrians and bicyclists.

The existing conditions analysis concluded that IH 45 is severely congested from SH 242 to the Hardy Toll Road, as are most of the major arterial streets and highways in the study area. These congested arterials and highways include Rayford Road, Sawdust Road, Woodlands Parkway, Robinson Road, Research Forest Drive, Tamina Road, Kuykendahl, Gosling, Lake Woodlands, Grogans Mill, FM 2978, SH 242, and FM 1488. The following are the top 10 most congested signalized intersections in the study area:

1. IH 45 Northbound Frontage Road at SH 242/College Park
2. IH 45 Southbound Frontage Road at Sawdust Road
3. College Park Drive/SH 242 at IH 45 Southbound Frontage Road
4. Woodlands Parkway at Kuykendahl Road
5. IH 45 Northbound Frontage Road at Rayford
6. IH 45 Northbound Frontage Road at Tamina
7. Woodlands Parkway at Six Pines Drive
8. College Park Drive/SH 242 at Gosling Road
9. Woodlands Parkway at Woodloch Forest
10. Lake Woodlands at Gosling

# EXECUTIVE SUMMARY

Traffic capacity analyses based on daily traffic volumes were performed for the major roadways in the study area and were validated with their corresponding average travel speed. The results of these analyses were reported in terms of four levels of condition: (1) Under capacity, (2) At capacity, (3) Over capacity, and (4) Severely over capacity. The criterion is based on the generalized capacity analysis tables and average speeds located in the 2010 Highway Capacity Manual (HCM). **Figure E2** shows the results of the daily roadway capacity analysis, average speed analysis, and delay observations of the helicopter videos.

A significant portion of the development currently underway in the Springwoods Village/ ExxonMobil campus area will be complete by 2018 and in The Woodlands Town Center/ Hughes Landing area by 2020. Likewise, east of IH 45 between SH 242 and Tamina Road, east of Aldine Westfield, and along the Grand Parkway, new development is occurring and a large portion of it should be in place by 2018. The Grand Parkway will be operational by 2018 and it could absorb a significant portion of the projected traffic demand provided the roadways accessing it are also improved by 2018. By 2020, the emphasis should be placed on relieving IH 45 with parallel facilities, rebuilding the IH 45 interchanges to urban standards, and providing grade separations at the major arterial streets crossing the Union Pacific railroad, and on Research Forest, Lake Woodlands Drive, and Woodlands Parkway.



Figure E2: Traffic Counts and Existing Roadway Capacity (Based on roadway capacity analysis, average speed analysis, and delay observed by the helicopter videos.)

# EXECUTIVE SUMMARY

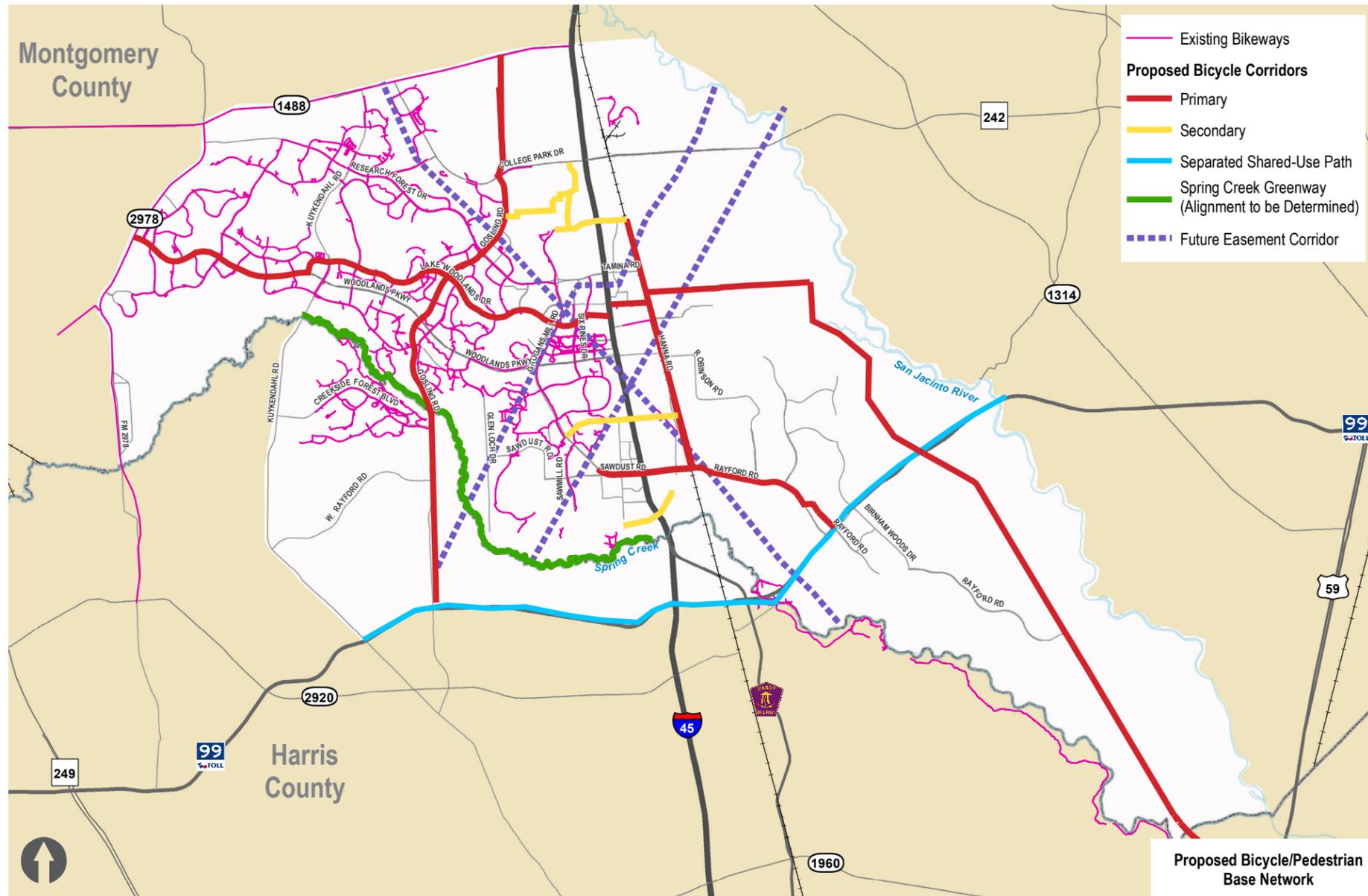


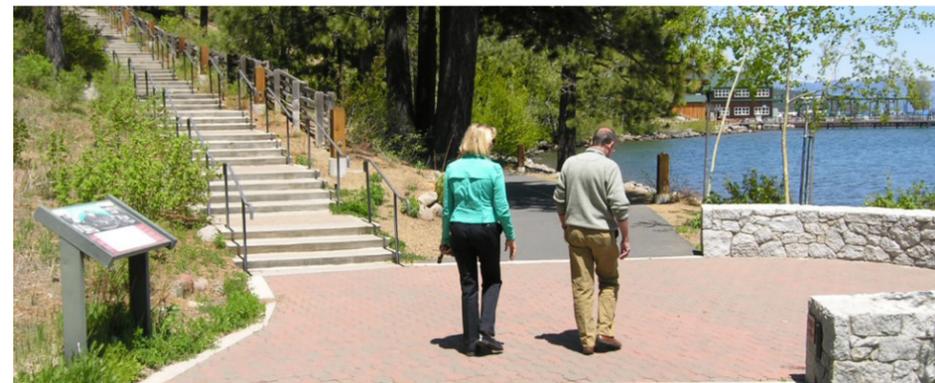
Figure E3: Proposed Bicycle and Pedestrian base network

## BICYCLE/PEDESTRIAN ANALYSIS

The South County region is growing rapidly and unless steps are taken to include other modal options, travel by walking and bicycling will become increasingly difficult. Currently, there is little bicycle or sidewalk access from residential areas east of IH 45 to the employment centers on the west side, with Rayford Road being the only possible route by bike. Along with the involvement activities for the general public and business communities, the bicycle and pedestrian communities were engaged to identify challenges, opportunities, and preferred solutions.

Lake Woodlands Drive was selected as the major east/west bicycle pedestrian corridor due to its central location in The Woodlands as well as its potential as a connector on the east side of IH 45 with Oak Ridge School Road and Sleepy Hollow Road. Gosling was selected as the major north/south corridor on the west of IH 45 due to its connectivity and parallel utility easement for a possible future shared use path.

East of IH 45, Hannah and Townsen Roads were selected in a similar manner. In addition to this, it is recommended that a multi-use facility be constructed adjacent to Grand Parkway. **Figure E3** shows approximately 77 miles of proposed bicycle/pedestrian facilities based on public input and field investigation.



Examples of shared use paths.

# EXECUTIVE SUMMARY

## RECOMMENDATIONS

The short- and long-term programs of proposed projects have been designed to address the mobility issues in South Montgomery County. The improvements to the transportation network have been identified based on both existing and anticipated future traffic demand in the study area. As a result, the proposed projects listed below are expected to address the needs of this fast-growing area and allow for improved access to homes, jobs, shopping and entertainment by the general public. It will be up to the state and local governments with jurisdictional authority to implement the suggested solutions.

The proposed project listing includes a brief description of the project, estimated 2014 construction cost (excluding of potential right-of-way acquisition and utility relocation), and implementing entity or entities (Shenandoah, Oak Ridge North, Woodlands RUD #1, Montgomery County, TxDOT, Harris County and Conroe). Further details about each project, including the potential funding sources (federal, state, local, etc.), plan goals met (economic development, maximization of mobility, quality of life, and project consensus, and mobility issues addressed (IH 45 alternative, N/S and E/W connectivity, access to Grand Parkway, local circulation, overall mobility, bicycle/pedestrian and intersection issues), are available in the full report.

The local funding sources include capital improvement programs and bond financing by local governmental agencies, and construction of transportation facilities by private land developers. State and federal funding sources are normally available for state-owned facilities, traffic management projects, multi-modal projects, and key transportation system projects.

The recommendations to improve mobility in the study area consist of the following general types of transportation improvement projects:

### Operational Strategies

- Traffic signal timing optimization
- Dynamic message signs
- Intersection widening
- New roadway interchanges

### Major Construction

- Roadway widening
- Roadway connections
- New roadways
- Roadway grade separations
- Railroad grade separations
- New cycling/pedestrian facilities

## SHORT TERM RECOMMENDATIONS (0-5 YEARS)

The short-term recommendations consist of feasibility studies, route studies, environmental and schematic studies, intersection improvements, street widening, and area-wide traffic management improvements. These traffic management programs include implementing an aggressive incident clearance program, employing a traffic signal timing optimization program, and installing dynamic message signs throughout the study area. The short-term recommendations were developed in order to mitigate the existing and recurring traffic congestion in the study area. (Note: Bicycle accommodations are recommended on all new or widened facilities. The type of accommodations will be determined by implementing entities and their partners during the design process.)

The short-term recommendations were broken into two separate categories: key corridors and additional short-term corridors.

TABLE E2: SHORT-TERM KEY CORRIDORS

Corridor	Segment	Description	Corridor Cost	
			Estimate (Millions)	Responsible Entity
<b>Rayford Road</b>			<b>57.8</b>	
	Rayford	Construct a roadway overpass at the UP Railroad.	13.7	M, U
		Widen Rayford Road to six lanes, incorporating access management strategies, from the UP Railroad to Legends Run Drive and Fox Ravine Drive to Grand Parkway.	21.5	M
	Birnam Woods	Widen to four-lanes from Elan Blvd to the Grand Parkway.	7.2	M
		Widen to four lane s from Grand Parkway, south, to Rayford Road.	9.9	M
	Elan	Widen to four lanes from Aldine Westfield to Birnam Woods Drive.	5.5	M
<b>Woodlands Parkway/Robinson Road</b>			<b>87.7</b>	
	Woodlands Parkway/Robinson at IH 45	Convert the Woodlands Parkway/Robinson Road at IH 45 to a single-point urban interchange (SPUI), including frontage road U-turn lanes.	51.2	M, T, R, O
	Robinson	Widen to four lanes from IH 45 to east of the UP Railroad.	10.0	O
	Woodlands Parkway	Extend IH 45 direct connectors over Woodloch Forest and Six Pines.	26.5	M, R
<b>Lake Woodlands/Grogans Mill</b>			<b>14.1</b>	
	Lake Woodlands	Widen to six lanes from Lake Front Circle to IH 45.	6.8	M, R
		Construct an overpass on Lake Woodlands at Grogans Mill.*		M, R
		Construct a westbound-to-eastbound U-turn at Target/The Woodlands Mall entrance.	1.3	M, R
	Grogans Mill	Widen to six lanes from Woodlands Parkway to Research Forest.	6.0	M, R
<b>Gosling</b>			<b>41.0</b>	
	Gosling	Widen to four lanes from Flintridge to Grand Parkway.	21.0	M, R, H
		Construct a two lane bridge over Spring Creek.	20.0	M, R, H
<b>Kuykendahl</b>			<b>6.6</b>	
	Kuykendahl	Widen to four lanes from Lake Woodlands to Bay Branch.	6.6	M, R
		Widen to four lanes from Flintridge to Augusta Pines.*		M, R, H
		Construct a two lane bridge over Spring Creek.*		M, R, H
<b>Total</b>	<b>9 Roads</b>	<b>16 Segments</b>	<b>207.2</b>	

\* Committed project

# EXECUTIVE SUMMARY

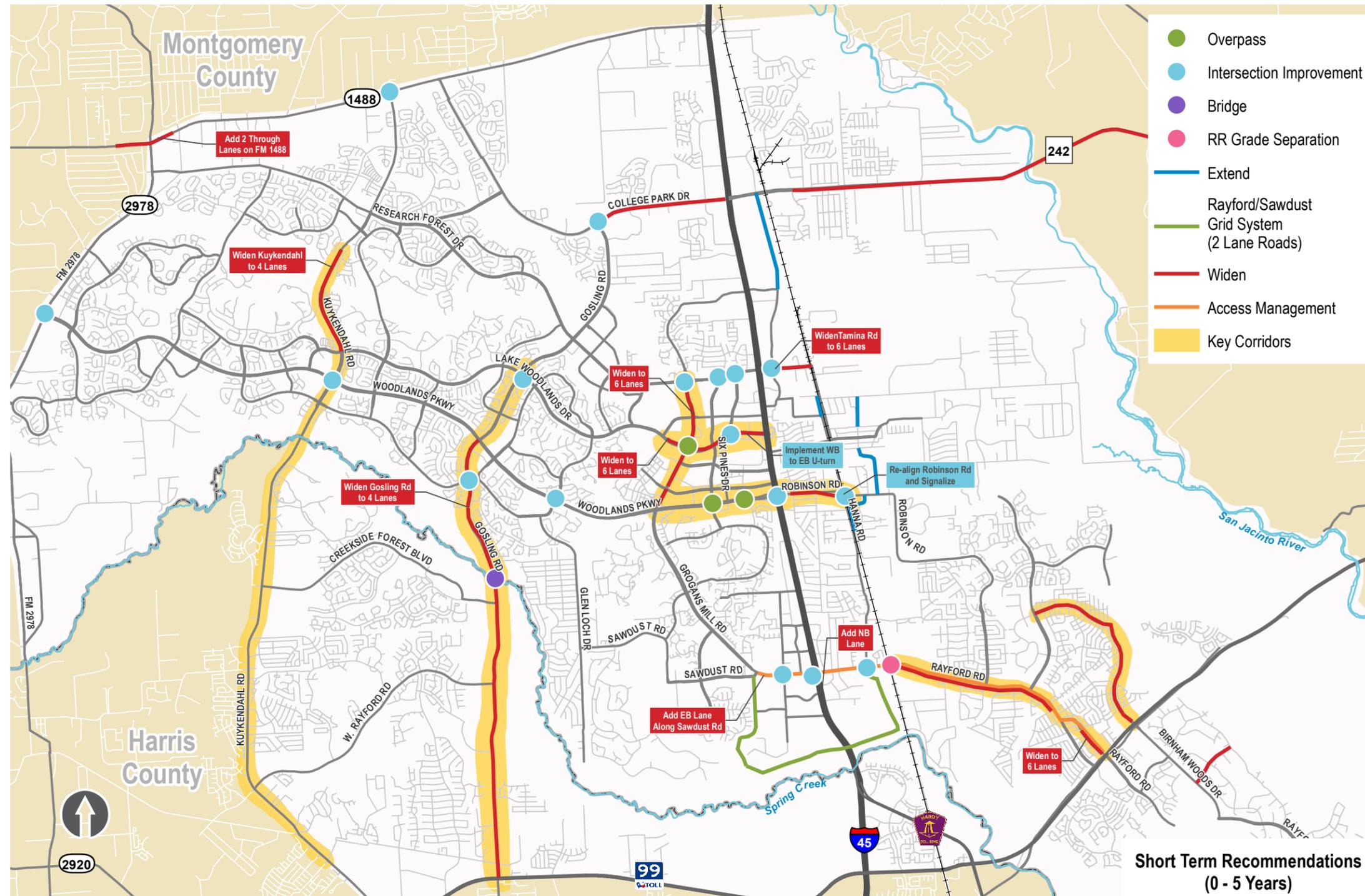


Figure E4: Short-Term Recommendations

## SHORT-TERM KEY CORRIDORS

The short-term key corridors were selected based on public input and the need for immediate congestion relief. The short-term key corridors are shown in **Table E2** and **Figure E4**.

These recommended improvements to the Rayford Road corridor improve the single arterial connecting IH 45 to Grand Parkway serving the study area east of IH 45. Widening Birnham Woods and Elan Blvd also improves access to Grand Parkway east of IH 45. The recommended improvements to Woodlands Parkway and Robinson Road consisted of improving access to the core business areas in the Woodlands Town Center and Oak Ridge North. The recommended improvements on Lake Woodlands and Grogans Mill address the mobility needs of the projected growth in the Woodlands Town Center area in the near term. The improvements on Gosling and Kuykendahl will provide the necessary access to the Grand Parkway, improve access to The Woodlands and consequently provide an alternative to IH 45.

# EXECUTIVE SUMMARY

## ADDITIONAL SHORT-TERM CORRIDORS

The additional short-term corridors shown in **Table E3** and **Figure E4** consist of various types of studies, including feasibility, environmental assessments, route alignment and alternative analyses as well as road construction projects that do not require additional right-of-way.

TABLE E3: SOUTH COUNTY MOBILITY PLAN: SHORT-TERM RECOMMENDATIONS (0-5 YEARS)				
Road	Segment Description	Segment Cost Estimate** (Millions)	Total Corridor Cost Estimate** (Millions)	Responsible Entity
<b>Aldine Westfield Road</b>			<b>5.0</b>	
	Conduct an environmental assessment and develop schematic drawings for the extension from the Riley Fuzzell/Grand Parkway to Ed Kharbat Drive in Conroe.			M, C, H
<b>Blair</b>			<b>1.8</b>	
	Extend the two lane road from Curry to Cox.			M
<b>David Memorial Drive</b>			<b>11.0</b>	
	Construct four lanes divided extension from Shenandoah Park Drive to SH 242.			M, S, C
<b>Fairview/Blair/Foster Corridor Study</b>			<b>0.9</b>	
	Conduct a route study to build a road from Rayford to SH 242 via Foster, Blair and Fairview alignments.			M, C
<b>FM 1488</b>			<b>1.4</b>	
	Perform an alternatives analysis to determine the alignment to extend from IH 45 to FM 1314.			M, C
<b>Gosling</b>			<b>0.8</b>	
	Conduct an environmental assessment to extend Gosling Road north from SH 242 to FM 1488.			M, R, C
<b>Grogans Mill Road</b>			<b>2.6</b>	
	Conduct a feasibility study to address the need for improving intersection at Woodlands Parkway	0.6		M, R
	Conduct a environmental and schematic study to evaluate options to improve capacity in the north-south direction of Grogans Mill, including the widening to six lanes from Woodlands Parkway to Sawdust, a direct connector from Grogans Mill to South Park Drive, widening of South Park Drive, widening of Westridge Road, widening of Pruitt Road, and a direct connector from IH 45 northbound to Pruitt Road westbound.	2.0		M, R
<b>Hanna/Oak Ridge School Road</b>			<b>1.4</b>	
	Extend the two lane road north to connect to Johnson			M, O
<b>Harpers Way</b>			<b>0.3</b>	
	Conduct a route study to extend road south from Laughing Falcon Trail to proposed Tamina Road extension.			M, C
<b>Kuykendahl</b>			<b>6.6</b>	
	Widen to four lanes from Lake Woodlands Drive to Bay Branch			M, R
<b>Lake Woodlands Drive</b>			<b>0.6</b>	
	Conduct an environmental impact study for the extension from IH 45 to Sleepy Hollow.			M, R, O
<b>Lexington Blvd</b>			<b>9.3</b>	
	Widen to four lanes from Rayford to East Benders Landing.			M
<b>Oak Ridge Park</b>			<b>1.1</b>	
	Extend two lane road from Robinson to Curry.			M
<b>Rayford/Sawdust Corridor</b>			<b>34.8</b>	
	Implement access management strategies (raised median, driveway consolidation) and add right turn lanes at all the signalized intersections between Grogans Mill and UP Railroad.	14.9		M
	Construct a new two-lane road under IH 45 at Spring Creek to connect both sides of IH 45.	19.9		M
<b>Research Forest</b>			<b>9.1</b>	
	Improve the intersection at Grogans Mill by converting the existing four-point intersection into a one- or two-point intersection.	3.1		M, R, S
	Improve the intersections at Six Pines, Holly Hill and Pinecroft by adding right turn lanes.	3.9		M, S
	Widen Research Forest/Tamina Road at IH 45 by adding one traffic lane in each direction under the freeway bridge.	2.1		M, S

# EXECUTIVE SUMMARY

**TABLE E3 (CONTINUED): SOUTH COUNTY MOBILITY PLAN: SHORT-TERM RECOMMENDATIONS (0-5 YEARS)**

Road	Segment Description	Segment Cost Estimate** (Millions)	Total Corridor Cost Estimate** (Millions)	Responsible Entity
<b>Robinson Road</b>			<b>0.8</b>	
	Conduct an environmental assessment to extend Robinson from east of UP Railroad to Townsen.			M, O
<b>Sawmill Road Extension Study</b>			<b>0.3</b>	
	Conduct an environmental assessment to extend Sawmill Road from South High Oak Circle (south of Sawdust) to Harris County, including a new bridge over Spring Creek.			M, H (ExxonMobil, Springwoods)
<b>SH 242</b>			<b>52.0</b>	
	Widen by adding one lane in each direction from Gosling to IH 45, and from Harpers Way to FM 1314.			T
<b>Shenandoah Park Drive</b>			<b>1.0</b>	
	Conduct a study to extend from David Memorial to the San Jacinto River.			M, S
<b>Songwood/Industrial Way</b>			<b>3.9</b>	
	Extend from Springwood to Robinson.			M
<b>Tamina</b>			<b>6.9</b>	
	Widen by adding one lane in each direction from IH 45 to David Memorial.	0.7		M, S
	Widen by adding one lane in each direction from David Memorial to Main St.	2.1		M, S
	Improve the intersection of Tamina and David Memorial.	1.1		M, S
	Conduct an environmental assessment to extend Tamina Road from Hanna Road to FM 1314, including a grade separation at the UP Railroad and a new bridge at the San Jacinto River.	3.0		M, C, S
<b>Townsen</b>			<b>6.3</b>	
	Conduct a route study extending road from Spring Creek to SH 242			M, C, H
<b>Totals</b>	<b>22 Roads, 13 Studies, 15 Roadway Projects</b>		<b>157.9</b>	

**Notes:**

**Directions**

**Responsible Entities**

- M = Montgomery County
- T = TxDOT
- S = Shenandoah
- O = Oak Ridge North
- R = Woodlands Road Utility District #1
- C = Conroe
- H = Harris County
- U = Union Pacific Railroad

- NB = North Bound
- SB = South Bound
- WB = West Bound
- EB = East Bound

\*\*Construction cost only; does not include potential right-of-way acquisition cost and/or the relocation of utilities. Costs based on 2014 dollars.

# EXECUTIVE SUMMARY

TABLE E3 (CONTINUED): SHORT -TERM ADDITIONAL CORRIDORS RECOMMENDATIONS (0 - 5 YEARS)				
Type of Improvement	Description	Improvement Cost Estimate (Millions)**	Total Cost Estimate (Millions)**	Responsible Entity
<b>Intersections</b>			<b>3.60</b>	
	E. Panther Creek at Woodlands Parkway	Construct dual SB left and right turn lane	0.69	M, R
	Flintridge at Gosling	Construct EB and WB designated left turn lanes	0.58	M, R
	FM 1488 at Kuykendahl	Construct dual WB left turn lane	0.17	M, R, T
	FM 2978 at Woodlands Parkway	Construct dual SB left turn lane, and NB right turn lane	0.34	M, R, T
	Gosling at SH 242	Construct dual left and dual right turn lanes on NB Gosling to SH 242	0.25	M, R, T
		Construct dual right turn lane on NB Gosling to EB SH 242	0.25	M, R, T
	Kuykendahl at Woodlands Parkway	Construct SB right turn lane	0.27	M, R
	Lake Woodlands Drive at Gosling	Construct dual WB left and WB right turn lanes	0.53	M, R
	Pinecroft Drive/Mall Entrance at Lake Woodlands Drive	Construct NB right turn lane	0.15	M, R
	SH 242 at Gosling	Construct dual left turn lanes on WB SH 242 to SB Gosling	0.25	M, R, T
	Woodloch Forest at Woodlands Parkway	Construct dual SB left turn lane	0.12	M, R
<b>Area Wide Improvement</b>			<b>6.40</b>	
	Traffic Management	Implement an aggressive incident clearance program.	1.80	M
		Implement a traffic signal timing optimization program.	0.90	M
		Install dynamic message signs throughout the study area.	0.70	M
	Bicycle/Pedestrian Network Preliminary Design	Conduct design for the new bicycle/pedestrian connector routes to correspond with new roadway construction	3.00	R, S, O, C
<b>Total</b>	<b>10 Intersections</b>	<b>15 Projects</b>	<b>10.00</b>	
<b>Notes:</b> <b>Responsible Entities</b> M = Montgomery County T = TxDOT S = Shenandoah O = Oak Ridge North R = Woodlands Road Utility District #1 C = Conroe H = Harris County U = Union Pacific Railroad		<b>Directions</b> NB = North Bound SB = South Bound WB = West Bound EB = East Bound  **Construction cost only; does not include potential right-of-way acquisition cost and/or the relocation of utilities. Costs based on 2014 dollars.		

# EXECUTIVE SUMMARY

**TABLE E4: LONG-RANGE RECOMMENDATIONS (6+ YEARS)**

Road	Segment Description	Segment Cost Estimate** (Millions)	Total Corridor Cost Estimate** (Millions)	Responsible Entity
<b>Aldine Westfield Road</b>			<b>131.9</b>	
	Depending on the result of the environmental assessment, extend from Riley Fuzzell to Ed Kharbat Drive in Conroe.	131.9		M, C
<b>Atkinson Lane</b>			<b>6.7</b>	
	Extend from Vision Park Blvd to St Lukes Way.	6.7		M, S
<b>Birnam Woods Drive</b>			<b>55.8</b>	
	Extend from Rayford Road to Birnamwood Blvd in Harris County. Includes a bridge over Spring Creek.	26.0		M, H
	Construct a new bridge over Spring Creek.	5.2		M, H
	Widen to 4 lanes from Rayford Rd to Grand Parkway.	9.9		M
	Widen and extend from Elan Blvd to Robinson.	14.7		M
<b>Elan Blvd</b>			<b>11.1</b>	
	Extend from Birnam Woods Dr to Townsen Blvd.	11.1		M
<b>Fairview/Blair/Foster Corridor</b>			<b>30.8</b>	
	Depending on results of earlier study, construct a 2-lane road from Rayford to SH 242 via Foster, Blair and Fairview alignments.	30.8		M
<b>FM 1488</b>			<b>78.6</b>	
	Depending on results of the previous study, extend FM 1488 east from IH 45 to FM 1314.	52.9		M, T
	Widen to 6 lanes and implement access management treatments from IH 45 to FM 2978.	25.7		M,T
<b>Gosling Road</b>			<b>25.0</b>	
	Extend from SH 242 to FM 1488.	25.0		M, C
<b>Grogans Mill Road</b>			<b>90.1</b>	
	Widen to six lanes between Woodlands Pkwy and Sawdust.	11.5		M, R
	Widen to four lanes from Research Forest to Vision Park.	5.5		M, R, S
	Depending on the results of earlier study, improve the intersection at Grogans Mill at Woodlands Pkwy to accommodate traffic volume.	20.0		M, R
	Depending on the results of earlier study, Construct a grade separation at South Park Drive, widen South Park Drive to four lanes, widen Westridge Road to four lanes, widen Pruitt Road to four lanes, and construct a new direct connector from northbound to Pruitt Road westbound.	53.1		M
<b>Harpers Way</b>			<b>11.0</b>	
	Depending on results of earlier study, extend Harpers Way south from Laughing Falcon Trail to Tamina Road.	11.0		M
<b>IH 45</b>				
	Encourage TxDOT and H-GAC to conduct a Major Investment Study (MIS) to investigate the need for and feasibility of additional capacity in the IH 45 N/Hardy Toll Road corridor from BW 8 in Harris County to Loop 336 North in Montgomery County.			T
<b>Lake Woodlands Drive</b>			<b>19.4</b>	
	Depending on results of the previous study, extend Lake Woodlands Drive from IH 45 to Sleepy Hollow Road, including an overpass at the UP Railroad.	19.4		M, O, U
<b>Lexington Blvd</b>			<b>18.9</b>	
	Extend from East Benders Landing to Townsen.	13.4		M
	Extend from Rayford to Birnam Wood Blvd.	5.5		M
<b>Nursery Road/Sagewood Drive</b>			<b>40.0</b>	
	Construct a u-turn overpass on IH 45 service road and Nursery Road/Sagewood Drive.	40.0		M, O, T

# EXECUTIVE SUMMARY

## LONG-TERM NEEDS (6-25 YEARS)

The long-term recommendations consist of street widening, construction of new roadways and extensions, new cycling/pedestrian facilities and grade separations. These improvements to the transportation network have been identified as necessary to handle the anticipated future traffic demand on the area's transportation network. The long-term key corridors are shown in **Table E4** and **Figure E5**.

TABLE E4 (CONTINUED): LONG-RANGE RECOMMENDATIONS (6+ YEARS)				
Road	Segment Description	Segment Cost Estimate** (Millions)	Total Corridor Cost Estimate** (Millions)	Responsible Entity
<b>Rayford Rd</b>			<b>76.2</b>	
	Extend from Townsen Blvd to Northpark, including a bridge across the San Jacinto River.	60.0		M, H
	Widen to 4 lanes from Waterbend Cove to Birnham Woods Dr.	8.7		M
	Widen to 4 lanes from Birnham Woods Dr. to Townsen Blvd.	7.5		M
<b>Research Forest</b>			<b>70.9</b>	
	Widen to 6 lanes from Shadow Bend to FM 2978.	16.5		M, R
	Construct an underpass at Grogans Mill.	14.3		M, R, S
	Reconstruct the interchange at IH 45 to accommodate ten traffic lanes under the bridge.	40.1		M, T, S
<b>Robinson Rd</b>			<b>30.2</b>	
	Depending on results of the previous study, extend from Hanna Road to Townsen Blvd.	30.2		M, O
<b>Sawdust Road and Rayford Road Corridor</b>			<b>56.9</b>	
	Widen to eight lanes from Grogans Mill to the UP Railroad.	16.8		M, T
	Reconstruct the IH 45 interchange to accommodate 10 lanes under the bridge.	40.1		M, T
<b>Sawmill Road Extension</b>			<b>8.8</b>	
	Depending on results of earlier study, extend from South High Oak Circle to Spring Creek. (Sawmill will connect to Holzwarth in Harris County which will provide a direct connection to Grand Parkway).	8.8		M, H (ExxonMobil, Spring Woods)
<b>Shenandoah Park Drive</b>			<b>33.0</b>	
	Depending on results of the previous study, extend Shenandoah Park Drive as 4 lanes from David Memorial to the San Jacinto River.	33.0		M, S
<b>Sleepy Hollow</b>			<b>24.6</b>	
	Depending on the results of the Lake Woodlands extension east, widen to 4 lanes from Main St to Hayes Ranch Rd.	24.6		M
<b>Tamina Road</b>			<b>92.0</b>	
	Depending on results of the previous study, extend Tamina Road from Hanna Road to FM 1314, including a grade separation at the UP Railroad and a new bridge at the San Jacinto River.	92.0		M, U
<b>Townsen Blvd</b>			<b>210.8</b>	
	Construct a bridge over Spring Creek.	21.1		M, H
	Construct a new road from the Spring Creek to Grand Parkway.	109.3		M
	Construct a new road from the Grand Parkway to SH 242.	80.4		M, C
<b>Vision Park/Shenandoah Park</b>			<b>40.0</b>	
	Construct overpass with u-turns at IH 45 and Vision Park Drive/Shenandoah Park Drive	40.0		M, S, T
<b>Woodlands Parkway</b>			<b>14.3</b>	
	Widen to six lanes from Kuykendahl to FM 2978			M, R
<b>Bicycle/Pedestrian Network</b>			<b>30.9</b>	
	Construct new bicycle/pedestrian connector routes to correspond with new roadway construction, the Spring Creek Greenway, and path in Grand Parkway right-of-way.	30.9		R, S, O, C
<b>Total</b>	<b>24 Roads</b>	<b>40 Roadway Projects</b>	<b>1207.9</b>	

Notes: Responsible Entities

M = Montgomery County

T = TxDOT

S = Shenandoah

O = Oak Ridge North

R = Woodlands Road Utility District #1

C = Conroe

H = Harris County

U = Union Pacific Railroad

\*\* Construction cost only; does not include potential right-of-way acquisition cost and/or the relocation of utilities. Costs were based on 2014 dollars.

# EXECUTIVE SUMMARY

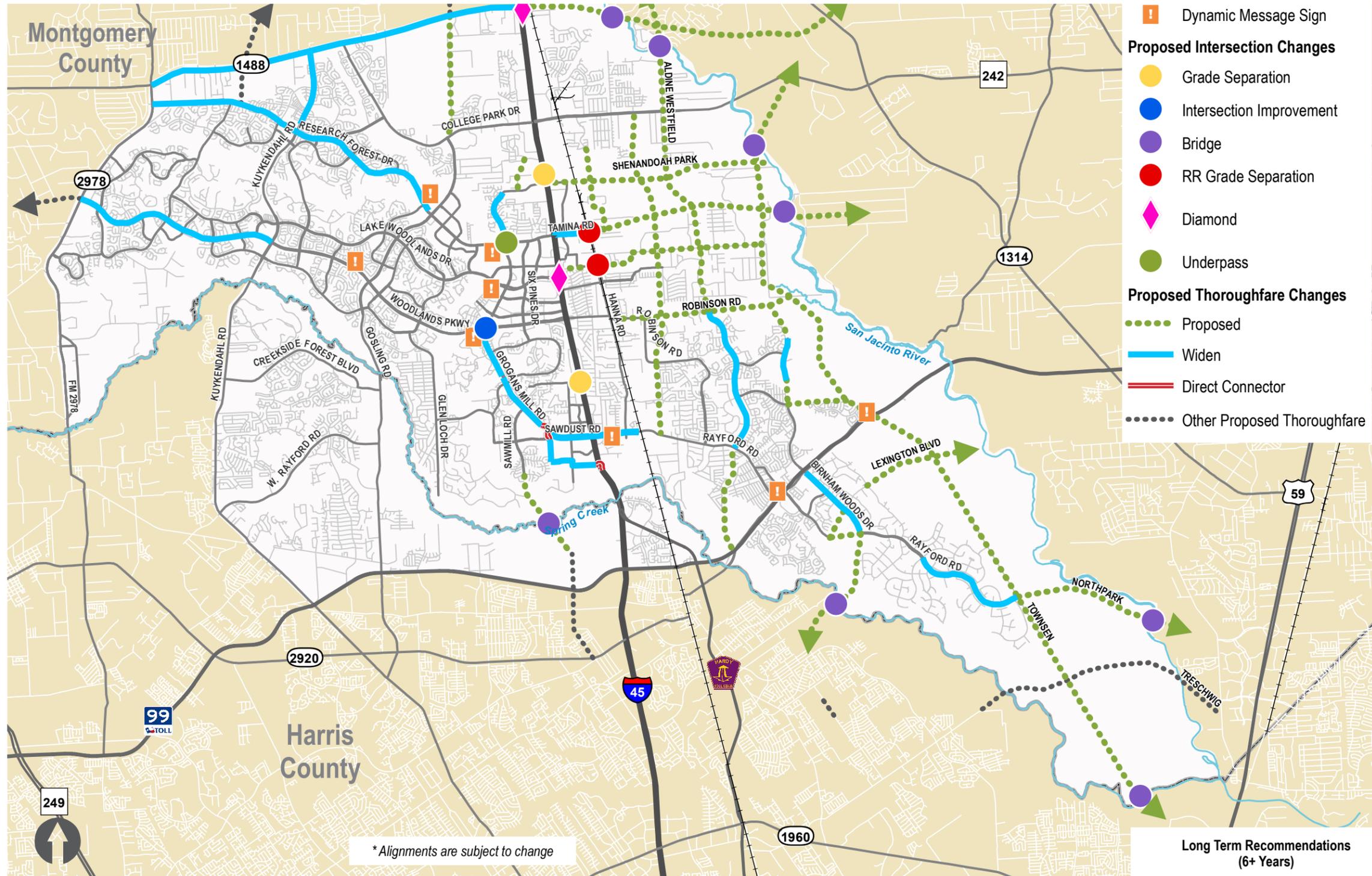


Figure E5: Long-Term Recommendations

# EXECUTIVE SUMMARY

**TABLE E5: LONG-TERM BICYCLE/PEDESTRIAN RECOMMENDATIONS**

Corridors and Limits		Corridor Type	Facility Type	Length (Miles)	Cost (Millions)
Gosling	SH 99 to Spring Creek	Core	Shared Use Path	3.89	2.45
-	Spring Creek to Lake Woodlands	Core	Shared Use Path	2.31	1.45
Gosling Extension	Lake Woodlands to College Park /SH 242	Core	Shared Use Path	2.27	1.43
-	College Park Dr/SH 242 to FM 1488	Core	Bike Lane - add pavement; no curb (with new construction)	2.32	.78
Hanna Extension	SH 242 to Sleepy Hollow	Core	Bike Lane - add pavement no curb with resurfacing	2.47	.83
-	Sleepy Hollow Rd to Rayford	Core	Bike Lane - add pavement no curb with resurfacing	3.22	.11
Lake Woodlands	Woodlands Parkway to Gosling	Core	Shared Use Path or Bike Lane - add pavement no curb with resurfacing	2.80	.94
-	Gosling to IH 45	Core	Shared Use Path or Bike Lanes on both sides	3.32	.67
New Road (South of Rayford/Sawdust)	Pruitt to Spring Hills	Secondary	Bike Lane - add pavement no curb with construction	3.30	.11
Oak Ridge School	IH 45 to Townsen	Secondary	Bike Lane - add pavement no curb with construction	3.92	.13
Sawdust Rd/Rayford	Grogans Mill to Hanna Extension	Core	Bike Lane - add pavement no curb with resurfacing	1.57	.53
Townsen Rd	Sleepy Hollow to SH 99	Core	Shared Use Path	3.83	.24
-	SH 99 to Rayford	Core	Shared Use Path	4.18	2.63
-	Rayford to W Townsen (Harris County)	Core	Shared Use Path	4.82	3.04
Woodlands Parkway	FM 2978 to Lake Woodlands	Core	Bike Lane - add pavement no curb with construction	3.37	.11
Nursery /Sagewood	Grogans Mill to Hanna Extension	Secondary	Retrofit with paved shoulders	2.19	.44
St Lukes Way	College Park /SH 242 to Gosling	Secondary	Bike Lane - widening on street with curb and gutter	1.00	.30
-	College Park /SH 242 to Gosling	Secondary	Retrofit with paved shoulders	1.20	.24
-	Alternate extension from St. Lukes Way to Vision Park Blvd	Secondary	Bike Lane - add pavement no curb with construction	0.70	.02
Vision Park Blvd/Shenandoah Park	Grogans Mill to Hanna Extension	Secondary	Bike Lane - widening on street with curb and gutter	1.32	.40
SH 99	SH 249 to Kuykendahl*	Core	Shared Use Path		*
-	Kuykendahl to Gosling	Core	Shared Use Path	1.71	1.08
-	Gosling to IH 45	Core	Shared Use Path	4.48	2.82
-	IH 45 to Rayford	Core	Shared Use Path	3.45	2.17
-	Rayford to Townsen	Core	Shared Use Path	2.08	1.31
-	Townsen to San Jacinto River	Core	Shared Use Path	1.60	1.01
-	San Jacinto River to US 59/IH 69*	Core	Shared Use Path		*
Spring Creek Greenway	Kuykendahl to Pruitt	Secondary	Various - depending on location	10.00	6.30
<b>Total</b>	<b>14 Corridors</b>			<b>77.32</b>	<b>30.95</b>

\* = Not in study area

# EXECUTIVE SUMMARY

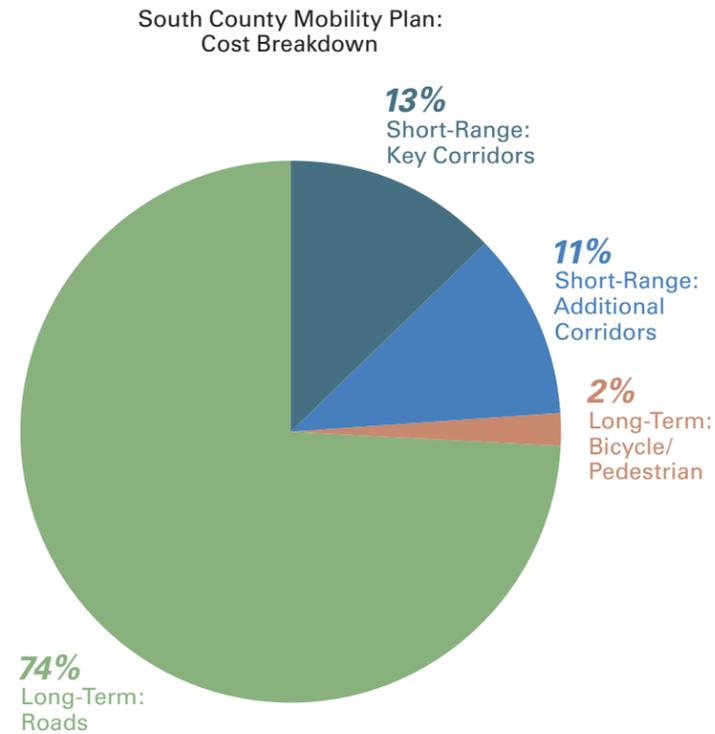
The long-term bicycle/pedestrian recommendations can be seen in **Table E5**. These recommendations include shared-use paths, bicycle lanes and cycling/pedestrian paths in utility easements. Bicycle accommodations are recommended on all new or widened facilities. The type of accommodations will be determined by implementing entities and their partners during the design process.

## COST ESTIMATE

The total cost to implement the South Montgomery County Mobility Plan has been divided into short-term and long-term projects. The costs below are only construction cost, and does not include potential right-of-way acquisition cost and/or the relocation of utilities.

TABLE E6: COST ESTIMATE	
Estimate	Total Cost Estimate
<b>Short-Term Cost Estimate*</b>	<b>\$375.1 Million</b>
Key Corridors: \$207.2 Million	
Additional Corridors: \$167.9 Million	
(Studies: \$23M, Roads: \$134.9M, Intersections: \$10M)	
<b>Long-Term Construction Cost Estimate*</b>	<b>\$1.2 Billion</b>
Bicycle/Pedestrian: \$31.4 Million	
<b>Grand Total Cost Estimate*:</b>	<b>\$ 1.6 Billion</b>

*\*Construction cost only; does not include potential right-of-way acquisition cost and/or the relocation of utilities. Costs based on 2014 dollars.*



The benefits of the SCMP include:

- Improved travel time by developing a network of E/W and N/S roads that improve connectivity.
- Distributing traffic by providing alternative travel routes.
- Congestion mitigation by the use of access management techniques, aggressive incident management program, traffic signal optimization and the installation of dynamic message signals throughout the study area.
- Communities working together for better mobility in South County.



# INTRODUCTION

# INTRODUCTION

## 1.0 INTRODUCTION

Southern Montgomery County is a rapidly growing part of the greater Houston-Galveston region in terms of population and employment. This study, the South County Mobility Plan (SCMP), was originally set in motion by Montgomery County Precinct 3 due to the need for transportation planning and coordination within the South County region. In order to harmonize planning efforts by local agencies, elected officials asked the Houston-Galveston Area Council (H-GAC) to establish a partnership between Montgomery County Precinct 3, The Woodlands Township, the City of Shenandoah, Oak Ridge North, Woodlands Road Utility District #1 (WRUD) and the Texas Department of Transportation (TxDOT), to cooperatively examine existing and future mobility needs.

The study analyzed existing and future roadway network conditions within a study area encompassing the southern portion of Montgomery County and the far northern section of Harris County, as shown in **Figure 1**. The study consisted of an extensive traffic data collection effort, roadway and intersection analyses, a series of steering committee meetings, and a public involvement program. The study area includes The Woodlands Township, the cities of Oak Ridge North and Shenandoah, the Rayford Corridor, and Springwoods Village/ExxonMobil development.

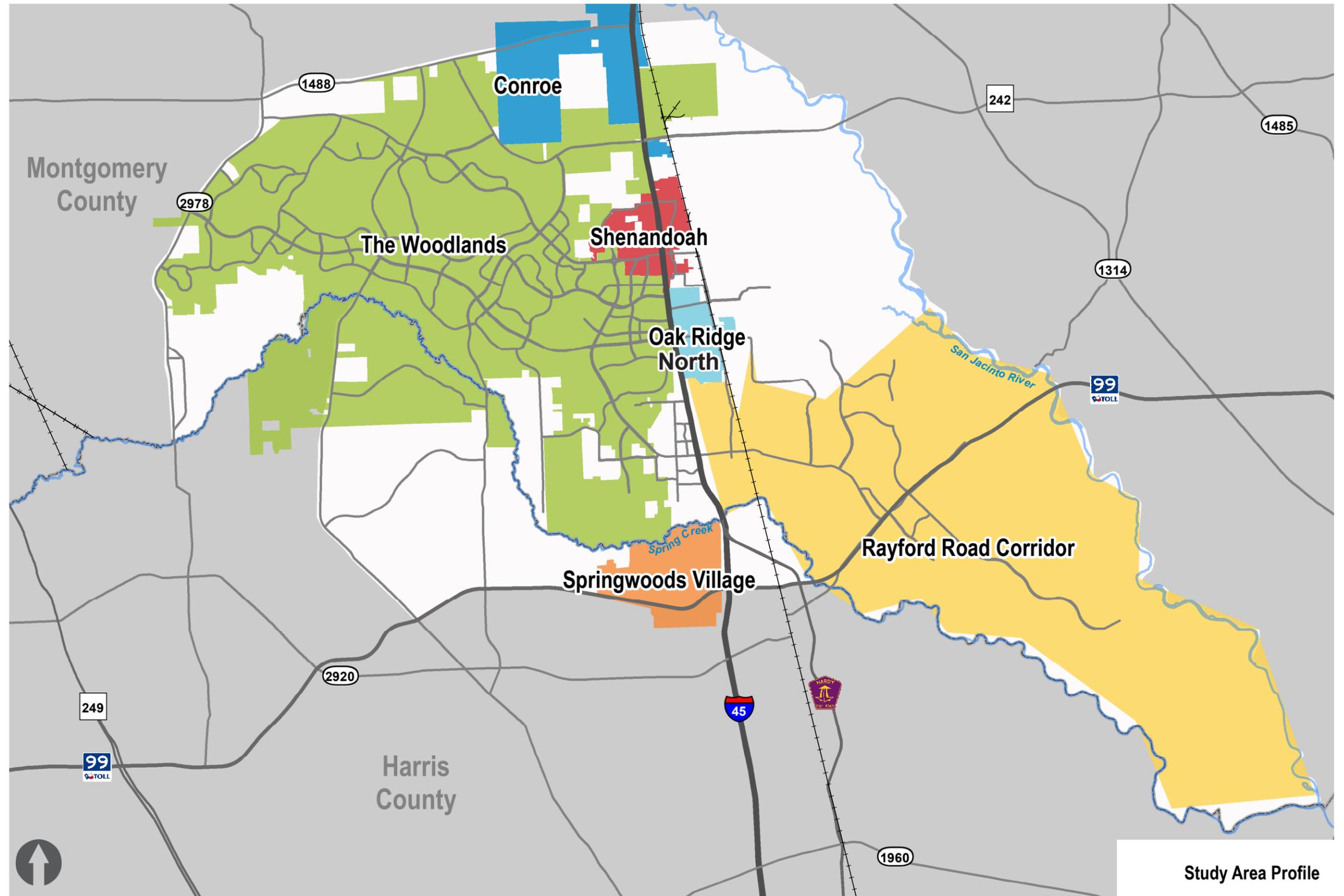


Figure 1: Study Area Map

# INTRODUCTION



Oak Ridge North, Texas



Shenandoah, Texas



The Woodlands, Texas

## 1.1 STUDY AREA PROFILE

The South County Mobility study area is located in Montgomery County in southeast Texas, approximately 30 miles north of Houston. The area has a diverse mix of communities and major developments which share common mobility needs. The largest development that will have a significant impact to the regional transportation network is the ExxonMobil campus located at the southwest corner of IH 45 and Spring Creek. Approximately 10,000 people will be employed by ExxonMobil and working at the 385-acre campus by the end of 2015. Other significant developments that will impact the regional transportation network with their continued growth are the 66-acre Hughes Landing mixed-use development and The Woodlands Town Center. The study area profile is illustrated in **Figure 1**.

### CITY OF OAK RIDGE NORTH

Located almost entirely to the east of IH 45, Oak Ridge North is primarily a residential community. The city itself encompasses only 1.1 square miles, but has a population of over 3,000 residents (2010 Census).

The city is served primarily by IH 45 and other roadways, namely Robinson and Hanna/Richard Roads. Retail development is primarily located along the IH 45 and Hanna Road. The city is bisected north/south by the Union Pacific Railroad, which is a barrier for those traveling east to west. In order to prepare for this anticipated growth and development, the City recently completed a thorough comprehensive planning effort and created the City of Oak Ridge North Comprehensive Plan: Our City | Our Future. This plan incorporated traditional planning recommendations for neighborhoods, parks, civic facilities, and commercial development along with a detailed transportation chapter. The plan concluded with several recommendations concerning Robinson Road, the northbound IH 45 frontage road, Woodson Road, and Hanna Road. Some recommendations included realigning the intersection of Robinson Road, and Hanna Road, adjusting the west side of the IH 45 frontage road to reduce weaving problems, and installing a signal at the intersection of Woodson Road and Hanna Road.

### THE CITY OF SHENANDOAH

The City of Shenandoah is located adjacent to The Woodlands Township and south of the City of Conroe, with the existing Union Pacific Railroad tracks forming the eastern boundary of the city. The City, with a population of 2,100 (2010 census), is also home to numerous restaurants, retail shopping centers, commercial developments and medical facilities. Given the small size of the city, 1.3 square miles, only a few major roadways provide significant regional access: IH 45, Research Forest Drive/Tamina Road, College Park Drive/SH 242 and Grogans Mill Road.

Shenandoah developed the City of Shenandoah: Comprehensive Plan which was adopted in 2010. The plan addressed future growth and development, walking and biking opportunities, and methods to improve the aesthetic appeal alongside arterials. The transportation section of the plan recommended extending Tamina Road beyond the railroad tracks on the east side of IH 45, installing an overpass at IH 45 and Vision Park Boulevard, and developing landscaped medians and bike lanes. The transportation element of this Comprehensive Plan is shown in **Appendix E**.

### THE WOODLANDS TOWNSHIP

The Woodlands Township is a 43.75 square mile master-planned community that lies mainly to the west of IH 45. The Township is composed of several small villages, including the Village of College Park, located at the northeast corner of IH 45 and SH 242, and the Village of Creekside Park is located just south of Spring Creek in Harris County. The Woodlands offers 210 miles of hike and bike trails connecting residential villages to schools, parks, and shopping centers. In 2014, The Woodlands Township was home to approximately 108,000 residents, 1,900 employers, and 54,500 employees.

The suburban development continues to attract residents, commercial development and corporate businesses. One focus of this growth is the Township's mixed-use Town Center. This area is located at the northwest corner of IH 45 and Woodlands Parkway and is home to high density residential, office buildings, hotels, shopping, dining, and entertainment venues.

Town Center is not only a regional destination, but a tourist destination as well. The Woodlands Township is served by 10 major arterials including IH 45, Woodlands Parkway, Lake Woodlands, Research Forest, SH 242/College Park, FM 1488, FM 2978, Kuykendahl, Gosling, and Grogans Mill/Sawdust Road.

### SPRINGWOODS VILLAGE

Springwoods Village is located in Harris County at the northwest corner of the intersection of IH 45 and Grand Parkway and is just south of The Woodlands Township. This master-planned mixed-use community consists of approximately 2,000 acres of land. The area is served by IH 45, Grand Parkway and Holzwarth Road. Holzwarth Road will one day serve as a major north/south route connecting Springwoods Village to The Woodlands Township.

ExxonMobil and Southwestern Energy have located their corporate headquarters in Springwoods Village. These two campuses account for over 12,000 employees and thus make this area a regional destination as well.

### RAYFORD ROAD CORRIDOR

The Rayford Road corridor is an unincorporated area located east of IH 45, north of Spring Creek/ Montgomery County line and east of the San Jacinto River. The area is primarily a single-family residential community that includes large planned developments such as Benders Landing, Imperial Oaks, Spring Trails, Legends Run and Fox Run, just to name a few. There is a significant amount of retail and commercial development along Rayford Road itself. The area has limited road access and is primarily served by Rayford Road, Hardy Toll Road, Richards/Hanna, and Riley Fuzzell Road.

### CONROE

The City of Conroe is located to the north of the study area. However, since portions of its city limits and a sizable portion of its extra-territorial jurisdiction (ETJ) extend south of FM 1488, the Transportation Chapter of the Conroe Comprehensive Plan as well as the city's 2035 Thoroughfare Plan were reviewed. The City of Conroe 2035 Thoroughfare Plan can be found in **Appendix E**.

# INTRODUCTION

## 1.2 STUDY AREA BARRIERS

The study area has both natural and man-made barriers that impede mobility. The natural barriers include Spring Creek and the San Jacinto River. Spring Creek separates Montgomery and Harris counties. The San Jacinto River separates the study area from the communities of Conroe, Porter, Porter Heights, Kingwood, and Humble.

The man-made barriers include IH 45 and the Union Pacific Railroad. Both form barriers that divide The Woodlands Township and the city of Shenandoah from Oak Ridge North and the Rayford Corridor area. These barriers have negative impacts on vehicular travel times, intersection and corridor levels-of-service, and overall community-to-community access.



Steering Committee Meeting



Business Open House

# INTRODUCTION

## PLAN DEVELOPMENT

South Montgomery County is one of the fastest-growing residential and employment centers in the greater Houston-Galveston region. Along with explosive growth in office, commercial, and residential developments in and around South Montgomery County, comes congestion and mobility challenges.

The study’s funding participants include:

- City of Oak Ridge North
- City of Shenandoah
- Montgomery County Precinct 3
- The Woodlands Road Utility District #1 (WRUD)
- The Woodlands Township
- Texas Department of Transportation (TxDOT)

## STEERING COMMITTEE

Each of the SMCP’s partner agencies is supporting the project by having members serve on the Steering Committee. This committee was formed to provide guidance and technical expertise throughout the development of the plan. The Steering Committee is facilitated by the project team and H-GAC staff. Members of the Steering Committee included non-elected representatives from:

- City of Oak Ridge North
- City of Shenandoah
- Harris County Precinct #4
- Montgomery County Engineer’s office
- Montgomery County Precinct #3
- Montgomery County Sheriff’s Office
- Rayford Road Corridor
- The Woodlands Road Utility District #1
- The Woodlands Township
- TxDOT Houston District
- TxDOT Montgomery County Area Office

## STUDY GOALS AND OBJECTIVES

The overall goal of the plan is to develop a transportation system that will accommodate current and future needs for mobility of all people and goods traveling within and through the area. In order to do this, the committee had to establish a vision for the region, and then the accompanying goals that would ultimately steer the plan development.

The steering committee developed the project’s vision, goals, and objectives. These set the purpose and character for the entire project. With so many different groups represented, it was imperative that a vision be established that encompassed the desires of each of the individual entities as well as the community as a whole.

*“The vision of the South Montgomery County Mobility Plan is to protect and enhance the economic competitiveness and quality of life of the growing South Montgomery County area by designing a safe, efficient, interconnected and cost-effective roadway network that recognizes the needs of all users: those traveling by autos, trucks and commercial vehicles, cyclists, and pedestrians.”*

Once the study’s vision was established, the committee developed specific goals, objectives and performance measures. These goals and objectives were used as guidelines in developing and evaluating alternative transportation systems and/or recommendations. The following goals and objectives were established as part of the plan’s development as shown in **Table 1**.

Performance measures (**Table 2**) were approved by the Steering Committee and align with the goals and objectives outlined above. These performance measures are used to quantify the performance of the study as a whole or individual parts of the study. Performance measures are important because they allow entities to directly determine the effectiveness of the pre-defined objectives. These metrics are targets to which the entities shall strive to meet or exceed and they will represent how each of the entities are doing individually, as well as how the South Montgomery County region is doing as a whole.

**TABLE 1: GOALS AND OBJECTIVES**

GOAL	OBJECTIVE
<b>Maximize Mobility</b> Develop innovative approaches to manage and improve transportation facilities throughout, minimize delays and selectively increase roadway capacity on the transportation network.	<ul style="list-style-type: none"> <li>• Develop innovative approaches to make the network more efficient</li> <li>• Preserve right-of-way</li> </ul>
<b>Quality of Life</b> Reflect the participating communities’ priorities on protecting quality of life and the natural environment through appropriate use of design concepts and mitigation techniques.	<ul style="list-style-type: none"> <li>• Balance between transportation and the natural environment</li> </ul>
<b>Project Consensus</b> Strengthen partnerships between local governments, TxDOT, other transportation agencies and the private sector by identifying projects with significant consensus in the South Montgomery County/North Harris County area.	<ul style="list-style-type: none"> <li>• Fiscal soundness</li> <li>• Community support</li> <li>• Strengthen partnerships</li> </ul>
<b>Economic Vitality</b> Support continued economic vitality by managing congestion, improving travel reliability and safety.	<ul style="list-style-type: none"> <li>• Manage congestion</li> <li>• Improve reliability</li> <li>• Improve safety</li> </ul>

**TABLE 2: PERFORMANCE MEASURES**

GOAL	PERFORMANCE MEASURE
Maximize Mobility	Real time traffic management Access to major arterials System connectivity
Quality of Life	Air quality improvements Land use impacts Availability of alternative modes (bicycle/pedestrian)
Project Consensus	Benefit/cost (benefit = travel time savings; Cost = cost to improve/construct facility) Stakeholder/public feedback Shared and innovative funding
Economic Vitality	Travel time and speed Volume to Capacity ratio (V/C) Level of Service (LOS) # of incidents/peak and average # of fatalities and fatality rate # of serious injuries



# PUBLIC INVOLVEMENT

# PUBLIC INVOLVEMENT

## PUBLIC INVOLVEMENT

This section outlines the steps that H-GAC, in collaboration with the consultant team, initiated to implement a transportation planning process that supports early and continued participation by the broad spectrum of affected and interested parties that live, work and play in the study area. The SCMP team customized a robust public involvement program that described the unique character of the area and needs of the residents, businesses, and employees who face daily mobility challenges. Two public meetings, a business open house, a project website and several stakeholder presentations allowed members of the community to participate and express their concerns on mobility issues.

The public involvement plan was more than simply following legislation and regulations. The study partners were in continuous contact during the decision-making process. In addition, the SCMP team used a variety of public involvement techniques, elicited public comments and encouraged community participation.

This section provides a brief overview of the sources used for obtaining public involvement. A detailed Public Involvement Plan (PIP) for the SCMP, as well as public comments collected during this process, can be found in **Appendix H**.

## PUBLIC ENGAGEMENT ACTIVITIES

Public engagement activities focused on engaging with diverse entities and individuals to provide input to the SCMP study process as outlined in the PIP's multi-pronged approach. The project team was able to define issues early in the process by convening with groups who provided guidance in prioritizing recommended improvements.

## STEERING COMMITTEE MEETINGS

Monthly Steering Committee Meetings were held to report progress of the project and receive feedback. In addition, H-GAC provided elected official briefings at key milestones during the project.

## PUBLIC MEETINGS

Public Meetings, as part of the PIP, promoted honest, active, two-way communication with the public. The team conducting the study sought to actively solicit and listen to the public's concerns and keep them informed of the study's progress. The goal was to provide members of the community the opportunity to participate, express their concerns, and to demonstrate that those concerns were being considered as a part of the project process. The two public meetings that were held accomplished the following:

- February 27, 2014 at Oak Ridge North Baptist Church: Explained why the study was being conducted and displayed potential improvement tools, and presented preliminary findings of the existing conditions analysis along with the measures that would be used to evaluate proposed improvements
- September 25, 2014 at Shenandoah's Municipal Complex: Provided draft recommendations for public questions and comments.

## COMMENT CARDS

Comment cards were available at the first public meeting and on the study website. A total of 939 comment cards were completed; 74 hard copy and 865 online. The comment card included a brief questionnaire in order to get the public to participate and deliver feedback to the study team. The questions on the comment card included the topics on existing and future transportation choices. A copy of the comment cards can be found in **Appendix H**.



Steering Committee Meeting



Public Meeting

# PUBLIC INVOLVEMENT



Business Open House



Bicycle and Pedestrian Focus Group Meeting

Comments received from the public meetings and online comment cards indicated that the public was most concerned about congestion on the following roadways:

- Rayford/Sawdust (381 comments)
- Kuykendahl Road (243 comments)
- Robinson Road (203 comments)
- Hanna Road (143 comments)
- Gosling Road (139 comments)
- Woodlands Parkway (68 comments)
- Riley Fuzzell (65 comments)
- IH 45 (57 comments)

## STAKEHOLDER INPUT

There were two Stakeholder meetings, a Business Open House and a Bicycle Focus Group.

## BUSINESS OPEN HOUSE

The goal of the Business Open House, held on January 14, 2014 at the Fairfield Inn, was to determine how the current transportation conditions impact the business community, particularly the business owners and operators. Twenty three business owners attended the Open House. The attendees were concerned with both the existing levels of traffic congestion as well as the planned roadway improvements. Their concerns included congestion, access, and barriers. Congestion concerns were identified along Rayford/Sawdust, Gosling, Grogans Mill and SH 242. Access between communities and major highways was a common theme. East of IH 45, in the communities of Oak Ridge North and the Rayford Corridor area there is only one major arterial, Rayford Road, which provides access between the residential areas and IH 45.

The third issue was the barrier created by the Union Pacific Railroad. There are a total of nine crossings (one grade separated and eight at grade) throughout the study area. This makes traveling east and west more difficult especially when there is a train on the tracks. Many times almost all of roads are blocked and vehicles, including emergency vehicles cannot cross the tracks.

## BICYCLE FOCUS GROUP

The goal of the Bicycle Focus Group was to receive input from several of the study area's bicycle enthusiasts and groups. Three people attended this meeting including a representative with Bike The Woodlands Coalition. Those people specifically invited are riders who not only ride for recreation, but are also commuters. The meeting attendees requested more flexibility in both commuting and recreational options. Attendees noted that as the region continues to develop so will the bicycling and walking culture. Other concerns included shrinking roadway shoulders, the need for safe north-south and east-west routes for higher speed cyclists and the lack of bicycle and sidewalk access on the east side of IH 45.

It was noted that, while the hike/bike trails in The Woodlands Township provide some connectivity, these can be hazardous to bicyclists traveling at high speeds due to poor sight distances and conflicts between users.



# EXISTING NETWORK

# EXISTING TRANSPORTATION NETWORK

## EXISTING TRANSPORTATION NETWORK

### ROADWAY TYPES

The area is served primarily by Interstate Highway 45 (IH 45) and a number of regional and county roadways. The study area is bisected (north-south) by IH 45, with about twice the population to the west side of IH 45 compared to the population to the east of IH 45. The existing primary roadway network within the study area is shown in **Figure 2**.

### INTERSTATE HIGHWAY

Interstate Highway 45 is the only interstate facility serving the SCMP area. IH 45 bisects the study area, connects it to the cities of Houston and Dallas, and serves as a major transportation corridor not only for the region but for the state as a whole. Access to and from IH 45 is provided by grade-separated interchanges along with three-lane frontage roads. IH 45 is an eight-lane divided highway, with shoulders and a posted speed limit of 65 mph. Throughout much of the length of the corridor, a wide median has been preserved for a High Occupancy Vehicle (HOV/HOT) lane, planned for construction in the year 2015.

Outside of, and to the east of, the study area, is US highway 59, which was recently co-designated as Interstate Highway 69 (IH 69).

### TOLL ROADS

The SCMP area currently has one toll road, The Hardy Toll Road, which intersects IH 45 on the southern edge of the study area and continues south into Houston. The Grand Parkway (SH 99), currently under construction, is the southern boundary of the study area. This new toll road will serve as the third loop around Houston and will provide direct access between IH 45 to US 59/IH 69 to the east and IH 45 to SH 249, US 290 and I 10 to the west. Two toll access ramps were also under construction during the study. The access ramps will provide direct access between IH 45 northbound to eastbound SH 242 and westbound SH 242 to southbound IH 45.

### STATE HIGHWAY

SH 242 (College Park Drive) is the one state highway serving the SCMP study area. TxDOT maintains this roadway, which serves as a primary east-west connection between IH 45 and US 59/IH 69. The roadway varies from a two-lane facility to a six-lane divided facility. This facility is the only road that crosses the San Jacinto River east of IH 45. Because this roadway traverses the entire length of the study area through a variety of development contexts, the daily traffic volumes vary.

### FARM-TO-MARKET ROADS

Like state highways, the farm-to-market (FM) roadway designation primarily allows for greater regional access, connectivity and mobility. These roadways are also typically maintained by TxDOT and serve to move residents not only within the region but also between residential developments. Two FM roadways are located within the study area:

FM 1488 – Farm-to-Market Road 1488 is a four-lane road within the study area and forms its northern boundary. FM 1488 is an east-west roadway that begins at IH 45 and continues west past the study area to Magnolia. This roadway carries a significant amount of local and regional traffic between Magnolia and IH 45.

FM 2978 – Farm-to-Market Road 2978 is a two-lane road that runs mainly in the north-south direction and is the western boundary of the study area. This roadway carries a significant amount of traffic between FM 1488 and FM 2920.

### MAJOR ARTERIALS

Major Arterials serve the local residents traveling within and through the study area. In addition to providing regional access, these roadways provide significant access points for both residential communities and commercial establishments. They are as follows:

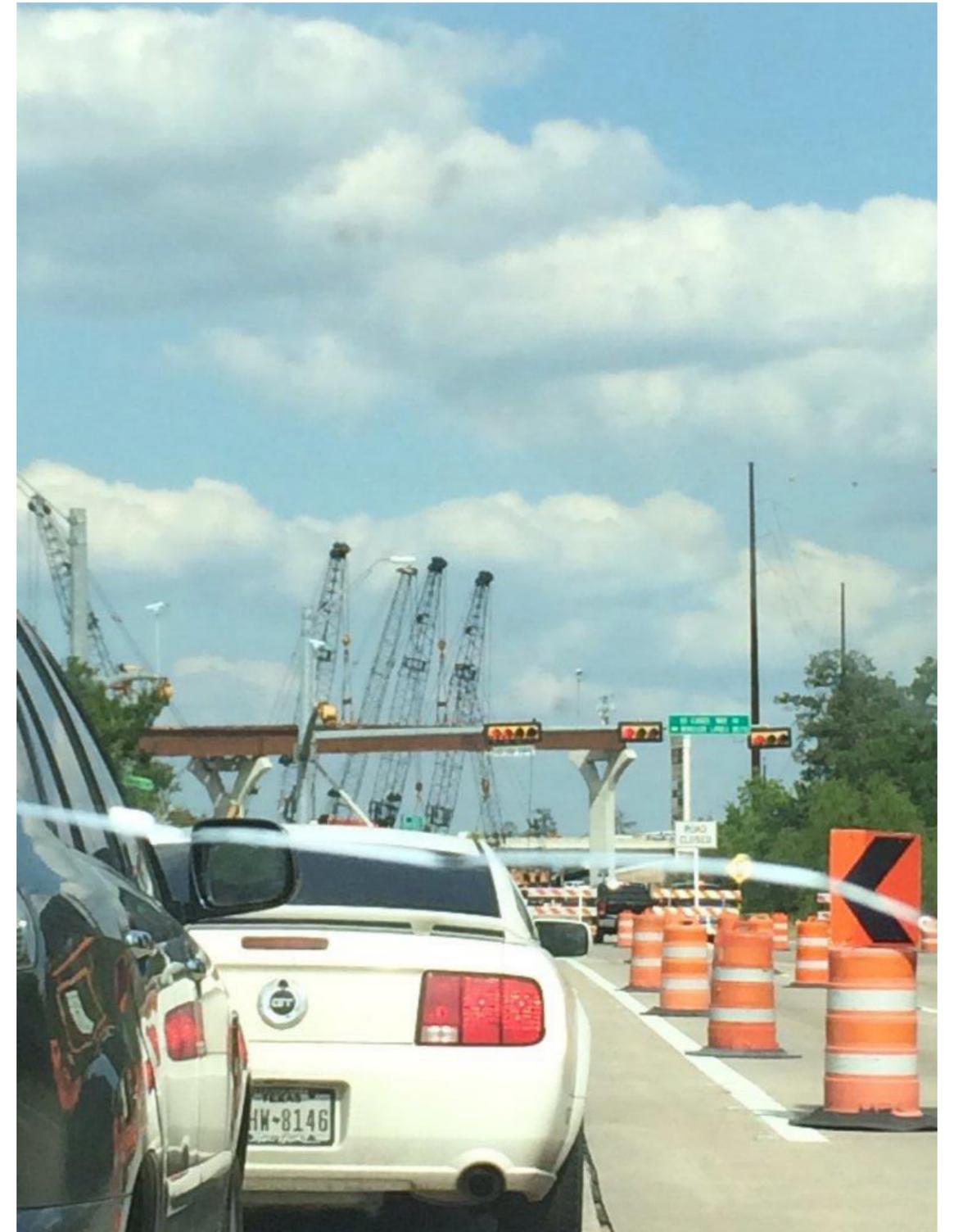
Gosling Road – This roadway traverses most of the north-south length of the study area. When Grand Parkway opens, Gosling will serve as a direct connector between SH 242

and Grand Parkway. At the northern terminus, the roadway is a four-lane divided arterial and to the south, it becomes a two-lane facility. Gosling Road crosses Spring Creek with a two-lane bridge structure. Gosling provides local residents direct access to the College Park area that includes Lone Star College.

Grogans Mill Road – Grogans Mill is a north-south four-lane divided roadway in The Woodlands Township. This facility provides access from the residential areas to the Town Center. Throughout the length of this roadway there are limited driveway intersections and limited roadway intersections allowing for cross median access. To the north of Research Forest Drive, Grogans Mill is a two-lane facility that provides access to residential areas of Shenandoah and The Woodlands Township and connects to Vision Park in Shenandoah, which provides access to multiple medical offices and facilities. Grogans Mill merges with Sawdust Road, which continues east to IH 45.

Kuykendahl Road – This roadway runs north-south through the length of the study area and provides access to the communities to the south including the City of Houston. The roadway crosses Spring Creek as a two-lane bridge and varies from a two-lane undivided to a four-lane divided facility that terminates at FM 1488. Within the study area, Kuykendahl has commercial and retail developments at the major intersections, but the road primarily serves the area's residential developments.

Lake Woodlands Drive – Lake Woodlands Drive is located within The Woodlands Township and serves as a primary conduit for residents traveling east to IH 45 and west to residential developments. The roadway provides significant access to The Woodlands Mall, Market Street, the many retail and commercial establishments in Town Center, and Hughes Landing. Through its entirety, it is a four-lane divided facility with a vegetated median providing access control.



Construction Zone: SH 242 at IH 45

# EXISTING TRANSPORTATION NETWORK

**Rayford Road** – Rayford Road located east of IH 45 begins as a six-lane commercial/retail roadway. Other than a few local roads, Rayford Road is the only road providing direct access between those residents living in the unincorporated areas to IH 45. Rayford Road has limited, if any, access management restrictions in place. Because of this, there are numerous driveways and unrestricted travel across multiple lanes of traffic.

**Research Forest Drive** – This east-west, two-to-six-lane roadway is located in The Woodlands Township and Shenandoah. A wide, landscaped median provides access control where the roadway is a four- and six-lane facility. Research Forest Drive serves a mixture of commercial and residential developments in both The Woodlands Township and the City of Shenandoah. The roadway connects IH 45 to FM 2978. Research Forest is a significant conduit for residents of both The Woodlands Township and the City of Shenandoah traveling to IH 45.

**Sawdust Road** – Sawdust Road is located west of IH 45. Starting at IH 45 as a six-lane roadway with minimal access management it changes onto a four-lane divided roadway between Grogans Mill Road and the point where Sawdust turns north, and then changes to a four-lane undivided roadway until it ends at Glen Loch Drive. The section of Sawdust located between IH 45 and the Grogans Mill consists of retail and commercial establishments. West of the split, Sawdust is a mixture of high density residential, commercial and retail developments.

**Woodlands Parkway/Robinson Road** – Woodlands Parkway, located west of IH 45, are a controlled-access roadway in The Woodlands Township that varies from a four- to six-lane divided facility. This roadway serves as a direct connection between FM 2978 and IH 45. Robinson Road, located east of IH 45, is a two-lane roadway that serves as “Main Street” of Oak Ridge North. This roadway provides access between IH 45 and residential neighborhoods as well as commercial businesses.

## ROADWAY FUNCTIONAL CLASSIFICATION SYSTEM

Roadway functional classification refers to the hierarchical arrangement between roadways and the interaction therein. The designated classification describes how a particular roadway is intended to function with respect to capacity, speed, mobility and access provided.

As shown in the adjacent graphic, those roadways with the highest functional classifications provide the greatest capacity and allow for higher speeds, but these roadways also allow for diminished access. While the lower functional classifications provide lower capacity and speeds but allow for greater access to adjacent properties.

**Freeways/Tollways** – Freeways and tollways tend to be controlled access roadways whose primary function is to allow for the movement of traffic through and/or around the region. This classification includes interstate highways, state highways, tollways and loops. These roadways have the ability to move large traffic volumes at high speeds with limited interference from cross streets. Direct property access is limited, as access is not the intended purpose of these facilities. Design characteristics of these facilities include multiple travel lanes, grade-separated interchanges, limited access points, high traffic volumes and high traffic speeds. IH 45 and Hardy Toll Road are included in this classification.

**Arterial Streets** – The primary function of arterial streets is to provide higher-speed traffic movement through and between different areas within the city, for relatively large traffic volumes. A secondary and more controllable function is to provide access to adjacent land uses. This is because typical driveway spacing can be controlled through ordinance, design manual or other specification and, if safety dictates, overall access can be limited to specific turning movements. Minor arterials tend to serve as connections between collectors and freeways. While major arterials tend to provide connections between major traffic generators and land use concentrations, they also serve much larger traffic volumes over greater distances. Both major and minor arterials serve as connectors to collector streets. The significant regional roads listed previously can be classified as arterial streets.

**Collector Streets** – These streets are intended to balance traffic and movement between arterial streets and local streets. These streets tend to carry a high volume of traffic over shorter distances while providing property access. They tend to provide access and movement between neighborhoods, parks, schools, hospitals, retail areas and the arterial street system. Examples of collector streets in the study area include Terramont, Branch Crossing, Flintridge, Pinecroft, Six Pines, Woodson, Sleepy Hollow, Elan, and Budde.

**Local Streets** – Completing the functional classification hierarchy, local streets are intended to function by providing access to adjoining properties and by collecting the traffic from surrounding areas and distributing to adjoining collectors or arterial streets. Local streets can access both collector level streets and arterial level streets. Local streets generally carry lower traffic volumes at lower speeds. These are primarily the neighborhood streets in the study area.

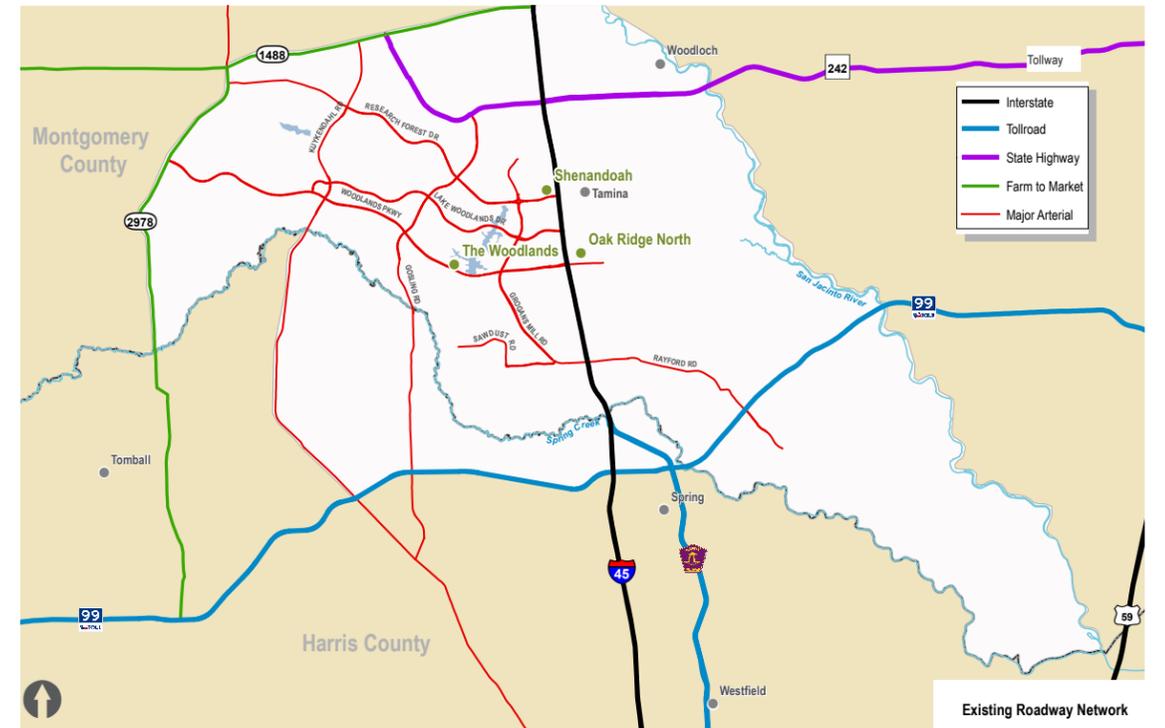


Figure 2: Existing Roadway Network



Source: American Association of State Highway and Transportation Officials (AASHTO)



# DATA COLLECTION AND FIELD REVIEW

# DATA COLLECTION AND FIELD REVIEW

## DATA COLLECTION AND FIELD REVIEW

In order to fully understand the existing transportation conditions and to provide input into the transportation model, key traffic and roadway characteristics were studied and inventoried. This included roadway geometries, traffic counts and traffic signal locations. All of these are important in order to accurately understand the current roadway network and its current conditions. An extensive amount of traffic data collection was performed for this study. Twenty-four hour traffic counts, peak-hour intersection movement counts, travel-time studies, origin-destination studies, roadway inventory, and peak-hour helicopter videos were performed. The table included in **Appendix A** shows a list of the locations where traffic data was collected. The helicopter videos are included in a CD attached to this report. The travel-time studies were used to compute the average roadway speeds and are shown in the **Appendix C**. The traffic data collection locations are shown in **Figure 3**.

### ASSEMBLY AND REVIEW OF DATA

The assembly and review of available data is a critical step in the overall understanding of the mobility conditions with the South Montgomery County study area. This section provides a summary of data that was reviewed by the consultant team.

Over 100 files were reviewed for this study. These files included Traffic Impact Analyses, comprehensive plans, thoroughfare plans, engineering plan sets, site development plans, and the like. The files that were reviewed are located in **Appendix E**.

### 2040 REGIONAL TRANSPORTATION PLAN (RTP) SUMMARY

The SCMP study area is part of the Houston-Galveston Area Council (H-GAC)'s eight county planning area, (Harris, Galveston, Brazoria, Fort Bend, Waller, Montgomery, Liberty, and Chambers counties) and as such, all transportation-related projects fall under the jurisdiction of H-GAC. Under federal law, H-GAC must complete and update the Regional Transportation Plan (RTP) every four years.

The RTP is a long-range planning document that identifies the region's transportation needs, goals, and policies for the next 25 years. It helps guide the region in making transportation funding decisions while laying the foundation for funding transportation projects. The RTP is financially constrained and does not specifically direct an entity when, where, or how to build a project. These decisions are left up to the respective jurisdictions. The RTP assists in the creation of the various Transportation Improvement Programs (TIPs), Congestion Management Plans (CMPs), State Implementation Plans (SIPs), and the Unified Planning Work Programs (UPWPs).

The RTP sets the framework for a balanced and forward-oriented transportation system with the identification of major investment strategies supporting traditional modes, such as roadway improvements, and alternative modes, such as mass transit, bicycle and pedestrian facilities.

The 2040 RTP projects a household population forecast of 9.6 million people and an employment forecast of 4.2 million jobs for the eight-county region. These forecasts are used to project the region's transportation needs into the future as well as the available revenue.

The recommended 2040 RTP investments located within the study area (**Table 3**) totals approximately \$72 billion (2014 dollars). The investment priorities in the 2040 RTP are based on conservative estimates of revenues available over the next 25 years. These investments are key steps toward realization of the vision plan.

**TABLE 3: SCMP STUDY AREA RTP 2040 UPDATE PROJECTS**

Project Limits	Description	Total Project Cost (Millions)	Year
Grogans Mill Road			
Research Forest to Woodlands Parkway	Widen from 4 to 6 lanes	3.07	2023
Honea Egypt/Fish Creek Thoroughfare			
SH 105 to FM 1488	Widen to 4 lanes	17.0	2022
FM 2978			
S. of Dry Creek to Conroe Huffsmith Road	Widen to 4 lanes	5.35	2019
Lake Woodlands Drive			
Grogans Mill	Construct grade separation	3.60	2023
Research Forest Drive			
Grogans Mill	Construct grade separation	3.60	2023
Shadowbend Dr to Kuykendahl Dr	Widen to 6 lanes	5.00	2020
Honea Egypt to Branch Crossing	Widen to 4 lanes	4.70	2018
Woodlands Parkway			
FM 2978 to SH 249	Construct new 2-lane divided	6.00	2023
Longmire Corridor			
FM 1488 to Sgt Ed Holcombe Rd	Construct new 4-lane road	18.67	2023
Sawmill Road			
High Oaks Circle to Spring Creek	Construct 4-lane divided with bridge across Spring Creek	4.80	2016
<b>Total</b>		<b>718.08</b>	

**TABLE 4: TIP PROJECTS (2015 - 2018)**

Project Limits	Project Description	Total Project Cost (Millions)	Fiscal Year
FM 2978			
FM 1488 to Conroe Huffsmith	Widen to 4 lanes	17.83	2015
IH 45 N			
Loop 336S to Harris County Line	Reconfigure to accommodate 2 managed lanes	1.50	2015*
Rayford-Sawdust to Woodlands Parkway	Reverse exit ramps	.20	2015
Research Forest Drive			
Egypt Lane to Branch Crossing	Construct new 2-lane road	4.70	2018
Robinson Rd			
IH 45 to Hannah Road	Widen to 4-lane undivided with realignment	6.80	2018
Sawmill Road			
High Oaks Cir to Spring Creek	Construct 4 lane divided with bridge	4.80	2016
<b>Total</b>		<b>35.79</b>	

\* *LET Project – project has been awarded to contractor*



Divided Arterial: Research Forest at IH 45

# DATA COLLECTION AND FIELD REVIEW

## TRANSPORTATION IMPROVEMENT PROGRAM

The Transportation Improvement Program (TIP) is a fiscally constrained financial plan of regional transportation projects approved to receive federal funding over the next four years. Projects selected for the TIP are priorities for the region in all surface transportation areas including transit, roadway and highways, bicycle and pedestrian, preventative maintenance, rehabilitation and transportation operations.

H-GAC's Transportation Policy Council (TPC) oversees development of and adopts the TIP. Following adoption, the TPC monitors implementation of the TIP and approves significant changes to projects contained in the TIP. New projects are added to the TIP on a periodic basis and a Call for Projects is conducted approximately every two years.

**Table 4** shows current projects that fall within the study area.

## ROADWAY INVENTORY

In December 2013, an inventory of all the roads, signs and bridges in Montgomery County Precinct 3 was performed. This inventory included field observation and documentation of the existing roadway pavement conditions, owner/maintenance, striping, speeds, traffic signals, signage, and lane configuration. The approximate cost to repair facilities was also included in the final report. The data is available in the CD attached to this report. The existing roadway inventory is shown in **Figure 4**.

In Precinct 3 there are a total of 571 center lane miles (arterials, collectors and local streets), only the arterials and collectors (206.44 center lane miles) were inventoried. 114 bridges, 100 traffic signals, and 2,169 signs are located within Montgomery County Precinct 3. The results of the roadway inventory identified approximately 3 miles of roadways requiring asphalt repair, 1.6 miles of concrete pavement repair, 5 intersections requiring restriping, nearly 35 miles of linear roadway restriping, and 10 new small signs at an estimated construction cost of \$3,025,476. In addition, speed limits on 11 roadway sections were found inadequate and recommended for further studies.

## TRAFFIC VOLUMES AND CHARACTERISTICS

Peak hour (6:30-8:30 am and 4:30-6:30 pm) turning movement counts and 24-hour tube counts were recorded at various locations throughout the study area's road network during the month of December 2013. The WRUD provided 24-hour counts on west side of IH 45. The Texas Department of Transportation provided the 24-hour counts for the east side. The count locations are shown in **Figure 3**. The complete count data is included in **Appendix A** and **Appendix B**.

## CRASH DATA

Crash records were obtained from TxDOT, covering the time period from January 2009 to December 2013. The data was used to perform a crash analysis of the study area.

## CENTRAL TRAFFIC MANAGEMENT SYSTEM

Montgomery County Precinct 3 has the Northstar Traffic Management system controlling over 90 traffic signals in the study area. The system uses the ATMS.now control software and an extensive fiber communication system. All the signals use video detection cameras, except for two intersections which use loop detectors and a few intersections with radar detectors. Montgomery County adds approximately two traffic signals per year. The system is operated from the Precinct 3 office. The signal timings were optimized along the major arterials in 2013-2014. Montgomery County Precinct 3 has installed the flashing yellow arrow operation at several intersections. The flashing yellow arrows allow left-turn movements; however, these movements must yield to oncoming traffic. In addition, the flashing yellow arrow provides additional opportunities for a driver to make a left-turn rather than traditional signal heads.

## TRAVEL TIME STUDIES

Bluetooth stations were set up at the intersections shown in **Figure 3** to capture travel-time data as well as origin-destination data. Speed charts and an origin-destination matrix can be found in **Appendix C** and **Appendix D**.

## HELICOPTER VIDEOS

Helicopter video recordings were taken on December 11, December 12, and December 14, 2013 at the major intersections for the weekday AM and PM peak hours, as well as the Saturday noon peak for the intersections near commercial developments. The video footage was used to analyze the existing traffic conditions and for comparison to the Synchro/SimTraffic traffic modeling.

## SOCIOECONOMIC CONDITIONS

This section summarizes historical trends and existing conditions in the Study Area and its geographic context for major socioeconomic factors including employment, household population, and number of households.



Signalized Intersection



Anadarko Tower, Woodlands

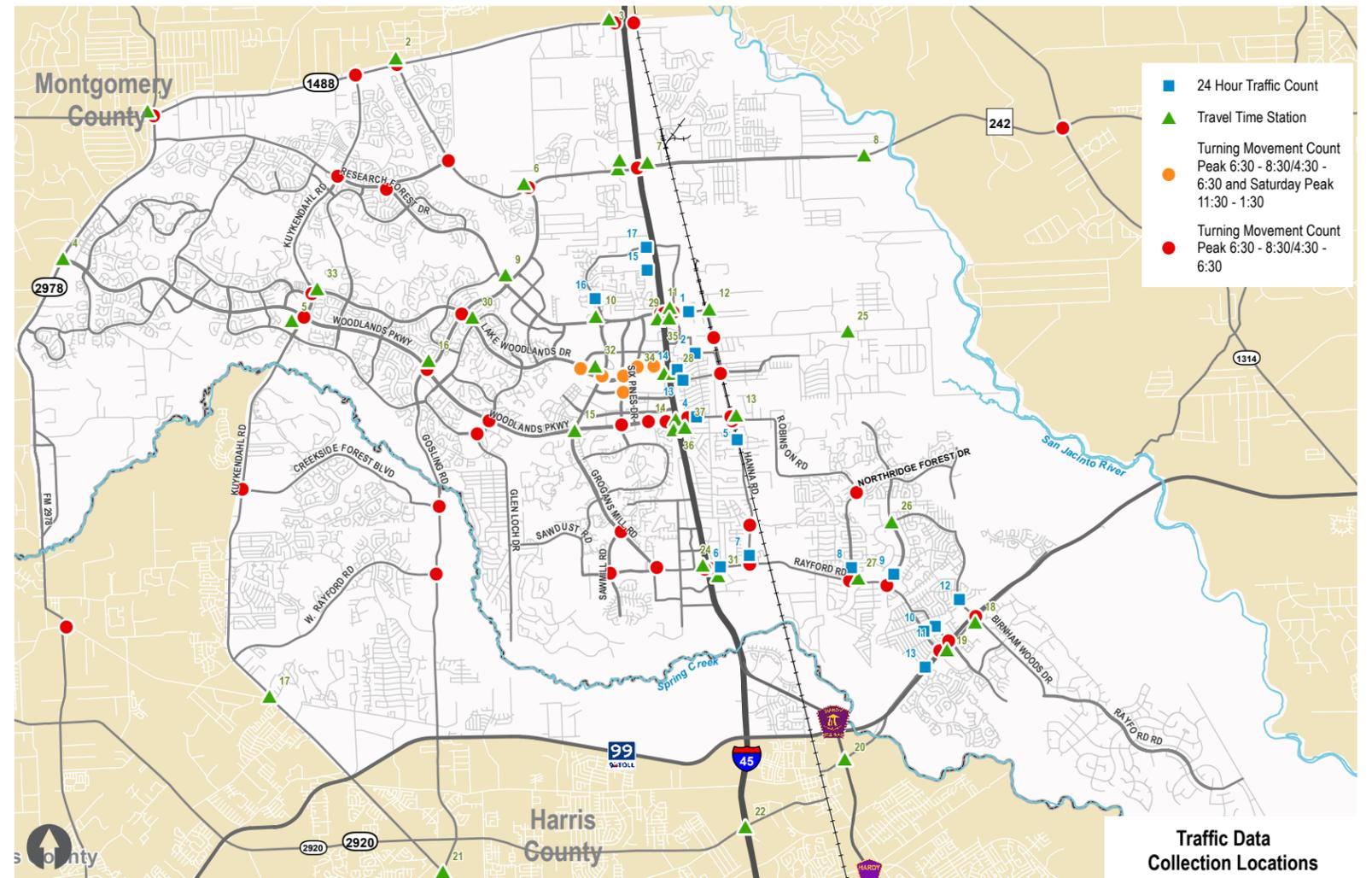
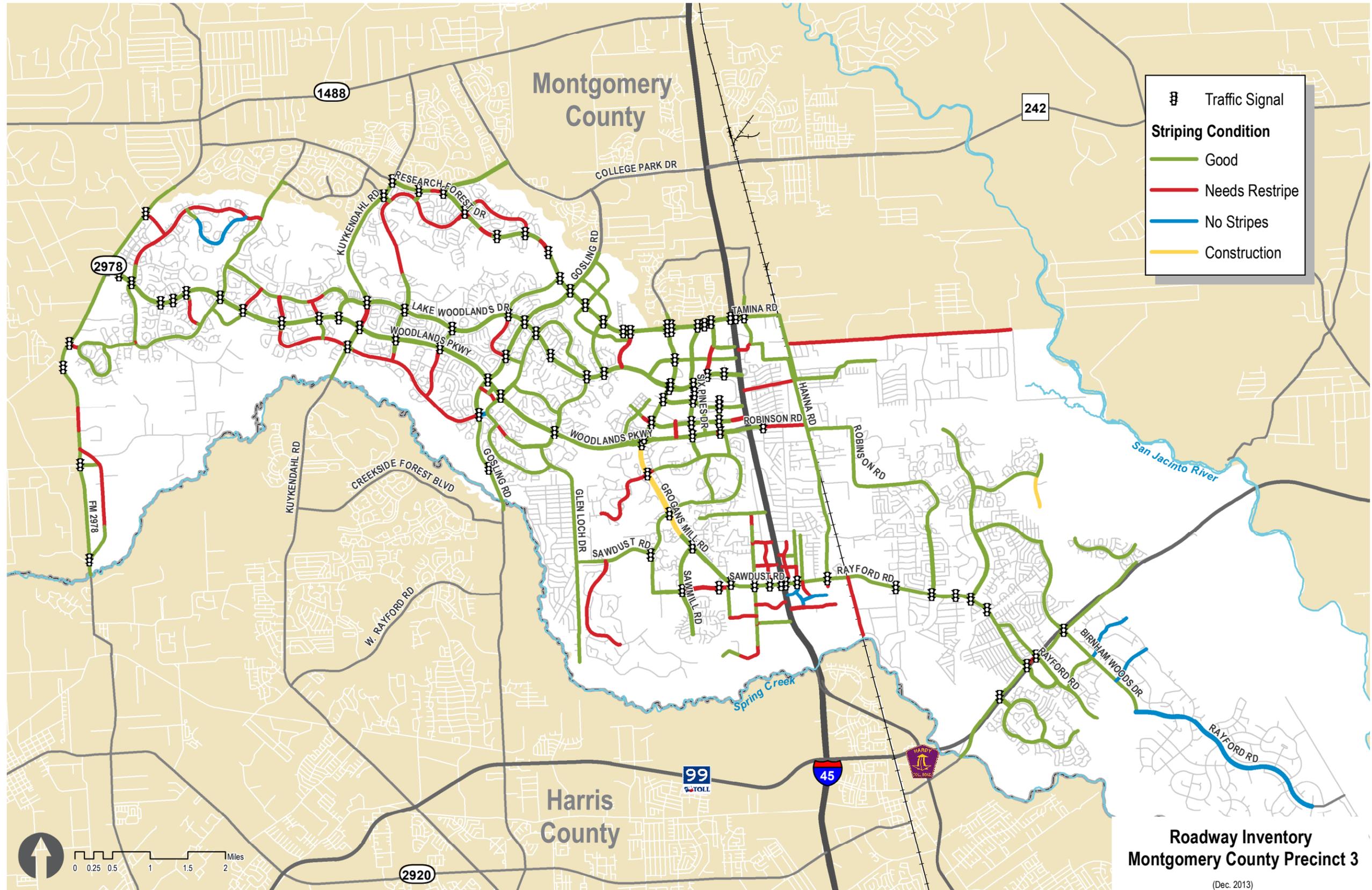


Figure 3: Traffic Data Collection Locations

# DATA COLLECTION AND FIELD REVIEW



**Roadway Inventory  
Montgomery County Precinct 3**  
(Dec. 2013)

Figure 4: Roadway Inventory Montgomery County Precinct 1

# DATA COLLECTION AND FIELD REVIEW

## EMPLOYMENT

The historical total estimated employment in the study area and various larger geographies is summarized in **Table 5**. An estimate of year 2000 employment was not available for the Study Area Traffic Analysis Zones (TAZs) from H-GAC at the time of this report.

Strong employment growth occurred throughout the region from 2000 to 2010. Montgomery County was able to capture an outsized share of job growth relative to its overall share of the total for the H-GAC eight-county region, resulting Montgomery County's share increasing over time. The study area was estimated to contain nearly 80,000 jobs in 2010 by H-GAC. The Woodlands Town Center is the most important concentration of jobs within the study area, although growth from ExxonMobil and other employers in the Springwoods Village project in far north Harris County will create a secondary significant employment center over the next several years.

## HOUSEHOLD POPULATION

"Household Population" is defined as the population living in occupied housing units by the Bureau of the Census; this excludes populations living in "Group Quarters" such as nursing facilities, prisons and jails, dormitories, and homeless shelters. **Table 6** summarizes household population trends for five different geographic levels relevant to anticipated travel demand in the study area.

The year 2000 household population estimate (and household estimate below) for the study area was determined by using H-GAC's TAZ geographies (tracts, block groups, and blocks) overlaying Census 2000 geographies and estimating using GIS techniques.

The Woodlands Census Designated Place (CPD) is the most significant defined place within the study area in terms of population; it accounts for over half (approximately 52%) of the study area population. This proportion has remained nearly unchanged from 2000 to 2010, despite dramatic growth in the study area overall, because The Woodlands captured approximately 52% of growth during this period.

In 2010, the study area contained approximately 180,000 residents, having increased by over two-thirds from 2000. It captured 6.0% of total growth in H-GAC's eight-county region. The study area increased its share of regional population from 2.3% to 3.1% in those ten years.

## NUMBER OF HOUSEHOLDS AND HOUSEHOLD SIZE

A household is defined by the Bureau of the Census as an occupied housing unit. **Table 7** summarizes information for households parallel to the information for household population provided in the previous table. Household growth for the various levels of geography shows patterns similar to those for household population, though the capture rates of growth are slightly higher in the areas under study and lower for Harris County.

The reason that household capture rates are higher than household population capture rates is that average household sizes are decreasing in the study area and Montgomery County. In other words, small households, such as one-person households, are being added at a higher rate than in Harris County or the regional overall. **Table 8** shows how average household sizes changed for the various geographies.

**TABLE 8: AVERAGE HOUSEHOLD SIZE, 2000-2010**

Geographic Area	2000	2010
The Woodlands CDP	2.78	2.67
Study Area	2.86	2.73
Montgomery County	2.83	2.78
Harris County	2.79	2.82
8-County Region	2.8	2.83

Sources: H-GAC, Bureau of the Census, PCensus for ArcView 2014 and CDS Market Research

**TABLE 5: EMPLOYMENT, 2000-2010**

Geographic Area	Payroll Employment		Change 2000 - 2010		Share of Region Total		Share of Regional Growth
	2000	2010	Number	% Change	2000	2010	2000 - 2010
Study Area	NA	76,738	NA	NA	NA	2.80%	NA
Montgomery County	98,931	134,249	35,317	35.70%	4.20%	4.90%	9.90%
Harris County	1,949,749	2,199,128	249,379	12.80%	82.20%	80.60%	70.00%
8-County Region	2,372,593	2,728,798	356,205	15.00%	100.00%	100.00%	100.00%

Sources: H-GAC, CDS Market Research

**TABLE 6: HOUSEHOLD POPULATION, 2000-2010**

Geographic Area	Household Population		Change 2000 - 2010		Share of Region Total		Share of Regional Growth
	2000	2010	Number	% Change	2000	2010	2000 - 2010
The Woodlands CDP	55,291	93,497	38,206	69.10%	1.20%	1.60%	3.10%
Study Area	106,615	179,865	73,250	68.70%	2.30%	3.10%	6.00%
Montgomery County	292,077	452,522	160,445	54.90%	6.40%	7.80%	13.20%
Harris County	3,358,444	4,047,935	689,491	20.50%	73.10%	69.60%	56.60%
8-County Region	4,595,847	5,814,383	1,218,536	26.50%	100.00%	100.00%	100.00%

Sources: H-GAC, Bureau of the Census, PCensus for ArcView 2014 and CDS Market Research

**TABLE 7: HOUSEHOLDS, 2000-2010**

Geographic Area	Households		Change 2000 - 2010		Share of Region Total		Share of Regional Growth
	2000	2010	Number	% Change	2000	2010	2000 - 2010
The Woodlands CDP	19,881	34,986	15,105	76.00%	1.20%	1.70%	3.70%
Study Area	37,268	65,952	28,684	77.00%	2.30%	3.20%	7.00%
Montgomery County	103,296	162,530	59,234	57.30%	6.30%	7.90%	14.40%
Harris County	1,205,516	1,435,155	229,639	19.00%	73.50%	69.90%	55.70%
8-County Region	1,639,401	2,051,692	412,291	25.10%	100.00%	100.00%	100.00%

Sources: H-GAC, Bureau of the Census, PCensus for ArcView 2014 and CDS Market Research

# DATA COLLECTION AND FIELD REVIEW

## HOUSING GROWTH DISTRIBUTION WITHIN THE STUDY AREA

The estimated change in households by TAZ between 2000 and 2010 and the change in household density (households per square mile) by TAZ during the same period, are shown in **Figure 5** and **Figure 6** respectively. They show where new housing construction is occurring and where it is occurring more intensely or at higher densities (such as through the addition of multifamily or single family attached housing rather than single family detached homes).

Since large areas of The Woodlands – generally the eastern end of the development close to IH 45 – are more built out compared to other parts of the study area, the highest amounts of growth took place in the southeast portion of the study area in developments such as Bender’s Landing and Spring Trails and the further western and southwestern reaches of The Woodlands, where large vacant tracts were still being converted to housing. The northern edge of the study area, north of SH 242, also experienced a large quantity of growth.

The household density change map is mostly similar to the household quantity change map. The principal difference is that several TAZs within and close to The Woodlands Town Center, as well as the northwestern-most portion of the community near FM 1488, experienced relatively higher increases in household density. In the case of areas near the Town Center, this is largely due to the addition of townhomes, small-lot detached homes, and multifamily housing.

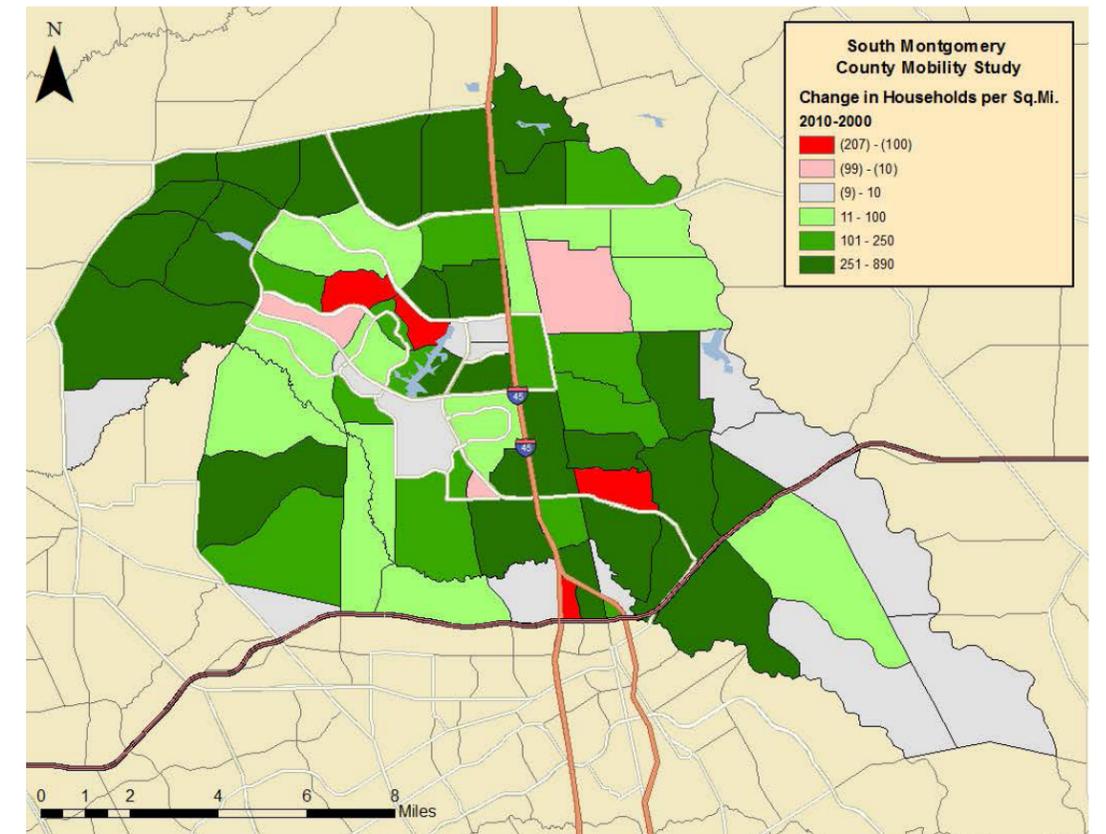


Figure 5: Households per Square Mile

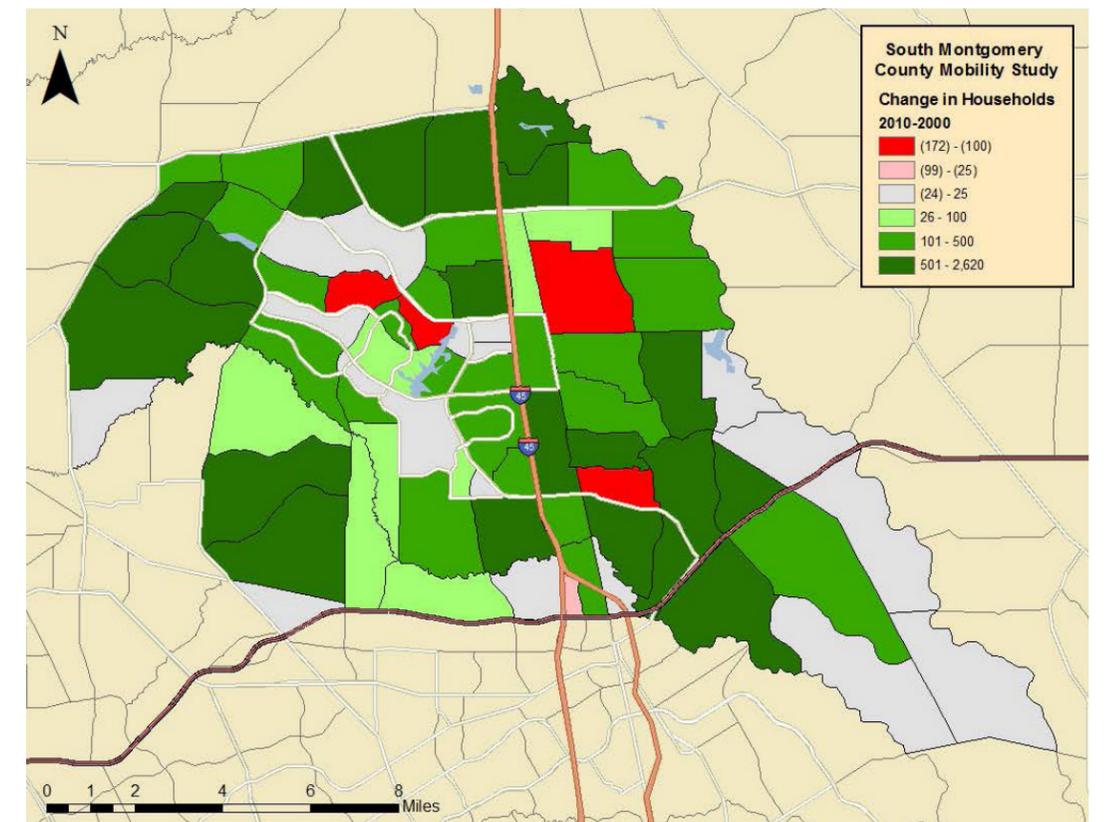


Figure 6: Change in Households



# EXISTING CONDITIONS

# EXISTING CONDITIONS

## EXISTING CONDITIONS

Existing traffic operations at various locations within the study area are essential to understanding if there are any intersection and/or roadway operational deficiencies that must be addressed as part of this study.

### DAILY ROADWAY CAPACITY

Traffic capacity analyses based on daily traffic volumes were performed for the major roadways in the study area and validated with their corresponding average travel speed. The results of these analyses were reported in terms of four levels of condition: (1) Under capacity, (2) At capacity, (3) Over capacity, and (4) Severely over capacity. The criteria is based on the generalized capacity analysis tables and average speeds located in the 2010 Highway Capacity Manual (HCM).

### LEVEL OF SERVICE (LOS)

The performance of an intersection or roadway is determined by conducting a roadway capacity/intersection “level of service” analysis or LOS. Capacity is defined as the maximum number of vehicles that a roadway can accommodate during a particular time period under prevailing roadway, traffic and control conditions. The qualifying results of a capacity analysis are Level of Service (LOS).

Level of Service is a measure of the operating conditions at an intersection or along a roadway segment and it is directly related to the volume-to-capacity ratio, as shown in **Table 9**. LOS is a letter designation from “A” to “F” (free flow conditions to heavily congested). LOS “D” is generally considered the threshold for an acceptable LOS. Utilizing the techniques outlined in the 2010 Highway Capacity Manual (HCM) and the traffic data obtained, level of service was determined for all significant roadways within the South Montgomery County study area. For “daily” capacity, the HCM recommends using 7,000 vehicles per lane per day for multilane streets, 9,000 vehicles per lane per day for a roadway with limited access and raised medians, and 9,000 vehicles per lane per day for two-lane roads. For freeways, the HCM recommends using 20,000 vehicles per lane per day as the capacity threshold.

### CAPACITY ANALYSIS

The results of these analyses show that IH 45 is severely congested from SH 242 to the Hardy Toll Road, carrying over 250,000 vehicles per day (vpd) which includes 100,000 vehicles traveling from the study area south on IH 45, as well as most of the major arterial streets in the study area, which are carrying anywhere from 30,000 to 60,000 vpd. In comparison, arterial streets are normally designed to carry up to 30,000 vpd, but not over. Similarly, an eight-lane freeway, such as IH 45 is normally designed to carry only up to 160,000 vpd on the main lanes and 40,000 vpd on the frontage roads. In contrast, IH 69/US 59, east of the study area and south of the proposed Grand Parkway, is also an eight-lane freeway that carries 125,000 vpd, which is less than half of the traffic volume on IH 45. SH 249 carries 111,000 vpd between the proposed Grand Parkway and Beltway 8. The results of these analyses are shown in **Figure 7**.

### AVERAGE SPEED

Average speeds were determined using Bluetooth stations, which measure the time in seconds it takes a vehicle takes to travel from one station to the next. The speed is calculated using the mileage between the two Bluetooth locations and the elapsed time converted to hours. The criteria for capacity is 30% of the free-flow speed for arterial streets and 50% of the free-flow speed for freeway main lanes. Below these thresholds, a facility is said to be operating over capacity. **Table 10** shows the average travel speeds for the roadways within the study area. The speed charts are located in **Appendix C**.

TABLE 9: LEVEL-OF-SERVICE CRITERIA FOR ROADWAYS SECTIONS

Operating Conditions	Level-of-Service (LOS)	Description	Volume-to-Capacity Ratio
Under Capacity	A	Very low vehicle delays, traffic signal progression extremely favorable, free flow most of the time, most vehicles arrive during green phase.	Less than 1.0
	B	Good signal progression, more vehicles are stopped and experience longer delays compared to LOS A	
	C	Stable flow, fair signal progression, a significant number of vehicles stop at traffic signals.	
At Capacity	D	Congestion noticeable, longer delays and unfavorable signal progression, many vehicles stop at traffic signals.	Equal to 1.0
	E	Upper limit of applicable delay, unstable flow, poor signal progression, traffic at/near roadway capacity, frequent cycle failures.	
Over capacity	F	Unacceptable delay, extremely unstable flow, and congestions, traffic exceeds roadway capacity, stop-and-go conditions. This is a theoretical measure, as volume can only in theory be higher than capacity.	More than 1.0

Source: 2010 Highway Capacity Manual

TABLE 10: AVERAGE PEAK HOUR TRAVEL SPEEDS

Facility	Date	Source	AM Peak (MPH)	PM Peak (MPH)
Birnam Woods Westbound, Riley Fuzzell to Aldine Westfield	2013	H-GAC	30	32
Elan Blvd. Eastbound, Aldine Westfield to Riley Fuzzell	2013	H-GAC	30	28
Elan Blvd. Westbound, Aldine Westfield to Hanna	2013	H-GAC	15	20
FM 1488 Eastbound, FM 2978 to SH 242	2013	H-GAC	20	20
FM 1488 Westbound, SH 242 to FM 2978	2013	H-GAC	30	25
FM 1488 Eastbound, SH 242 to IH 45	2013	H-GAC	23	43
FM 1488 Westbound, IH 45 to SH 242	2013	H-GAC	40	18
FM 2978 Southbound, FM 1488 to Woodlands Pkwy	2013	H-GAC	25	20
FM 2978 Northbound, Woodlands Pkwy to FM 1488	2013	H-GAC	25	20
Fox Run Blvd. Westbound, Riley Fuzzell to Imperial Oaks	2013	H-GAC	15	12
Gosling Rd. Northbound, Kuykendahl to Woodlands Pkwy	2013	H-GAC	25	16
Gosling Rd. Southbound, Woodlands Pkwy to Kuykendahl	2013	H-GAC	29	19
Gosling Rd. Northbound, Woodlands Pkwy to Research Forest	2013	H-GAC	12	5
Gosling Rd. Southbound, Research Forest to Woodlands Pkwy	2013	H-GAC	20	11
Gosling Rd. Southbound, 242 to Research Forest	2013	H-GAC	20	15
Grogans Mill Southbound, Woodlands Pkwy to IH 45	2013	H-GAC	25	15

# EXISTING CONDITIONS

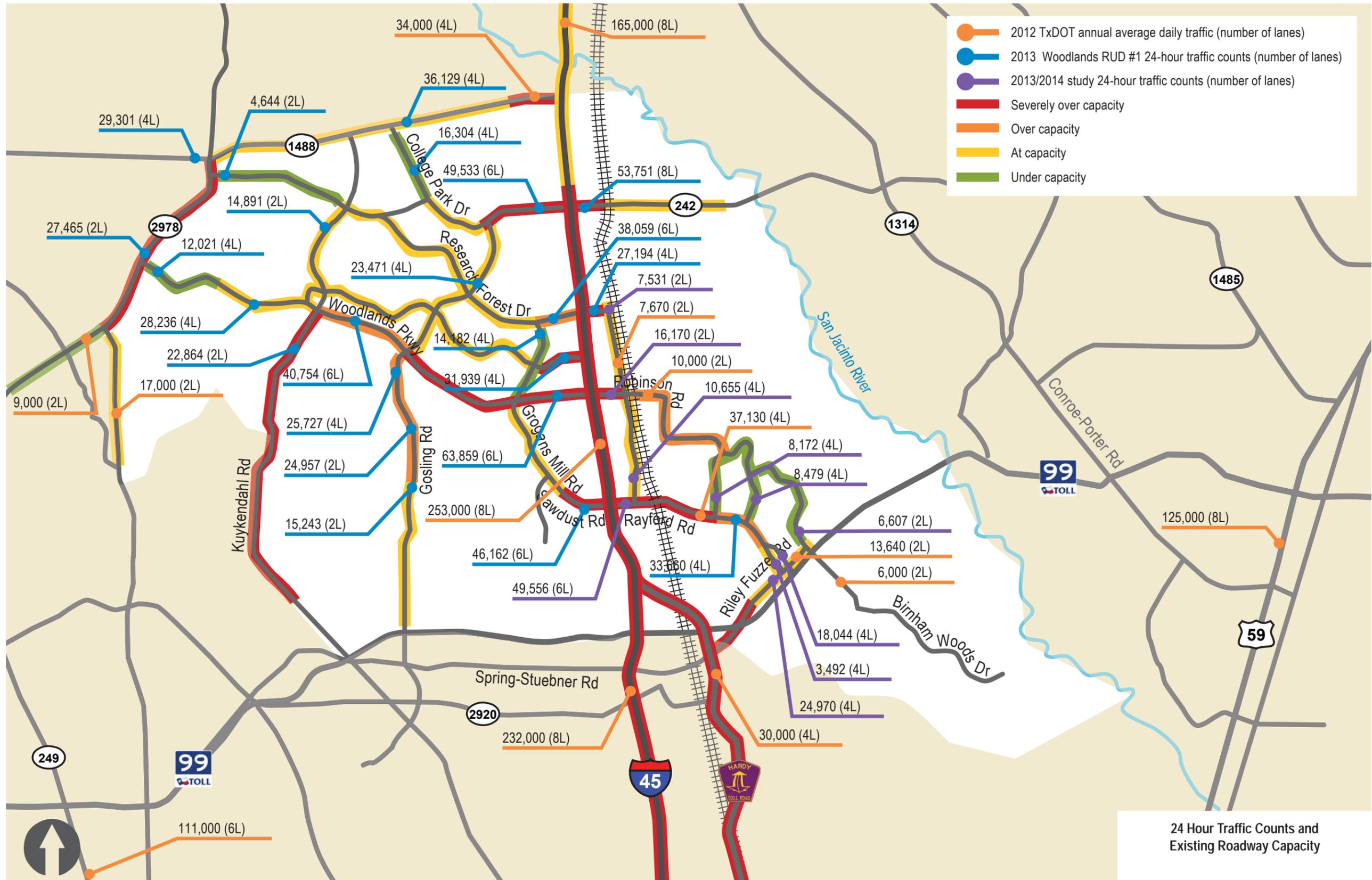


Figure 7: Existing Roadway Capacity and Traffic Counts

# EXISTING CONDITIONS

TABLE 10 (CONTINUED): AVERAGE PEAK HOUR TRAVEL SPEEDS

Facility	Date	Source	AM Peak (MPH)	PM Peak (MPH)
Hardy Toll Rd. Northbound, Cypresswood to IH 45 North	2013	Transtar	70	66
Hardy Toll Rd. Southbound, IH 45 North to Cypresswood	2013	Transtar	31	70
IH 45 North, Louetta to Hardy Toll Rd	2013	Transtar	38	21
IH 45 North, Southbound Hardy Toll Rd to Louetta Rd.	2013	Transtar	40	52
IH 45 North, Northbound Hardy Toll Rd to Woodlands Pkwy	2013	Transtar	57	41
IH 45 North, Southbound Woodlands Pkwy to Hardy Toll Rd.	2013	Transtar	48	27
IH 45 North, Northbound Woodlands Pkwy to FM 1488	2013	Transtar	61	51
IH 45 North, Southbound FM 1488 to Woodlands Pkwy	2013	Transtar	59	52
IH 45 North, Northbound FM 1488 to Loop 336 North	2013	Transtar	66	66
IH 45 North, Southbound Loop 336 North to FM 1488	2013	Transtar	51	59
Kuykendahl Rd. Northbound, Gosling to Hufsmith-Kuykendahl	2013	H-GAC	30	22
Kuykendahl Rd. Southbound, Hufsmith-Kuykendahl to Gosling	2013	H-GAC	22	18
Kuykendahl Rd. Northbound, Hufsmith-Kuykendahl to Woodlands Pkwy	2013	H-GAC	20	22
Kuykendahl Rd. Southbound, Woodlands Pkwy to Hufsmith-Kuykendahl	2013	H-GAC	25	20
Lake Woodlands Dr. Eastbound, Kuykendahl to Gosling	2013	H-GAC	21	20
Lake Woodlands Dr. Westbound, Gosling to Kuykendahl	2013	H-GAC	25	30
Lake Woodlands Dr. Eastbound, Gosling to Grogans Mill	2013	H-GAC	23	21
Lake Woodlands Dr. Westbound, Grogans Mill to Gosling	2013	H-GAC	35	25
Lake Woodlands Dr. Eastbound, Grogans Mill to IH 45	2013	H-GAC	15	8
Lake Woodlands Dr. Westbound, IH 45 to Grogans Mill	2013	H-GAC	14	14
Rayford Rd. Eastbound, IH 45 to Imperial Oaks	2013	H-GAC	28	18
Rayford Rd. Westbound, Imperial Oaks to IH 45	2013	H-GAC	12	8
Rayford Rd. Eastbound, Imperial Oaks to Riley Fuzzell	2013	H-GAC	22	21
Research Forest Eastbound, Grogans Mill to IH 45	2013	H-GAC	38	12
Research Forest Westbound, IH 45 to Grogans Mill	2013	H-GAC	32	35
Riley Fuzzell Rd. Northbound, Hardy Toll Rd. to Fox Run	2013	H-GAC	32	24
Riley Fuzzell Rd. Southbound, Fox Run to Hardy Toll rd.	2013	H-GAC	19	30
Riley Fuzzell Rd. Northbound, Fox Run to Birnham Woods	2013	H-GAC	20	12
Riley Fuzzell Rd. Southbound, Birnham Woods to Fox Run	2013	H-GAC	20	12
Robinson Rd. Eastbound, IH 45 to Hanna	2013	H-GAC	30	9
Robinson Rd. Westbound, Hanna to IH 45	2013	H-GAC	20	18
Robinson Rd. Eastbound, Hanna to Aldine Westfield	2013	H-GAC	30	15
SH 242 Eastbound, FM 1488 to Gosling	2013	H-GAC	31	31
SH 242 Westbound, Gosling to FM 1488	2013	H-GAC	38	30
SH 242 Eastbound, Gosling to IH 45	2013	H-GAC	10	10
SH 242 Westbound, IH 45 to Gosling	2014	H-GAC	19	29
SH 242 Eastbound, IH 45 to Lazy River Rd.	2014	H-GAC	42	41
SH 242 Westbound, Lazy River Rd. to IH 45	2014	H-GAC	20	39
Tamina Rd. Eastbound, IH 45 to Main St.	2013	H-GAC	18	18
Tamina Rd. Westbound, Main St. to IH 45	2013	H-GAC	15	10

TABLE 10 (CONTINUED): AVERAGE PEAK HOUR TRAVEL SPEEDS

Facility	Date	Source	AM Peak (MPH)	PM Peak (MPH)
Woodlands Pkwy Eastbound, FM 2978 to Kuykendahl	2013	H-GAC	30	25
Woodlands Pkwy Westbound, Kuykendahl to FM 2978	2013	H-GAC	30	30
Woodlands Pkwy Eastbound, Kuykendahl to Gosling	2013	H-GAC	30	35
Woodlands Pkwy Westbound, Gosling to Kuykendahl	2013	H-GAC	30	30
Woodlands Pkwy Eastbound, Gosling to Grogans Mill	2013	H-GAC	15	33
Woodlands Pkwy Westbound, Grogans Mill to Gosling	2013	H-GAC	40	19
Woodlands Pkwy Eastbound, Grogans Mill to Woodloch	2013	H-GAC	38	30
Woodlands Pkwy Westbound, Woodloch Forest to Grogans Mill	2013	H-GAC	30	20

# EXISTING CONDITIONS

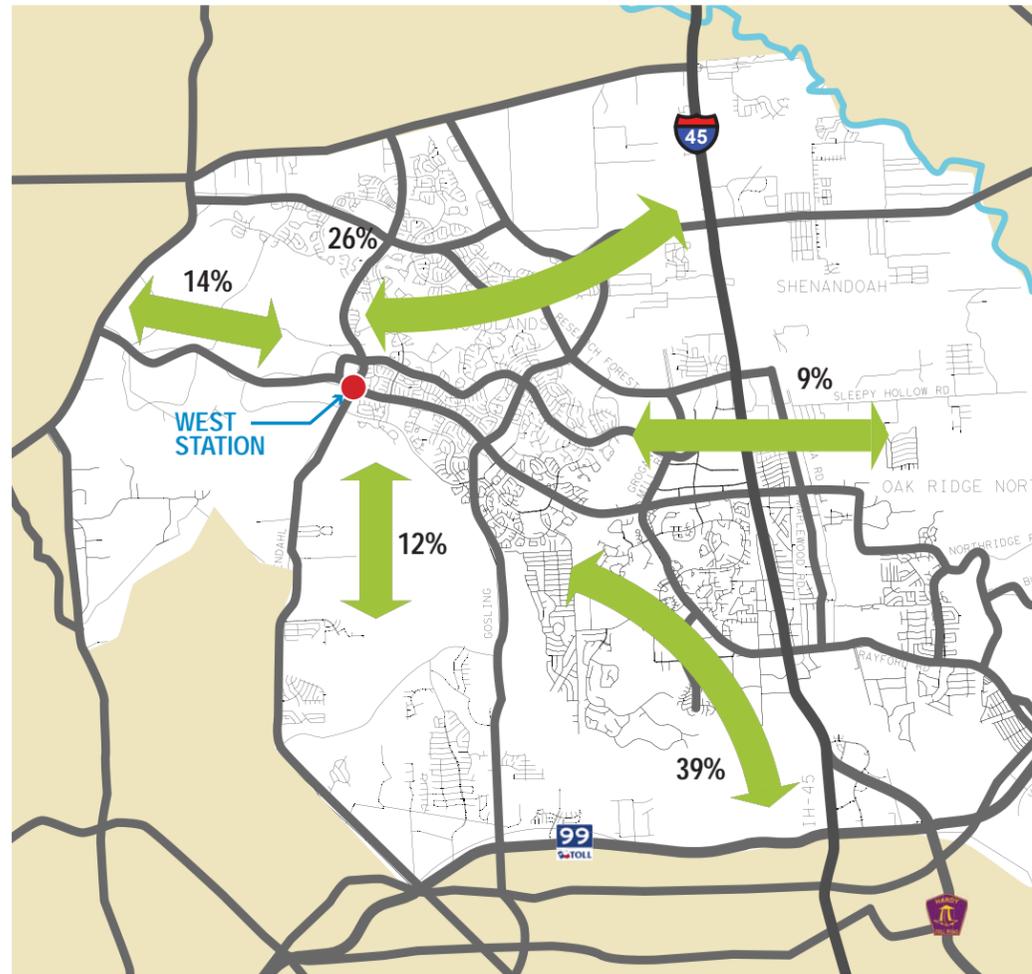


Figure 8: West Station Trip Distribution



Trip Distribution  
West Station  
Woodlands Pkwy  
at Kuykendahl Rd

- LEGEND**
- ORIGIN/DESTINATION STATION
  - ↔ TRIP DISTRIBUTION TO/FROM STATION

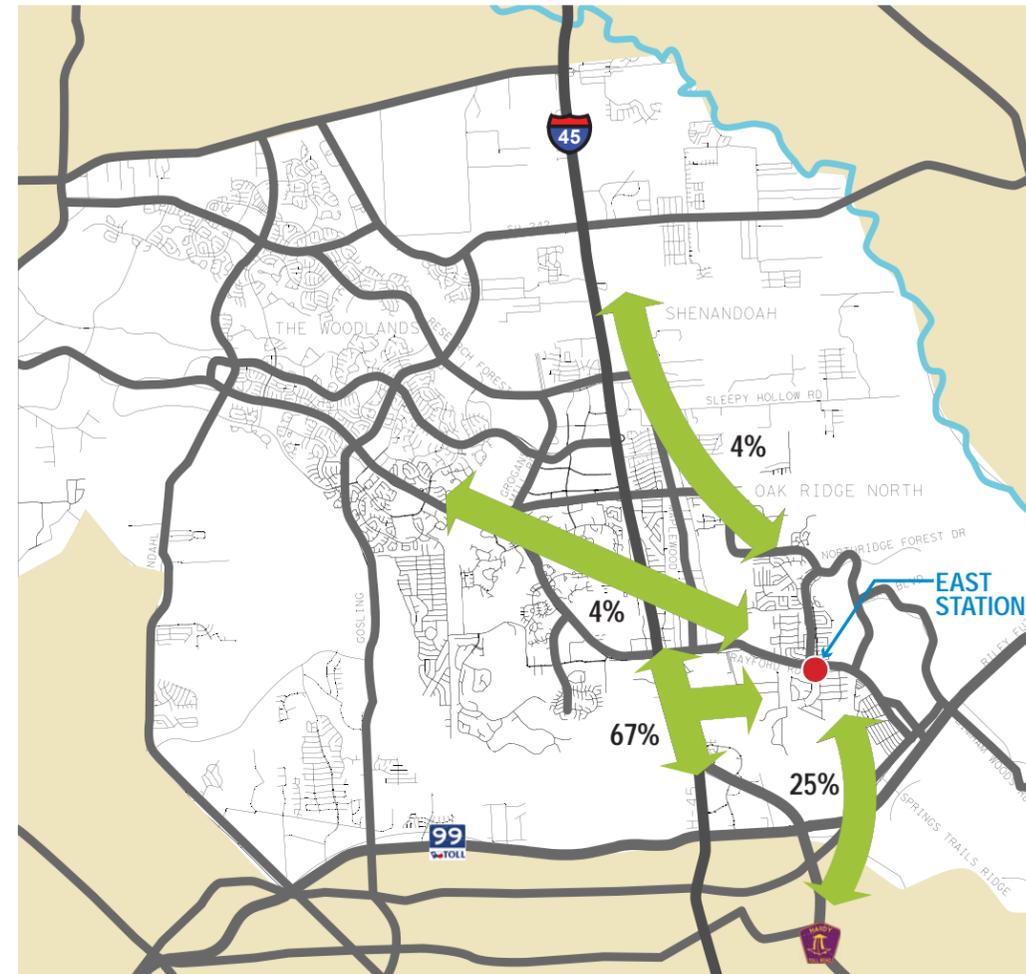


Figure 9: East Station Trip Distribution



Trip Distribution  
East Station  
Rayford Rd at  
Imperial Oaks Blvd

- LEGEND**
- ORIGIN/DESTINATION STATION
  - ↔ TRIP DISTRIBUTION TO/FROM STATION

## ORIGIN-DESTINATION DATA

Bluetooth stations were used to measure the travel time between established points of interest, as well as origin-destination data. By analyzing the data that was gathered between the hours of 7 a.m. to 7 p.m., and setting the maximum allowable capture of travel time between established points to 30 minutes, the data was interpreted to determine the traffic direction. (The maximum allowable capture of travel time chosen was 30 minutes in order to avoid collecting information from vehicles that do not originate from the study area, and to determine the flow of traffic.) Two locations were chosen as the base locations, one on the west side of IH 45 (West Station) and one on the east side of IH 45 (East Station), to display the flow of traffic origination from those locations, and also arriving at those locations during the time frame of the study.

The west station, shown in **Figure 8**, was located at the intersection of Woodlands Parkway at Kuykendahl Road. The data revealed:

- 39 percent of motorists traveled to IH 45 and proceeded south toward Houston
- 26 percent of the traffic traveled in the northeast direction towards Conroe
- 14 percent traveled further west
- 12 percent traveled south via Kuykendahl or Gosling
- 9 percent traveled east across IH 45

The east station, shown in **Figure 9**, was located at the intersection of Rayford Road at Imperial Oaks Boulevard. The data indicated:

- 67 percent of motorists traveled west toward IH 45
- 25 percent traveled south to Riley Fuzzell Road and the Hardy Toll Road
- 4 percent of the traffic traveled north using local roads
- 4 percent traveled across IH 45

# EXISTING CONDITIONS

## PEAK HOUR INTERSECTION CAPACITY

### TRAFFIC OPERATIONS ANALYSIS

This section describes analysis of existing traffic operations conducted at intersections and interchanges within the study area. The purpose of this analysis was to determine the level of congestion currently experienced at these locations.

### TRAFFIC MODEL

The traffic analysis model using Synchro/SimTraffic (version 8) was developed to assist in the evaluation of the existing traffic conditions. This traffic model will also serve to evaluate the projected conditions after the identification of recommended improvements. Model inputs include traffic volumes, lane geometry, posted speed limits, traffic signal control timing plans, and vehicle/driver parameters.

Available Synchro/SimTraffic networks from Montgomery County were obtained and reviewed. An overall model network, consisting of 59 intersections and 3 interchanges, was developed. The existing roadway geometry was coded in the model which included travel lanes, speed limits, intersection lane configuration, and storage bays. This information was verified using the latest Google Earth aerial imagery and field reconnaissance.

Daily traffic and peak period turning movement counts were conducted along the study corridors and intersections. Turning movement counts were collected for a two-hour period, both in the morning (6:30 am to 8:30 am) and in the afternoon (4:30 pm to 6:30 pm). Based on the review of traffic count data at major intersections, one hour periods from 7:15 am to 8:15 am in the morning and from 5:00 pm to 6:00 pm in the afternoon were selected to model the AM and PM peak hour traffic conditions.

Signal timing information, including cycle lengths, timing splits, and phase sequencing, was obtained from field observations and coded in the traffic model. At the three interchange locations along IH 45 - College Park Drive/SH 242, Research Forest Drive,

and Rayford-Sawdust Road, four-phase signal timing strategy was used to model the signal timing operations of the two closely spaced intersections, commonly known as TTI-4-phase diamond.

The Synchro/SimTraffic model was calibrated to better replicate real-world conditions and validated to ensure the output reflected existing traffic operations and congestion levels observed in the field. Data collected from the field included helicopter videos, turning movement count camera captures, field observations, and corridor travel time data. Additionally, 24-hour traffic counts were used to validate the traffic volumes in model.

### MEASURES OF EFFECTIVENESS

Measures of effectiveness (MOE) utilized in evaluating traffic operations for the study intersections include level of service and average delay per vehicle.

Level of service (LOS) is a qualitative measure of operating conditions provided at an intersection. Letter "A" to "F" is assigned to describe the congestion level – LOS A representing free-flow conditions and LOS F representing heavy congestion or traffic breakdowns. Typically, LOS D is considered the acceptable limit of traffic operations in urban areas. LOS E and F represent unacceptable traffic conditions and congestion. For signalized intersections, LOS is based on the average control delay at the intersection (seconds per vehicle). The definition of control delay is the portion of total delay attributed to traffic signal operation and includes initial deceleration delay, queue move-up time, stop delay, and final acceleration delay. For unsignalized but sign-controlled two-way and four-way intersections, LOS is also based on the control delay, but the ranges are different from that of signalized intersections. The standards of LOS based on the ranges of control delays from the 2010 Highway Capacity Manual (HCM) are shown in

**Table 11.**

TABLE 11: LEVEL OF SERVICE CRITERIA FOR INTERSECTIONS			
Level of Service (LOS)	Control Delay (seconds per vehicle)		Description
	Signalized	Unsignalized	
A	≤ 10.0	≤ 10.0	Highest quality of traffic service; free-flow conditions; motorists drive at desired speed; minor traffic flow disruptions.
B	> 10.0 ≤ 20.0	> 10.0 ≤ 15.0	Good quality of traffic service; reasonable flow conditions; noticeable presence of other vehicles; ability to maneuver slightly restricted.
C	> 20.0 ≤ 35.0	> 15.0 ≤ 25.0	Stable traffic flow; noticeable increases in platoon formation; ability to maneuver noticeably restricted; minor disruptions could cause traffic service deterioration.
D	> 35.0 ≤ 55.0	> 25.0 ≤ 35.0	Approaching unstable traffic flow; speed and ability to maneuver severely restricted; limit of acceptable operations.
E	> 55.0 ≤ 80.0	> 35.0 ≤ 50.0	Unstable traffic flow; travel demand approaching or at roadway capacity.
F	> 80.0	> 50.0	Heavy congested flow; traffic demand exceeds roadway capacity; forced or breakdown traffic flow.

Source: Highway Capacity Manual, Transportation Research Board, 2010.

# EXISTING CONDITIONS

**TABLE 12: EXISTING AM AND PM PEAK HOUR INTERSECTION LEVEL-OF-SERVICE**

Intersection	Intersection Control Type	AM Peak		PM Peak	
		Delay(sec/veh)	LOS	Delay (sec/veh)	LOS
Roadway - College Park Drive/SH 242					
College Park Drive/SH 242 at Gosling Road	Signalized	58.2	E	58.3	E
College Park Drive/SH 242 at Green Bridge Drive	Signalized	51	D	27	C
College Park Drive/SH 242 at IH 45 NBFR	Signalized	116.5	F	157.8	F
College Park Drive/SH 242 at IH 45 SBFR	Signalized	82.4	F	85.6	F
SH 242 at FM 1314	Signalized	56.8	E	45.4	D
Roadway - FM 1488					
FM 1488 at College Park Drive/SH 242	Signalized	26.2	C	35.2	D
FM 1488 at FM 2978	Signalized	48.2	D	58.3	E
FM 1488 at Kuykendahl Road	Signalized	63.8	E	46.7	D
Roadway - FM 2978					
FM 2978 at FM 1488	Signalized	48.2	D	58.3	E
FM 2978 at Research Forest Drive	Signalized	20.6	C	21.3	C
FM 2978 at Woodlands Pkwy	Signalized	41.4	D	37.5	D
Roadway - Gosling Road					
Gosling Road at Creekside Forest Drive	Signalized	36	D	19.3	B
Gosling Road at Flintridge Drive	Signalized	43.1	D	43.5	D
Gosling Road at W Rayford Road	Signalized	25	C	23.7	C
Roadway - Grogans Mill/Sawdust Road					
Grogans Mill Road at Sawdust Road	Signalized	24.6	C	33.3	C
Grogans Mill Road at Sawmill Road	Signalized	20.3	C	29.6	C
Sawdust Road at IH 45 SBFR	Signalized	86.9	F	106.3	F
Roadway - Hanna Road/Main Street					
Hanna Road at Richard Road	Unsignalized	20.9	C	11.4	B
Hanna Road at Robinson Road (north side)	Unsignalized	39.4	E	31.3	D
Hanna Road at Robinson Road (south side)	Unsignalized	18.9	C	77.1	F
Hanna Road at Woodson Road	Unsignalized	15.9	C	33.8	D
Main St at Sleepy Hollow Road	Unsignalized	6.3	A	6.2	A
Roadway - Imperial Oaks Boulevard					
Imperial Oaks Blvd at Northridge Forest Drive	Unsignalized	11.4	B	14.2	B
Roadway - Kuykendahl Road					
Kuykendahl Road at Creekside Forest Drive (east)	Signalized	31.1	C	26.7	C
Kuykendahl Road at Creekside Forest Drive (west)	Signalized	26	C	35.1	D
Roadway - Lake Woodlands Drive					
Lake Woodlands Drive at Gosling Road	Signalized	42.6	D	73.9	E

Source: SCMP Study Team using Synchro/SimTraffic (version 8.0)

## TRAFFIC ANALYSIS RESULTS

Existing traffic operations were evaluated using Synchro/SimTraffic traffic model for the study intersections based on the identified MOEs and results are presented in **Table 12**.

During the AM peak (7:00 – 8:00 am), the following signalized intersections are the most congested within the study area:

1. College Park Drive/SH 242 at IH 45 NBFR
2. Sawdust Road at IH 45 SBFR
3. College Park Drive/SH 242 at IH 45 SBFR
4. Woodlands Parkway at Kuykendahl Road
5. Rayford Road at IH 45 NBFR
6. Tamina Road at IH 45 NBFR
7. College Park Drive/SH 242 at Gosling Road
8. Woodlands Parkway at Six Pines
9. FM 1488 at Kuykendahl Road
10. Riley Fuzzell Road at Rayford Road

The unsignalized intersection of Hanna Road at Robinson Road (north side) also operates at LOS E. There are 13 intersections that are currently operating at LOS D, i.e. approaching congestion. The intersections operating at LOS E or F are generally located along IH 45 or at the intersecting points of major east-west and north-south corridors.

During the PM peak period, there is more congestion observed at many intersections. A total of 15 signalized intersections operate at LOS E or F. The intersection of College Park Drive/SH 242 at IH 45 NBFR (northbound frontage road) experiences the highest delay of 157.8 seconds. The unsignalized intersection of Hanna Road at Robinson Road (south side) also operates at LOS F with a delay of 77.1 seconds.

During the PM peak (5:00-6:00 pm) the following signalized intersections are the most congested intersection within the study area:

1. College Park/SH 242 at IH 45 NBFR
2. Sawdust at IH 45 SBFR
3. College Park/SH 242 at IH 45 SBFR
4. Woodlands Parkway at Woodloch Forest Drive
5. Hanna Rd at Robinson Road (south side)
6. Woodlands Parkway at Kuykendahl
7. Woodlands Parkway at Six Pines
8. Tamina Road at IH 45 NBFR
9. Rayford Road at IH 45 NBFR
10. College Park/SH 242 at Gosling

The five worst intersections in the study area during AM and PM peak hours include:

1. College Park Drive/SH 242 at IH 45 NBFR
2. Sawdust Road at IH 45 SBFR
3. College Park Drive/SH 242 at IH 45 SBFR
4. Woodlands Parkway at Kuykendahl Road
5. Rayford Road at IH 45 NBFR

Level of service conditions for the AM and PM peaks are shown in **Figure 10** and **Figure 11**.

On Saturday afternoons between the hours of 12:00 pm -1:00 pm the following intersections performed at LOS E.

1. Lake Woodlands Drive at Six Pines
2. Lake Woodlands Drive at Pinecroft
3. Lake Woodlands Drive at Target/Mall Entrance

The existing signal system is interconnected, so it would not require an equipment upgrade to implement optimized signal timings; however, engineering analyses and implementation would be required. Typically, traffic signal optimization improves traffic operations by reducing the vehicle delay on the major streets between 5 and 15 percent, depending on the level of saturation of the system.

# EXISTING CONDITIONS

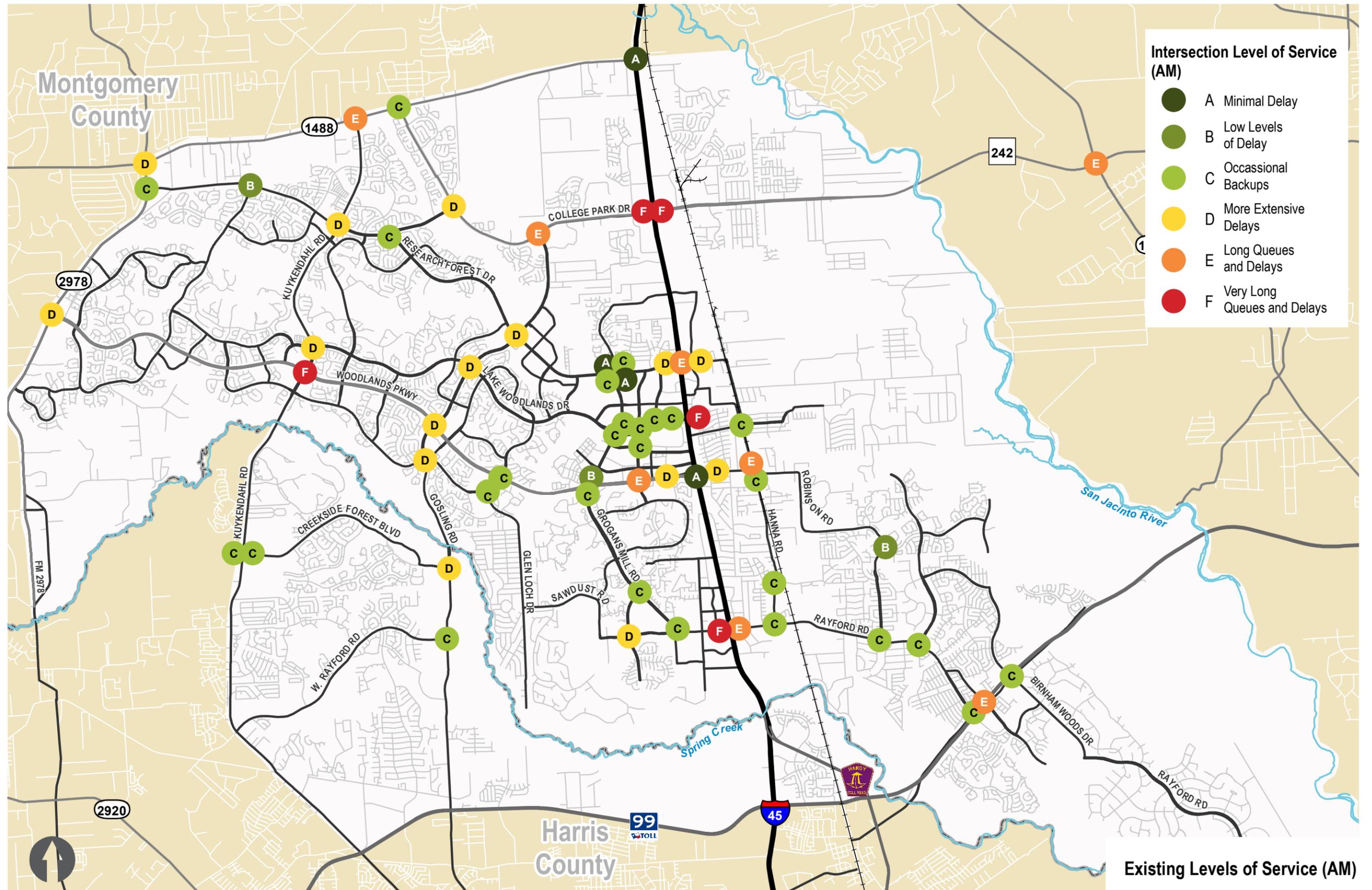


Figure 10: Existing Levels of Service (AM)

# EXISTING CONDITIONS

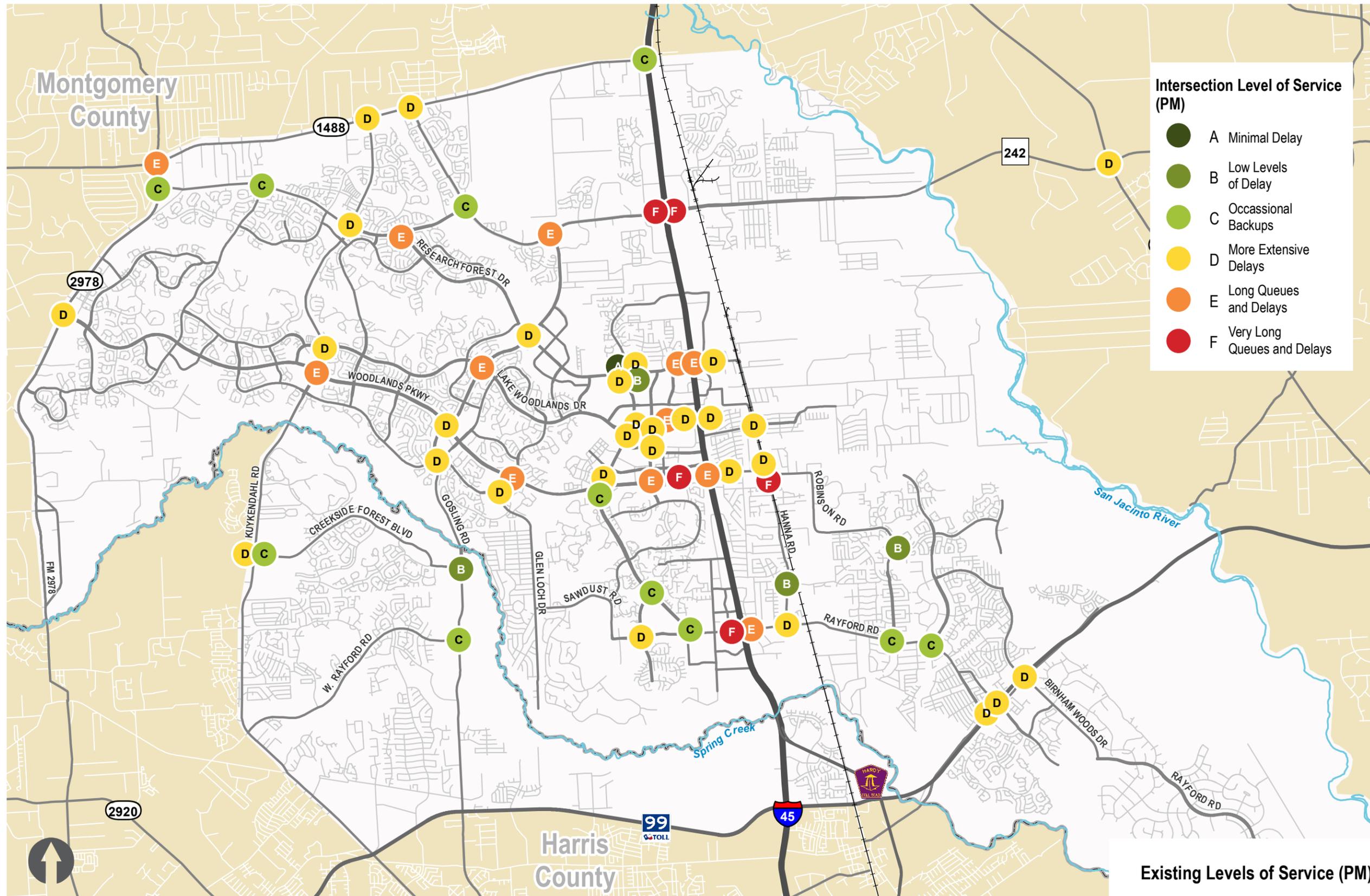


Figure 11: Existing Levels of Service (PM)

Existing Levels of Service (PM)

# EXISTING CONDITIONS

## EXISTING INTERCHANGE ANALYSIS

The Synchro/SimTraffic model was also utilized to evaluate the existing traffic operations at the various merge/diverge points at the ramps for the following three interchanges along IH 45 in the study area:

1. FM 1488
2. Lake Woodlands Drive
3. Woodlands Parkway/Robinson Road

The traffic evaluation results including delay and corresponding LOS at various merge/diverge locations is summarized in **Table 13**. The LOS calculation is based on the 2010 HCM methodology for unsignalized intersections. The overall LOS for the interchange was derived by averaging delays at all merge/diverge locations within that interchange and weighted by traffic volumes. The direct connector from the IH 45 northbound main lanes to westbound Woodlands Parkway experiences severe congestion due to the fact that it terminates at a signalized intersection. The impeded free flow of traffic results in a large queue of vehicles backing up into the main lanes of IH 45. Maps containing the locations of individual ramps and movements at the interchanges along IH 45 are shown in **Appendix G**.

During peak hours, all three interchanges, when evaluated at an overall level, operated at acceptable LOS of C or better. However, certain individual merge/diverge locations within the interchange experience congestion. The ramp from IH 45 southbound frontage road to Lake Woodlands Drive westbound experiences significant delay with LOS E or worse, in the AM peak hour, since the ramp traffic has to yield to heavy traffic volume going westbound on Lake Woodlands. The merge onto Woodlands Parkway eastbound from IH 45 NB exit ramp experiences delay approaching congestion and operating at LOS D. This is mainly due to higher eastbound traffic volume on Woodlands Parkway in the PM peak hour, and lack of adequate spacing and storage capacity to the adjacent intersection at Westwood Drive in Oak Ridge North, which results in long queues on this exit ramp. The Woodlands Parkway eastbound

to IH 45 northbound entrance ramp also experiences significant delays at the stop-controlled merge point with traffic queuing on the ramp in the PM peak hour. This delay is due to heavy traffic on the frontage road and short distance to the downstream ramp resulting in a weaving conflict.

## CRASH ANALYSIS

Crash records were obtained from TxDOT, covering the time period from January 1, 2009 to December 31, 2013 to determine safety issues at the major intersections. **Table 14** shows the intersections with 25 or more crash events in the study area during the 5-year time period. **Figure 12** shows the number of non-intersection related crash events. The Crash Frequency Map is shown in **Figure 13**. This map shows the top 30 intersection locations with the most crashes in the study area, as well as the intersection locations within the SCMP study area that are in the top 30 Montgomery County crash list. The intersection of IH 45 and SH 242 has the highest number of intersection crash events in the study area. Rayford road is the arterial with the largest number of non-intersection crash events in the study area.

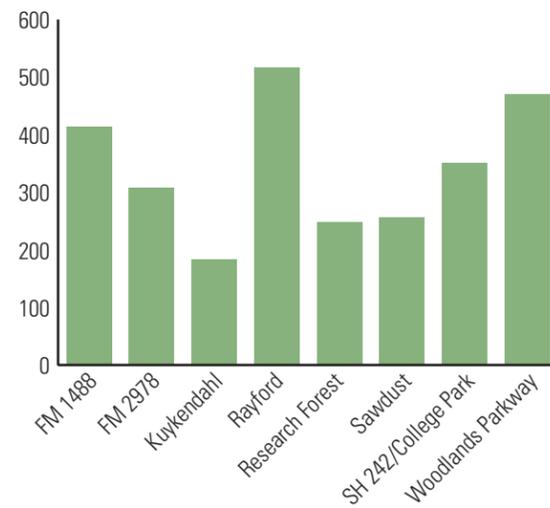


Figure 12: Non-Intersection Crashes

TABLE 13: EXISTING AM AND PM PEAK HOUR INTERCHANGE LEVEL OF SERVICE

Interchange	Type	AM Peak		PM Peak	
		Delay (s/veh)	LOS	Delay (s/veh)	LOS
FM 1488 and IH 45 Frontage Roads		3.1	A	5.2	A
IH 45 SBFR @ Exit Ramp to FM 1488 WB	Diverge	2.2	A	2.3	A
IH 45 SBFR @ Entrance Ramp from FM 1488 WB	Merge	0.5	A	0.5	A
FM 1488 WB @ IH 45 SBFR Exit Ramp	Merge	5.5	A	2.7	A
FM 1488 @ IH 45 SBFR Entrance/Exit Ramps	Merge/Diverge	0.8	A	2.2	A
IH 45 SBFR @ Exit Ramp to FM 1488 EB	Diverge	0.9	A	0.9	A
IH 45 SBFR @ Entrance Ramp from FM 1488 EB	Merge	4.8	A	2.4	A
IH 45 NBFR @ Entering Ramp from FM 1488 WB	Merge	0.3	A	0.6	A
IH 45 NBFR @ Exit Ramp to FM 1488 WB	Diverge	2.2	A	17	C
FM 1488 @ IH 45 NBFR Entrance/Exit Ramps	Merge/Diverge	2.2	A	9.8	A
FM 1488 @ IH 45 NBFR Entrance/Exit Ramps	Merge/Diverge	0.4	A	0.6	A
IH 45 NBFR @ Entrance Ramp from FM 1488 EB	Merge	1.3	A	5.2	A
IH 45 NBFR @ Exit Ramp to FM 1488 EB	Diverge	3.2	A	11.3	B
Lake Woodlands Drive and IH 45 Frontage Roads		20.9	C	13.4	B
IH 45 SBFR @ Exit Ramp to Lake Woodlands WB	Diverge	55.8	F	25.7	D
Lake Woodlands @ IH 45 SBFR Entrance/Exit Ramps	Merge/Diverge	47.3	E	31.3	D
IH 45 SBFR @ Entrance Ramp from Lake Woodlands EB	Merge	1.9	A	4.9	A
IH 45 NBFR @ Entrance Ramp from Lake Woodlands EB	Merge	1.1	A	2.1	A
IH 45 NBFR @ Exit Ramp to Lake Woodlands WB	Diverge	4.8	A	3.7	A
Woodlands Parkway @ IH 45 Frontage Roads		2.3	A	9.2	A
IH 45 SBFR @ Entrance/Exit Ramps North of Woodlands Pkwy	Merge/Diverge	1.9	A	1.5	A
Woodlands Pkwy @ IH 45 SBFR Entrance/Exit Ramps	Merge/Diverge	0.9	A	1.1	A
Woodlands Pkwy @ IH 45 SBFR Exit Ramp	Merge	0.6	A	1	A
Woodlands Pkwy @ IH 45 SBFR Entrance Ramp	Diverge	1.6	A	1.9	A
IH 45 SBFR @ Entrance/Exit Ramps South of Woodlands Pkwy	Merge/Diverge	1	A	1.5	A
IH 45 NBFR @ Entrance Ramp from Woodlands Pkwy WB	Merge	0.5	A	0.6	A
IH 45 NBFR @ Exit Ramp to Woodlands Pkwy WB	Diverge	1.4	A	2.1	A
Woodlands Pkwy @ IH 45 NBFR Exit Ramp	Merge	1.4	A	16.1	C
Woodlands Pkwy @ IH 45 NBFR Entrance Ramp	Diverge	1.4	A	11.4	B
Woodlands Pkwy @ IH 45 NBFR Entrance/Exit Ramps	Merge/Diverge	9.2	A	31.7	D

Source: Study Team using SimTraffic (version 8.0)

# EXISTING CONDITIONS

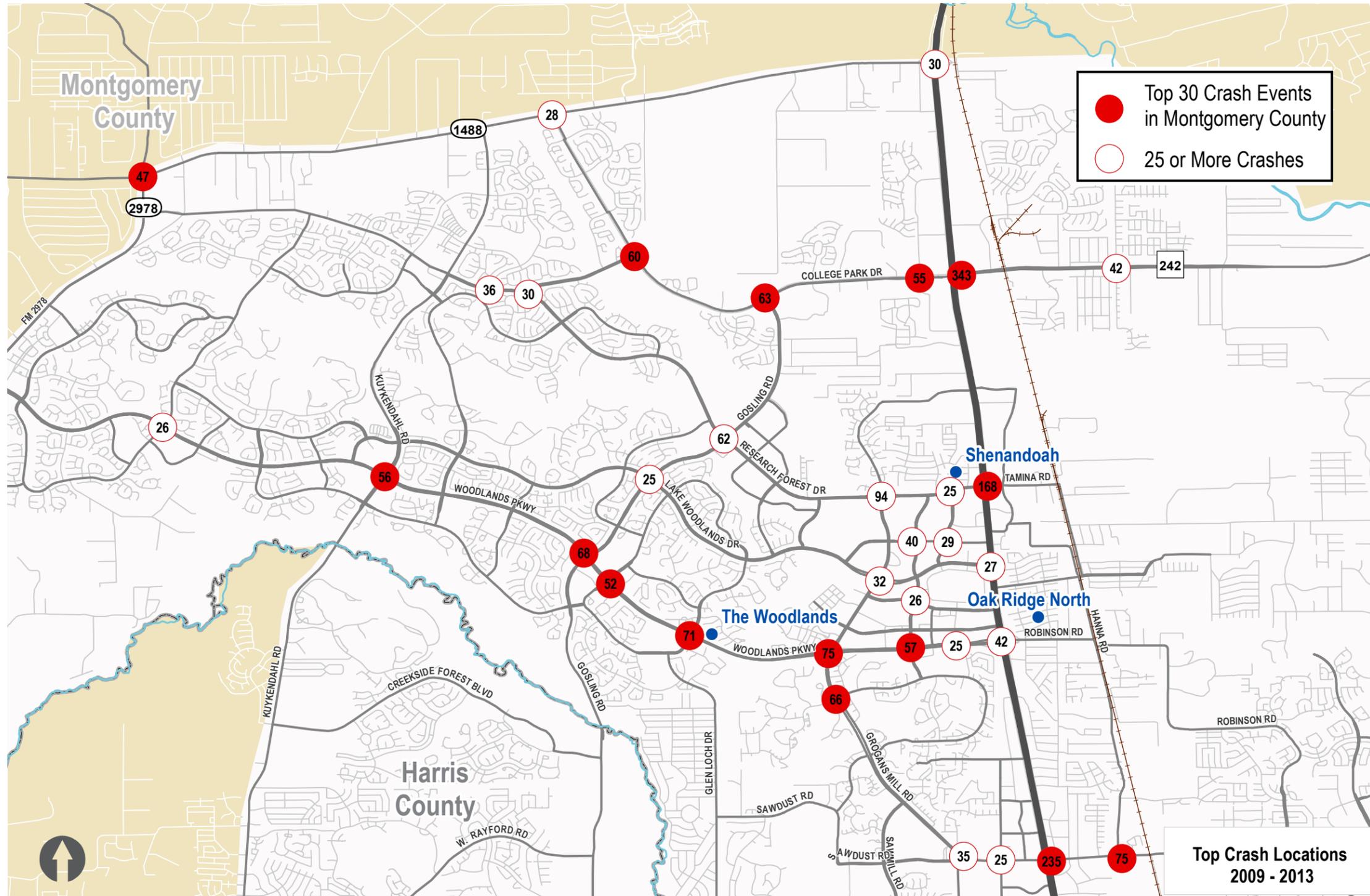


Figure 13: Crash Frequency Map

**TABLE 14: INTERSECTION CRASH EVENTS (2009-2013)**

Location	Number of Incidents
IH 45 at SH 242	343
IH 45 at Rayford/Sawdust	235
IH 45 at Research Forest/Tamina	168
Research Forest at Grogans Mills	94
Rayford at Richard	75
Woodlands Pkwy at Grogans Mill	75
Woodlands Pkwy at Panther Creek E*	71
Woodlands Pkwy at Gosling	68
Grogans Mill at Millbend	66
SH 242 at Gosling	63
Research Forest at Gosling	62
SH 242 at Green Bridge	60
Woodlands Pkwy at Six Pines	57
Woodlands Pkwy at Kuykendahl	56
SH 242 at St Lukes Way	55
Woodlands Pkwy at Panther Creek W*	52
FM 1488 at FM 2978	47
SH 242 at Gleneagle	42
Woodlands Pkwy at IH 45	42
Lake Front at Six Pines	40
Research Forest at Alden Bridge	36
Grogans Mill at Sawdust Rd	35
FM 2978 at Woodlands Pkwy	33
Lake Woodlands at Grogans Mill Rd	32
IH 45 at FM 1488	30
Greenbridge at Research Forest	30
Lake Front at Pinecroft	29
Rayford at Oakhurst	29
FM 1488 at SH 242	28
IH 45 at Lake Woodlands	27
Six Pines at Lake Robbins	26
Woodlands Pkwy at Branch Crossing	26
Lake Woodlands at Gosling	25
Research Forest at Pinecroft	25
Sawdust at Budde	25
Woodlands Pkwy at Many Pines	25

\*Divided S. Panther Creek crashes between East and West Panther Creek. Based on percent of crashes.

Note: These are not all the crashes within the study area. There are some intersection locations with less than 25 crashes in the 5 year period.

# EXISTING CONDITIONS

## LAND USE AND VALUE

The forecast of property values in the Study Area is based on the 2013 parcel-level certified values from the Harris (HCAD) and Montgomery (MCAD) County Appraisal Districts. Using the State of Texas Real Property Codes associated with each parcel, the 2013 assessed values were categorized by land use. The acreage of each parcel was calculated using ArcGIS. Values and acreages were then aggregated to each of the 78 Traffic Analysis Zones of the study area. A total of 12 TAZs in the Study Area are located in Harris County, with 66 zones located in Montgomery County.

The land use-specific values were then combined into one of three assigned categories: Residential, Commercial, and Other. For the residential and commercial land uses, samples of property value per acre were taken at multiple densities. These samples were taken from the medians of TAZs that currently typify a certain level of density and development. Using H-GAC's second quarter 2014 TAZ-level forecast, samples were also taken of 2013 households and jobs per acre, of residential and commercial use land respectively, in each of the 78 Study Area TAZs. **Table 15** illustrates the specific density factors used in this project.

Considering proposed transportation improvements and known proposed developments these density factors were applied on a TAZ-by-TAZ basis to H-GAC's forecast figures to create the property value forecast. The first step in this process involved applying the requisite household and job density factors to H-GAC's forecast of households and jobs in 2018 and 2040. The resulting theoretical "demand" for acreage in each of these land uses is then applied to the requisite value per acre factor, creating a forecast of value for residential and commercial property in the years 2018 and 2040.

Higher density factors were chosen in TAZs that are located along existing or proposed freeway-level roads such as IH 45 and the Grand Parkway and zones that presently have or have announced high density development, most importantly mid- or high-rise office buildings and hotels. Lower densities were used in zones that are presently or are expected to be lower-density suburban development.

## POPULATION AND EMPLOYMENT GROWTH

The household population is projected to increase by 7%, while the employment is projected to increase by 26% in the study area by 2018. The household population is projected to increase by 74%, while the employment is projected to increase by 84% in the study area by 2040. **Table 16** shows the year 2040 increase in population and employment.

## FUTURE DEVELOPMENTS

South Montgomery County continues to grow with new single family housing, multi-family housing, office buildings, hotels, shopping centers, dining, and entertainment venues.

**Table 17** shows a detailed summary of the developments in the study area. Most of the major projected commercial and residential developments in the study area are shown in **Figure 14**.

## COMMUNITY EFFORTS

Montgomery County Precinct 3, The Woodlands Road Utility District (WRUD) #1, Shenandoah, and The Woodlands Township have all taken an active role in the ongoing development of short-term transportation projects. Both Montgomery County Precinct 3 and the WRUD have completed many roadway projects and there are many more planned for the community. The short-term improvements are shown in **Table 18**. The Long-term projects are included in Appendix F.

In addition to taking an active role in the development of transportation projects, The Woodlands Development Company (TWDC) has been meticulous in the context of development in and around the roadway network. TWDC has used the concept of access management in order to create a safer and higher capacity roadway, which creates a more inviting community. This is especially evident along Woodlands Parkway, Lake Woodlands Drive, and Research Forest Drive where TWDC has strategically used access management techniques to minimize driveway and intersection conflicts and create more aesthetically pleasing entrances.

**TABLE 15: 2013 VALUE, HOUSEHOLDS, AND JOBS PER ACRE**

Density	Low	Medium	High
Residential			
Value	\$1,228,202	-	\$3,687,662
Households	4.34	-	23.1
Commercial			
Value	\$306,116	\$555,004	\$1,270,480
Jobs	4.01	8.99	28.08

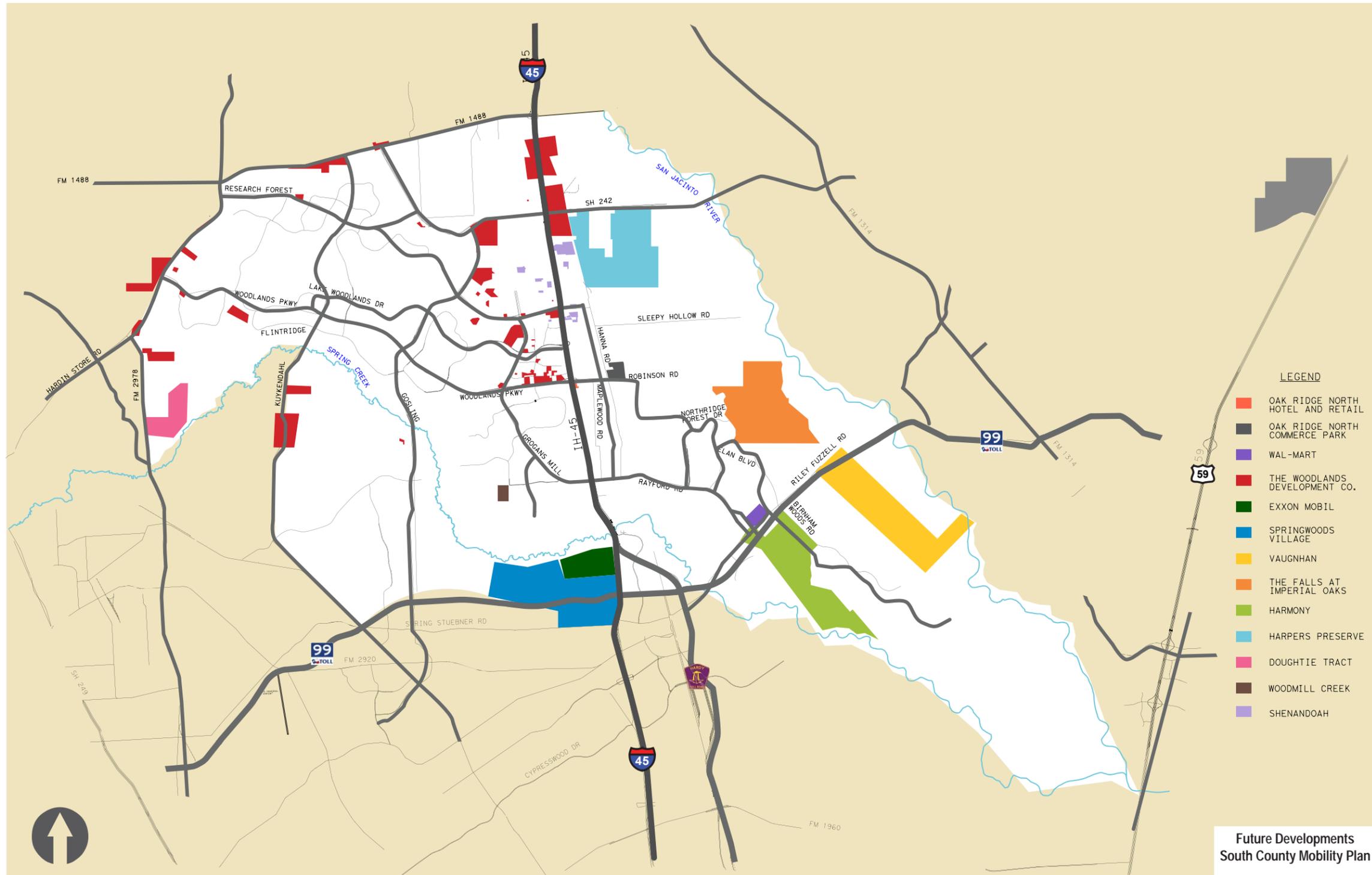
Source: 2013 Certified Values from MCAD, HCAD, H-GAC 2Q 2014 Forecast

**TABLE 16: POPULATION AND EMPLOYMENT GROWTH IN STUDY AREA**

	2014	2040	Growth
Household Population	226,223	393,582	74%
Employment	101,920	187,446	84%

Source: H-GAC 2Q 2014 Forecast

# EXISTING CONDITIONS



Future Developments  
South County Mobility Plan

Figure 14: Future Developments

TABLE 17: FUTURE DEVELOPMENTS

The Woodlands Development Co.	
Residential DUs	3,942
Office (SF)	7,818,441
Retail (SF)	532,370
Hotel (Rooms)	925
ExxonMobil	
Employees	10,000
Springwoods Village	
Residential DUs	5,000
Commercial (SF)	8,000,000
Retail (SF)	1,000,000
Hotels	5
Vaughan Development	
Single Family (Lots)	1,230
The Falls at Imperial Oaks	
Single Family (Lots)	1,540
Shenandoah	
Retail (SF)	128,000
Apartments (Units)	350
Single Family (DU)	1,580
Office (SF)	780,600
Hotels (Rooms)	775
Harmony	
Single Family (Lots)	1,962
Harpers Preserve	
Single Family (Lots)	510
Apartments (units)	300
Retail (SF)	250,000
Elementary School (students)	600
Doughtie Tract	
Single Family (Lots)	725
Grand Texas	
Retail (SF)	120,000
Hotel (Rooms)	600
Theme Park (Acres)	120
Oak Ridge North	
Hotel (SF)	100,000
Other	
Wal-Mart	

DU- Dwelling Units  
SF- Square Footage

# EXISTING CONDITIONS

## FINDINGS

After extensive data collection and analysis, the results indicate that the existing roadway system in the area is currently severely congested due mainly to the following factors:

1. Inadequate alternative routes to IH 45 for north-south mobility. Currently IH 45, the IH 45 interchanges, and the Hardy Toll Road are congested.
2. Limited access to IH 45 from the east side of IH 45. Currently, the intersections of Tamina Road at IH 45, Rayford Road at IH 45, and Riley Fuzzell Road at Hardy Toll Road are very congested.
3. Insufficient roadway capacity for FM 1488, SH 242, Woodlands Parkway, Research Forest Drive, Lake Woodlands Drive, Gosling Road, Kuykendahl Road, FM 2978 and Sawdust Road on the west side of IH 45. Likewise, insufficient roadway capacity on Tamina Road, Robinson Road, and Rayford Road on the east side of IH 45.
4. Shortage of IH 45 overpasses to provide for adequate local circulation within the study area. One additional IH 45 overpass is needed between SH 242 and Research Forest Drive, and another IH 45 overpass is needed between Woodlands Parkway and Rayford/Sawdust Roads.
5. Absence of adequate grade separations over the Union Pacific Railroad (UPRR) on the major streets on the east side of IH 45.

The first factor is that IH 45 carries not only through traffic, but also most of the north-south local traffic in the study area. In addition, the Hardy Toll Road terminates at the southern boundary of the study area, so IH 45 has to carry and distribute its traffic demand as well. Therefore, two corridors need to be developed on both sides of IH 45 to serve the local area street traffic. The west side corridor should begin on the southern end of the study area, generally following the Grogans Mill Road alignment up to Research Forest. From Grogans Mill at Research Forest, the corridor alignment should follow Research Forest to the west up to Gosling, where it should turn and head north to FM 1488 where it would intersect a new arterial street heading north to

Conroe. Similarly, the east side corridor should begin from Hardy Toll Road on the south side and head north following the Aldine Westfield alignment, crossing Rayford and SH 242, and eventually intersecting FM 1314, which would take traffic into Conroe. These two corridors would provide the local area access away from IH 45 and improve the connectivity between two of the most vibrant economic engines in Montgomery County: Conroe and South Montgomery County. In addition, the capacity of the streets and intersections serving the core business areas, namely The Woodlands Town Center and the Rayford-Sawdust corridor, should be improved.

The second and third factors are that IH 45 represents the only regional traffic option and preferred local traffic option for north-south travel. Most of the traffic in the study area uses IH 45 for regional trips and local trips; therefore, all the east-west arterial streets leading to IH 45 are carrying both north-south and east-west traffic demand. The Grand Parkway will help partially resolve this issue, provided the arterial streets leading to it (FM 2978, Kuykendahl, Gosling, Sawmill, Aldine Westfield, Rayford, and Birnham Woods) are improved. In addition, a new arterial street, Townsen Blvd, needs to be developed to provide access to US 59/IH 69 east of the study area to provide an alternative to using IH 45 to get to Houston.

The fourth factor is that IH 45 frontage roads run without interruption for 3.6 miles, from Rayford-Sawdust to Research Forest. This allows the frontage roads to function more as freeway main lanes than frontage roads serving adjacent land access. The frontage roads operate at high speeds (50-60 mph) and carry twice as much traffic as they would normally be expected to carry, per HCM guidelines (80,000 vehicle/day versus 40,000 vehicle/day combined for both frontage roads). This impedes cross street and driveway traffic from entering the traffic stream safely and efficiently.

Two additional IH 45 overpasses with channelized U-turns should be considered, one between Rayford-Sawdust and Woodlands Parkway, and the other one between Lake Woodlands Drive and Research Forest. In addition, the existing interchanges on IH 45 should be improved for additional capacity.

The fifth factor is the Union Pacific Railroad line running on the east side area of IH 45. The heavy volume of freight operations along this line hinders the flow of east-west movement of traffic along the entire area east of IH 45. Moreover, two of the three streets serving east-west movement are not continuous across the railroad tracks, Tamina and Robinson. The third street, Rayford, carries approximately 40,000 vehicles/day over a busy at-grade railroad crossing. These railroad crossings should be improved, as well as the connectivity of the existing streets running parallel to the railroad line to provide for adequate circulation around the railroad tracks.

In order to address these mobility deficiencies, five improvement strategies were developed. These improvement strategies are illustrated in **Figure 15**.

TABLE 18. 2013-2014 WOODLANDS/SHENANDOAH SHORT-TERM IMPROVEMENT PROJECTS

Montgomery County Precinct 3 and The Woodlands Road Utility District #1	The Woodlands Township and Shenandoah	
Woodlands Parkway at	Research Forest - install smart signals at	
Grogans Mill westbound add left turn lane	Grogans Mill	New Trails Dr
Grogans Mill eastbound add left turn lane	Lakeside Blvd	Bear Branch
Six Pines westbound extend right turn lane	Research Park	Cats Cradle
Timberloch Place at	Trillium	Cochrans Crossing
Grogans Mill westbound add left turn lane	Gosling	Technology Forest
Grogans Mill eastbound add left turn lane	Greenbridge	Shadowbend
Lake Woodlands Drive at	Alden Bridge	Kuykendahl
Lake Front Circle westbound add right turn lane	Pinecroft	Holly Hill
Lake Front Circle westbound add right turn lane	Six Pines	IH 45
Grogans Mill construct grade separation/other improvement	Lake Woodlands Drive - install smart signals at	
Grogans Mill Road at	IH 45	New Trails Dr
Lake Woodlands widen northbound and southbound lanes through proposed grade separation	Mall Ring Rd	Cochrans Crossing
Lake Woodlands add southbound right turn lane	Pinecroft Dr	Split Rock Rd
Woodlands Parkway widen northbound approach	Six Pines Dr	W Panther Creek
Woodlands Parkway widen southbound approach and include turn lane	Grogans Mill	Gosling Rd
Woodlands Parkway widen northbound under overpass	E. Panther Creek	Shadowbend Rd
Timberloch extend southbound left turn lane	Falconwing	Kuykendahl
Lake Woodlands Drive at	Lakeside Dr.	
Grogans Mill construct grade separation/other improvement	Woodlands Parkway - install smart signals at	
Six Pines at	Woodloch Forest	Gosling Rd
Woodlands Parkway extend southbound left turn lane	Six Pines Dr	Falconwing
	Grogans Mill	Cochrans Crossing
	E. Panther Creek	Kuykendahl
	W. Panther Creek	
	Tamina Road - install smart signal at	
	IH 45	David Memorial

# EXISTING CONDITIONS

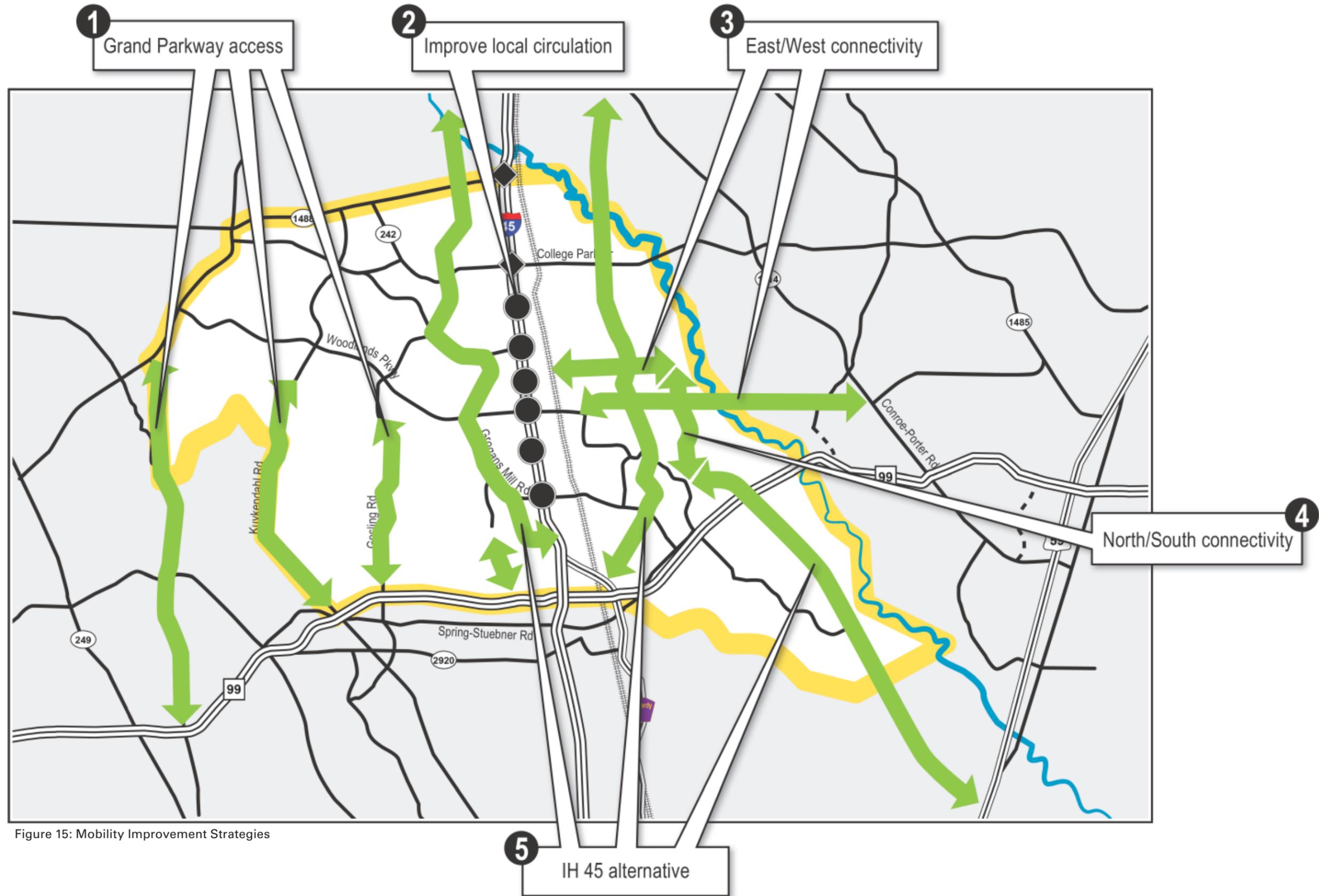


Figure 15: Mobility Improvement Strategies



# DATA ANALYSIS

# DATA ANALYSIS

## DATA ANALYSIS

This section contains the methodology used to develop the traffic forecast for two design-year scenarios, 2018 and 2040. The traffic projections consisted of projected average daily traffic (ADTs) and projected peak-hour traffic volumes for both the weekday morning peak hour and the afternoon peak hour. The traffic forecast was based on H-GAC 's travel demand model outputs, which utilizes the demographic and land use projections for the region.

### TRAFFIC VOLUMES AND INTERSECTION CAPACITY ANALYSIS

Projected household and employment growth will result in traffic growth ranging from approximately 22 percent to 84 percent by 2018, and from 44 percent to 94 percent by 2040. By 2018, Research Forest, Lake Woodlands Drive, Woodlands Parkway, and Sawdust are projected to have a combined increase of approximately 40,000 vehicles per day, or 22 percent over the existing traffic volumes, just east of IH 45. By 2040, the demand on these facilities is projected to increase by 80,000 vehicles per day, or 44 percent over the 2013 volumes. East of IH 45, Tamina, Robinson, Rayford, and Riley Fuzzell are projected to have a combined increase of 20,000 vehicles per day, or 84 percent over the existing traffic volumes, by 2018. These facilities are projected to have an increase of 70,000 vehicles per day, or 60 percent over the 2013 traffic volumes, by 2040. The Grand Parkway is projected to experience a demand 109,000 vehicles per day west of IH 45, and 100,000 vehicles per day east of IH 45. IH 45 is projected to increase by 21,000 vehicles per day, or 8 percent, by 2018, and by 129,000 vehicles per day, or 51 percent, by 2040. The intersection peak hour traffic volumes were derived by applying growth factors based on the daily traffic growth percentages of the intersecting roads. The projected daily traffic volumes for 2040 are shown in **Figure 16**. The level of service for 2018 and 2040 No-Build and Build Conditions are shown in **Table 19** and **Table 20**.

The traffic volumes shown in **Figure 16** are unadjusted traffic projections obtained from the travel demand model. These volumes were adjusted using the screen line methodology to refine computer-based traffic projections outlined in the NCHRP 255 report. A screen line is an imaginary line that crosses parallel facilities in a corridor, and it is used to redistribute the traffic volumes according to the number of lanes on each facility.

The No-Build conditions represent the existing intersection geometry with committed projects in the H-GAC TIP. The Build conditions represents the proposed intersection geometry by the alternative improvement projects defined in Section 8.0 of this report. In the Year 2018, there were four alternatives analyzed for short-term improvements at the intersections of Research Forest Drive at Grogans Mill. For Alternative 1, the intersection of Research Forest Drive at Grogans Mill N (side) and Research Forest Drive at Grogans Mill S side will be converted to two intersections. For Alternative 2, the intersections of Research Forest Drive at Grogans Mill on the NW side, NE side, SW side, and SE side will have an additional lane constructed at the approach. For Alternative 3, the intersections that were analyzed for Alternative 2 were analyzed with the construction of an overpass. For Alternative 4, the intersection of Research Forest Drive at Grogans Mill SE side was analyzed as one intersection.

TABLE 19: 2018 INTERSECTION LEVEL OF SERVICE (LOS)

Intersection	2018 AM No-	2018 AM No-	2018 AM	2018 AM	2018 PM No-	2018 PM No-	2018 PM	2018 PM
	Build Delay	Build LOS	Build Delay	Build LOS	Build Delay	Build LOS	Build Delay	Build LOS
	(sec/veh)		(sec/veh)		(sec/veh)		(sec/veh)	
Lake Woodlands at Kuykendahl	45.1	D	36.2	D	82.6	F	64.8	E
Lake Woodlands at Gosling	88.7	F	76.9	E	225.5	F	110.7	F
Research Forest at Kuykendahl	58.5	E	27.9	C	80.3	F	71.4	E
Research Forest at Green Bridge	99.5	F	23.7	C	212.6	F	117.2	F
FM 1488 at FM 2978	59.4	E	46.9	D	72.1	E	58.3	E
Research Forest at Gosling	37.6	D	34.6	C	46.8	D	38.8	D
FM 1488 at Kuykendahl	85.3	F	61.4	E	61.7	E	37.3	D
Research Forest Dr at Grogans Mill N side (ALT 1)	89.8	F	31.4	C	226.6	F	83.1	F
Research Forest Dr at Grogans Mill S side (ALT 1)	73.7	E	24.8	C	282.4	F	68.8	E
Research Forest Dr at Grogans Mill NW side (ALT 2)	11.0	B	9.0	A	56.8	E	29.4	C
Research Forest Dr at Grogans Mill NE side (ALT 2)	78.8	E	30.6	C	169.8	F	52.1	D
Research Forest Dr at Grogans Mill SW side (ALT 2)	39.0	D	25.6	C	156.8	F	36.8	D
Research Forest Dr at Grogans Mill SE side (ALT 2)	34.7	C	10.3	B	125.6	F	37.7	D
Research Forest Dr at Grogans Mill NW side (ALT 3)	11.0	B	16.3	B	56.8	E	13.4	B
Research Forest Dr at Grogans Mill NE side (ALT 3)	78.8	E	11.7	B	169.8	F	6.9	A
Research Forest Dr at Grogans Mill SW side (ALT 3)	39.0	D	17.5	B	156.8	F	15.8	B
Research Forest Dr at Grogans Mill SE side (ALT 3)	34.7	C	14.0	B	125.6	F	19.6	B
Research Forest Dr at Grogans Mill SE side (ALT 4)	163.5	F	36.3	D	509.0	F	88.9	F
Research Forest Dr at Branch Crossing Dr	16.6	B	16.9	B	21.9	C	19.8	B
Research Forest at IH 45 SBFR	56.6	E	33.8	C	67.8	E	59.0	E
Tamina Rd at IH 45 NBFR	65.0	E	47.2	D	92.2	F	56.6	E
Sawdust Rd at IH 45 SBFR	111.8	F	91.2	F	124.7	F	96.5	F
Rayford at IH 45 NBFR	120.3	F	103.9	F	135.6	F	86.0	F
Rayford at Richard	116.5	F	71.7	E	151.3	F	78.3	E
Rayford at Imperial Oaks	161.6	F	27.1	C	108.9	F	38.2	D
Rayford at Aldine Westfield	65.2	E	23.9	C	76.2	E	34.4	C
Woodlands Pkwy at FM 2978	30.7	C	24.8	C	36.9	D	25.5	C
Robinson at Westwood	41.8	D	31.0	C	48.5	D	26.3	C
Woodlands Pkwy at Kuykendahl	128.6	F	84.5	F	78.6	E	48.8	D
Woodlands Pkwy at Six Pines	61.5	E	33.9	C	80.0	E	68.2	E
Woodlands Pkwy at Woodloch Forest	42.4	D	39.8	D	94.2	F	41.1	D
Woodlands Pkwy at Gosling (north side)	44.6	D	43.8	D	37.6	D	33.6	C
Woodlands Pkwy at E Panther Creek	31.1	C	29.5	C	73.9	E	44.1	D
Woodlands Pkwy at Grogans Mill (north side)	16.7	B	13.4	B	45.8	D	34.9	C
Robinson at Hanna (north side)	200.7	F	-	-	181.7	F	-	-

# DATA ANALYSIS

**TABLE 19 (CONTINUED): 2018 INTERSECTION LEVEL OF SERVICE (LOS)**

Intersection	2018 AM No-Build Delay (sec/veh)	2018 AM No-Build LOS	2018 AM Build Delay (sec/veh)	2018 AM Build LOS	2018 PM No-Build Delay (sec/veh)	2018 PM No-Build LOS	2018 PM Build Delay (sec/veh)	2018 PM Build LOS
Robinson at Hanna (south side)	227.3	F	47.9	D	384.7	F	80.8	F
Hanna Rd at Richard Rd	25.4	D	25.4	D	12.0	B	12.0	B
Imperial Oaks Blvd at Northridge Forest Dr	11.9	B	11.9	B	15.3	C	15.3	C
Fox Run /Discovery Creek at Riley Fuzzell	36.0	D	32.8	C	37.2	D	37.1	D
Riley Fuzzell Rd at Rayford	86.6	F	30.5	C	60	E	37.2	D
Riley Fuzzell Rd at Birnham Woods Dr	26.7	C	25.3	C	35.6	D	27.3	C
Gosling at Flintridge	47.2	D	42.5	D	62.2	E	35.6	D
Gosling at Creekside Forest	37.5	D	31.8	C	18.6	B	17.6	B
Panther Creek Dr at Glen Loch Dr	29.8	D	23.4	C	33.9	D	24.1	C
Gosling at W Rayford	25.4	C	20.9	C	26.4	C	18.6	B
Kuykendahl at Creekside Forest (west side)	25.2	C	21.8	C	34.0	C	29.0	C
Kuykendahl at Creekside Forest (east side)	30.4	C	27.2	C	25.7	C	21.0	C

**TABLE 20: 2040 INTERSECTION LEVEL OF SERVICE (LOS)**

Intersection	2040 AM No-Build Delay (sec/veh)	2040 AM No-Build LOS	2040 AM Build Delay (sec/veh)	2040 AM Build LOS	2040 PM No-Build Delay (sec/veh)	2040 PM No-Build LOS	2040 PM Build Delay (sec/veh)	2040 PM Build LOS
Lake Woodlands at Kuykendahl	135.8	F	93.5	F	198.6	F	181.8	F
Lake Woodlands at Gosling	203.9	F	191.4	F	459.8	F	275.3	F
Research Forest at Kuykendahl	188.0	F	116.4	F	299	F	230.1	F
Research Forest @ Green Bridge	116.6	F	29.5	C	206.7	F	133.0	F
FM 1488 at FM 2978	206.1	F	112.0	F	289.8	F	176.2	F
Research Forest at Gosling	96.4	F	73.0	E	118.9	F	96.1	F
FM 1488 at Kuykendahl	322.6	F	308.8	F	226.2	F	189.4	F
Research Forest Dr at Grogans Mill NW side	34.5	C	16.6	B	64.8	E	16.9	B
Research Forest Dr at Grogans Mill NE side	125.2	F	10.9	B	220.4	F	9.2	A
Research Forest Dr at Grogans Mill SW side	33.2	C	10.2	B	184.5	F	24.8	C
Research Forest Dr at Grogans Mill SE side	167.1	F	12.6	B	414.6	F	54.3	D
Research Forest Dr at Branch Crossing Dr	35.6	D	23.5	C	110.1	F	36.6	D
Research Forest at IH 45 SBFR	135.1	F	81.8	F	304.7	F	144.7	F
Tamina Rd at IH 45 NBFR	361.9	F	143.8	F	332.5	F	274.3	F
Sawdust Rd at IH 45 SBFR	195.4	F	129.0	F	227.2	F	127.1	F
Rayford at IH 45 NBFR	203.8	F	174.8	F	250.6	F	128.6	F
Rayford at Richard	131.4	F	87.9	F	161.5	F	91.6	F
Rayford at Imperial Oaks	239.7	F	64.9	E	165.3	F	71.8	E
Rayford at Aldine Westfield	128.1	F	46.2	D	134.4	F	51.0	D
Woodlands Pkwy at FM 2978	156.8	F	111.4	F	243.1	F	205.6	F
Robinson @ Westwood	35.6	D	34.5	C	56.8	E	55.8	E
Woodlands Pkwy at Kuykendahl	389.8	F	261.4	F	348.8	F	167.3	F

In the Year 2040, the only improvement for the intersection of Research Forest Drive at Grogans Mill is the construction of the overpass. The results of the 2018 intersection LOS analysis indicate that the proposed projects will alleviate a significant amount of intersection traffic congestion by improving the LOS from E and F to D or better. However, there will be a few intersections at LOS E and LOS F, such as Rayford/Sawdust at IH 45, Rayford at Richard, Woodlands Parkway at Kuykendahl and Robinson at Hanna. The results of the 2040 intersections LOS analysis indicate that the proposed projects under the Build conditions will reduce a significant amount of the projected vehicle delay under the No-Build conditions. However, most of the intersections will still be at LOS E and LOS F. Therefore, it is crucial that the mobility improvement strategies shown in **Figure 15** are implemented to accommodate the long-term conditions.

# DATA ANALYSIS



Robinson Road at Hanna Road.



Robinson Road at Hanna Road.

TABLE 20 (CONTINUED): 2040 INTERSECTION LEVEL OF SERVICE (LOS)

Intersection	2040 AM No-	2040 AM No-	2040 AM	2040 AM	2040 PM No-	2040 PM No-	2040 PM	2040 PM
	Build Delay	Build LOS	Build Delay	Build LOS	Build Delay	Build LOS	Build Delay	Build LOS
	(sec/veh)		(sec/veh)		(sec/veh)		(sec/veh)	
Woodlands Pkwy at Grogans Mill (south side)	39.0	D	36.1	D	47.4	D	60.7	E
Woodlands Pkwy at Six Pines	200.3	F	35.9	D	158.6	F	68.4	E
Woodlands Pkwy at Woodloch Forest	81.3	F	80.7	F	180.5	F	36.9	D
Lake Woodlands at Grogans Mill (north side)	201.6	F	56.9	E	447.0	F	164.8	F
Lake Woodlands at Grogans Mill (south side)	260.1	F	68.9	E	503.7	F	209.4	F
Research Forest Dr at FM 2978	128.3	F	55.4	E	116.9	F	110.2	F
Grogans Mill at Sawmill	39.1	D	27.3	C	55.2	E	26.3	C
Grogans Mill at Sawdust	40.4	D	32.1	C	125.7	F	95.4	F
Six Pines at Lake Robbins	35.5	D	30.6	C	57.7	E	51.6	D
Lake Woodlands at Lake Front Cir	219.2	F	174.0	F	424.1	F	392.2	F
FM 1488 at College Park Dr	89.1	F	79.8	E	117.3	F	106.2	F
College Park Dr at Green Bridge Dr	448.4	F	187.6	F	147.3	F	73.8	E
College Park Dr at Gosling	305.8	F	129.1	F	256.6	F	83.1	F
Sawmill at Sawdust	40.3	D	39.1	D	56.2	E	54.3	D
Lake Woodlands at Six Pines	312.5	F	57.7	E	425.2	F	165.8	F
Lake Woodlands at Pinecroft	225.9	F	67.6	E	408.1	F	172.9	F
Lake Woodlands at Mall Entrance	294.1	F	87.7	F	398.6	F	160.3	F
Lake Woodlands at Six Pines	312.5	F	57.7	E	425.2	F	165.8	F
Lake Woodlands at Pinecroft	225.9	F	67.6	E	408.1	F	172.9	F
Lake Woodlands at Mall Entrance	294.1	F	87.7	F	398.6	F	160.3	F
College Park Dr at IH 45 SBFR	119.1	F	118.2	F	177.2	F	120.4	F
College Park Dr at IH 45 NBFR	62.6	F	59.2	E	114.4	F	107.2	F
Tamina Rd at David Memorial	64.2	E	54.9	D	409.4	F	115.5	F
Hanna Rd/Main St at Sleepy Hollow Rd	7.8	A	7.8	A	18.8	C	18.8	C
Hanna Rd at Woodson Rd	145.4	F	145.4	F	196.4	F	196.4	F
Hanna Rd/Main St at Sleepy Hollow Rd	7.8	A	7.8	A	18.8	C	18.8	C
Hanna Rd at Woodson Rd	145.4	F	145.4	F	196.4	F	196.4	F
Robinson at Hanna (north side)	288.5	F	-	-	271.6	F	-	-
Robinson at Hanna (south side)	3377.9	F	61.3	E	892.9	F	112	F
Hanna Rd at Richard Rd	67.9	F	67.9	F	16.4	C	16.4	C
Imperial Oaks Blvd at Northridge Forest Dr	26.2	D	26.2	D	125.1	F	125.1	F
Fox Run /Discovery Creek at Riley Fuzzell	59.9	E	52.8	D	49.7	D	44	D
Riley Fuzzell Rd at Rayford	164.5	F	59.0	E	131.2	F	71	E
Riley Fuzzell Rd at Birnham Woods Dr	32.4	C	29.7	C	41.1	D	36	D
Gosling at Flintridge	425.7	F	278.4	F	508.3	F	171.8	F
Gosling at Creekside Forest	283.4	F	67.5	E	301.7	F	45.0	D
Panther Creek Dr at Glen Loch Dr	70.9	F	70.9	F	87.5	F	87.5	F
Gosling at W Rayford	93.7	F	27.9	C	272.0	F	47.9	D
Kuykendahl at Creekside Forest (west side)	23.5	C	21.5	C	67.3	E	47.8	D
Kuykendahl at Creekside Forest (east side)	46.4	D	43.7	D	25.5	C	24.1	C

# DATA ANALYSIS

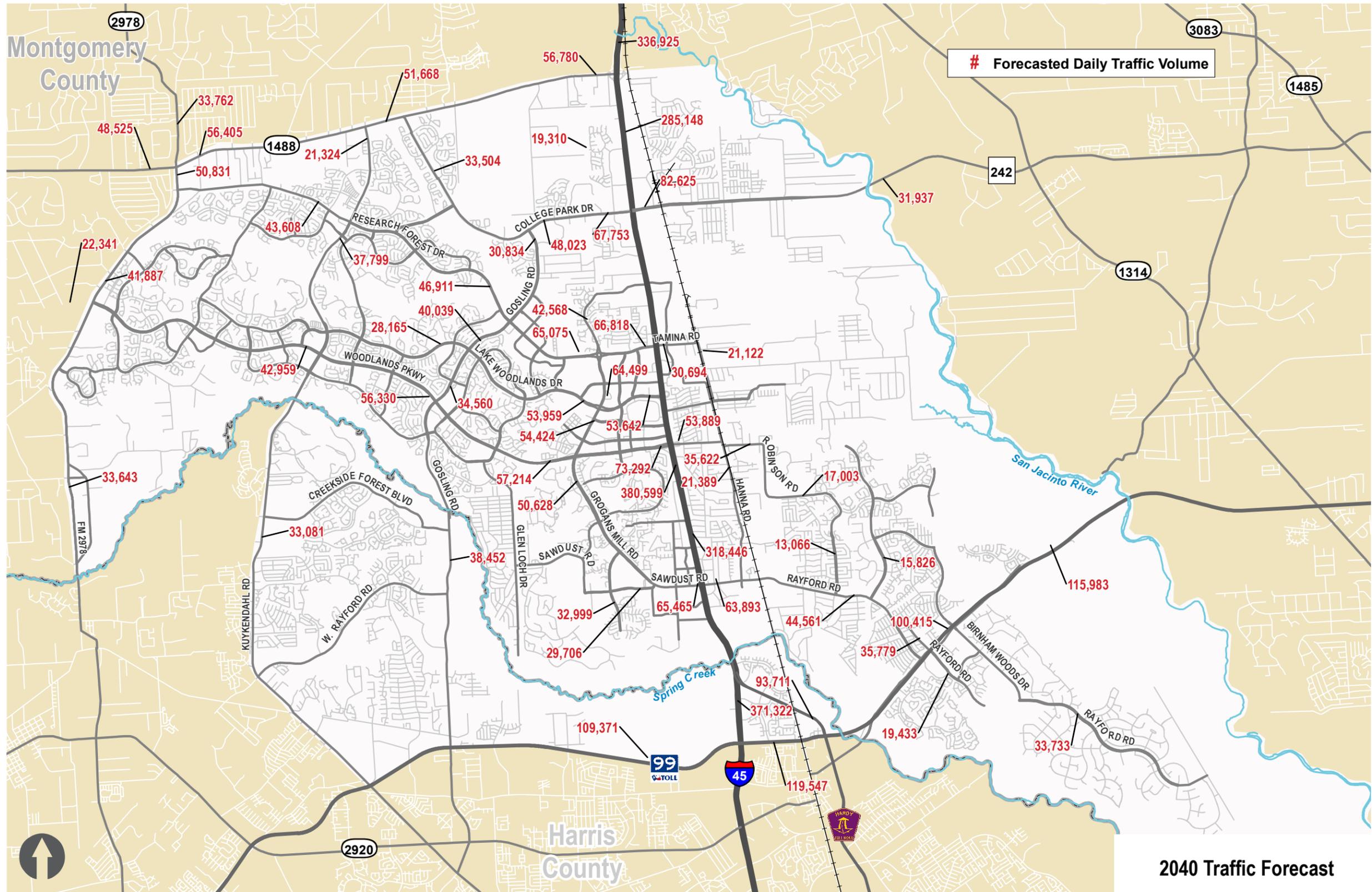


Figure 16: 2040 Traffic Forecast



# NEEDS-BASED PLAN

# NEEDS-BASED PLAN

## NEEDS-BASED PLAN OVERVIEW

This section presents the needs-based plan and the proposed improvements to address those needs. The needs-based plan is not financially constrained and was developed by analyzing existing traffic conditions in addition to projected traffic volumes and population growth. The needs-based plan, shown in **Figures 17 and 18**, identify the road and intersection improvements that are needed between now and in the future. Various alternatives were considered to address the needs and priority projects were identified by ranking the results of existing condition analysis to determine what improvements need to be implemented immediately. The projects were then presented to the Steering Committee for review and input.

## SAFETY ISSUES

### SHOULDERS

There is a lack of shoulders on the major arterial roads throughout the study area. On some roads, the shoulders are used by cyclists and often serve as stopping lanes for vehicles in the event of a breakdown or emergency.

### WEAVING

Vehicles traveling on IH 45 frontage roads at Woodlands Parkway/Robinson Road experience weaving conflicts from vehicles entering and exiting the cloverleaf interchange. Recommendations such as a Diverging Diamond or the Single Point Urban Interchange (SPUI) could mitigate this type of weaving conflict.

### RAILROAD CROSSING

The Union Pacific Railroad on the east side runs in the north-south direction, intersecting several major east-west arterial roads in the study area at grade. Not only does the railroad create a barrier due to the trains that delay traffic at these intersections, it also can be very dangerous for vehicles traveling across the tracks. Railroad grade separations are recommended at Tamina Road, Robinson Road, and Rayford Road.

## TRAVEL SPEEDS

Major arterials in the study area experience vehicles traveling at speeds exceeding posted speed limits. High speeds in a rural area transitioning to urban setting can lead to the increase of vehicle accidents. It is recommended to evaluate the speeds in 2018.

## ROADWAY INVENTORY

The results of the roadway inventory for Montgomery County Precinct 3 consisted of approximately 3 miles of roadways requiring asphalt repair, 1.6 miles of concrete repair, 5 intersections requiring restriping, 35 miles of linear roadway restriping, 6 school zones with improper speed limits and the need for 10 small signs. It is recommended to address these issues to prevent vehicle accidents.

## 2018 NEEDS-BASED PLAN

The needs-based plan was developed using the projected traffic volumes and conducting daily and peak hour capacity analyses along the critical roads and intersections. This plan is a group of projects that will address forecasted traffic demand in the study area. A feasible list of financially unconstrained projects was intended to identify a list of regional mobility needs. Some of the identified needs did not proceed to the final recommendations due to several reasons, including but not limited to cost, ROW needs, and Steering Committee concurrence.

The Year 2018 improvements consist of intersection improvements, roadway widening and area wide improvements. In order to mitigate the existing recurring traffic congestion area-wide traffic management improvements need to be implemented by 2018. These traffic management programs include implementing an aggressive incident clearance program, implementing a traffic signal timing optimization program, and installing dynamic message signs throughout the study area.

## BIRNHAM WOODS DRIVE

Birnham Woods Drive needs to be widened from two to four lanes from Ella Boulevard to the Grand Parkway.

## DAVID MEMORIAL DRIVE

David Memorial Drive is projected to have a demand of 22,465 vehicles per day between Tamina Road and Shenandoah Park Drive. This volume warrants extending David Memorial Drive with four lanes from Shenandoah Park Drive to SH 242.

## FM 2978

FM 2978 is projected to have a traffic demand of 30,101 vehicles per day between Dry Creek and FM 1488. This demand warrants the widening of FM 2978 from two to four lanes. This project is currently in the 2013-2016 TIP, so it was not included in the short-term recommendations.

## GOSLING ROAD

Gosling is expected to have a demand of 19,000 to 24,000 vehicles per day at Spring Creek. This volume warrants widening this road from two to four lanes, including a bridge over Spring Creek by 2018.

## GROGANS MILL ROAD

Grogans Mill Road is projected to have a demand of 36,000 to 41,000 vehicles per day between Woodlands Parkway and Research Forest by 2018. These volumes warrant the widening of Grogans Mill from four to six lanes in this section.

## GROGANS POINT ROAD

Grogans Point Road currently dead ends at N. Tranquil Path and W. High Oaks. Completing this link across the ditch would provide a connection between Sawmill and Sawdust Road. This connection would also improve the safety of the residence in the Grogans Point area by providing an alternative entrance/exit. This recommendation was eliminated due to the lack of consensus by the Steering Committee.

## HANNA ROAD

A north-south alternative to IH 45 is needed. Using Hanna Road and Johnson Road, this can be done by extending Hanna Road north of Woodson Road, connecting to Johnson Road. The existing facility is in substandard condition and should be improved to accommodate existing and future traffic.

## KUYKENDAHL ROAD

Kuykendahl is expected to have a demand of 22,000 to 31,000 vehicles per day at Spring Creek. This volume warrants widening this road from two to four lanes, including a bridge over Spring Creek, by 2018.

## LAKE WOODLANDS DRIVE

Lake Woodlands Drive is projected to have a demand of 42,000 to 61,000 vehicles per day between Grogans Mill and IH 45 by 2018. These volumes warrant the widening from four to six lanes and a grade separation at Grogans Mill. The intersection of Lake Woodlands Drive at The Woodlands Mall entrance road just west of IH 45 needs to allow westbound-to-eastbound U-turn movement to allow traffic movement connectivity to the east side of IH 45.

## LEXINGTON BOULEVARD

Lexington Boulevard needs to be widened from two to four lanes from Rayford Road to E. Benders Landing to improve existing traffic operations and accommodate future growth.

## MAIN STREET

The connected from Rayford Road to SH 242 is needed on the east side to provide a north south alternative to IH 45. However due to the existing commercial development, the steering committee suggested an alternative using Fairview/Blair/Foster alignments.

# NEEDS-BASED PLAN

## RAYFORD ROAD

Rayford Road is projected to have a demand of 55,000 vehicles per day in the vicinity of IH 45. This volume warrants the implementation of access management strategies and adding turn lanes at all the signalized intersections including IH 45 and the Union Pacific Railroad.

A railroad overpass is needed by 2018 on Rayford at the Union Pacific Railroad; Rayford is currently the only road that connects IH 45 and Grand Parkway east of IH 45. In addition, Rayford Road needs to be widened to six lanes from Union Pacific Railroad to Grand Parkway.

## RESEARCH FOREST ROAD

Research Forest is projected to have a demand of 49,000 to 56,000 vehicles per day between Grogans Mill and IH 45. These daily volumes exceed the capacity of a six-lane road. Therefore, Research Forest should be widened and all the intersections improved between Grogans Mill and IH 45. The widening of Research Forest was eliminated due to the lack of consensus by the Steering Committee and lack of ROW. However, intersection improvements were retained. Improvements will include the widening at the intersections of Research Forest at Grogans Mill Road. The improvements will include the construction of dual left-turn lanes and exclusive right-turn lanes to improve intersection operations.

Currently, the lane geometry at the intersection of Research Forest and Grogans Mill is a six lane divided facility on Research Forest and four lane divided on Grogans Mill. Due to four intersections being at this one location congestion occurs frequently. Three alternatives were developed to minimizing congestion. Alternative 1 consisted of converting the four intersections into one intersection. Alternative 2 consisted of converting the four existing intersections at this roadway crossing to two intersections. Alternative 3 consisted of widening the existing four intersections by adding one lane in each direction.

The capacity analyses for these three alternatives revealed that Alternative 2 would yield acceptable levels of service and allow the construction of a grade separation in the future.

**Figure 19** and **Figure 20** illustrate Alternative 1 and Alternative 2.

The intersection of Research Forest/Tamina Road at IH 45 will need to be widened by one traffic lane in each direction under the freeway bridge, which is possible without having to rebuild the overpass.

## ROBINSON ROAD

Robinson Road is projected to have a traffic demand of 22,000 vehicles per day by 2018. This traffic volume warrants the widening of Robinson Road to four lanes. Hanna Road is projected to have a traffic demand of 18,000 vehicles per day in the vicinity of its two intersections with Robinson Road. This warrants the realignment of Robinson Road to convert the two intersections into a single intersection controlled by a traffic signal.

## SAWDUST ROAD

Sawdust is projected to have a demand of 50,000 vehicles per day in the vicinity of IH 45. This volume warrants the implementation of access management strategies and adding turn lanes at all the signalized intersections including between Grogans Mill and IH 45. In addition, a new two-lane road at Spring Creek under IH 45 that would connect both sides of IH 45 and mitigate the congestion on Sawdust/Rayford at IH 45 interchange.

## SAWMILL ROAD

The extension south into Harris County would connect The Woodlands to Springwoods Village. This connection is needed to improve north-south connectivity; however, it was decided by the Steering Committee to move this project to the long-term project list.

## SH 242

SH 242 is projected to have a demand of 46,000 to 54,000 vehicles per day at IH 45. SH 242 will need to be widened by adding one lane in each direction from Gosling to IH 45, and from Harpers Way to FM 1314.

## SIX PINES

The intersection of Six Pines and Woodlands Parkway has a 2018 projected level of service E. This warrants double left-turn lanes on Six Pines Southbound at Woodlands Parkway.

## SONGWOOD/BLAIR/OAKRIDGE

A north-south alternative to IH 45 is needed. This can be done so by using the existing alignments of Songwood/Blair/Oakridge.

## TAMINA ROAD

The intersection at Tamina Road and David Memorial will need to be improved and widened by one lane in each direction.

## WOODLANDS PARKWAY

Woodlands Parkway is projected to have a demand of 71,000 vehicles per day between Grogans Mill and IH 45 by 2018. This warrants additional turn lanes on Six Pines and Woodloch Forest in the interim. Eventually, grade separations at these two intersections will be needed.

## WOODLANDS PARKWAY/ROBINSON ROAD AT IH 45

Three alternatives were analyzed to modify the interchange of Woodlands Parkway/Robinson Road at IH 45 to improve traffic operations and access to Robinson Road. The first alternative was a diverging diamond interchange, the second alternative was a single point urban interchange (SPUI), and the third alternative was a diamond interchange. The steering committee discussed the diverging diamond alternative as a short-term solution and the SPUI be a longer term solution. However after further analysis it was discovered that the SPUI would preserve access to the southeast quadrant of the interchange, where a new development is planned, where as the Diverging Diamond would not. The SPUI also allows for U-turns for the frontage roads as shown in **Figure 20**, which the diverging diamond did not. In addition, the SPUI will assist with the changing of the South Montgomery County from a rural to an urban area as well as allow access to the east, mitigate weaving issues that occur on the IH 45 frontage roads, and provides more efficient traffic operations. The diverging diamond alternative is shown in **Figure 19** and the diamond interchange alternative is shown in **Figure 21**.

## WOODLOCH FOREST

The intersection of Woodloch Forest and Woodlands Parkway has a 2018 projected level of service F. This warrants double left turn lanes on Woodloch Southbound at Woodlands Parkway.

# NEEDS-BASED PLAN

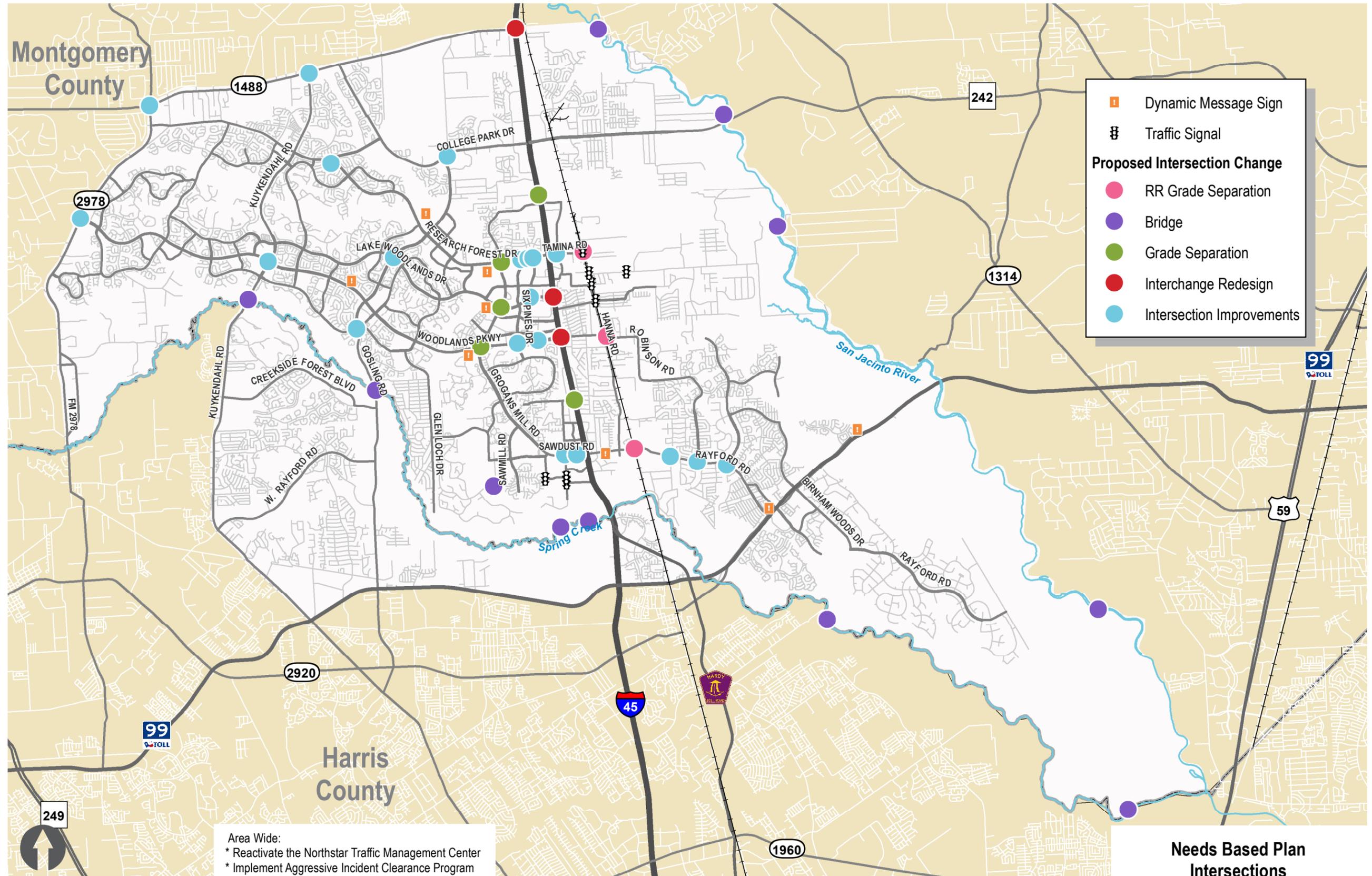


Figure 17: Needs-Based Plan Intersections

# NEEDS-BASED PLAN

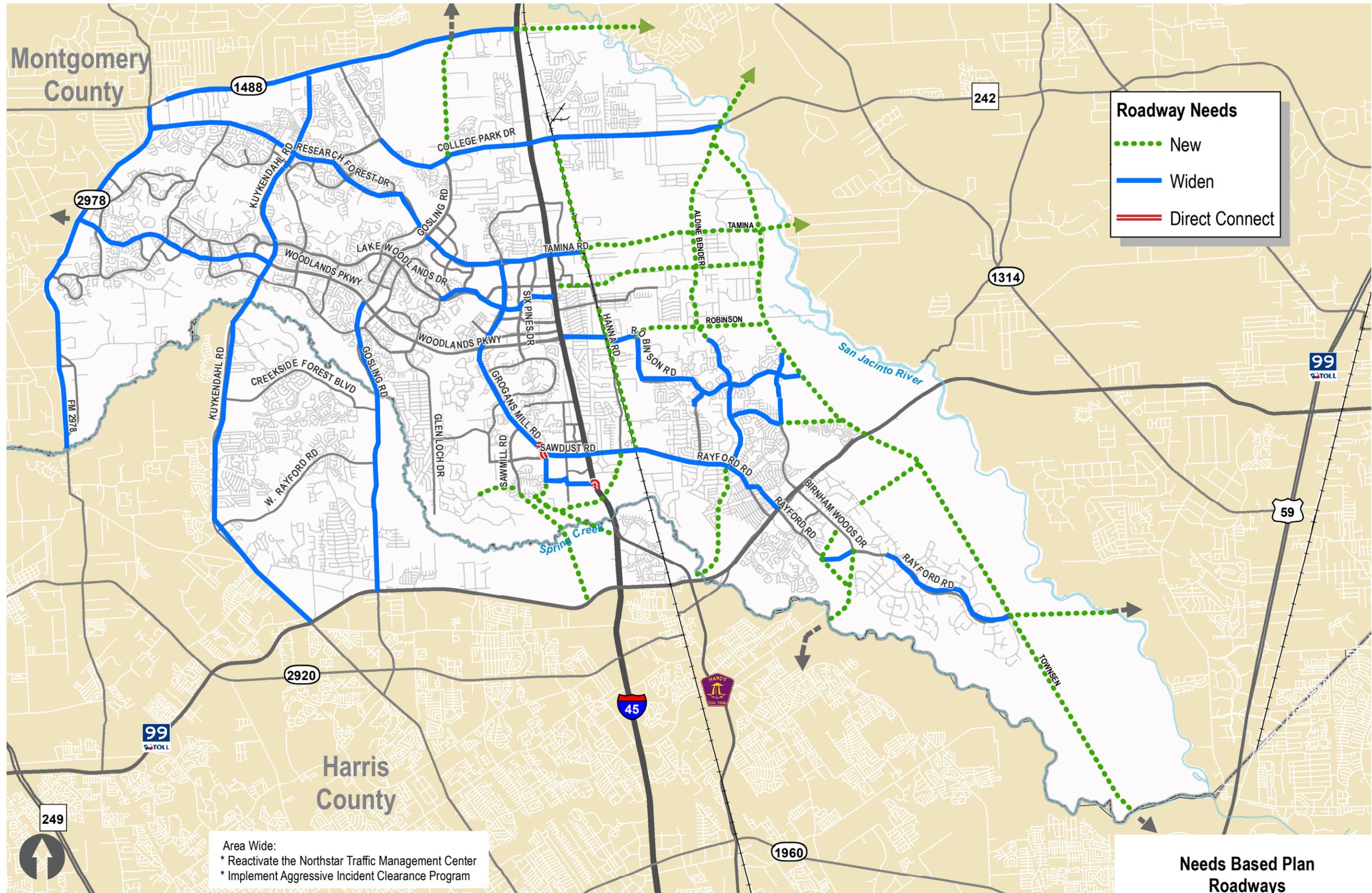
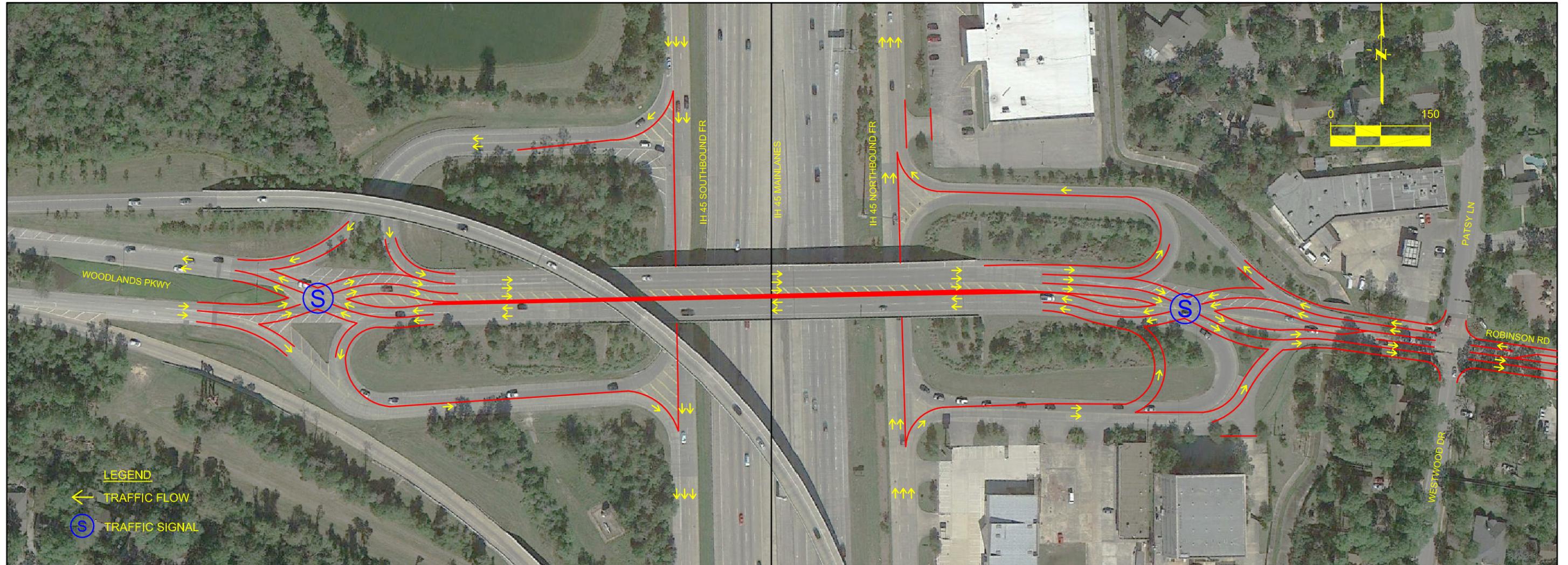


Figure 18: Needs-Based Plan Roads

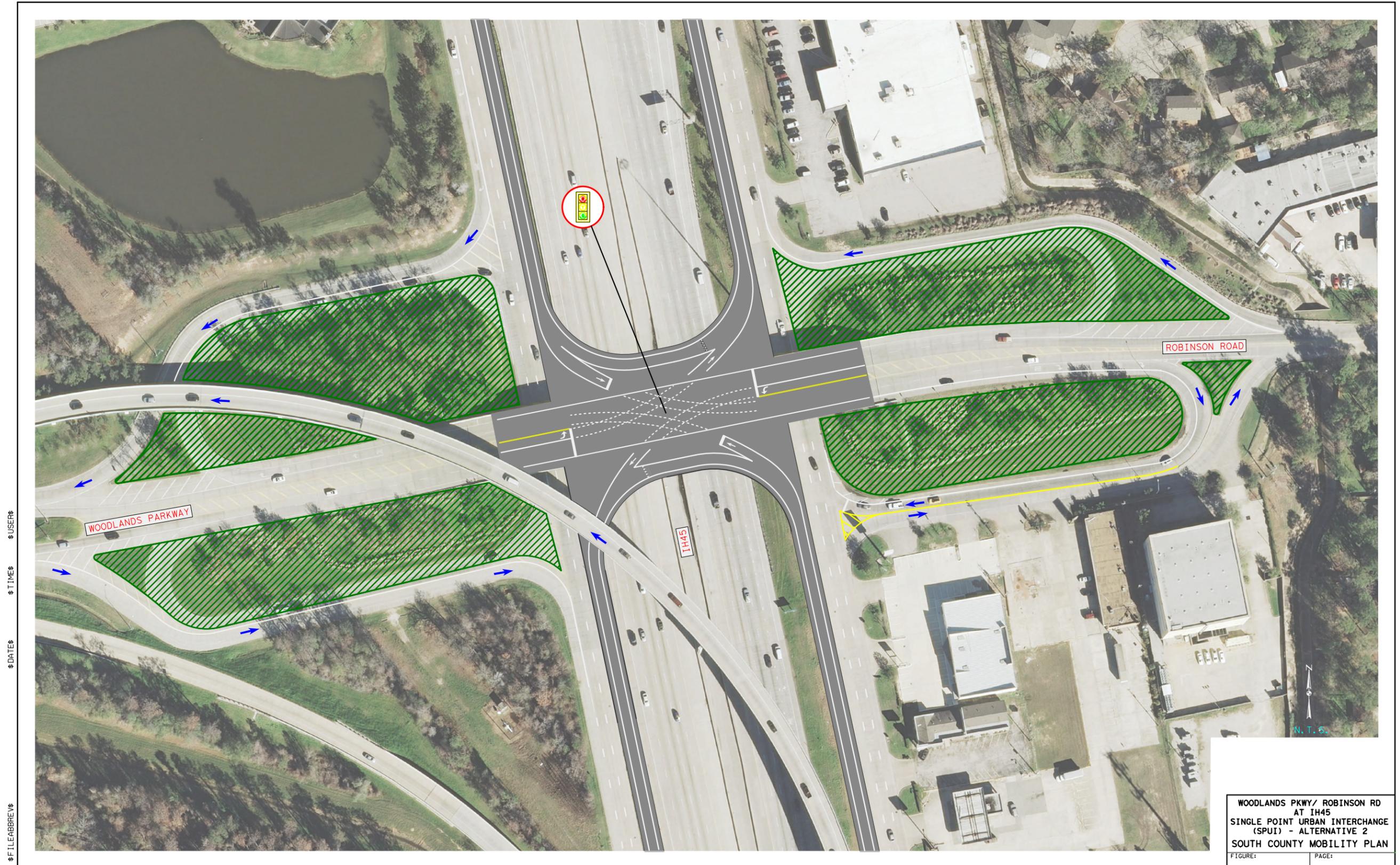


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MONTGOMERY COUNTY, TEXAS

DIVERGING DIAMOND INTERCHANGE  
ROBINSON ROAD - PLANNING LAYOUT

Figure 19: Diverging Diamond Intersection Design



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Figure 20: Single Point Urban Interchange

# NEEDS-BASED PLAN

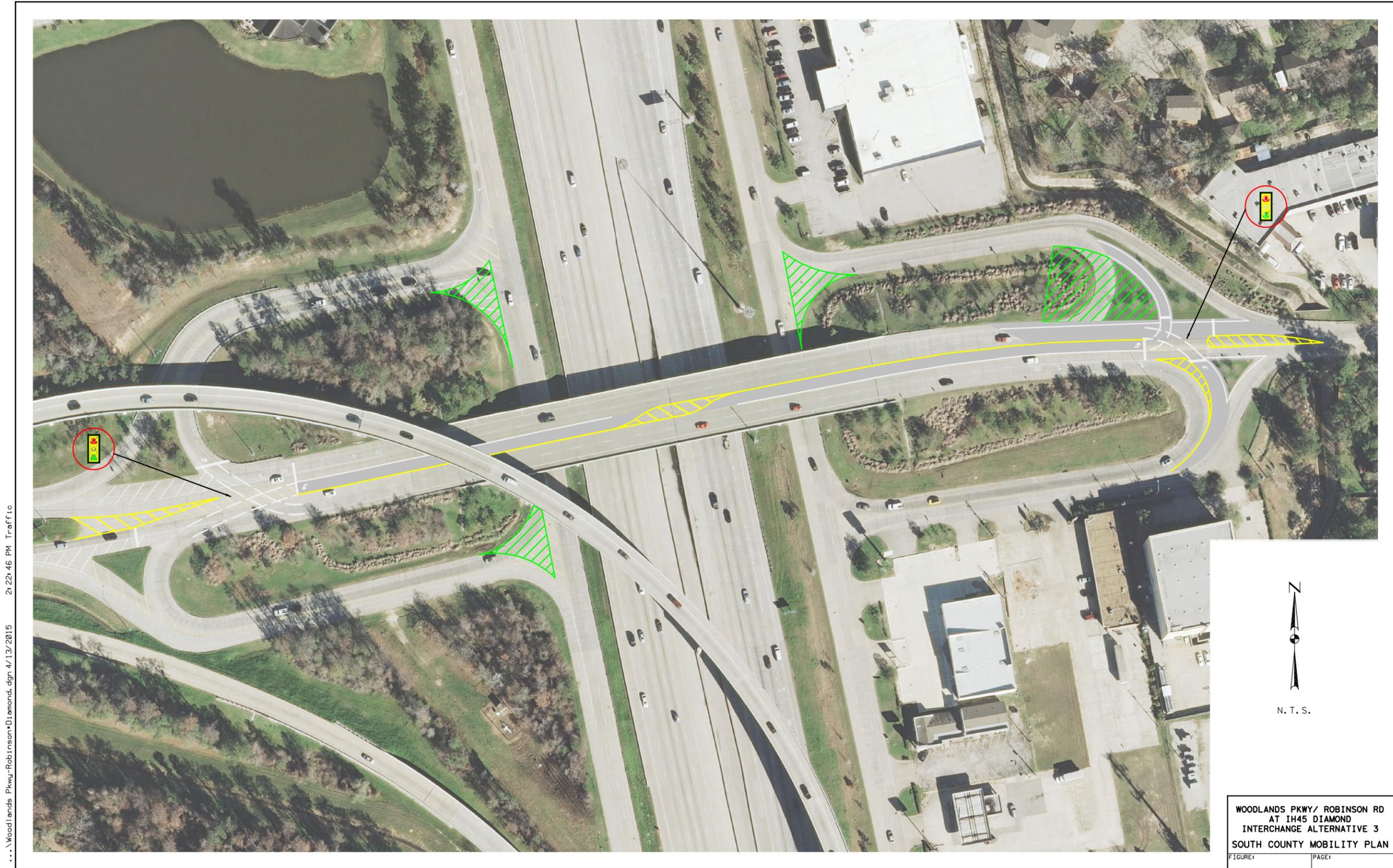


Figure 21: Diamond Interchange

# NEEDS-BASED PLAN

## YEAR 2040 NEEDS-BASED PLAN

The needs-based plan was developed using the projected traffic volumes and conducting daily and peak hour capacity analyses along the critical roads and intersections. This plan is a group of projects that will address forecasted traffic demand in the study area. This group of projects is not financially constrained, and some of the recommendation are not always feasible. The identified needs were analyzed to determine which projects were best suited for the area. Some of the identified needs did not proceed to the final recommendations due to several reasons, including but not limited to cost, ROW needs, and Steering Committee concurrence.

### ALDINE WESTFIELD ROAD

Aldine Westfield Road could serve as a north-south alternative to IH 45 from the Hardy Toll Road all the way to Conroe. This could be accomplished with two direct connectors from the Hardy Toll Road to the Aldine Westfield extension from Rayford Road, as shown in **Figure 22**. However, due to the design of Hardy Toll Road and Grand Parkway, as well as the location of Spring Creek, Denis Johnston Park, and Old Riley Fuzzell Road Preserve (Nature Preserve), this connection was eliminated. Other alternatives to this concept include the extension of Aldine Westfield to Riley Fuzzell east of the preserve. The extension of Aldine Westfield to Conroe will require a bridge at the San Jacinto River.

### ATKINSON LANE

Atkinson Lane needs to connect from Vision Park Boulevard to Saint Lukes Way to provide a north-south alternative to IH 45.

### BIRNHAM WOODS DRIVE

Birnam Woods Drive needs to connect to Birnamwood Boulevard in Harris County, including a new bridge over Spring Creek. (Note that 'Birnamwood' is the correct spelling in Harris County.)

### FM 1488

FM 1488 is projected to have a traffic demand between 52,000 to 57,000 vehicles per day between FM 2978 to IH 45 by 2040. This volume of traffic warrants the widening of FM 1488 to 6 lanes with access management techniques and a new interchange at IH 45. This rural interchange will need to be converted into an urban interchange such as a diamond. The facility should also be extended east past FM 1314 to provide regional connectivity.

### GOSLING

Gosling Road is projected to have a traffic demand of 31,000 vehicles per day just south of SH 242. It will need to be extended from SH 242 to FM 1488. The extension will improve north/south connectivity to FM 1488. In addition to this, the City of Conroe has a future road on their Thoroughfare Plan that would connect FM 1488 to Conroe. This extension of Gosling to FM 1488 would complete the missing connection and would improve access to Conroe without having to use IH 45. This project will require further environmental studies due to its potential impact to the W.G. Jones State Forest.

### GROGANS MILL ROAD

Grogans Mill Road is projected to have a demand of 51,000 vehicles per day between Woodlands Parkway and Sawdust by 2040. These volumes warrant the widening of Grogans Mill from four to six lanes in this section. Also, Grogans Mill needs to provide an alternate route to IH 45 with a grade separation at South Park Drive, widening South Park Drive, widening Westridge Road, widening Pruitt Road, and a new direct connection from IH 45 to Pruitt Road. This concept will require further environmental studies due to the potential impacts to the area. This concept is illustrated in **Figures 23, 24 and 25**.

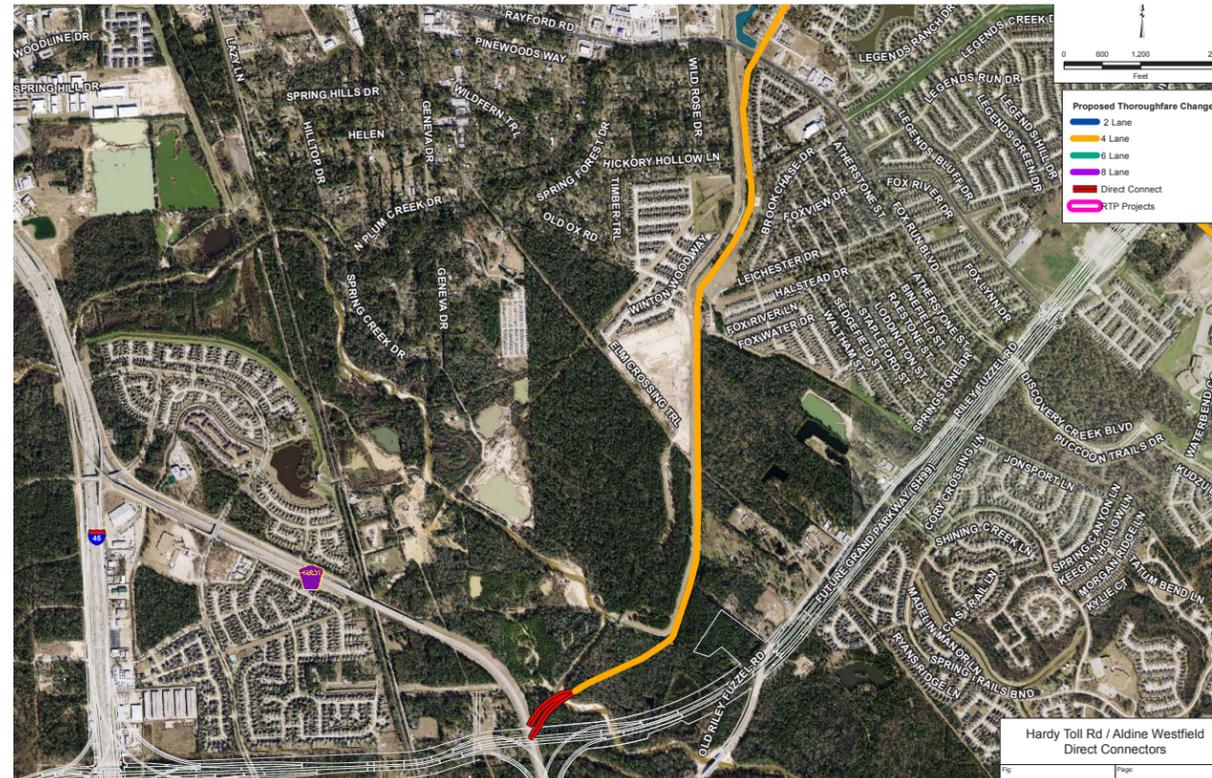


Figure 22: Hardy Toll Road/ Aldine Westfield Connectors



Figure 23: Grogans Mill at South Park Grade Separation

# NEEDS-BASED PLAN

The existing interchange at Woodlands Parkway will need additional capacity by 2040. One alternative considered was a three-level interchange where Grogans Mill Road would cross the existing interchange as an underpass. This alternative was defined to be studied as part of a corridor-wide improvement on Grogans Mill Road from Sawdust Road to Research Forest.

Challenges:

1. Access to adjacent E. Shore Drive cross street
2. Existing pipeline easement in ROW

## IH 45

IH 45 currently carries approximately 250,000 vehicles per day and is expected to increase to approximately 380,000 vehicles per day by 2040. IH 45 will need long term improvements to address the high volume of traffic. It is encouraged that TxDOT and H-GAC conduct a Major Investment Study (MIS) to investigate the need for and feasibility of additional capacity in the IH 45 N/Hardy Toll Road corridor from BW 8 in Harris County to Loop 336 North in Montgomery County.

## LAKE WOODLANDS DRIVE

Lake Woodlands Drive is projected to have a demand of 54,000 vehicles per day at IH 45 by 2040. These volumes warrant the reconstruction of its interchange with IH 45 to a standard diamond interchange. Lake Woodlands Drive also needs to be extended to the east to connect with Sleepy Hollow Road as a four-lane street along the southern boundary of Oak Ridge High School, including a grade separation at the UP railroad. This concept will require further environmental studies due to its potential impacts to the area. This concept is illustrated in **Figure 26**.

## LEXINGTON BOULEVARD

As for a 2040 long-term measure, Lexington Boulevard is proposed to be extended from East Benders Landing to Townsen and from Rayford to Birnham Woods Drive to provide access to the surrounding residential communities.

## NEW IH 45 OVERPASSES/U-TURNS

Two new main lane overpasses will be needed on IH 45 to provide local circulation in the study area by 2040. One overpass is needed at approximately halfway between Research Forest/Tamina and SH 242, at Vision Park Drive/Shenandoah Park Drive. The second overpass is needed approximately halfway between Woodlands Parkway/Robinson and Sawdust/Rayford, at Nursery Road/Sagewood Drive.

The Year 2040 improvements will consist of roadway extensions, intersection improvements, and railroad overpasses. The long-term needs are shown in **Figure 28**, and the existing and committed projects are shown in **Figure 29**. The 2040 intersection level of service analysis is shown in **Table 20**.

## NEW STREET GRID EAST OF IH 45

A new street grid on the east side of IH 45 between SH 242 and the Grand Parkway will be needed to support the future development in the area. This can be done by extending Shenandoah Park, Tamina Road, Robinson Road and Lake Woodlands to the east and also by extending Foster Lane, Aldine Westfield, Birnham Woods Drive and Townsen Boulevard to the north.

## RAYFORD ROAD

Rayford Road needs to connect Townsen Road to Northpark Drive in Harris County, including a bridge over the San Jacinto River.

## RESEARCH FOREST ROAD

Research Forest is projected to have a demand of 44,000 to 65,000 vehicles per day between FM 2978 and Grogans Mill by 2040. These daily volumes warrant the widening of Research Forest by one lane in each direction and building a grade separation at the intersection of Grogans Mill, with Research Forest having the free-flow traffic either over or under Grogans Mill. Grogans Mill would have the signalized crossings with the Research Forest ramps. The concept of the underpass on Research Forest is illustrated in **Figure 23**. The underpass was evaluated based on the alternative of the overpass. However, the underpass was chosen due to the underpass allowing for steeper grades and access to the businesses on the eastern quadrants of the intersection of Research Forest at Grogans Mill Road, which would have been an issue for the construction of the overpass. The Steering Committee agreed that the underpass would have less impact on the surrounding residential areas.

Research Forest is projected to have a traffic demand of 67,000 vehicles per day at IH 45. This will require that the existing interchange at IH 45 be rebuilt to accommodate ten traffic lanes under the bridge.

Research Forest also needs to be widened to six (6) lanes from Shadowbend to Kuykendahl and four (4) lanes from W. Alden Bridge to Egypt Road.

## ROBINSON ROAD

Robinson Road is projected to have a traffic demand of 54,000 vehicles per day at IH 45 and 36,000 vehicles per day just east of the Union Pacific Railroad by 2040. This traffic volume warrants a grade separation at the Union Pacific Railroad. This recommendation did not progress forward due to the possible impact on existing development.

## SAWDUST ROAD AND RAYFORD ROAD

Sawdust is projected to have a demand of 65,000 vehicles per day, while Rayford is projected to have a demand of 64,000 vehicles per day in the vicinity of IH 45 by 2040. These volumes warrant the widening of these two roads from six to eight lanes from Grogans Mill to the Union Pacific Railroad, including the reconstruction of the IH 45 interchange with 10 lanes under the bridge.

## SAWMILL ROAD

Sawmill Road needs to be extended south into Harris County where it would align with Holzwarth. This extension would align with Holzwarth and will provide a new direct connection between The Woodlands Township and Grand Parkway. The extension will mitigate the impact of the ExxonMobil and Springwoods Village developments by providing an alternate route to The Woodlands without using IH 45.

## TAMINA ROAD

Tamina Road is projected to have a traffic demand of 31,000 vehicles per day at IH 45 by 2040. Tamina will need to be extended to the east all the way to FM 1314 to provide connectivity, including a grade separation at the Union Pacific Railroad and a new bridge at the San Jacinto River.

## TOWNSEN BOULEVARD

The construction of Townsen from Grand Parkway to West Townsen Blvd (west of IH 69/ US 59) in Harris County is needed to provide an alternative to using IH 45 and the Hardy Toll Road.

## WOODLANDS PARKWAY

Woodlands Parkway is projected to have a demand of 43,000 vehicles per day between FM 2978 and Kuykendahl by 2040, which warrants the widening to six lanes.

Woodlands Parkway is projected to have a demand of 56,000 to 73,000 vehicles per day between Kuykendahl and IH 45 by 2040. This demand the extension of the IH 45 direct connector over Six Pines and Woodloch Forest. This concept is illustrated in **Figure 26**.

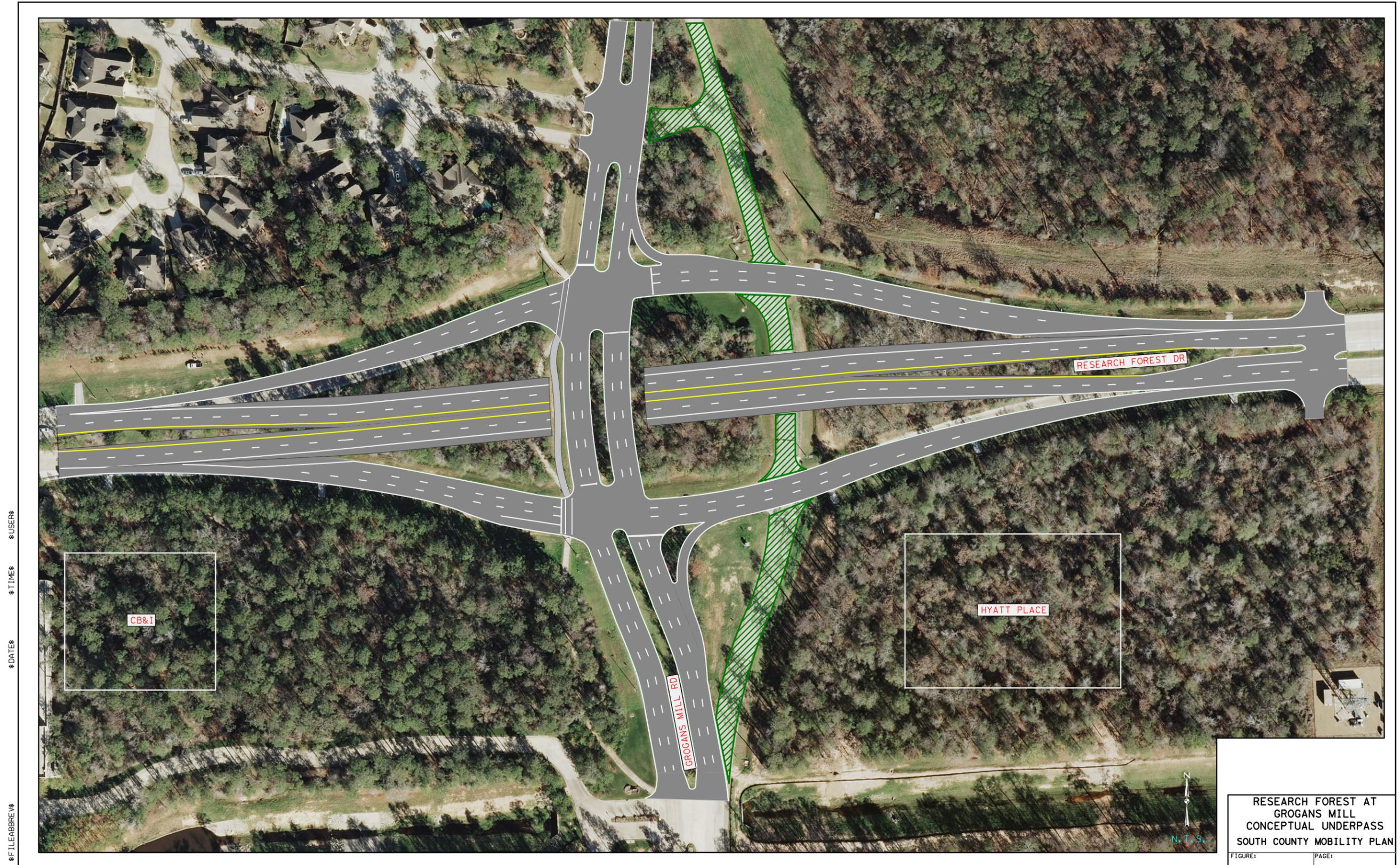
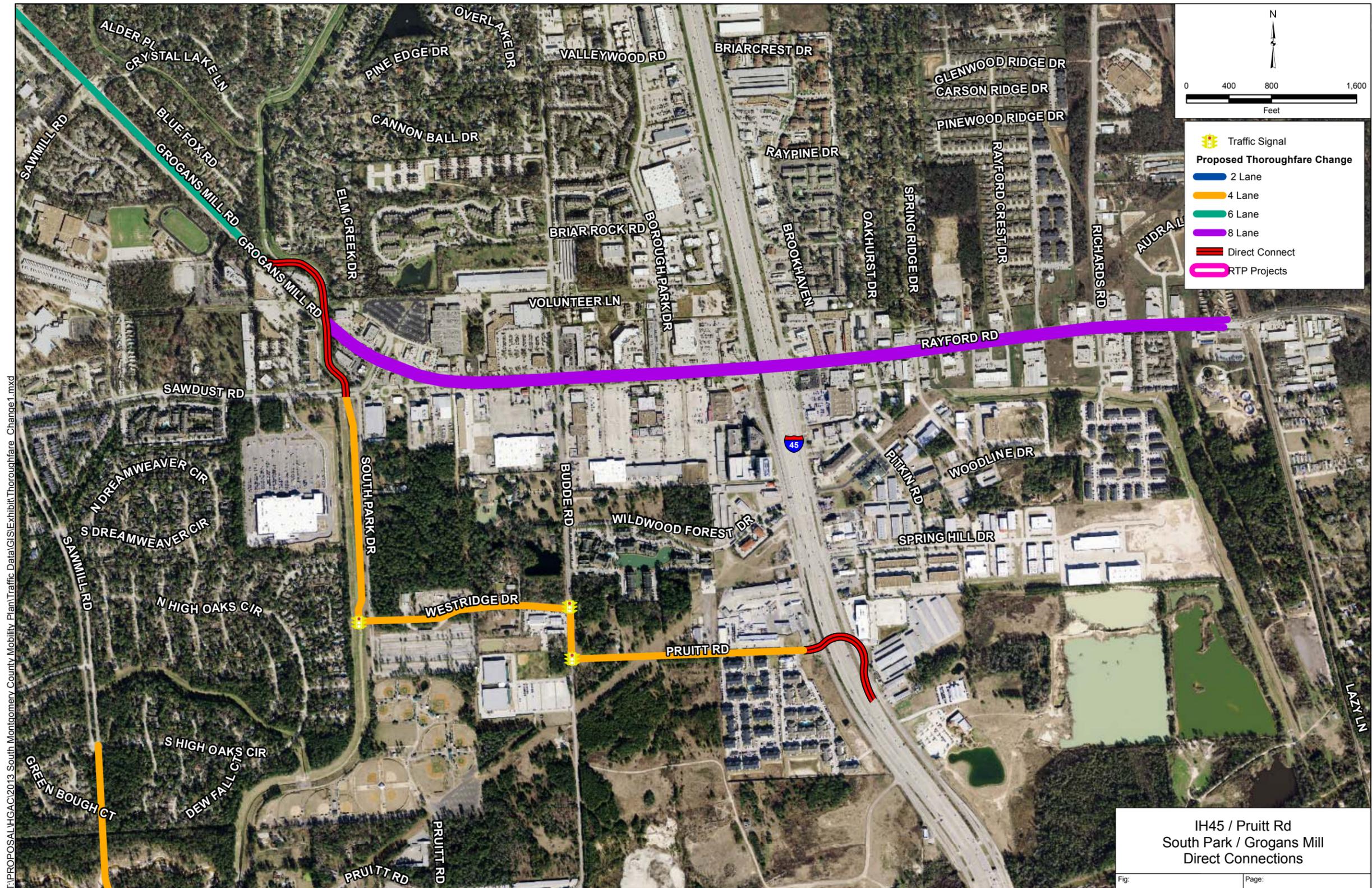


Figure 24: Grogans Mill at Research Forest Underpass

# NEEDS-BASED PLAN



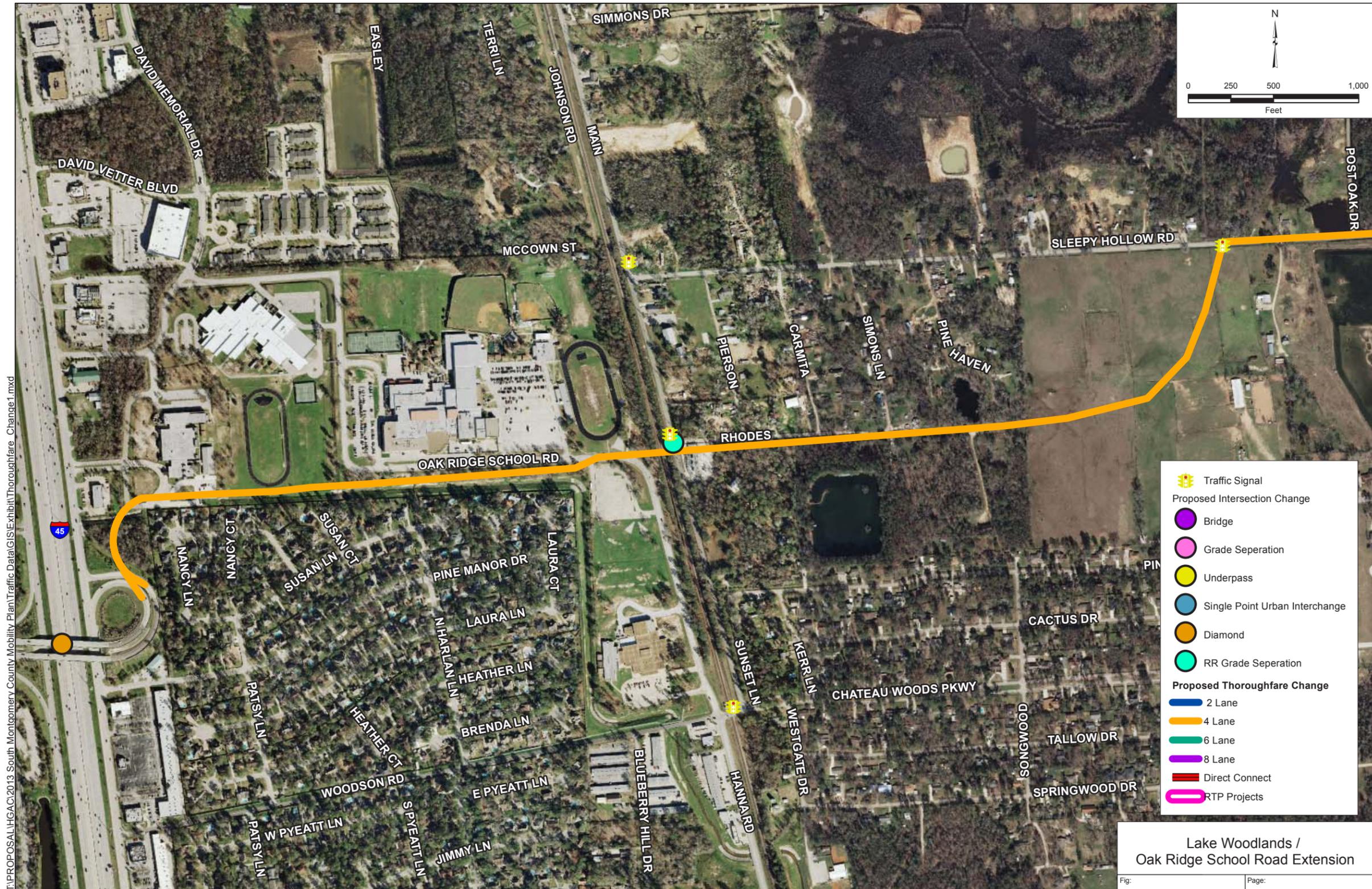
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IH45 / Pruitt Rd  
South Park / Grogans Mill  
Direct Connections

Fig: \_\_\_\_\_ Page: \_\_\_\_\_

Figure 25: IH 45 / Pruitt / South Park / Grogans Mill Direct Connections

# NEEDS-BASED PLAN



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Figure 26: Lake Woodlands Dr

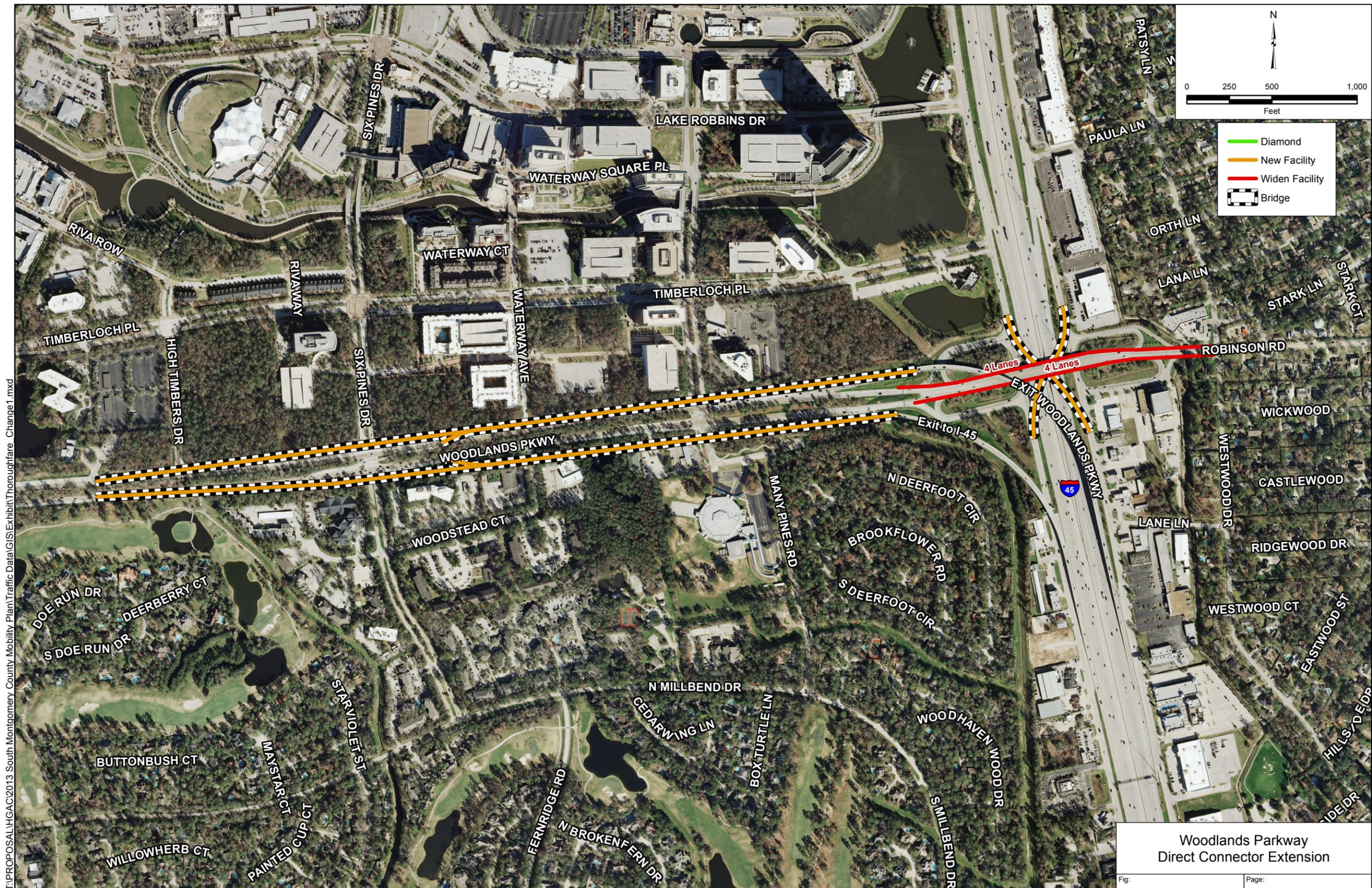


Figure 27: Woodlands Parkway Direct Connector

# NEEDS-BASED PLAN

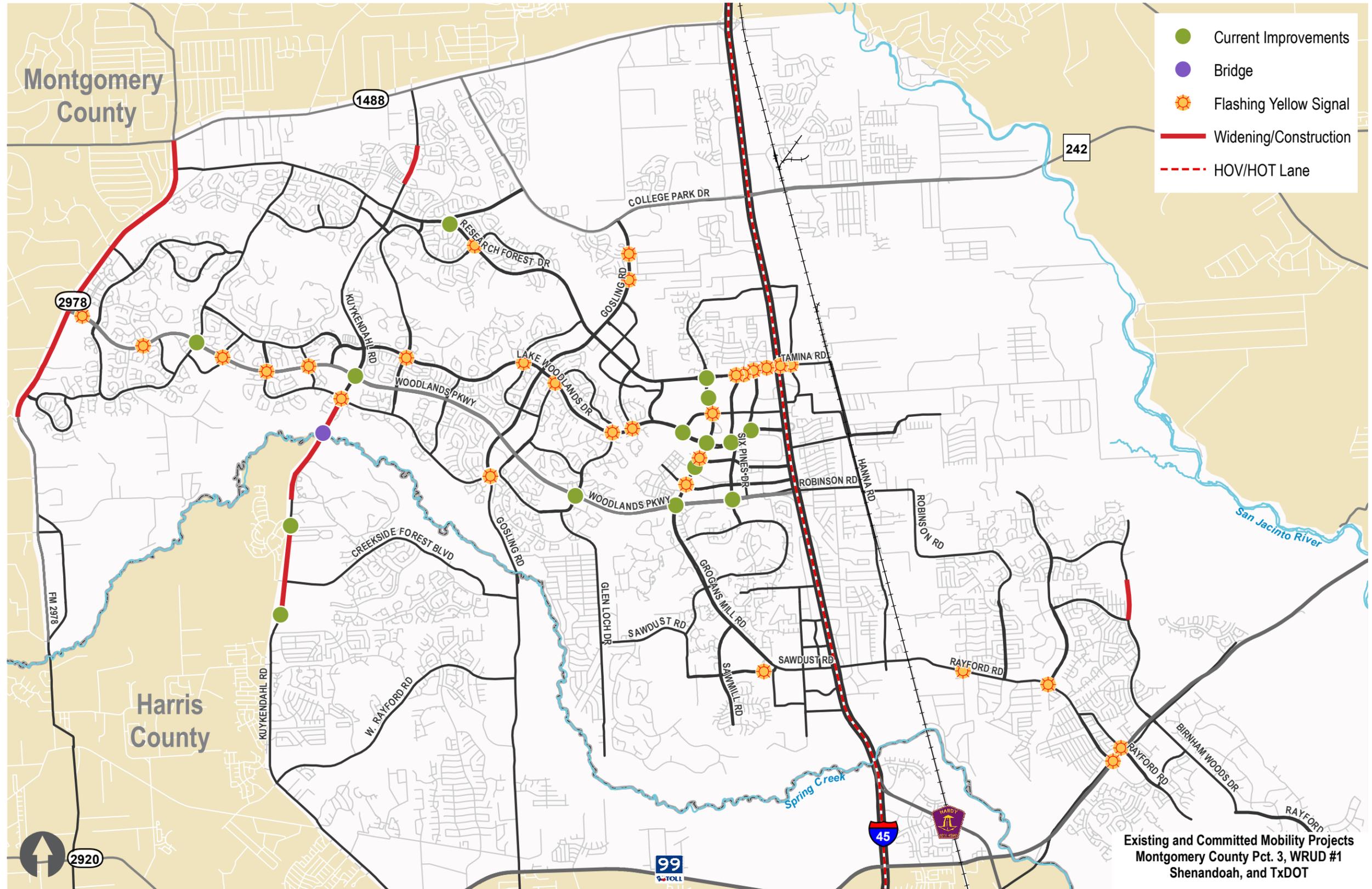


Figure 28: Existing and Committed Mobility Projects



# BICYCLE AND PEDESTRIAN INFRASTRUCTURE

# BICYCLE AND PEDESTRIAN INFRASTRUCTURE

## BICYCLE AND PEDESTRIAN INFRASTRUCTURE

The South Montgomery County area is rapidly developing from a rural area to an urban area due to population and employment growth, while trying to accommodate the transportation needs of cyclists and pedestrians. The region has historically put an emphasis on accommodating automobile traffic growth, but this has sometimes had the effect of hindering cyclist and pedestrian transportation infrastructure. For example, due to the need to reduce roadway congestion, paved shoulders once used by cyclists have in many instances been reconstructed to be used for widening the existing roadways to limit the impact of acquiring land. In some parts of the study area, facilities for cyclists and pedestrians are essentially non-existent. As a result, this study has focused on developing projects that will assist and improve the needs of bicyclists and pedestrians within the entire study area.

## EXISTING CONDITIONS

Existing cycling and pedestrian infrastructure is extensive in some parts of the study area. For example, The Woodlands Township is known for its more than 200 miles of hike and bike trails for pedestrians and cyclists. In fact, the Woodlands Township has received the League of American Bicyclists Bronze Bicycle Friendly Community designation. Over the years, this reputation for supporting cycling and walking has attracted a population of walking and cycling enthusiasts who expect the community to support these activities. However, bicycle connections between The Woodlands Township and other parts of the study area are generally poor. The areas to the east of IH 45 have limited hike/bike trails. With the expansion of the roadway network, the movement of bicyclists and pedestrians is limited. Future projects are needed to improve and expand existing facilities to provide improved connectivity for bicyclists and pedestrians within the South Montgomery County region.

## CONNECTIVITY NEEDS

As a result of limited cycling and pedestrian facilities, there is poor connectivity for bicyclists wishing to travel within the region. With little bicycle or sidewalk access from residential areas east of IH 45 to the employment centers on the west side, commuting to work by cycling or walking is difficult.

Bicycles can play an important and growing role in the regional and local transportation system. While this has traditionally been limited to local neighborhood travel, interest in bicycling across the region has been continually expanding. A regional effort is underway to create a connected greenway. Segments of the Spring Creek Greenway are paved and provide an excellent opportunity to build connectivity to the regional Bayou Trail System leading into Houston.

Creeks and drainage ditches could also be part of a long term solution. These corridors, along with pipeline and power line rights of way, could provide viable alternative for pedestrians and cyclists, which do not require access to the roadways.

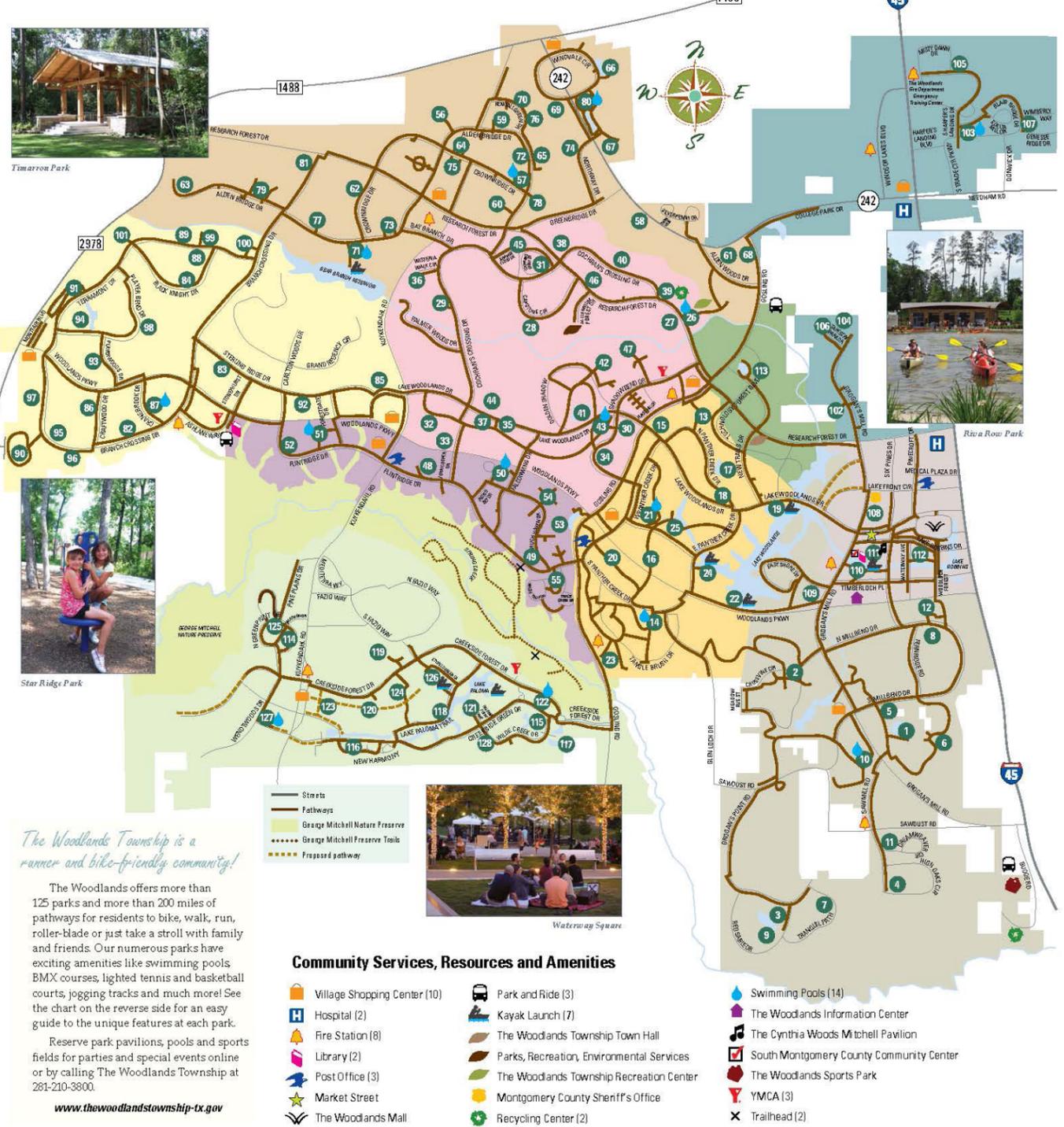
## RECOMMENDATIONS

Through the understanding of the existing conditions and connectivity needs as well as public involvement, these future conditions and recommendations were developed. The primary group involved in the development of the future conditions was the Bike The Woodlands Coalition; however, the Greater Houston Off Road Bicycle Association, Bike Houston, and Bayou Land Conservancy were all engaged as well. In addition, the comments/concerns received through the project website regarding bicycle and pedestrian elements and coordination with The Woodlands Township Transit Plan (which was being conducted concurrently with the SCMP) were used in developing recommendations.

- Village of Grogan's Mill**
  1. Cokerberry Pond Park
  2. Crossvine Park
  3. Grogan's Point Park
  4. High Oaks Park
  5. Loggers Hollow Park
  6. Maplewood Park
  7. Mel Killian Park
  8. Millbend Linear Park
  9. Pastoral Pond Park
  10. Sawmill Park
  11. Sunset Springs Park
  12. Tamarac Park
- Village of Panther Creek**
  13. Clover Park and Pond
  14. Creekwood Park
  15. Hidden Lake Park
  16. Lehigh Springs Park
  17. Long Lake Park
  18. Meadowlake Park
  19. Northshore Park
  20. Rainprint Park
  21. Ridgewood Park
  22. Southshore Park
  23. Tallowberry Park
  24. The Cove Park
  25. Wedgewood Park
- Village of Cochran's Crossing**
  26. Bear Branch Park
  27. Bear Branch Sportsfields
  28. Capstone Park
  29. Cattail Park
  30. Cochran's Bend Park
  31. Cochran's Green Park
  32. Copper Sage Park
  33. Entry Lake Park
  34. Forest Lake Park
  35. Golden Sage Park
  36. Hayden's Run Park
  37. Hidden View Pond Park
  38. Mystic Forest Park
  39. Mystic Lake Park
  40. Pachyderm Park
  41. Shadow Lake Marsh Experience
  42. Shadow Point Park
  43. Shadowbend Park
  44. Somerset Pond Park
  45. Summer Cloud Park
  46. Summer Storm Park
  47. Turnstone Park
- Village of Indian Springs**
  48. Chandler Creek Park
  49. Deer Rush Pond Park
  50. Falconwing Park
  51. Forestgate Park
  52. Hazelcrest Park
  53. Reedy Pond Park
  54. Rush Haven Park
  55. Trace Creek Park
- Village of Alden Bridge**
  56. Acacia Park
  57. Alden Bridge Park
- Research Forest**
  58. Alden Bridge Sports Park
  59. Alden Place Park
  60. Alden Trace Park
  61. Alden Woods Park
  62. Bethany Bend Park
  63. Bluff Creek Park
  64. Cottage Green Park
  65. Cypress Lake Park
  66. Deepdale Pond Park
  67. Evangeline Oaks Park
  68. Gosling Pond Park
  69. Granite Ridge Park
  70. Hollylaurel Park
  71. Lakeside Park
  72. Larkwood Park
  73. Maple Glade Park
  74. Northway Park
  75. Pipers' Green Park
  76. Pleasant Hill Park
  77. Slatestone Park
  78. Spring Hill Park
  79. Sundance Park
  80. Windvale Park
  81. Wynnoak Park
- Village of Sterling Ridge**
  82. Artist Grove Park
  83. Bantam Woods Park
  84. Black Knight Park
  85. Bonny Branch Commons
  86. Craftwood Park
  87. Cranebrook Park
  88. Kirkpatrick Glen Park
  89. Marquise Oaks Park
  90. May Valley Park
  91. Montfair Park
  92. Old Sterling Park
  93. Pepperdale Park
  94. Player Bend Park
  95. Spindle Tree Ponds Park
  96. Spinning Wheel Park
  97. Star Ridge Park
  98. St. Peter's Gate Park
  99. Terrace Mill Pond Park
  100. Terramont Park
  101. Winterra Park
- Village of College Park**
  102. Avalon Park
  103. Harper's Landing Park
  104. Mason Pond Park
  105. Misty Dawn Park
  106. Tapestry Park
  107. Wimberly Park
- Town Center**
  108. Evergreen Park
  109. Olmstead Park
  110. Riva Row Park
  111. Town Green Park
  112. Waterway Square
- Village of Creekside Park**
  113. Venture Tech Park
  114. Camellia Pond Park
  115. Hullwood Pond Park
  116. Jagged Ridge Park
  117. Kayak Ridge Pond Park
  118. Lake Paloma Trail
  119. Lake Voyageur Pond Park
  120. Liberty Square Park
  121. Paloma Point Park
  122. Rob Fleming Park
  123. Rockwell Square Park
  124. Spincaster Park
  125. Timarron Park
  126. Tupelo Park
  127. Wendwoods Park
  128. Wilde Creek Park



## THE WOODLANDS PARKS & PATHWAYS



### Community Services, Resources and Amenities

- Village Shopping Center (10)
- Hospital (2)
- Fire Station (8)
- Library (2)
- Post Office (3)
- Market Street
- The Woodlands Mall
- Park and Ride (3)
- Kayak Launch (7)
- The Woodlands Township Town Hall
- Parks, Recreation, Environmental Services
- The Woodlands Township Recreation Center
- Montgomery County Sheriff's Office
- Recycling Center (2)
- Swimming Pools (14)
- The Woodlands Information Center
- The Cynthia Woods Mitchell Pavilion
- South Montgomery County Community Center
- The Woodlands Sports Park
- YMCA (3)
- Trailhead (2)

Existing Woodland Park and Pathway Network

# BICYCLE AND PEDESTRIAN INFRASTRUCTURE

**TABLE 21: BICYCLE FACILITIES TYPE AND CONSIDERATIONS KEY**

Type	Description / Considerations
Paved Shoulders	Benefits to drivers: space for evasive maneuvers, space for disabled vehicles to slow down or stop safely Benefits to bicyclists and pedestrians: reduce passing conflicts between motor vehicles and bicyclists and pedestrians Allows bicyclists to ride at their own pace
Shared Lane Marking	Known as “sharrow,” used to label a shared environment of automobiles and bicyclists Encourages bicyclists to position themselves safely in lanes too narrow for vehicles to safely pass bicyclists Advertises bikeways to all road users without requiring additional right of way Considerations: Appropriate for low speed and low volume roadways
Bike Lane	A portion of the roadway striped, signed, and marked for use by bicyclists Allows bicyclists to ride at their own pace with little interference from vehicular traffic Makes both bicyclists and drivers predict each other’s movement more easily Considerations: A designated buffer space between bike lane and vehicular traffic or parked cars further separate bikes from cars Law enforcement should help prevent vehicle encroachment and double parking Must be kept well swept or bicyclist will ride in roadway
Cycle Track	Provides physical separation between bicyclists and auto traffic or sidewalk by a physical barrier Helps bicyclists of all skills ride in a more protective environment Considerations: Can be installed at the street level, the sidewalk level, or an intermediate level Requires wider right-of-way and more intricate engineering design at intersections
Shared Use Path	Best used where there are minimal driveways or cross streets Helps bicyclists of all skills ride in a more protective environment Considerations: Requires grade separation or exclusive signal operation at intersections with major roadways Requires wider right-of-way Usually installed along waterways, railroad lines, limited access highways, or within parks and open space areas

Source: National Association of City Transportation Officials, Oregon Department of Transportation, Austin Cycling Association, Pedestrian and Bicycle Information Center, and Houston Chronicle.

The evaluation of the bicycle groups, public opinion/concerns, and The Woodlands Township Transit Plan resulted in the following key conclusions:

1. There was strong sentiment that at least one major continuous north/south and east/west corridor be implemented on both sides of IH 45 in the project area to connect residential areas to major employment areas: The Woodlands Town Center, St Luke’s Hospital and Memorial Hermann Hospital (SW corner of IH 45 and SH 242 extending down IH 45 to Lake Front Circle), Technology Forest (NE corner of Gosling and Research Forest) and Springwoods/ExxonMobil.
2. New crossings of IH 45 should facilitate bicycle and pedestrian travel.
3. Any off-road solutions should have good sight distances and crossings to allow through bicycle travel, as current hike/bike paths in The Woodlands pose a hazard to cyclists traveling at higher speeds.
4. All roadway shoulders currently being used for bicycle travel should be maintained as such, and future widening should include bicycle and pedestrian facilities rather than using the shoulder as an additional roadway lane.
5. New roadways east of IH 45 should be designed as “Complete Streets” and include pedestrian and bicycle facilities. Where possible, major roadway improvements west of IH 45 should accommodate pedestrian/bicycle travel as well.
6. Intersections with raised curbs blocking bicycle travel prior to the cross street should be retrofitted to allow bicycles to travel to the intersection on the shoulder.

These key conclusions were part of the developing the bicycle recommendations. The bicycle recommendations are discussed based on bicycle facility types and usage considerations. **Table 21** provides a general description for bicycle facility types are provided along with guidance on their suitability for different situations.

To make these recommendations the most cost effective, bicycle/pedestrian facilities were selected to coincide with proposed roadway improvements in this document. At some locations, such as the crossing of IH 45, specific bicycle pedestrian facilities were recommended to connect these crossings with other portions of the bicycle/pedestrian network without a roadway improvement component.

A robust network of recommended improvements was refined to one major continuous north/south and east/west corridor on both sides of IH 45 in the project area. This was accomplished with input from the bicycle/pedestrian stakeholders.

Lake Woodlands Drive was supported as the major east/west bicycle pedestrian corridor by the bicycle/pedestrian community. It also has good potential for continuing as a connector on the east side of IH 45 with the Oak Ridge School Road and Sleepy Hollow Road.

Gosling was selected as the major north south corridor on the west of IH 45, due to its connectivity and adjacent utility easement for a separated shared use path. East of IH 45, Hanna and Townsen Roads were selected in a similar manner. **Figures 29, 30, 31 and 32** show possible treatments for Gosling, Lake Woodlands and Townsen to accommodate both pedestrians and cyclists.

The rough planning-level cost estimates for implementing these improvements to correspond with the recommended roadway improvements in the South County Mobility Plan are contained in Section 10.3. In addition, cross sections for these improvements have been included to understand the impact of the bicycle and pedestrian facilities.

These facility costs do not include the cost of right of way and are generalized and in no way reflect specific conditions along roadways in the study area. Source data for these costs are included in the appendix.

# BICYCLE AND PEDESTRIAN INFRASTRUCTURE

## FUTURE EFFORTS

It is recommended that new and reconstructed streets be built to complete street standards. This would ensure that roads will accommodate various modes of transportation, including bicycles.

It is also recommended that a detailed analysis be performed to bring a bicycle/pedestrian network into and through The Woodlands Town Center of The Woodlands and connect with transit improvements proposed by The Woodlands Township Transit Plan. In addition, secure, well-marked and visible bicycle parking should be provided in the Town Center and all major activity centers for safety in the South Montgomery County Region.

It is recommended that designated roads be signed as bicycle facilities in the study area so that cyclists and motorists alike know that bicyclists are users of the roadway. It should be ensured that intersection curbs be made bicycle compatible before designating the shoulder as a bike lane.

In addition, wayfinding signage should be installed on bike facilities indicating major destinations. In places where gaps exist during the construction of the bicycle pedestrian network, it is recommended that connector routes be signed.

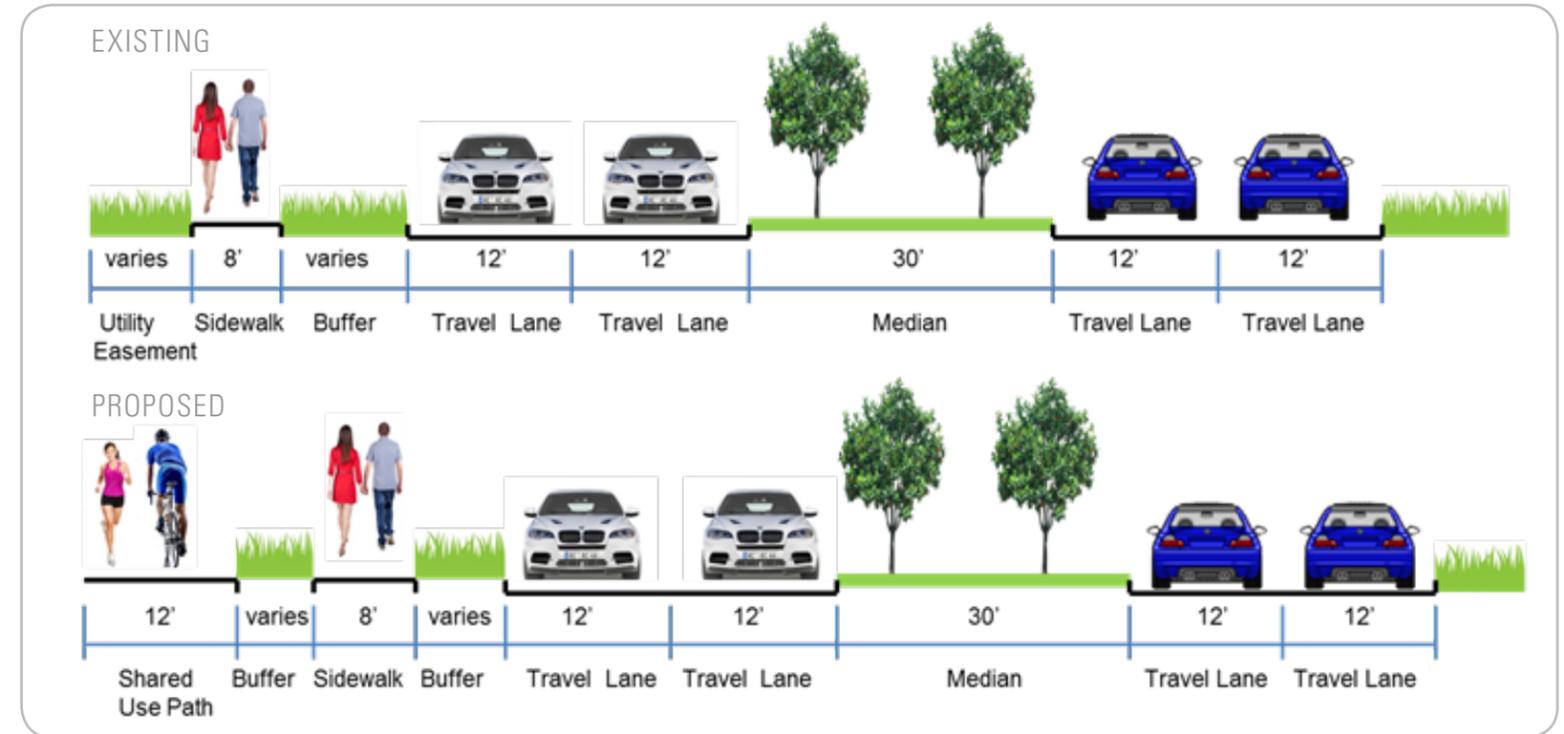


Figure 29: Bicycle/Pedestrian Improvements - Gosling Road SH 242 to Lake Woodlands Drive

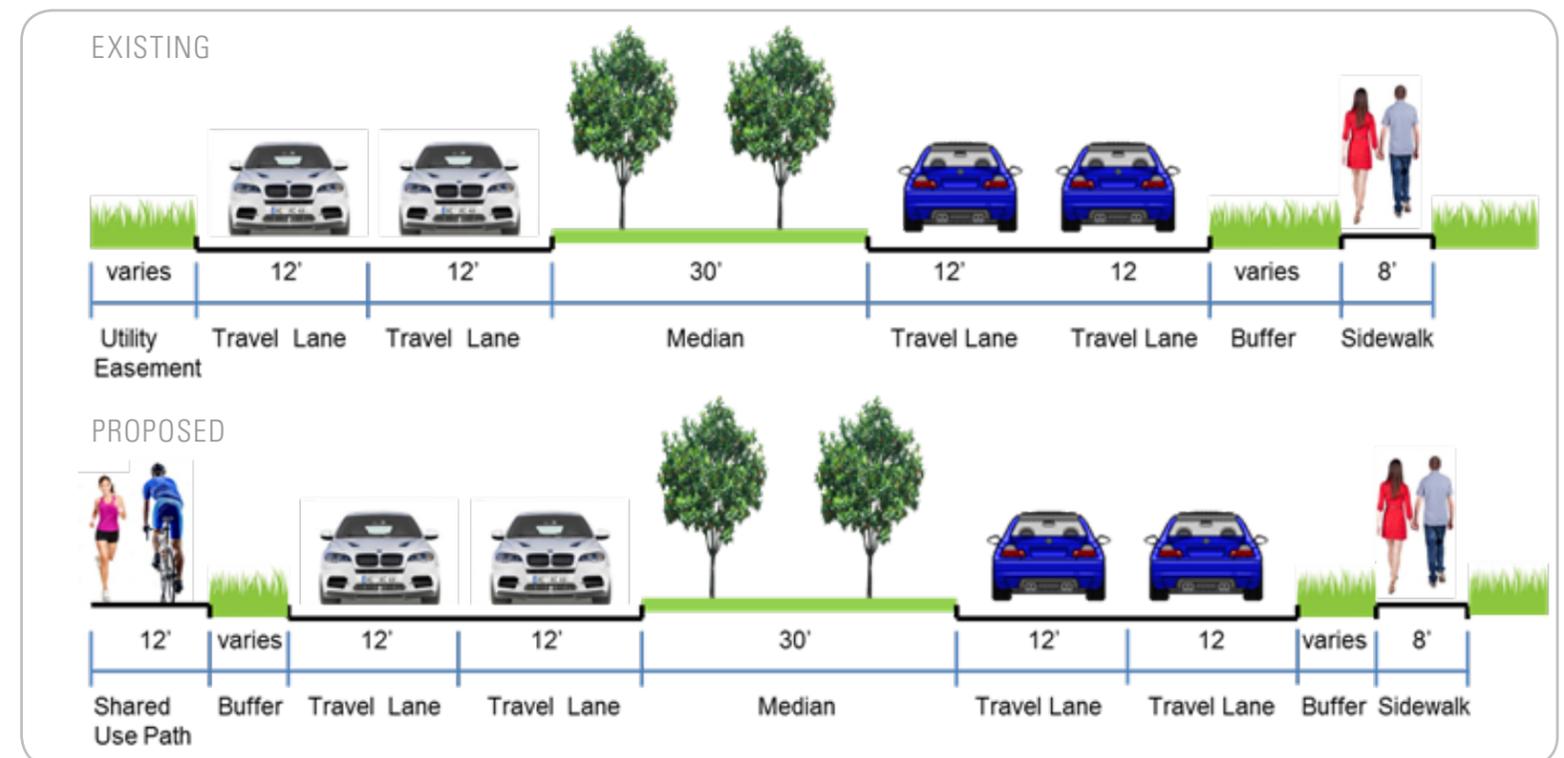


Figure 30: Bicycle/Pedestrian Improvements - Gosling Road Flintridge Drive to Spring Creek

# BICYCLE AND PEDESTRIAN INFRASTRUCTURE

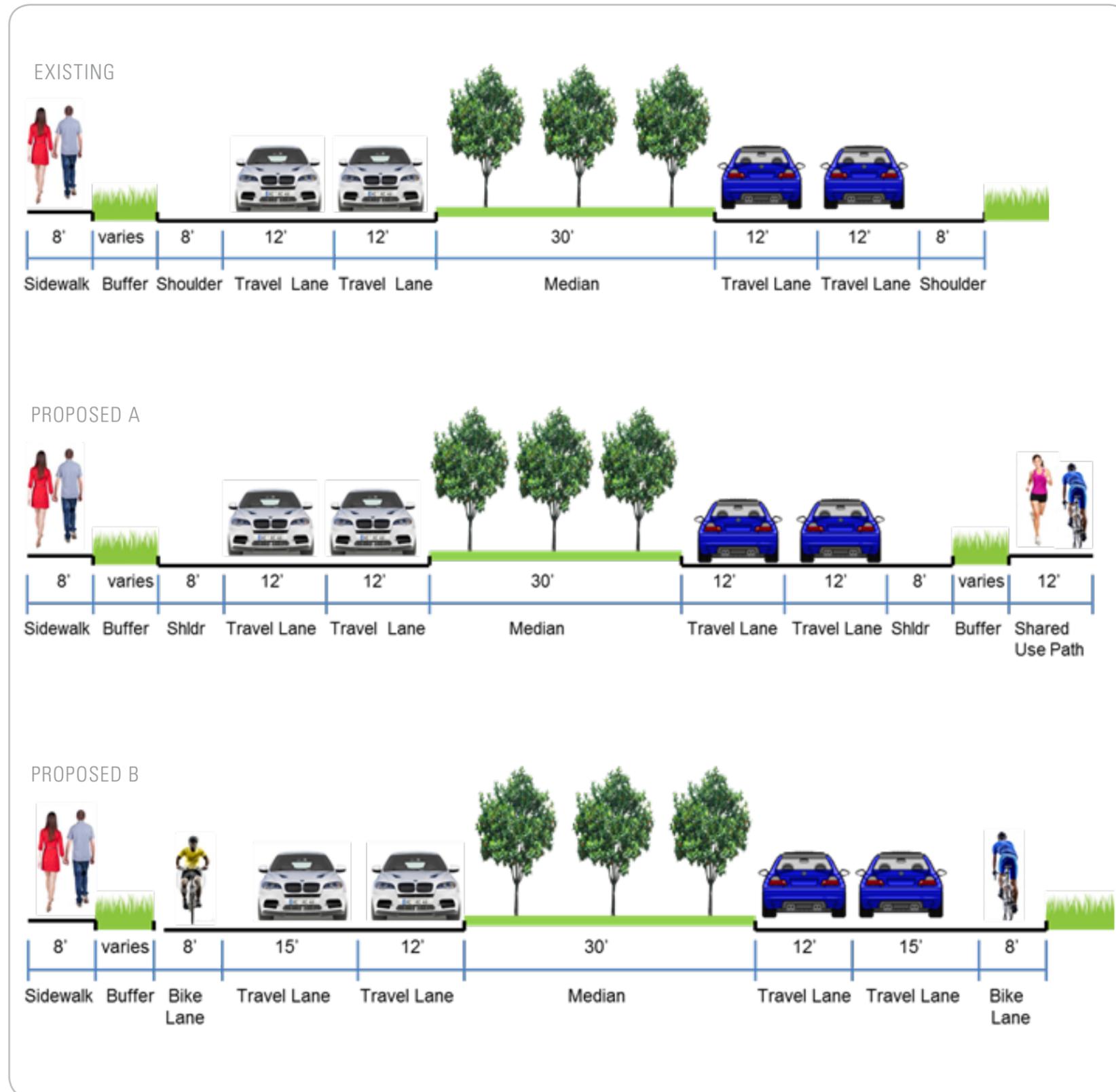


Figure 31: Bicycle/Pedestrian Lake Woodlands possible treatments

# BICYCLE AND PEDESTRIAN INFRASTRUCTURE

## LONG-TERM CONSIDERATIONS

For future growth and connectivity with limited roadway space in the study area, opportunities should be explored for creating pedestrian and bicycle facilities in utility, waterway and pipeline rights of way. Portions of the Spring Creek Greenway which are not reserved for conservation use can provide good opportunities for bicycle and pedestrian transportation facilities.

Oil and natural gas pipelines rights of way have been used successfully in other cities in Texas as well as other areas of the country. These pipeline corridors can often provide direct connections while minimizing roadway crossing conflicts.

Pipeline corridors could be used to make some needed connections in the north part of the study area. One extends northwest from Lake Woodlands Drive crossing Gosling and running parallel to College Park Drive extending to FM 1488. The other connection to explore extends northeast from Hanna Road near Tamina Road to the west of Bird Lake, crossing College Park Drive to Woodloch.

A facility parallel to the Union Pacific Railroad which bisects the study area could also be explored. While abandoned rail corridors across the country have been used as trails, there are also hundreds of examples of trails being constructed parallel to active rail corridors. Best practices are available that demonstrate methods of separating the trail users from railroad activity.

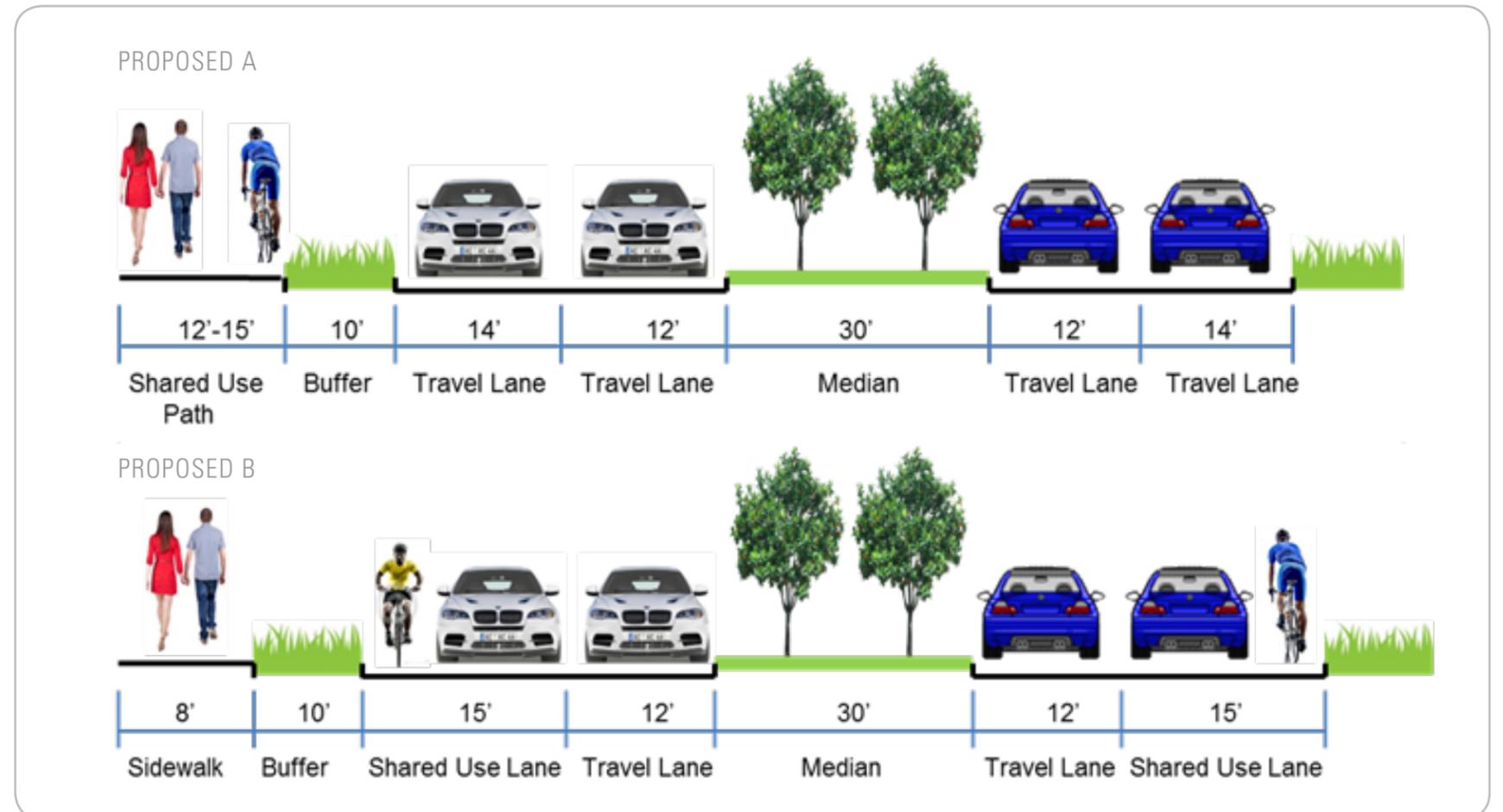


Figure 32: Bicycle/Pedestrian Townsen Road - Possible Treatments (New Facility)

# BICYCLE AND PEDESTRIAN INFRASTRUCTURE

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# RECOMMENDATIONS

# RECOMMENDATIONS

## RECOMMENDATIONS

The short- and long-term programs of proposed projects listed below have been designed to address the mobility issues in South Montgomery County. These improvements to the transportation network have been identified as necessary to handle the existing and anticipated future traffic demand on the area's transportation network. As a result, the proposed projects listed below are expected to address the needs of this fast-growing area and allow for the reasonable access of the general public to homes, jobs, shopping and entertainment. It will be up to the responsible entities to implement the suggested solutions.

The proposed projects have been listed alphabetically and includes a brief description of the project, estimated construction cost (2014 dollars, exclusive of potential right-of-way acquisition), implementing entity or entities (Shenandoah, Oak Ridge North, WRUD, Montgomery County, TxDOT, Harris County and Conroe), potential funding sources (federal, state, local, etc.), plan goals met (economic vitality, maximization of mobility, quality of life, and project consensus), and mobility issues addressed (IH 45 alternative, N/S and E/W connectivity, access to Grand Parkway, local circulation, overall mobility, bicycle/pedestrian, and intersection).

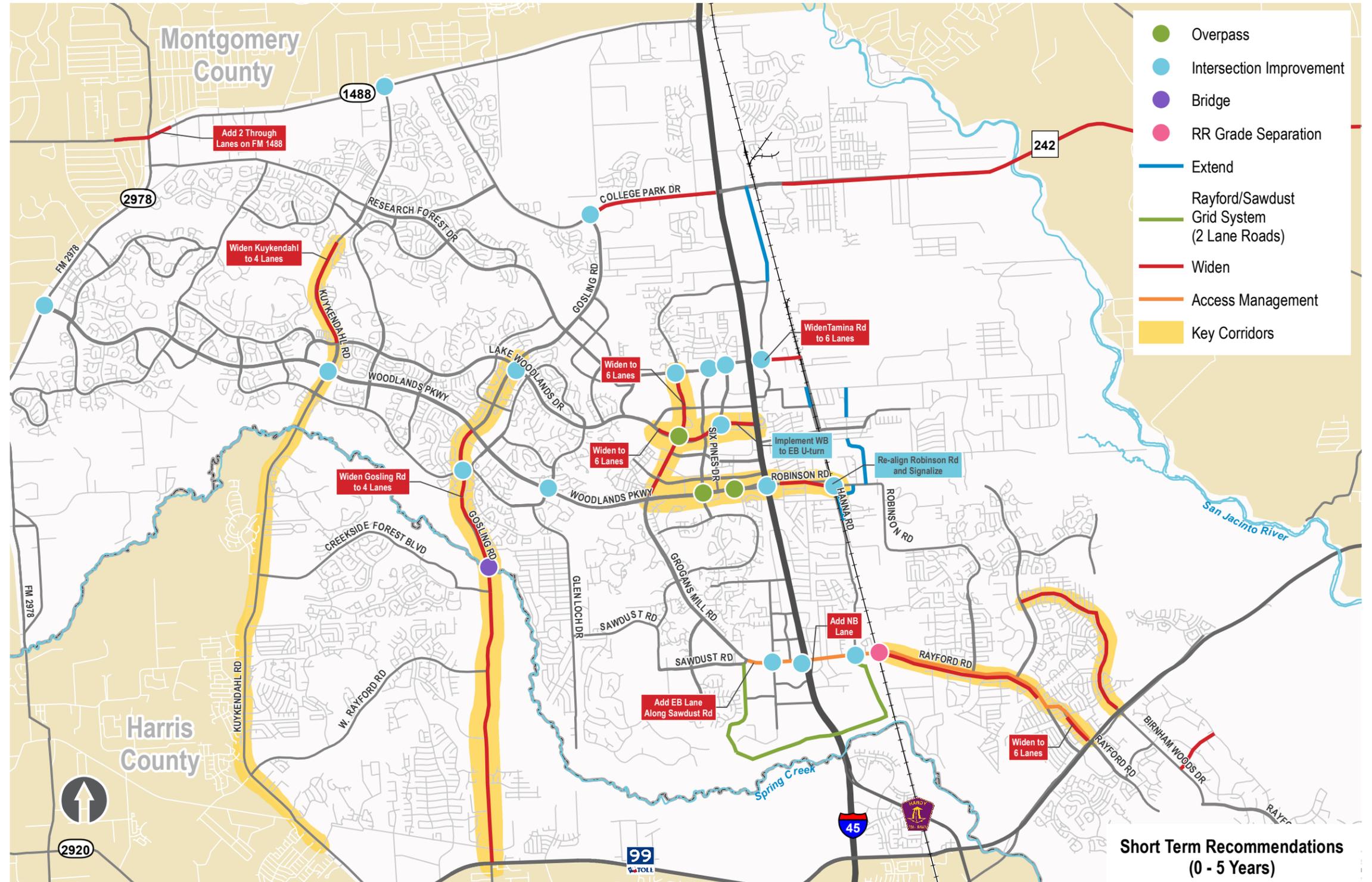


Figure 33: Short Term Recommendations

## SHORT-TERM RECOMMENDATIONS (0-5 YEARS)

The Year 2018 improvements will consist of intersection and area wide improvements. As a result of the intersection analysis for the existing conditions and the 2018 conditions, several intersections will need to have turn lanes added as shown in **Figure 33 (also seen in Figure E4)**.

In order to mitigate existing recurring traffic congestion in the study area, area wide traffic management improvements need to be implemented by 2018. These traffic management programs include implementing an aggressive incident clearance program, developing a traffic signal timing optimization program, and installing dynamic message signs throughout the study area.

### ALDINE WESTFIELD ROAD

Conduct an environmental assessment and develop schematic drawings for the extension of Aldine Westfield Road from the Hardy Toll Road to Ed Kharbat Drive in Conroe.

- Study cost estimate: \$5 million
- Implementation entities: Montgomery County, Harris County, Conroe
- Potential funding sources: Federal, state, local
- SCMP goals: Maximize mobility
- Mobility issues addressed: IH 45 alternative, N/S connectivity, Grand Parkway access

### BIRNHAM WOODS DRIVE

Widen to four-lanes from Elan Blvd to the Grand Parkway.

- Construction cost estimate: \$7.2 million
- Implementation entity: Montgomery County
- Potential funding sources: Local
- SCMP goals: Maximize mobility
- Mobility issues addressed: Grand Parkway access, local circulation, N/S connectivity

### DAVID MEMORIAL DRIVE

Construct four lanes divided extension from Shenandoah Park Drive to SH 242.

- Construction cost estimate: \$11 million
- Implementation entities: Shenandoah, Montgomery County, Conroe
- Potential funding sources: Local, private (Methodist Hospital)
- SCMP goals: Economic vitality, maximize mobility
- Mobility issues addressed: IH 45 alternative, N/S connectivity

### ELAN BOULEVARD

Widen to 4 lanes from Aldine Westfield to Birnham Woods Drive.

- Construction cost estimate: \$5.5 million
- Implementation entity: Montgomery County
- Potential funding sources: Local
- SCMP goals: Maximize mobility
- Mobility issues addressed: Access to Grand Parkway, local circulation.

### FAIRVIEW/BLAIR/FOSTER CORRIDOR STUDY

Conduct a route study to build a road from Rayford to SH 242 via Foster, Blair and Fairview alignments.

- Study cost estimate: \$900,000
- Implementation entities: Montgomery County, Conroe
- Potential funding sources: Federal, state, local
- SCMP goals: Maximize mobility
- Mobility issues addressed: IH 45 alternative, N/S connectivity

### FM 1488

Perform an alternatives analysis to determine the alignment of FM 1488 from IH 45 to FM 1314. This extension would provide an alternative to SH 242.

- Study cost estimate: \$1.4 million
- Implementation entities: Montgomery County, Conroe
- Potential funding sources: Federal, state, local, UP Railroad
- SCMP goals: Economic vitality, maximize mobility
- Mobility issues addressed: Overall mobility, E/W Connectivity.

### GOSLING ROAD

Widen to four lanes from Flintridge to Grand Parkway, including a 2 lane bridge over Spring Creek.

- Construction cost estimate: \$41 million
- Implementing entities: WRUD#1, Montgomery County, Harris County, Conroe
- Potential funding sources: State, local
- SCMP goals: Maximize mobility
- Mobility issues addressed: N/S connectivity, IH 45 alternative, Grand Parkway access

### GOSLING ROAD NORTH EXTENSION

Conduct an environmental assessment to extend Gosling Road north from SH 242 to FM 1488.

- Study cost estimate: \$800,000
- Implementing entities: WRUD#1, Montgomery County, Conroe
- Potential funding sources: State, local
- SCMP goals: Maximize mobility
- Mobility issues addressed: N/S connectivity, IH 45 alternative, Grand Parkway access

### GROGANS MILL ROAD

Widen to six lanes from Woodlands Parkway to Research Forest. Estimated cost: \$6.0 million

Conduct a feasibility study to address the need for improving intersection at Woodlands Parkway. Study cost estimate: \$600,000

Conduct an environmental and schematic study to evaluate options to widen Grogans Mill to six lanes from Woodlands Parkway to Sawdust, construct a grade separation from Grogans Mill to South Park Drive, widening of South Park Drive, widening of Westridge Road, widening of Pruitt Road, and a direct connector from IH 45 northbound to Pruitt Road westbound. Study cost estimate: \$2.0 million

- Total Cost estimate: \$8.6 million
- Implementation entities: WRUD#1, Montgomery County, TxDOT
- Potential funding source: Federal, state and local
- SCMP goals: Maximize mobility, economic vitality
- Mobility issues addressed: N/S connectivity, overall mobility

### HANNA ROAD/JOHNSON ROAD

Extend north to connect to Johnson.

- Construction cost estimate: \$1.4 Million
- Implementation entities: Oak Ridge North, Montgomery County
- Potential funding sources: Local
- SCMP goals: Economic vitality, maximize mobility
- Mobility issues addressed: N/S connectivity

### HARPERS WAY STUDY

Conduct a route study to extend Harpers Way south from Laughing Falcon Trail to proposed Tamina Road extension.

- Study cost estimate: \$300,000
- Implementation entities: Montgomery County, Conroe
- Potential funding source: Local
- SCMP goals: Maximize mobility
- Mobility issues addressed: IH 45 alternative, N/S connectivity.

### IH 45 DIRECT CONNECTORS STUDY

Conduct the environmental and schematic study to evaluate options to improve interchange capacity in the north-south direction. A new direct connection from IH 45 to Pruitt Road.

- Study cost estimate: \$2.6 million
- Implementing Entities: WRUD#1, Montgomery County, TXDOT
- Potential Funding sources: federal, state and local
- SCMP goals: Economic vitality, maximize mobility
- Mobility issues addressed: IH 45 N Alternative, N/S connectivity.

### KUYKENDAHL ROAD

Widen to four lanes from Lake Woodlands Drive to Bay Branch.

- Construction cost estimate: \$6.6 million
- Implementing entities: WRUD#1, Montgomery County
- Potential funding sources: Local
- SCMP goals: Maximize mobility
- Mobility issues addressed: N/S connectivity

### LAKE WOODLANDS DRIVE

Widen to six lanes from Lake Front Circle to IH 45. Estimated cost: \$6.8 million

Construct an overpass on Lake Woodlands at Grogans Mill. Estimated cost: \$4.3 million

Construct a westbound-to-eastbound U-turn at the intersection of Lake Woodlands Drive at Target/The Woodlands Mall entrance. Estimated cost: \$1.3 million

Conduct an environmental impact study for the extension of Lake Woodlands Drive from IH 45 to Sleepy Hollow Road. Estimated cost: \$600,00

- Total construction cost estimate: \$13 million
- Implementation entities: WRUD#1, Oak Ridge North and Montgomery County
- Potential funding sources: State, local
- SCMP goals: Economic vitality; maximize mobility, project consensus
- Mobility issues addressed: E/W connectivity, local circulation, overall mobility

### LEXINGTON BOULEVARD

Widen Lexington Blvd to four lanes from Rayford to East Benders Landing.

- Construction cost estimate: \$9.3 million
- Implementing entity: Montgomery County
- Potential funding source: Local
- SCMP goals: Maximize mobility
- Mobility issues addressed: N/S and E/W connectivity

### RAYFORD ROAD

Construct a roadway overpass on Rayford at the UP Railroad. Estimated cost: \$13.7 million

Widen Rayford Road to six lanes, incorporating access management strategies, from the UP Railroad to Legends Run Drive and from Fox Ravine Drive to Grand Parkway.

- Estimated cost: \$21.5 million construction cost estimate: \$35.2 million
- Implementation entity: Montgomery County
- Potential funding sources: Federal, state, local, UP Railroad
- SCMP goals: Economic vitality; maximize mobility
- Mobility issues addressed: overall mobility, E/W connectivity

### RESEARCH FOREST ROAD

Improve the intersection at Research Forest and Grogans Mill by converting the existing four-point intersection into a one- or two-point intersection. Estimated cost: \$3.1 million

Improve the intersections at Six Pines, Holly Hill and Pinecroft by adding right turn lanes. Estimated cost: \$3.9 million

Widen Research Forest/Tamina Road at IH 45 by adding one traffic lane in each direction under the freeway bridge. Estimated cost: \$2.1 million

- Total construction cost estimate: \$ 9.1 million
- Implementation entities: Shenandoah, Montgomery County
- Potential funding sources: Federal, state, local
- SCMP goals: Economic vitality, maximize mobility, project consensus
- Mobility issues addressed: E/W connectivity, local circulation

### ROBINSON ROAD

Widen to four lanes from IH 45 to east of the UP Railroad, including its realignment to convert the two intersections at Hanna Road into a single intersection controlled by a traffic signal.

- Construction cost estimate: \$10 million
- Implementation entities: Oak Ridge North, Montgomery County
- Potential funding sources: Federal, state, local
- SCMP goals: Economic vitality, maximize mobility
- Mobility issues addressed: E/W connectivity

### SAWDUST ROAD AND RAYFORD ROAD

Implement access management strategies (raised median, driveway consolidation) and add right turn lanes at all the signalized intersections between Grogans Mill and UP Railroad. Estimated cost: \$14.9 million

Construct a new two-lane road under IH 45 at Spring Creek to connect both sides of IH 45. Estimated cost: \$19.9 million

- Total construction cost estimate: \$34.8 million
- Implementation entity: Montgomery County
- Potential funding sources: Federal, state, local, UP Railroad
- SCMP goals: Economic vitality, maximize mobility
- Mobility issues addressed: overall mobility, E/W connectivity

### SAWMILL ROAD STUDY

Conduct an environmental assessment to extend Sawmill Road from South High Oak Circle (south of Sawdust) to Holzwarth, including a new bridge over Spring Creek.

- Study cost estimate: \$300,000
- Implementation entities: Montgomery County, Harris County; potentially ExxonMobil and Springwoods
- Potential funding sources: State, local, private
- SCMP goals: Economic vitality, maximize mobility.
- Mobility issues addressed: N/S connectivity

### SH 242

Widen by adding one lane in each direction from Gosling to IH 45, and from Harpers Way to FM 1314.

- Construction cost estimate: \$52 million
- Implementation entity: TxDOT
- Potential funding sources: Federal, state
- SCMP goals: Economic vitality, maximize mobility
- Mobility issues addressed: Overall mobility, E/W Connectivity

### SHENANDOAH PARK DRIVE

Conduct a route study to extend from David Memorial to future Townsen alignment.

- Study cost estimate: \$1 million
- Implementation entity: Montgomery County
- Potential funding source: Local
- SCMP goals: Maximize mobility
- Mobility issues addressed: E/W connectivity

# RECOMMENDATIONS

## SONGWOOD DRIVE, BLAIR ROAD, AND OAK RIDGE CORRIDOR

### Songwood

- Extend Songwood Drive from Pinewood to Sleepy Hollow.
- Estimated cost: \$2 million
- Extend Songwood Drive/ Industrial Way from Springwood to Robinson.
- Estimated cost: \$3.9 million

### Blair

- Extend Blair Road from Curry to Cox. Estimated cost: \$1.8 million

### Oak Ridge Park

- Extend Oak Ridge Park from Robinson to Curry. Estimated cost: \$1.1 million
  - Total construction cost estimate: \$8.8 Million
  - Implementation entities: Oak Ridge North, Montgomery County
  - Potential funding source: Local
  - SCMP goals: Economic vitality, maximize mobility
  - Mobility issues addressed: N/S connectivity

## TAMINA ROAD

Widen by adding one lane in each direction from IH 45 to Union Pacific Railroad. Estimated cost: \$700,000

Improve the intersection of Tamina and David Memorial. Estimated cost: \$1.1 million

Conduct an environmental assessment to extend Tamina Road from Hanna Road to FM 1314, including a grade separation at the UP Railroad and a new bridge at the San Jacinto River. Estimated cost: \$3 million

- Total construction cost estimate: \$ 4.8 million
- Implementation entities: Shenandoah, Montgomery County, Conroe
- Potential funding sources: Federal, state, local
- SCMP goals: Economic vitality, maximize mobility, project consensus
- Mobility issues addressed: E/W connectivity, local circulation

## TOWNSEN BOULEVARD

Conduct a route study extending Townsen Boulevard from W. Townsen (Harris County) to SH 242 in order to provide a connection between Rayford, Robinson, and Tamina. The cost estimate for this study is \$6.3 million.

- Study cost estimate: \$6.3 million
- Implementation entities: Montgomery County, Harris County, Conroe
- Potential funding sources: State, local, private
- SCMP goals Economic vitality, maximize mobility,
- Mobility issues addressed: N/S connectivity, IH 45 alternative, Grand Parkway access

## WOODLANDS PARKWAY/ROBINSON AT IH 45

Convert the Woodlands Parkway/Robinson Road at IH 45 to a single-point urban interchange (SPUI), including frontage road U-turn lanes. In the event that funding is not available for a SPUI, it is recommended that a Diverging Diamond interchange be constructed as an interim solution.

- Construction cost estimate: \$51.2 million
- Implementation entities: Montgomery County, TxDOT
- Potential funding sources: Federal, state, local
- SCMP goals: Maximize mobility, project consensus
- Mobility issues addressed: E/W connectivity, local circulation

## WOODLANDS PARKWAY

Extend IH 45 direct connectors over Woodloch Forest and Six Pines.

- Construction cost estimate: \$26.5 million
- Implementation entities: Woodlands RUD#1, Montgomery County
- Potential funding sources: Federal, state, local
- SCMP goals: Maximize mobility
- Mobility issues addressed: E/W connectivity

## INTERSECTION IMPROVEMENTS

- College Park Drive/SH 242 at Gosling  
Dual northbound right turn lanes, dual westbound left-turn lanes, and dual northbound left-turn lanes will need to be constructed.
- East Panther Creek at Woodlands Parkway  
Dual southbound left-turn lanes and a southbound right-turn lane will need to be constructed.
- Flintridge at Gosling  
Eastbound left-turn lane and a westbound left-turn lane will need to be constructed
- FM 1488 at Kuykendahl  
Dual westbound left-turn lane will need to be constructed.
- FM 2978 at Woodlands Parkway  
Dual southbound left-turn lanes and a northbound right-turn lane will need to be constructed.
- Kuykendahl at Woodlands Parkway  
Southbound right-turn lane will need to be constructed.
- Lake Woodlands Drive at Gosling  
Dual westbound left-turn lanes and a westbound right-turn lane will need to be constructed.
- Pineroft/Mall entrance at Lake Woodlands Drive  
Northbound right-turn lane will need to be constructed.
- Woodloch Forest at Woodlands Parkway  
Dual southbound left-turn lanes will need to be constructed.
  - Total construction cost estimate: \$4.1 million
  - Implementation entities: WRUD#1 and Montgomery County
  - Potential funding sources: Federal, local
  - SCMP goals: Maximize mobility
  - Mobility issues addressed: Intersection improvement

## AREA-WIDE IMPROVEMENTS

The following traffic management programs should be implemented throughout the study area:

- Aggressive incident clearance program (\$0.9M),
- 10-year traffic signal timing optimization program (\$1.8M),
- Dynamic message signs throughout the study area \$(0.7M).
- Total cost estimate: \$3.4 million
- Implementation entity: Montgomery County
- Potential funding sources: Federal, local
- SCMP goals: Maximize mobility, project consensus
- Mobility issues addressed: Overall mobility

## BICYCLE/PEDESTRIAN NETWORK PRELIMINARY DESIGN

Conduct preliminary design for the new bicycle/ pedestrian connector routes to correspond with new roadway construction and the Spring Creek Greenway.

- Design cost estimate: \$3 million
- Implementation entity: Montgomery County
- Potential funding sources: Federal, local
- SCMP goals: Quality of life
- Mobility issues addressed: Lack of multimodal transportation options

# RECOMMENDATIONS

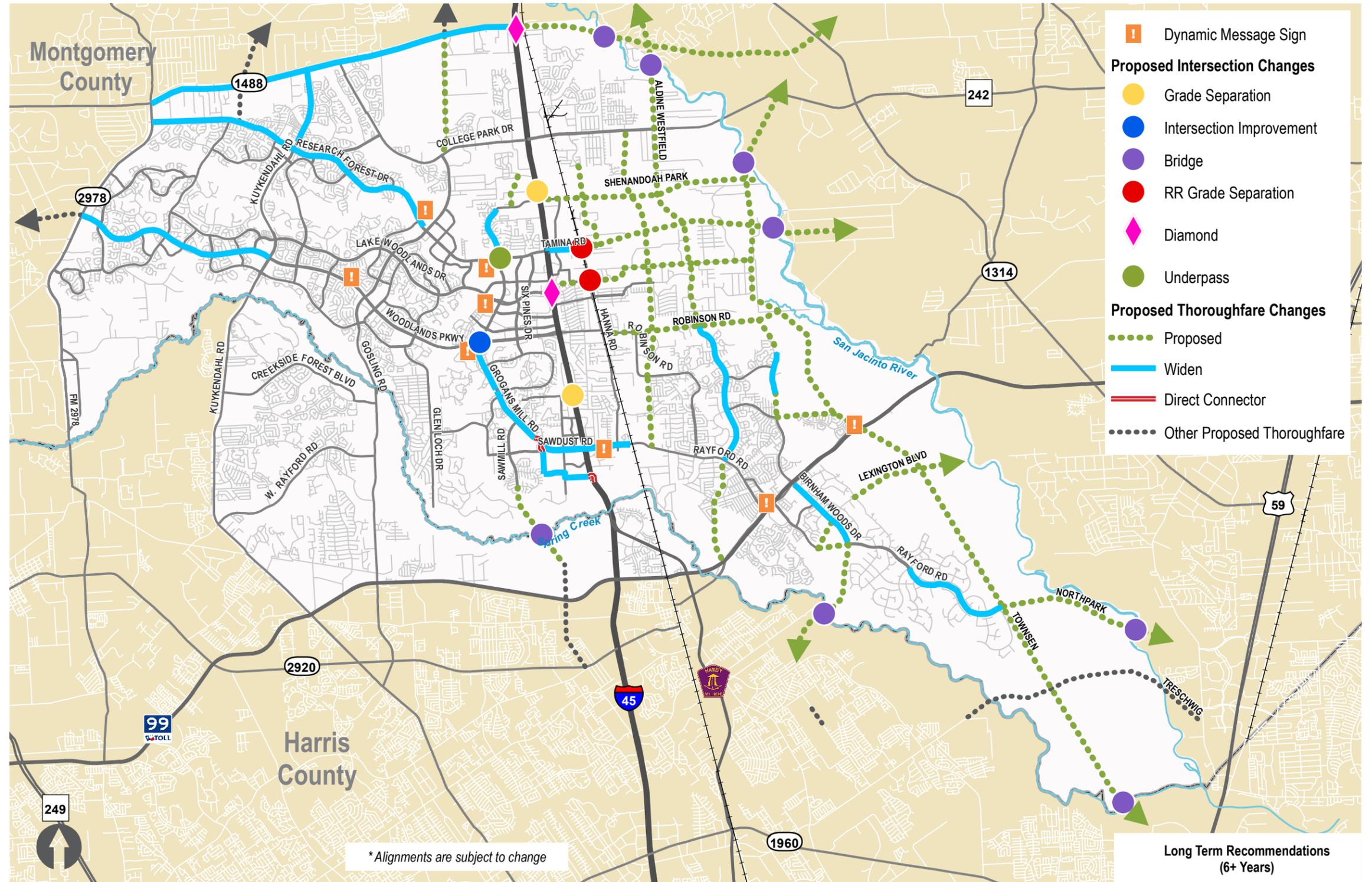


Figure 34: Long Term Recommendations

# RECOMMENDATIONS

## LONG-TERM RECOMMENDATIONS (6-25 YEARS)

The long term recommendations consist of street widening, construction of new roadways and extensions, new cycling/pedestrian facilities and grade separations. These improvements, identified in **Figure 34 (also seen in Figure E5)**, have been identified as necessary to handle the anticipated future traffic demand on the area's transportation network. Many of these recommendation serve as alternatives to IH 45 and address the N/S and E/W connectivity that is currently lacking in the study area.

### ALDINE WESTFIELD EXTENSION

Depending on the result of the environmental assessment, extend from Riley Fuzzell to Ed Kharbat Drive in Conroe.

- Construction cost estimate: \$131.9 million
- Implementation entities: Conroe, Montgomery County
- Potential funding sources: Federal, state, local
- SCMP goals: Maximize mobility
- Mobility issues addressed: IH 45 alternative, N/S connectivity, local circulation, Grand Parkway access

### ATKINSON LANE

Extend from Vision Park Blvd to St Lukes Way.

- Construction cost estimate: \$6.7 million
- Implementation entities: Shenandoah, Montgomery County
- Potential funding source: Local
- SCMP goals: Economic vitality, maximize mobility
- Mobility issues addressed: IH 45 alternative, N/S connectivity

### BIRNHAM WOODS DRIVE

Extend Birnham Woods Drive from Rayford Road to Birnamwood Blvd in Harris County. Estimated cost: \$26 million

Construct a new bridge over Spring Creek. Estimated cost: \$5.2 million

Widen to 4 lanes from Rayford Rd to Grand Parkway. Estimated cost: \$9.9 million

Widen and extend Birnham Woods from Elan Blvd to Robinson. Estimated cost: \$14.7 million

- Total construction cost estimate: \$55.8 million
- Implementation entities: Montgomery County, Harris County
- Potential funding sources: Federal, state, local
- SCMP goals: Maximize mobility
- Mobility issues addressed: IH 45 alternative, N/S connectivity, Grand Parkway access

### ELAN BOULEVARD

Extend from Birnham Woods Dr to Townsen Blvd.

- Construction cost estimate: \$11.1 million
- Implementation entity: Montgomery County
- Potential funding sources: State, local
- SCMP goals: maximize mobility
- Mobility issues addressed: E/W connectivity

### FAIRVIEW/BLAIR/FOSTER CORRIDOR

Depending on results of earlier study, construct a 2-lane road from Rayford to SH 242 via Foster, Blair and Fairview alignments.

- Construction cost estimate: \$30.8 million
- Implementation entities: Montgomery County, Harris County
- Potential funding sources: Federal, state, local
- SCMP goals: Maximize mobility
- Mobility issues addressed: IH 45 alternative, N/S connectivity

### FM 1488

Depending on results of the previous study, extend FM 1488 east from IH 45 to FM 1314 and build a bridge over the San Jacinto River. Cost estimate is \$52.9

Widen to six lanes and implement access management treatments from FM 2978 to IH 45. Cost estimate is \$25.7 million

- Total construction cost estimate: \$78.6 million
- Implementation entities: Montgomery County, TxDOT
- Potential funding sources: Federal, state, local
- SCMP goals: Maximize mobility, economic vitality
- Mobility issues addressed: E/W connectivity

### GOSLING ROAD

Extend Gosling Road from SH 242 to FM 1488.

- Construction cost estimate: \$25 million
- Implementation entity: Montgomery County
- Potential funding sources: State, local
- SCMP goals: Maximize mobility
- Mobility issues addressed: IH 45 alternative, N/S connectivity

### GROGANS MILL ROAD

Widen Grogans Mill Road from four to six lanes between Woodlands Parkway and Sawdust. Estimated cost: \$11.5 million

Widen Grogans Mill from two to four lanes from Research Forest to Vision Park. Estimated cost: \$5.5 million

Depending on the results of earlier study, improve the intersection at Grogans Mill at Woodlands Parkway to accommodate traffic volume. Estimated cost: \$20 million

Depending on the results of earlier study, Construct a grade separation at South Park Drive, widen South Park Drive to four lanes, widen Westridge Road to four lanes, widen Pruitt Road to four lanes, and construct a new direct connector from northbound to Pruitt Road westbound. Estimated cost: \$53.1 million

- Total construction cost estimate: \$90.1 million
- Implementation entities: Woodlands RUD#1, Montgomery County, TxDOT
- Potential funding sources: Federal, state, local
- SCMP goals: economic vitality maximize mobility
- Mobility issues addressed: IH 45 alternative, N/S connectivity

### HARPERS WAY

Depending on results of earlier study, extend Harpers Way south from Laughing Falcon Trail to Tamina Road.

- Construction cost estimate: \$11 million
- Implementation entities: Montgomery County
- Potential funding sources: Local
- SCMP goals: Maximize mobility
- Mobility issues addressed: IH 45 alternative, N/S connectivity

### IH 45

Encourage TxDOT and H-GAC to conduct a Major Investment Study (MIS) to investigate the need for and feasibility of additional capacity in the IH 45 N/Hardy Toll Road corridor from BW 8 in Harris County to Loop 336 North in Montgomery County.

### LAKE WOODLANDS DRIVE

Depending on results of the previous study, extend Lake Woodlands Drive from IH 45 to Sleepy Hollow Road, including an overpass at the UP Railroad. Estimated cost: \$19.4 million

- Total construction cost estimate: \$19.4 million
- Implementation Construction entities: Oak Ridge North, Montgomery County
- Potential funding sources: State, local, UP Railroad
- SCMP goals: Maximize mobility
- Mobility issues addressed: E/W connectivity, local circulation

### LEXINGTON BOULEVARD

Extend Lexington Blvd from East Benders Landing to Townsen. Estimated cost: \$13.4 million

Extend Lexington Blvd from Rayford to Birnamwood Blvd. Estimated cost: \$5.5 million

- Total construction cost estimate: \$18.9 million
- Implementing entity: Montgomery County
- Potential funding source: Local
- SCMP goals: Maximize mobility
- Mobility issues addressed: N/S and E/W connectivity

# RECOMMENDATIONS

## NEW IH 45 OVERPASSES

Construct two new main-lane overpasses/u-turn ramps at IH 45 and Vision Park Drive/ Shenandoah Park Drive and at IH 45 and Nursery Road/Sagewood Drive.

- Construction cost estimate: \$80 million
- Implementation entities: Shenandoah, Oak Ridge North, Montgomery County, TxDOT
- Potential funding sources: Federal, state, local
- SCMP goals: Economic vitality, maximize mobility
- Mobility issues addressed: Local circulation

## RAYFORD ROAD

Construct and widen to 4 lanes from Waterbend Cove to Birnham Woods Dr. Estimated cost: \$8.7 million

Widen to 4 lanes from Birnham Woods to Townsen Blvd. Estimated cost: \$7.5 million

Extend from Townsen Blvd to North Park. Estimated cost: \$60 million

- Total construction cost estimate: \$76.2 million
- Implementation entities: Montgomery County, Harris County
- Potential funding sources: State, local, private
- SCMP goals: Economic vitality, maximize mobility
- Mobility issues addressed: E/W connectivity

## RESEARCH FOREST DRIVE

Widen by adding one lane from Shadow Bend to W. Alden Bridge and from W. Alden Bridge to FM 2978. Estimated cost: \$16.5 million

Construct an underpass at Research Forest at Grogans Mill. Estimated cost: \$14.3 million

Reconstruct the interchange at Research Forest at IH 45 to accommodate ten traffic lanes under the bridge. Estimated cost: \$40.1 million

- Total construction cost estimate: \$70.9 million
- Implementation entities: WRUD#1, Montgomery County, Shenandoah, TxDOT
- Potential funding sources: Federal, state, local
- SCMP goals: Maximize mobility, project consensus
- Mobility issues addressed: E/W connectivity

## ROBINSON ROAD

Depending on results of the previous study, extend Robinson Road from Hanna Road to Townsen Blvd. Estimated cost: \$30.2 million

Construct railroad grade separation. Estimated cost: \$23.5 million

- Construction cost estimate: \$53.7 million
- Implementation entities: Oak Ridge North, Montgomery County
- Potential funding sources: State, local, UP Railroad
- SCMP goals: Maximize mobility
- Mobility issues addressed: E/W connectivity

## SAWDUST ROAD AND RAYFORD ROAD

Widen Sawdust and Rayford Roads from six to eight lanes from Grogans Mill to the UP Railroad. Estimated cost: \$16.8 million

Reconstruct the IH 45 interchange to accommodate 10 lanes under the bridge. Estimated cost: \$40.1 million

- Total construction cost estimate: \$56.9 million
- Implementation entities: Montgomery County, TxDOT
- Potential funding sources: Federal, state, local
- SCMP goals: Maximize mobility
- Mobility issues addressed: E/W connectivity, Grand Parkway access, local circulation.

## SAWMILL ROAD

Depending on results of earlier study, extend from South High Oak Circle to Spring Creek. (Sawmill will connect to Holzwarth in Harris County which will provide a direct connection to Grand Parkway).

- Construction cost estimate: \$8.8 million
- Implementation entities: Montgomery County, Harris County
- Potential funding sources: State, local
- SCMP goals: economic vitality, maximize mobility
- Mobility issues addressed: N/S connectivity, IH 45 alternative, Grand Parkway access

## SHENANDOAH PARK DRIVE

Depending on results of the previous study, extend Shenandoah Park Drive as 4 lanes from David Memorial to the San Jacinto River.

- Construction cost estimate: \$33 million
- Responsible implement entities: Montgomery County
- SCMP goals: Maximize mobility, economic vitality
- Mobility issues addressed: E/W connectivity

## SLEEPY HOLLOW ROAD

Widen Sleepy Hollow Rd from Main St to Hayes Ranch Rd.

- Construction cost estimate: \$24.6 million
- Implementation entity: Montgomery County
- Potential funding sources: State, local
- SCMP goals: Maximize mobility
- Mobility issues addressed: E/W connectivity

## TAMINA ROAD

Depending on results of the previous study, extend Tamina Road from Hanna Road to FM 1314, including a grade separation at the UP Railroad and a new bridge at the San Jacinto River.

- Construction cost estimate: \$92 million
- Implementation entity: Montgomery County
- Potential funding sources: State, local, UP Railroad
- SCMP goals: Maximize mobility, economic vitality
- Mobility issues: E/W connectivity

## TOWNSEN BOULEVARD

Construct a bridge on Townsen Boulevard over Spring Creek. Estimated cost: \$21.1 million

Construct a new road from the Spring Creek to Grand Parkway. Estimated cost: \$109.3 million

Construct a new road from the Grand Parkway to SH 242. Estimated cost: \$80.4 million

- Total construction cost estimate: \$210.8 million
- Implementation entities: Montgomery County, Harris County, Conroe
- Potential funding sources: State, local, private
- SCMP goals: Economic vitality, maximize mobility
- Mobility issues addressed: IH 45 alternative, N/S connectivity, Grand Parkway access.

## WOODLANDS PARKWAY

Widen from Kuykendahl to FM 2978 to six (6) lanes. The construction cost estimate for this project is 14.3 million.

- Total construction cost estimate: \$14.3 million
- Implementation entities: Montgomery County, WRUD
- Potential funding sources: State, local
- SCMP goals: Maximize mobility, committee consensus
- Mobility issues addressed: E/W connectivity, economic vitality

# RECOMMENDATIONS

## BICYCLE/PEDESTRIAN RECOMMENDATIONS

Lake Woodlands Drive was selected as the major east/west bicycle/pedestrian corridor due to its centralized location in The Woodlands Township. This roadway also has the potential to be extended on the east side of IH 45 with Oak Ridge School Road and Sleepy Hollow Road. Gosling was selected as the major north/south corridor on the west of IH 45, due to its connectivity and potentially available utility easement for a shared use path. East of IH 45, Hannah and Townsen Roads were selected in a similar manner.

Construction of new bicycle/pedestrian routes should be included with new roadway construction, the Spring Creek Greenway, and a path in Grand Parkway right-of-way. The construction cost estimate for this project is \$36.7 million.

The responsible entities for implementation are Woodlands RUD#1, Shenandoah, Oak Ridge North, and TxDOT. The potential funding sources include federal, state and local. This project will accomplish two of the four SCMP goals: (1) quality of life (balance transportation and the natural environment) and (2) maximize mobility (N/S and E/W connectivity).

The recommended projects are shown in **Figure 35** and the detailed project listing is in **Table 22**. Detailed Bicycle/Pedestrian Recommendations can be found in **Appendix J**.



Shared use path

TABLE 22: BICYCLE/PEDESTRIAN PROJECTS

Type	Adjacent Facility	Limits	Facility Type	Length (Miles)
New Bicycle/Pedestrian Connector Routes		SH 99 to Spring Creek	Separated Shared Use Path	3.89
	Gosling Rd	Spring Creek to Lake Woodlands Dr	Separated Shared Use Path	2.31
		Lake Woodlands Dr to College Park Dr/SH 242	Separated Shared Use Path	2.27
	Gosling Rd Extension	College Park Dr/SH 242 to FM 1488	Bike Lane, add pavement no curb	2.32
	Hanna Rd Extension	SH 242 to Sleepy Hollow Rd	Bike Lane, add pavement no curb	3.0
		Sleepy Hollow Rd to Rayford Rd	Bike Lane, add pavement no curb	2.75
		Woodlands Pkwy to Gosling Rd	Separated Shared Use Path or Bike Lane, add pavement no curb	2.80
	Lake Woodlands Dr	Gosling Rd to IH 45	Separated Shared Use Path or Bike Lane, (5' Paved Shoulders) both sides	3.32
		Pruitt Rd to Spring Hills Dr	Bike Lane, add pavement no curb	1.34
	Oak Ridge School Rd	IH 45 to Townsen Rd	Bike Lane, add pavement no curb	3.92
	Sawdust Rd/Rayford Rd	Grogans Mill Rd to Hanna Rd Extension	Bike Lane, add pavement no curb	1.57
		Sleepy Hollow Rd to SH 99	Separated Shared Use Path	3.83
	Townsen Rd	SH 99 to Rayford Rd	Separated Shared Use Path	4.18
		Rayford Rd to Townsen Blvd W	Separated Share Use Path	4.82
New Bicycle/Pedestrian Facilities	Woodlands Parkway	FM 2978 to Lake Woodlands	Bike Lane, add pavement no curb with construction	3.37
	Nursery Rd/Sagewood Dr	Grogans Mill Rd to Hanna Rd	Retrofit with paved shoulders	2.19
		College Park Dr/SH 242 to Gosling Rd	Bike Lane, widening on street with curb and gutter	1.00
	St Lukes Way	College Park Dr/SH 242 to Gosling Rd	Retrofit with paved shoulders	1.20
		Alternate extension from St. Lukes Way to Vision Park Blvd	Bike Lane, add pavement no curb with construction	0.70
	Vision Park Blvd/Shenandoah Park Dr	Grogans Mill Rd to David Memorial Extension	Bike Lane, widening on street with curb and gutter	1.32
	St Lukes Way	Alternate extension from St. Lukes Way to Vision Park Blvd	Bike Lane add pavement no curb with construction	0.70
Separated Shared Use Path in ROW of Grand Parkway	Vision Park Blvd/Shenandoah Park Dr	Grogans Mill Rd to David Memorial Extension	Bike Lane, widening on street with curb and gutter	1.32
		SH 249 to Kuykendahl	Shared Use Path	*
		Kuykendahl to Gosling Rd	Shared Use Path	1.71
		Gosling Rd to IH 45	Shared Use Path	4.48
		IH 45 to Rayford Rd	Shared Use Path	3.45
		Rayford Rd to Townsen Rd	Shared Use Path	2.08
		Townsen Rd to San Jacinto River	Shared Use Path	1.60
		San Jacinto River to US 59/IH 69	Shared Use Path	*
Spring Creek Greenway	Spring Creek	Kuykendahl Rd to Pruitt Rd	TBD	10.00
<b>TOTAL</b>				<b>77.32</b>

\*Not located within the SCMP study area.

# RECOMMENDATIONS

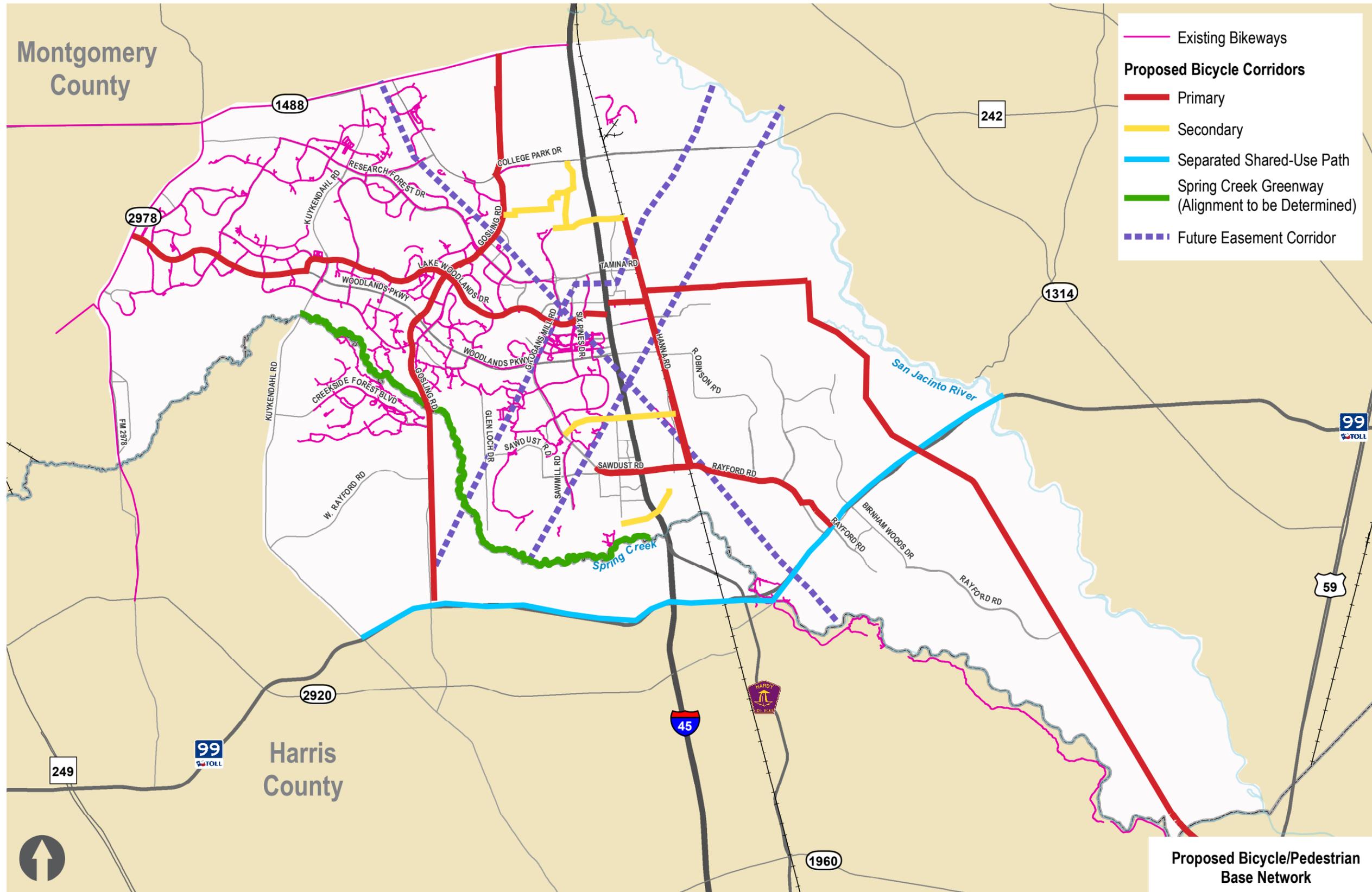


Figure 35: Bicycle/Pedestrian Base Network

# RECOMMENDATIONS

## COSTS AND BENEFITS

The total cost to implement the South Montgomery County Mobility Plan has been divided into short-term and long-term projects, as follows:

TABLE 23: COST ESTIMATE	
Estimate	
Short Term Cost Estimate	\$375.1 Million
Key Corridors:	\$207.2 Million
Additional Corridors:	\$167.9 Million
(Studies: \$23 Million, Roads: \$134.9 Million, Intersections: \$10 Million)	
Long Term Construction Cost Estimate*:	\$1.2 Billion
Bicycle/Pedestrian:	\$31.41 Million
<b>Grand Total Cost Estimate*:</b>	<b>\$1.6 Billion</b>

\*Construction cost only; does not include potential right-of-way acquisition cost and/or the relocation of utilities. Costs were based on 2014 dollars.

The benefits of the SCMP include:

- Improved travel time by developing a network of E/W and N/S roads that improve connectivity.
- Distributing traffic by providing alternative travel routes.
- Congestion mitigation by the use of access management techniques, aggressive incident management program, traffic signal optimization and the installation of dynamic message signals throughout the study area.
- Communities working together for better mobility in South County.

## IMPLEMENTING THE PLAN

There are many development tools and strategies available to local jurisdictions to implement the recommendations in this study. These items will be discussed with an emphasis on encouraging greater coordination of effort among local jurisdictions, private land developers, and other area stakeholders. In addition to the federal and state funding available through the H-GAC RTP/TIP process, local jurisdictions and stakeholders can utilize existing funding mechanisms or collaborate to create new ones where appropriate.

The State of Texas provides an array of tools to help local and county governments encourage and maintain the economic vitality of their jurisdictions. Tools applicable to the Study Area are described below.

1. *Tax Increment Financing (Tax Code, Chapter 311)* is a tool that local governments can use to publicly finance needed structural improvements and enhanced infrastructure within a reinvestment zone. These improvements are usually undertaken to promote existing businesses and/or to attract new business to the area.
2. Local Government Code Chapter 387 allows counties to create *County Assistance Districts* that are funded by a portion of sales taxes. Any county may adopt this sales tax, in all or part of the county, if the new combined local sales tax rate would not exceed 2 percent at any location within the district. A county may create up to four county assistance districts, but not more than one district may be created in a commissioner's precinct. The commissioners'

court may serve as the governing body of the district; or alternatively, the commissioners' court, by order, may appoint a board of directors to administer the district. A county assistance district may fund construction, maintenance or improvement of roads or highways; provision of law enforcement and detention services; maintenance or improvement of libraries museums, parks or other recreational facilities; promotion of economic development and tourism; firefighting and fire prevention services and provision of services that benefit the public welfare.

3. *Chapters 380 (cities) and 381 (counties) of the Local Government Code* grant cities and counties broad discretion to make loans and grants of public funds or the provision of public services, at little or no cost, to promote all types of business development including industrial, commercial and retail projects. Each agreement can be uniquely tailored to address the specific needs of both the local government entity and the business prospect.

4. *Public Improvement Districts (PID) (Local Government Code, Chapter 372)* offer cities and counties a means for improving their infrastructure to promote economic growth in an area. The Public Improvement District Assessment Act allows cities and counties to levy and collect special assessments on properties that are within the city or its extraterritorial jurisdiction. Additional financing options are available to certain large counties. PIDs may be formed to create water, wastewater, health and sanitation, or drainage improvements; street and sidewalk improvements; mass transit improvements; parking improvements; library improvements; park, recreation and cultural improvements; landscaping and other aesthetic improvements; art installation; creation of pedestrian malls or similar improvements; supplemental safety services for the improvement of the district, including public safety and security services; or supplemental business-related services for the improvement of the district, including advertising and business recruitment and development.

5. *Impact Fees* impose a charge on new development to pay for the construction or expansion of off-site capital improvements that are necessitated by and benefit the new development. Impact fees are authorized through the police power; not the taxing power. They are part of the development approval process. Requiring an impact fee to provide adequate public facilities is similar to meeting site planning and zoning requirements. Many builders and developers are impact fee proponents because they know that impact fees add predictability to the development approval process and create a "level playing field" between them and their competitors. They also know impact fees replace less fair negotiated exactions. (Source: ImpactFees.com)



# SUMMARY

# SUMMARY

## SUMMARY

Continued growth and development in South Montgomery County is severely straining the current road network. The existing conditions analysis revealed that most of the major transportation facilities in the area are over capacity during the morning and afternoon peak hours.

The traffic forecast for the South Montgomery County area shows a significant traffic growth for the short term period (0-5 years) period as well as for the long term period (5-25 years). The projected growth is due to new developments occurring within and outside the study area.

In order to address the traffic issues identified during the analysis, five mobility improvement strategies were crafted. These include improved access to Grand Parkway, improved local circulation along IH 45, improved east-west connectivity, improved north-south connectivity and the development of alternatives to IH 45.

The proposed improvements address the identified needs and improves access to homes, jobs, shopping, and entertainment by the general public. The recommendations fall into the following transportation improvement categories:

### Operational Strategies

- Traffic signal timing optimization
- Dynamic message signs
- Intersection widening
- New roadway interchanges

### Major Construction

- Roadway widening
- Roadway extensions
- New roadways
- Roadway grade separations
- Railroad grade separations
- New cycling/pedestrian facilities

After the consultant team developed a needs-based plan, the funding partners came together and worked as a team to identify 74 projects to be implemented in the short-term and long-term periods. These projects will be funded with provable local, state, and federal sources and implemented by Montgomery County Precinct 3, The Woodlands Township, The Woodlands Road Utility District (WRUD) #1, The City of Oak Ridge North, the City of Shenandoah, or the Texas Department of Transportation (TxDOT).

The short term recommendations consist of feasibility studies, route studies, environmental and schematic studies, intersection improvements, street widening, and area wide traffic management improvements. These traffic management programs include implementing an aggressive incident clearance program, employing a traffic signal timing optimization program, and installing dynamic message signs throughout the study area.

The short term recommendations were broken into two separate categories, Key Corridors and Additional Short Term Corridors. The short term key corridors were selected based on public input and the need for immediate congestion relief. The additional short term corridors consist of various types of studies, including feasibility, environmental assessments, route alignment and alternative analysis' as well as road construction projects that do not require additional right-of-way. The total cost for all the short-term recommendations is \$375.1 Million.

The long term recommendations consist of street widening, construction of new roadways and extensions, new cycling/pedestrian facilities and grade separations. These improvements to the transportation network have been identified as necessary to handle the anticipated future traffic demand on the area's transportation network. (Note: Bicycle accommodations are recommended on all new or widened facilities. The type of accommodations will be determined by implementing entities and their partners during the design process.) The total cost for all the long-term recommendations is \$1.2 Billion. The total for all projects is \$1.6 Billion.



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