League City Texas

LEAGUE CITY 2018
MASTER MOBILITY PLAN UPDATE

Final Report

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Plan Definitions

The following plan definitions were developed to provide guidance on planning concepts utilized in the development of the League City Master Mobility Plan.

Thoroughfare Plan – A thoroughfare plan is a long-range plan that identifies right-of-way (ROW) for the location and type of roadways needed to meet future transportation system demands. It is based on existing and forecasted employment and population growth and considers existing system needs.

Capital Improvement Plan (CIP) – A CIP is a short-term plan that identifies capital infrastructure projects or purchases and includes an implementation schedule and funding options.

Metropolitan Transportation Plan (MTP) – An MTP is a comprehensive and multi-modal regional transportation plan designed to meet long-range transportation needs.

Average Annual Daily Traffic (AADT) - AADT is the total volume of vehicle traffic on a particular roadway or road segment divided by 365 days.

Average Daily Traffic (ADT) - ADT is the number of vehicles traveling along a roadway or road segment in a 24-hour period, greater than a day – but less than one year.

Traffic Volumes – Traffic volumes provide an estimate of the amount of traffic on a roadway or road segment during a particular time period. The estimate is based on several factors, including, but not limited to, the existing and projected population and employment in an area.

Traffic Counts – Traffic volumes provide the actual number of vehicles passing a particular point in a roadway over a specified period of time.

Level-of-Service (LOS) – is a qualitative measure of traffic congestion, ranging from A, free flow traffic, to F – which is gridlock.

Functional Classification of Roads – Roadways are classified by their overall function in terms of how they move traffic between origins and destinations, and the level of access to adjacent land uses. Typical classifications include major arterials, minor arterials, collectors, highways, and local roads.

Freeways/ Highways – The freeway is the highest capacity thoroughfare in the transportation system. This thoroughfare usually requires 400 feet or more right-of-way and has partial control of access from the adjacent land and streets. Access is restricted to widely spaced interchange points (typically one (1) mile apart) and land adjacent to the freeway is usually accessed by a parallel frontage road that is separated from the main freeway lanes. All thoroughfare crossings are grade separated.

Major Arterials – Major arterials are ideally designed to accommodate large volumes of traffic and operate at a high level of mobility. A major arterial is designed for longer distance trips and provides access to major activity centers and adjacent cities. There should be a limited number of driveways directly accessing major arterials, and they should only connect to other primary arterials or freeways.

Minor Arterials – Minor arterials connect traffic from collectors to primary arterials. They are designed to accommodate moderate traffic volumes at relatively low speeds, and often extend to a larger geographic area. In certain situations, minor arterials may accommodate on street parking. Minor arterials should be the primary access route for higher density multi-family developments.

Collector – Collectors are designed for short trips and low speeds. Their primary function is to collect and distribute traffic from local access streets to the arterial system. This thoroughfare is usually positioned to not attract through traffic movements.

Residential/ Local Street – Local streets facilitate trips within residential areas and to collector streets. Only vehicles having an origin or destination on the local street are usually attracted to it.

Cross-section – A cross-section provides an illustration of a roadway's dimensions in terms of width, number of lanes, and overall all right-of-way. They also indicate the dimensions and presence of medians, sidewalks, on-street parking, and other roadway elements.

Median – A median is a strip of land designed to separate opposing lanes of traffic on a roadway. Medians may be raised with curbs, vegetated, and/or striped.

Right-of-Way (ROW) – ROW, in terms of transportation, is an area of land designated for roadways, utilities, trails and other public infrastructure elements. The width is generally determined by the pavement section required to accommodate the traffic and perform the function for which the roadway is designed. Other considerations of right-of-way include safety areas, sidewalks and utility locations. The land is dedicated or deeded in fee simple to the perpetual use of the public or other specified entity.

Shoulder – A shoulder is the portion of the roadway contiguous with the traveled way for accommodation of stopped vehicles, for emergency use and for lateral support of sub-base and surface pavement. Roadway shoulders shall be constructed adjacent to all pavement edges that are not curbed.

Sidewalk - Sidewalks are primarily pedestrian off-street facilities located between the curb line of the roadway and the adjacent property. They are an integral part of the thoroughfare network, improving pedestrian access to business and residential development, and improving overall mobility.

Stopping Sight Distance – Stopping site distance is the length of roadway a driver needs to be able to see to stop before colliding with an object on a roadway. It is composed of two parts:

1. Brake reaction distance, the distance in which the vehicle travels from the time the driver sights an object to the time the brakes are applied, and
2. Braking distance, the distance required for the vehicle to stop after the brakes are applied.

Stopping sight distance should be adequate at every point along a roadway for drivers to come to a safe stop before reaching the object.

Vertical Clearance – Vertical clearance is the minimum height a bridge structure can be to accommodate passing trucks. The minimum vertical clearance for freeway and arterial facilities, according to AASHTO guidelines is 16 feet. Consideration should be given to future roadway resurfacing which would decrease the clearance provided.

Primary Truck Route - Primary truck routes include roadways that connect to major gateways, ports of entry, and freight generators. Most of these routes are listed among FHWA's highways of national significance.

Secondary Truck Route - Secondary routes provide connections to rural areas and energy sector corridors. Energy sector corridors are roadways (located in identified energy sector areas) frequented by heavy trucks and other automobiles that service the oil and gas industry.

Travel Demand Model (TDM) – A TDM is a computerized representation of a community or region's transportation system. TDMs use land use and demographic forecasts to simulate the movement of commuters throughout a transportation network under various conditions. TDMs include the following steps:

- Trip Generation - the number of trips produced and attracted to a destination or TAZ based on trip purpose.
- Trip Distribution – the estimation of the number of trips between each TAZ, i.e., where the trips are going.
- Modal Split – the prediction of the number of trips made by each mode of transportation between each TAZ.
- Traffic Assignment – the amount of travel (number of trips) loaded onto the transportation network through path-building. This is used to determine network performance.

Traffic Analysis Zone (TAZ) – TAZs specific demographic and land use data associated with them and are used to determine trip demand and travel patterns

Design Speed – Design speed is the maximum safe speed maintainable over a specified section of street. It is a design standard based on geometric design elements, terrain, land use to be served, roadway type, anticipated traffic volumes and economic factors. Design speed does not reflect the speed that should be used for a particular roadway type and is generally higher than speed limits.

Traffic Delay – The additional travel time added to a vehicle or pedestrian trip due to conditions that impede the desirable flow of traffic. It is measured as the time difference between actual travel time and free-flow travel time

Traffic Signal Warrant Study – A traffic signal warrant study determines of traffic conditions, such as volumes, geometry, or other conditions are averse enough to justify installation of traffic signalization.

Roadway Right Sizing – Roadway sizing adjusts the number of lanes on a roadway or segment to accommodate projected traffic volumes.

Road Diet – Road diets reduce the number of travel lanes on roadway to accommodate other systematic roadway improvements such as turning lanes and bike and pedestrian accommodations. Road diets are typically only used on roadways with adequate capacity to accommodate existing and projected traffic volumes. Road diets can occur without reducing the overall right-of-way on a facility. Road diets re-purpose auto lanes on a street from serving through auto traffic to accommodating other uses, including center turn lanes, bicycle lanes, and sidewalks.

Bike Trail – A bike trail is an off-street bike route.

Shared Use Path – A shared use path is an on or off-street facility separated by a barrier or open space that is designed to accommodate all non-motorized modes including pedestrians, bicyclists, skaters, and joggers.

Shared Lane or Sharrow – Sharrows are painted emblems or "share the road" signs that indicate to drivers that bicyclists has equal access to the travel lane.

Flood Plain – A low lying area, typically adjacent to a river or creek, that is subject to flooding.

Impact Fee – An impact fee is a fee imposed by a local government on new or proposed development to pay for all or a portion of the cost of providing services to the new development.

Headway – Headway is the frequency of service on a particular transit route.

Choice Rider – A choice rider is a commuter who owns an automobile, but chooses to utilize transit.

Park and Ride Station – a transit station, typically a suburban bus station, where commuters park their vehicles and utilize public transportation to travel to the city center.

Chapter 1: Introduction

The transportation network is one of the most vital and visible elements of a city. Through a number of modes, it provides access to housing, employment, entertainment, and other resources vital to the well-being of a city. The overall all goal of a thoroughfare network is mobility. The system should be able to efficiently move commuters to and from destinations in any sector of the city.

Some of the keys to an efficient network are seamless connections between major destinations, easy access to and from major road facilities, and efficient access to local land uses. One of the most important – and often unappreciated benefits of a thoroughfare network – is the ability to provide a framework for economic development. The network should not only accommodate development but help shape it. The following plan was developed to improve connectivity within League City, better accommodate the planned growth and development, and improve travel conditions within the city.

Purpose of the Plan

The purpose of the League City Master Mobility Plan Update is to retrofit the 2011 Master Mobility Plan with up-to-date travel demand model analyses and improve long-term transportation connectivity and access and create a more efficient framework for economic development. The Master Mobility Plan Document includes transportation policy, goals and objectives, and implementation strategies to guide the growth and development of the thoroughfare network. The Mobility Plan Map is the long-term illustration of the thoroughfare network with identified general alignments and rights-of-way for future preservation.

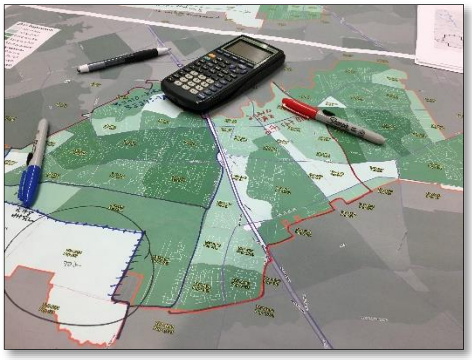
The League City Master Mobility Plan update was coordinated with other adopted city planning documents, as well as those from adjacent cities and regional agencies. The plan identifies current deficiencies in the existing network and is used as a basis to help guide the development of a comprehensive citywide thoroughfare system. Because the Master Mobility Plan guides the preservation of rights-of-way needed for the development of long-range improvements, it has far-reaching implications on the growth and development of both developed and undeveloped areas.

As one of the most visible and permanent public investments for the city, it is critically important for the plan to align roadway and right-of-way needs for facility implementation and to maximize the potential for economic development. This long-term plan will be a catalyst for private development in the city and inform decisions on transportation infrastructure needs, maintenance, and facility placement. As development occurs, it becomes increasingly difficult to make changes to the thoroughfare network without significant cost and disruption.

By identifying and preserving rights-of-way along existing corridors and connecting planned developments, stakeholders can maximize the economic return on transportation investments. The plan considers current conditions, stakeholder input, City goals and objectives, H-GAC's Metropolitan Transportation Plan, and other input from TxDOT and regional and local agency documents.

City Profile

League City is located in the southeast sector of the Houston-Woodlands-Sugarland metropolitan area. The city's population has dramatically increased in the past 30 years, growing from 30,000 in 1990 to over 100,000 in 2016. With the addition of planned developments in the southwest sector of the city, population is projected to more than double to over 220,000 residents by 2040. The projected population increase not only signals more rooftops, but potential demand for more diversified housing options as the city becomes denser. This, coupled with more employment opportunities within the city, will increase the amount of traffic on the already highly traveled network. The following section provides a summary existing and projected demographics within the city.



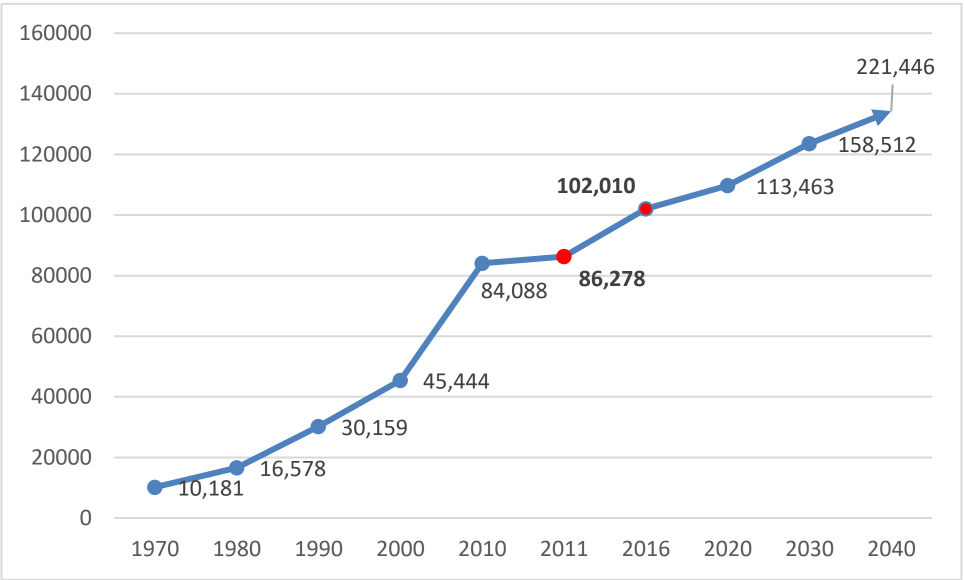
It is important to note that the population projection numbers below were not used to inform the travel demand model. Travel demand model demographics were developed through a separate exercise prior to adoption of the demographics below. The following demographics were utilized in the plan document to comport with the City's future land use plan update and capital recovery fee land use forecast.

Demographics

Current demographics were examined to strategically plan for the League City's future transportation system. Understanding who and what League City is today will help the City better understand the needs and desires of existing residents. Factors such as population, age, and income impact transportation choice and the level of stress placed upon the transportation network. This information will be used to determine volume of people using the transportation system, where they need to go, and the types of transportation they will require to get there.

Figure 1 illustrates population growth from 2000 to 2040. Since adoption on the 2011 Master Mobility Plan, forecasted population has increased 18 percent. More importantly, since 2010 the city's population has increased nearly twice as fast as the county and the region as a whole.

Figure 1. League City Population Projection



Source: 2010 Census and FNI Calculations

Table 1. League City and the Region Population Growth Comparison

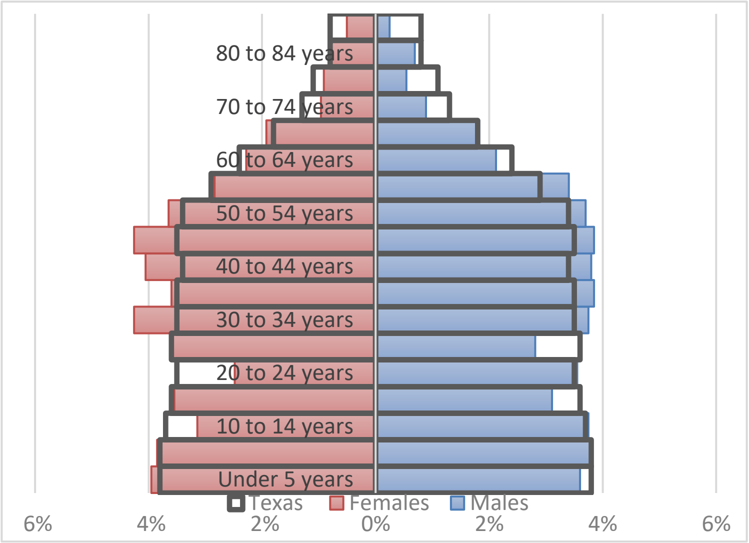
Location	2000 Census	2006 Estimate	2010 Census	2016 Estimate	2010-2016 Growth
League City	47,406	64,097	83,471	102,010	22%
Galveston County	250,155	278,865	291,309	322,054	11%
Harris County	3,400,577	3,855,800	4,092,459	4,555,625	11%
Houston MSA	4,669,545	5,434,389	5,891,999	6,647,828	12%

Source: US Census, American Community Survey, PCensus, CDS Community Development Strategies

Age and Gender

Figure 2 depicts the distribution of age and gender within League City compared to the state. Overall, age and gender within the city and state are similar. However, the City has a lower percentage of residents between ages 10 and 29 and a higher percentage of residents between 30 and 60. What stands out, however is the large percentage or residents (30 percent) between 25 and 44 years old, which as key family formation years. This potentially indicates the need for additional family friendly amenities, such as parks, schools, trails, and entertainment venues.

Figure 2. League City Age/Gender Cohorts and Population Pyramid



Source: 2010 Census

These findings are consistent with the regional trend of families seeking to live outside of the urban core and taking advantage of both urban amenities, such as retail and employment opportunities, and rural suburban benefits, such as a decreased cost of living. Another important discrepancy between the League City and the state is the percentage of residents over 85 years old. Given the increased life span of Americans, and projected population growth within the city, additional investments in ADA accessible sidewalks, walking trails, assisted living facilities, and other senior amenities may be needed in the future.

Overall, League City has a well dispersed population in terms of age and gender. However, efforts to improve and attract higher education and employment opportunities would help draw and retain 20-29-year-olds. Ample opportunities and a balanced population will make League City an attractive place to live for all ages, and it will create the potential for life-cycle housing and infrastructure. Providing transportation solutions for people of all ages could include safe routes for children through school zones, connectivity to regional amenities for families, efficient thoroughfares for commuters, and connectivity to healthcare and community facilities for those aging in place.

Race and Ethnicity

Considered alone, race and ethnicity help illustrate the makeup of League City but do not provide insight as to the needs or desires of residents. However, the information can be cross-referenced with income data to better understand socioeconomic breakdowns and corresponding transportation needs.

Overall, League City is fairly homogeneous in terms of racial and ethnic diversity. According to **Table 2** and **Figure 3**, almost 66 percent of the population identified as White, roughly 19 percent identified as Hispanic or Latino, and about 35 percent identified as a race other than White. These trends are also consistent across individual sections of the City.

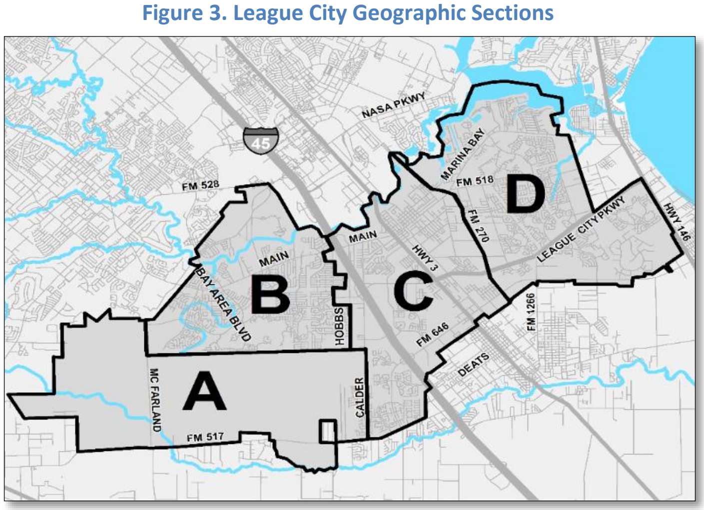
Table 2. League City Race and Ethnicity

Race	Percent of Total Population	Section A	Section B	Section C	Section D
White *	65.5%	65.6%	65.0%	56.7%	73.1%
Black *	6.9%	6.8%	6.0%	9.8%	5.5%
Asian *	6.4%	5.7%	8.0%	7.1%	4.4%
Other *	2.6%	1.9%	2.9%	2.6%	2.4%
Hispanic	18.5%	20.1%	18.1%	23.9%	14.6%

Source: US Census, American Community Survey, PCensus, CDS Community Development Strategies

Notes: * Non-Hispanic

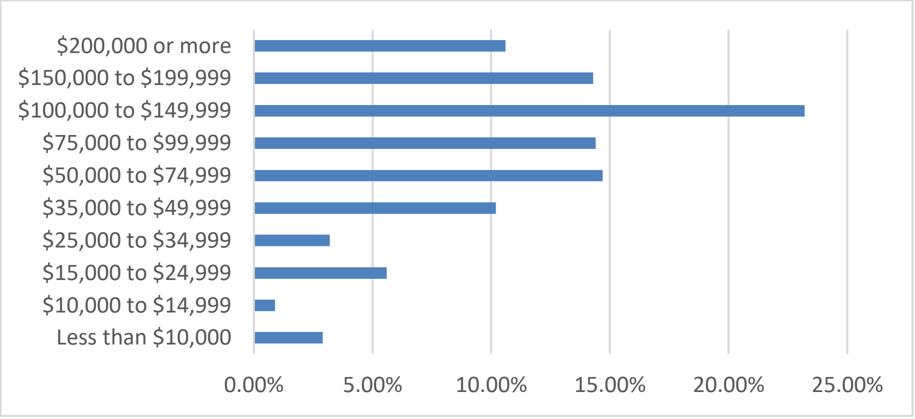
Figure 3. League City Geographic Sections



Income

It is important to understand income distribution as it is often an indicator of a community's car ownership levels, need for public transportation, and ability to finance public improvements.
The median income in League City is $104,736. This is greater than that of the State of Texas and the City of Dickinson, which are $51,900 and $68,324 per year respectively. The cities of Friendswood and Pearland are similar at $95,120 and $94,653 per year, respectively. It is important to note that median income is not a measure of average; instead, it signifies the exact middle value of all incomes earned by all households in a given jurisdiction. The average household income is $111,396.

Figure 4. League City Income Distribution



Source: 2009-2013 American Community Survey

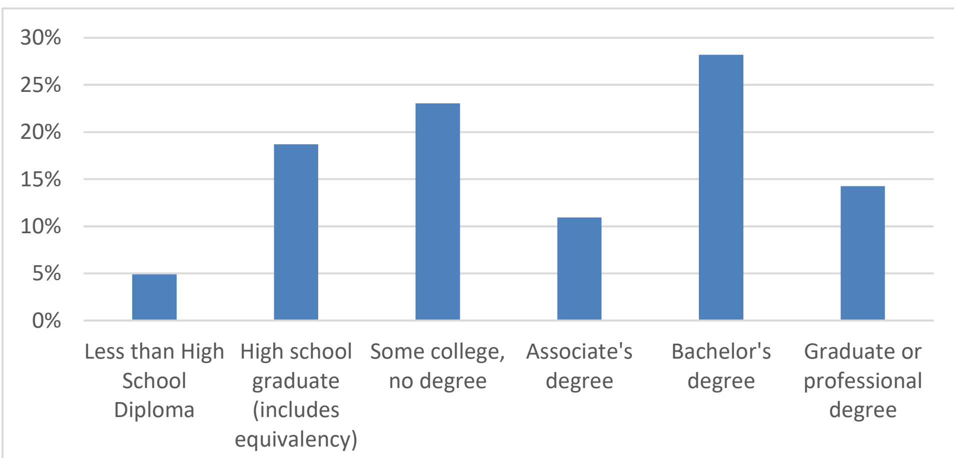
Figure 4 illustrates the distribution of household income in League City. Despite a high median household income ($104,736), about 13 percent of League City households earn less than $35,000 annually, with 4 percent of the city making less than $15,000 annually. This subset of the population, though small, will be important to consider as transportation planning progresses because it is the subgroup least likely to have adequate access to personal transportation. Addressing this portion of the community may require consideration for expanded public transportation or multimodal accessibility for those who walk or bike to work. For the roughly 50 percent of the population that earns over $100,000 annually, transportation planning could include ample roadway connectivity and capacity for those who commute to or from neighboring cities.

Educational Attainment

Considered alone, educational attainment has seemingly little correlation with transportation planning. However, it does have a direct correlation with earned income, which impacts transportation planning. Educational attainment helps provide background to the abilities and needs of a community's workforce. That workforce greatly influences the jobs and industries that are attracted to a community, and those different industries have a wide range of transportation needs.

Educational attainment can also be an indicator of educational offerings in a community, and the location of schools often drives development patterns and therefore roadways.
League City residents are well educated; 95 percent of residents over the age of 25 have at least a high school diploma and about 76 percent have attended college. Nearly 43 percent have obtained at least a bachelor's degree.

Figure 5. Educational Attainment



Source: 2009-2013 American Community Survey

Plan Input

Town Hall Meeting

A town hall meeting to glean input on the initial draft of the Master Mobility Plan was held on January 11, 2018. Residents provided feedback on the plan recommendations including the draft mobility plan map, roadway alignments, functional classifications, and associated right-of way designations throughout the city. Approximately 50 persons attended and heard an overview presentation followed by break-out sessions to receive public comment.

Key feedback/ concerns included:

- Landing Extension
- Palomino Bridge/ Roadway Improvements
- Main Street Congestion
- Southwest League City Network Additions

League City Staff Input

League City staff provided input and feedback throughout the planning process, providing guidance on network and demographic amendments, transportation issues and needs, and proposed development plans throughout the city. Staff Input meetings were held with League City staff between November 2016 and April 2017 and included guidance on inputs to the travel demand model, new and amended roadway alignments, and planned developments within the city. In addition to the meetings, various conference calls were had throughout the planning process to ensure plan recommendations were in alignment with League City's long-term vision.

League City Transportation and Infrastructure Committee

A meeting was also held with the League City Transportation and Infrastructure Committee to gather input on the plan approach, preliminary recommendations, initial travel demand model results, and overall transportation system connectivity.
Key feedback/ concerns included:

- Main Street Congestion
- Base 2015 and 2040 Projected Volumes and Level-of-Service
- Critical Intersections

Previous Planning Efforts

League City Plans

League City Subdivision and Development Ordinance

The City's Subdivision and Development Ordinance provides detailed design requirements for rights-of-way, private streets, and points of access. The regulations specifically recognize the Master Transportation Plan as the guiding document from which service levels and roadway designs are determined, as well as decisions that impact circulation and extension of main thoroughfares within subdivisions. Because of this, it is important to update the subdivision ordinance as the Master Mobility Plan is amended over time.

League City Main Street Implementation Plan
In 2012, League City adopted the Main Street Implementation Plan: A Livable Centers Study to focus on revitalization efforts along Main Street and in the Historic District. The implementation plan specifically focuses on assessing the feasibility of various development concepts, catalyst areas, and making specific recommendations for projects and strategies to be implemented over the short- and long-terms.

Source: League City Main Street Implementation Plan

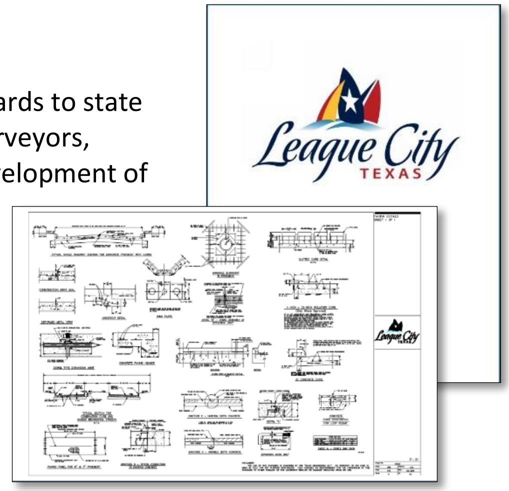
The primary connectivity and walkability goals of the Livable Center Study include:

- Maximize corridor and intersection mobility for multi-modal use
- Maximize walkability
- Minimize impact of additional traffic on existing land uses and context

The study included a transportation analysis that included a detailed examination of Main Street in its function as a regional roadway as well as its ability to serve the local traffic and businesses as a destination along the mile stretch through the Historic District. The plan resulted in recommendations and design options for the redesign of Main Street that address walkability and commuter issues identified in the existing conditions assessment. The three options included a three-lane road diet, four -lane road diet, and Intelligent Transportation System (ITS) integration and reversible lanes. The study also addresses changing uses in League Park that will have implications on access management.

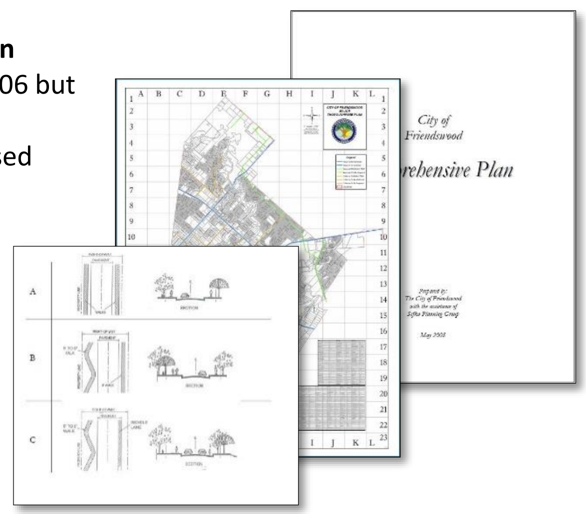
League City General Design and Construction Standards

It is the intent of the General Design and Construction Standards to state the requirements for sub-dividers, developers, engineers, surveyors, realtors, and other parties interested and involved in the development of land. The Standards provide the general requirements of the Engineering Department for designing public storm sewers, drainage facilities, water lines, paving, and sanitary sewers within the City and its ETJ, as well as the roadways, driveways, and rights-of-way. The document provides specifications, including lanes, ROW, Medians, intersection, etc. for each functional classification. The document will need to be updated to comport with the recommendations from the Master Mobility Plan.

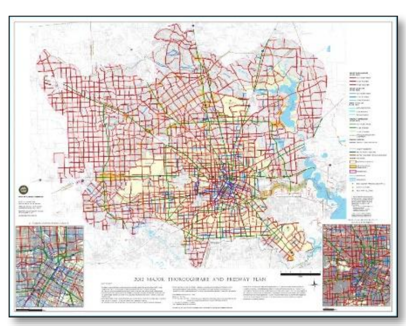


Adjacent City Plans

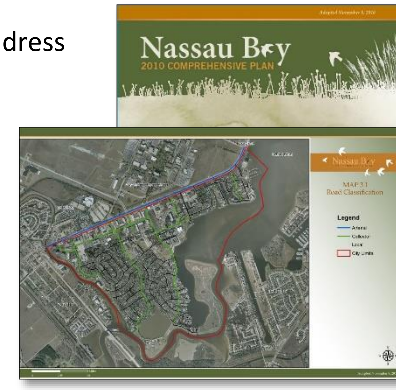
Friendswood Thoroughfare Plan and Comprehensive Plan
The Friendswood Thoroughfare Plan was developed in 2006 but was updated as part of the 2008 Comprehensive Plan. It includes recommendations on intercity connections, revised functional classifications, and a transportation system management plan. Both League City and Friendswood's plans for regionally significant roadways, such as FM 518 (Main Street) League City Parkway, and Bay Area Boulevard that should be coordinated from a regional perspective to ensure efficient traffic flow, growth, and development between the two cities. Recommended functional classifications include: Major Thoroughfares, Collectors, Commercial, Boulevards, and Minors.



Houston Thoroughfare Plan
Given its size and proximity to League City, City of Houston plans, particularly in its southwest sector, have a significant impact of League City's thoroughfare network. Planned expansions for facilities such as IH-45, have a direct impact on congestion and traffic flow in League City. The spillover growth from Houston into League City will also impact future development and travel patterns in League City.



Nassau Bay Comprehensive Plan



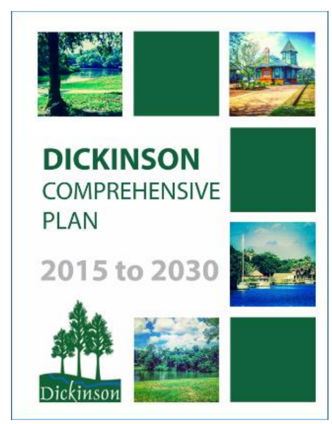
The City of Nassau Bay adopted its Comprehensive Plan in 2010 to address concerns with future growth and development. The plan provides strategies and short- and long-term actions to implement the city's 20+ year vision. It includes a future land use analysis with guidelines on land use intensity, transportation, infrastructure, governance, economic development community beautification, public facilities, and parks/open spaces.

The primary purpose of the Nassau Bay Comprehensive Plan is to:

- Lay out a "big picture" vision regarding the future growth and enhancement of the community.
- Simultaneously consider the entire geographic area of the community, including areas where new development and redevelopment may occur.
- Assess near- and longer-term needs and desires across a variety of inter-related topics that represent the key "building blocks" of a community (i.e. land use, transportation, urban design, economic development, redevelopment, housing, neighborhoods, parks and recreation, utility infrastructure, public facilities and services, etc.).

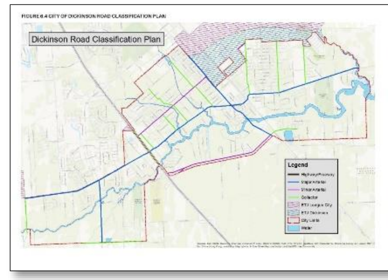
The Nassau Bay Comprehensive Plan presents a Road Classification map that categorizes the City's existing street network into typical functional classes (arterials, collectors, and local streets), citing roadway design standards for each that accommodate the uses and users along the respective roadways. It is important to consider the Nassau Bay Comprehensive Plan and Road Classification map to ensure adjacent properties are adequately served by inter-city connections.

Dickinson Comprehensive Plan



The Dickinson Comprehensive Plan provides a long-term outlook to 2030 and specifically addresses transportation in Chapter 6 of the document. The chapter provides an efficient and structured framework for planning and guiding the rational and orderly development of the City of Dickinson's thoroughfare system, including Interstate Freeways, Minor Arterials-Major Roads, Major Collector-Frontage Roads, and Local Streets, to accommodate future growth and development. It works alongside the Future Land Use Plan and includes an overview of existing facilities and services, analysis of travel characteristics and development of the thoroughfare system plan. Dickinson has many proposed roadway improvements and proposed hike and bike trails that could have direct impacts on connections to League City and roadway usage across Highway 45, SH 3, FM 646, and FM 1266.

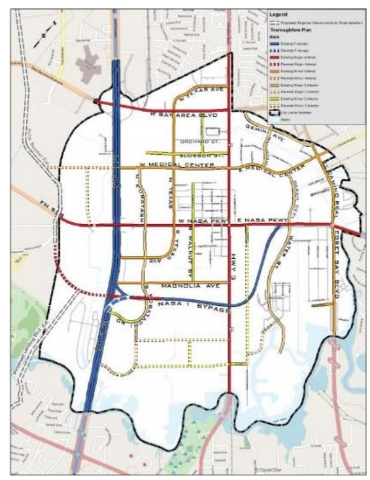
Dickinson Comprehensive Plan Goals for Transportation:



1. Improve citywide mobility to accommodate present and future transportation needs
2. Ensure adequate connectivity and access throughout the city.
3. Reduce traffic congestion, improve safety of traveling public, and increase level of service in main traffic corridors.
4. Increase opportunities for multi-modal connectivity throughout the City and region.
5. Promote citywide pedestrian mobility and livability.
6. Enhance regional mobility and connectivity options through public transportation

Webster Comprehensive Plan

The City of Webster's thoroughfare plan, originally developed in 2001, was updated as part of its 2014 comprehensive plan. The plan includes revised functional classifications and right-of-way designations and incorporates planned League City facilities such as the proposed Landing Extension and NASA Bypass. Coordination between League City and Webster will be pivotal to the implementation of these two projects. Transportation chapter elements also include recommended bike and pedestrian routes and transit options.



SH 99 Environmental Document (EIS Summary)

SH 99 serves nine cities, including League City, Alvin, Iowa Colony, Hillcrest Village, Manvel, Dickinson, Santa Fe, Friendswood, and Liverpool. Traveling from west to east along SH 99, the density and development pattern would increase, and there would be a greater diversity of land use with commercial uses developing along the corridor—along with industrial, residential, and government/medical/education facilities. The proposed SH 99 alignment will likely induce additional development in areas where infrastructure elements, such as water, wastewater, and electrical utilities are present, or could be reasonably extended.

Land use changes, which would include the construction of buildings, streets and roadways, parking areas, walkways, and other developed facilities, would likely occur in League City—which would result in the removal and reduction of natural vegetation and permeable surfaces, ultimately affecting the patterns of stormwater runoff and drainage needs. The EIS provides extensive discussion regarding the potential impacts to water quality and vegetated areas, as well as the conservation of wetlands and air quality. It will be critical for the Mobility Plan to consider the positive and negative impacts that increased access via SH 99 will yield—bringing additional development and thus an increasing number of users to the local network. Long-term implications are incorporated into this plan.

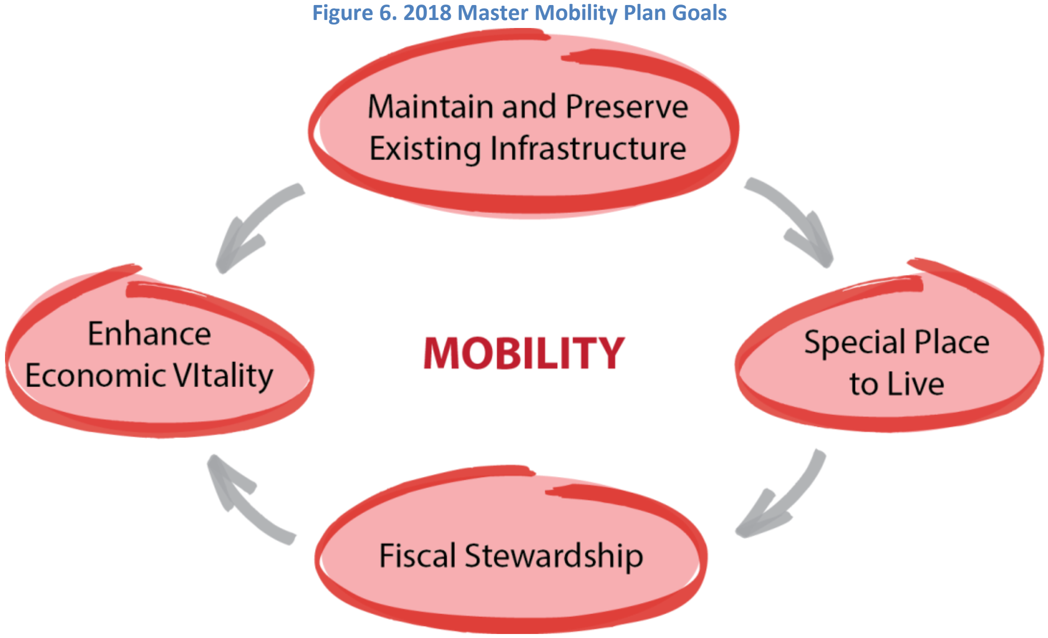
Chapter 2: Goals and Objectives

Objectives
- **Specific**
- **Measurable**
- **Achievable**
- **Relevant**
- **Time Oriented**

The Goals and Objectives section of a Mobility Plan reflects the ideology and aspirations that a city desires of its transportation system. Goals are philosophical in nature and serve as a vision of what transportation should be in the future. The objectives discussed in this section are action oriented and are intended to create the framework for specific strategies to achieve the stated goals. Objectives should be: **S**pecific, **M**easurable, **A**chievable, **R**elevant, and **T**imely.

The goals and objectives for the League City Master Mobility Plan Update were adopted from the guiding principles developed for the 2011 plan, and refined and redeveloped under the umbrella of the following categories: Mobility, Preservation and Maintenance of Existing Infrastructure, Enhance Economic Vitality, Fiscal Stewardship, and Special Place to Live. The 2011 guiding principles, listed below, reflect the city's long-term mobility vision.

Figure 6. 2018 Master Mobility Plan Goals



2011 League City Master Mobility Plan Guiding Principles
- Effieciently and safely move people and goods
- Connects destinations
- Offers travel options
- Respects and enhances context and character
- Adds to community marketability

GOAL 1 | MOBILITY

Mobility is the essential goal and purpose of any thoroughfare system, moving people and goods within and through the transportation network. Improving mobility is essential to the overall well-being of League City because as city grows and develops existing burdens such as congestion, truck traffic, and limited east to west connectivity, will only be exacerbated. The following mobility objectives were developed to address mobility concerns within the city.

The tenets of mobility include:

- A seamless system of transportation options and solutions that accommodates all users.
- A range of accessible and convenient, multi-modal transportation choices that provide connections between cities, neighborhoods and employment centers throughout the region.

Guiding Principles:

- Effieciently and safely move people and goods
- Connects Destinations
- Offers Travel Options

1. **Identify roadways for improvement that will enhance and improve access to employment and activity destinations within League City and neighboring communities.**
   Objectives:

   1.1 Improve the ease of access to residential and commercial destinations within the city.
   Action and Performance Measures:
   - Develop access management strategies for roadways connecting adjacent development areas and residential communities.
   - Develop access management strategies for commercial corridors including, but not limited to intersection, speed, and traffic calming.
   - Identify and evaluate key traffic generators and special destinations based on traffic counts and projected volumes on connecting roadways to gage the impact of plan recommendations.

   1.2 Monitor regional transportation systems and agency planning efforts to ensure proactive responses to issues affecting League City.
   Action and Performance Measures:
   - Develop a matrix of potential funding sources for transportation improvements.
   - Develop a matrix of needed capital improvement projects to be evaluated in the regional travel demand model, prioritized, vetted through TxDOT and H-GAC, and incorporated into the regional mobility plan.

- Provide a yearly status report to the League City Transportation and Infrastructure Committee detailing the long-term progress/ status of capital improvement projects to ensure projects are progressing and/or transportation funds are obligated to projects that can be implemented during their projected capital improvement period.

1.3 Plan and implement new and/or improved roadways to effectively accommodate vehicular traffic within the city and throughout the region.

Action and Performance Measures:

- Develop a matrix of recommended prescriptive roadway improvements to improve connectivity within the city.
- Evaluate recommended roadway improvements in the travel demand model to determine the facilities' impact on the overall transportation network in terms of vehicle miles traveled (VMT), level-of-service, traffic volumes, and/or changes to rate of vehicles collisions per 1,000 vehicles per day.

1.4 Plan and implement strategic transit, bicycle and pedestrian mobility options for residents traveling within the city and adjacent communities.

Action and Performance Measures:

- Assist transit agencies in the identification of additional park and ride locations based on projected population and employment growth areas around the city.
- Identify potential additions to the bike and pedestrian network and incorporate intercity connections to adjacent community networks in order to bolster League City's overall non-motorized network.

2. Provide a transportation system that will effectively and economically serve the existing and projected travel needs of the city in a safe and efficient manner.

Objectives:

2.1 Develop a coordinated and unified thoroughfare network that takes into account the concerns of all system users.

Action and Performance Measures:

- Coordinate and incorporate existing development plans into the revised thoroughfare network.
- Incorporate adjacent city thoroughfare plans into the League City thoroughfare plan to maintain and improve regional connectivity.
- Coordinate with adjacent Cities at the end of the mobility planning process to ensure consistency to create more seamless network connectivity.

2.2 Identify and enforce designated truck routes to reduce the amount of through truck traffic on commercial corridors and residential areas.

Action and Performance Measures:

- Develop roadway maintenance prioritization criteria for known truck corridors based on identified pavement conditions and/or load zone rating.

- Recommend truck routes to divert truck traffic away from commercial corridors, residential areas, and load zoned roadways.
- Conduct annual traffic counts in identified high truck traffic corridors and measure the change in the percentage of trucks on identified high truck traffic corridors.

2.3 Develop a plan that prioritizes overall connectivity within the city.
Action and Performance Measures:

- Reduce overall Vehicle Miles Traveled (VMT) within the city by creating more direct routes between major destinations within the city.
- Define transportation improvements to reduce forecasted 2040 Level-of-Service (LOS) F roadways to LOS DE or better.
- Conduct annual traffic counts to measure short and long-term changes in level-of-service and congestion.

2.4 Improve roadway safety.
Action and Performance Measures:

- Identify and assess critical and high accident intersections to determine mitigation strategies to reduce collisions.
- Identify strategies to reduce traffic accidents along congested corridors.
- Identify safety concern areas and develop specific mitigation strategies to improve overall driving conditions within the city.
- Utilize crash records from TxDOT's Crash Record Information System (CRIS) to identify high crash locations and measure changes in the number of crashes as safety improvements are implemented.

2.5 Identify feasible east to west roadway alignments to improve connectivity across IH45 and direct north to south facilities to improve connectivity in the western segment of the city and to serve as backage roads and provide congestion relief for IH45.
Action and Performance Measures:

- Conduct detailed planning studies to identify potential alignments for advancement to the environmental documentation and conceptual schematic planning.
- Evaluate recommended east to west corridors in the travel demand model to measure their individual performance and overall impact on the city's thoroughfare network.

2.6 Identify long-term transit feasibility and needs within the city.
Action and Performance Measures:

- Determine the most effective location of commuter rail station within League City Limits.
- Develop transit routes that connect to adjacent city fixed route transit networks such as Houston Metro, Connect Transit in League City and Dickinson, and Harris County Transit Service.

- Utilize ridership (or projected ridership) numbers to gage the effectiveness of routes.

2.7 Increase the number of direct alternative connections between League City, adjacent cities, and major destinations throughout the region.

Action and Performance Measures:

- Identify alignments for east-west backage roads to parallel major inter-city/ regional corridors within the city for traffic mitigation and improved connectivity.
- Evaluate the impact of inter-city/ regional backage roads on the overall city network and adjacent city facilities by measuring the change in volumes and level-of-service on major arterial or higher classified facilities after construction of recommended backage roads.

2.8 Maintain a hierarchy of thoroughfare classifications that will provide for safe and convenient flow of traffic throughout the city.

Action and Performance Measures:

- Develop transitionary thoroughfare standards for roadways aligned between adjacent cities to ensure more seamless connectivity.
- Maintain a transportation planning process to ensure efficient and desirable connections between arterial class facilities and other major thoroughfares.

2.9 Coordinate with the Clear Creek, Dickinson, and Friendswood, Alvin, and Santa Fe ISDs on transportation system implications of proposed school facility expansion/needs.

Action and Performance Measures:

- Identify school bus routes within League City.
- Identify the location of future school sites and anticipated bus routes.
- Assess existing school bus routes in terms of accessibility to residential areas, congestion, maintenance, and safety.
- Evaluate changes in level-of-service, traffic collisions, and traffic volumes along identified school bus routes to gage the impact school bus routes and sites have on the overall transportation network.

2.10 Promote integration between transportation and land use development.

Action and Performance Measures:

- Incorporate master planned developments activities into the transportation planning process to promote connectivity with other planned facilities in adjacent areas.
- Develop a matrix of roadway treatments/characteristics that may be applied to roadways to better accommodate different land uses.

GOAL 2 | PRESERVATION AND MAINTAINENCE OF EXISTING INFRASTRUCTURE

The tenets of Preservation and Maintenance of Existing Infrastructure include:

- Prioritize maintenance, rehabilitation, reconstruction and safety.
- Investments that balance the transportation needs of local communities.
- Community viability through maintaining streets, sidewalks, utilities, storm water systems and other infrastructure facilities.

Guiding Principles: Effectively and safely move people and goods

1. Upgrade and improve existing transportation infrastructure to enhance system carrying capacity, reduce congestion and minimize accidents.

Objectives:

1.1 Identify structurally deficient corridors and bridges for inclusion in a database that prioritizes roadway improvements by level of deficiency, current and projected traffic volumes, and cost of maintenance and repairs.

Action and Performance Measures:

- Develop a roadway performance index that allows the City to assign points to key roadways to indicate adequacy and maintenance thresholds.
- Dedicate adequate resources to maintain existing roadways, bridges and other infrastructure components at or above established minimum conditions standards.
- Utilize the performance index to evaluate the long and short-term to determine long and short-term changes in the overall condition of League City Roadways.

1.2 Identify future points of congestion along existing major corridors and develop potential mitigation strategies to better accommodate projected volumes.

Action and Performance Measures:

- Utilize initial travel demand model or Synchro outputs to pinpoint projected areas of congestion and deficiencies within the city.

- Define roadway improvements to reduce congestion (LOS DE) on major transportation corridors.
- Evaluate the impact of plan improvements of roadway LOS using Synchro and future travel demand model outputs.

1.3 Develop and prioritize a list of long and short-term transportation projects to address current and projected transportation needs within League City.
Action and Performance Measures:
- Identify keystone projects whose performance provide a basis to measure the impact of emerging network areas and can be used to leverage additional transportation dollars.
- Identify alignments for backage and frontage roads paralleling IH45 and SH99 that may be used to relieve congestion, facilitate economic development, and provide an alternative emergency evacuation route.
- Utilize future traffic counts and travel demand model outputs to gage the impact of plan improvements.

1.4 Identify existing roadways and/or intersections that can be realigned and widened to improve connectivity to major roadways and alleviate congestion.
Action and Performance Measures:

- Analyze congestion level of poor performing roadways and intersections to determine appropriate mitigation strategies.
- Identify routes frequented by emergency response vehicles to ensure adequate sizing to accommodate wider vehicles.
- Measure the change in level-of-service at identified and improved intersections and corridors in future iterations of the travel demand model to gage the impact of the improvements.

1.5 Identify high accident areas and develop alternative strategies to reduce overall traffic accidents and fatalities.
Action and Performance Measures:
- Develop a map and matrix of high accident areas in the city to determine accident hotspots and trends. Utilize the data gathered from the matrix and map to develop specific recommendations for each high accident area.
- Measure the change in the number of traffic collisions at identified and improved intersections and corridors using TxDOT CRIS collision data every three years to determine the impact of the improvements.

1.6 Establish proactive planning dialogue and coordination with ISDs to optimize traffic operations and school safety to site-specific issues.

Action and Performance Measures:

- Meet with school district representatives to glean transportation and school siting issues and needs within the city.

1.7 Upgrade and improve existing street infrastructure to enhance efficiency, improve intersection operations, reduce congestion and minimize accidents.

Action and Performance Measures:

- Develop matrix of mitigation strategies that can be applied to specific types of intersection deficiencies.
- Utilize TxDOT CRIS traffic collision data to measure the change in the number of traffic collisions at intersections identified in the mitigation strategies matrix.
- Utilize future iterations of the travel demand model, turning movement counts, and/or other intersection analysis tools to measure the change in level-of-service at improved intersections.

1.8 Upgrade and improve existing transit, bicycle and pedestrian infrastructure to encourage usage of alternative transportation.

Action and Performance Measures:

- Develop a League City transit feasibility study to assess transit demand, identify areas with residents more likely to utilize transit, and includes ridership forecasts in order to determine the best locations for park and ride facilities and bus routes.
- Utilize bike and pedestrian counters to determine the how many people utilize implemented bike and pedestrian facilities.
- Utilize ridership data to determine the number of people utilizing transit services.

GOAL 3 | A SPECIAL PLACE TO LIVE

The tenets of a Special Place to Live include:

- Transportation and Infrastructure designed to reflect both people and places.
- Enhance transportation choices and accessibility.
- Create a unique place with lasting value.
- Blends seamlessly with the character of League City neighborhoods, employment centers and activity centers.

Guiding Principles: Effectively and safely move people and goods
Offers travel options
Respects and enhances context and character
Adds to community marketability

1. **Promote a more livable city and high quality of life through incorporation of context sensitive transportation design practices and a proactive approach to aesthetic quality of key transportation corridors.**

1.1 Promote policies that limit the number of driveways/curb cuts along major thoroughfares identified as commercial corridors.

Action and Performance Measures:

- Identify existing and proposed commercial corridors within the city, based on existing future land use plans, to implement access management strategies.
- Identify existing commercial destinations that may be able to consolidate and share parking between adjacent land uses and businesses.
- Encourage shared parking lots along major thoroughfares identified as commercial corridors.
- Conduct traffic and turning movement counts along identified commercial corridor every five years and utilize Synchro or other corridor analysis tools to gage the change in level-of-service and overall impact of corridor improvements.

1.2 Encourage sidewalks and other pedestrian amenities along commercial corridors to facilitate pedestrian activity between adjacent uses and contiguous destinations.

Action and Performance Measures:

- Evaluate existing sidewalks along key commercial corridors in terms of connectivity (to parks, businesses, and neighborhoods) and overall maintenance/condition.
- Identify key locations for pedestrian amenities and landscaping along identified commercial corridors.

- Utilize pedestrian counters to measure the change in the pedestrian traffic along corridors with pedestrian improvements.

1.3 Identify corridors for bike routes between residential areas, parks, and other destinations within the city.
Action and Performance Measures:
- Identify missing connections between existing and planned bike routes, and key destinations such as schools, parks, residential areas, and retail and entertainment venues in the 2010 bike network.
- Utilize bicycle counters to measure the change in the bicycle traffic along corridors with identified bike routes.

1.4 Enhance the aesthetics of roadways that lead commuters into the community core and/or other defined emerging development areas.
Action and Performance Measures:
- Identify key connectivity corridors for the implementation of gateways and other aesthetic treatments.
- Develop a map highlighting key bicycle and pedestrian destinations within the city and identify existing and planned roadways that may be used as on-street routes to access them. The map should be updated annually, highlighting corridors that have been enhanced.

1.5 Create visual gateways and other landmarks to enhance the city's identity to visitors and existing residents.
Action and Performance Measures:
- Develop a city gateway and corridor design scheme (to be approved by a City identified group) to be taken into consideration when developing beautification strategies for the city.
- Identify key locations for city gateways along proposed and existing roadways.

1.6 Adopt policies and programs that promote context sensitive considerations and aesthetics into the planning and funding of transportation projects.
Action and Performance Measures:
- Identify funding sources that can be used to design and/or construct context sensitive design elements, such as pedestrian amenities, landscaping, and other beautification strategies along commercial corridors within the city.
- Incorporate context and aesthetic considerations as part of the development process.

1.7 Invest in projects that minimize the impacts of railroad delay and noise.
Action and Performance Measures:
- Identify quiet zones along rail corridors.
- Engage stakeholder community leadership to determine key locations for quite zones along the Rail Line.

GOAL 4 | FISCAL STEWARDSHIP

The tenets of Fiscal Stewardship Include:

- Provide a detailed roadmap of actions for transportation and infrastructure improvements.
- Investments that maximize benefits across multiple user groups in a way that is fiscally and environmentally responsible.

Guiding Principles: Effieciently and safely move people and goods
Offers travel options
Respects and enhances context and character

1. **Optimize the use of City funds and leverage additional funding for strategic implementation of transportation improvements to maximize public return on investment in transportation infrastructure and operation.**

1.1 Identify funding sources to leverage existing city investments to maximize the impact of dollars allocated to transportation improvements in the city.

Action and Performance Measures:

- Partner with regional and state agencies, such as H-GAC and TXDOT, to fund transportation infrastructure improvements.
- Consider the construction of toll roads, managed lanes, and HOV lanes to meet funding gaps for future thoroughfares within the city.
- Develop a recommended project matrix that includes available funding sources and whether the project meets preliminary requirements.
- Utilize transportation funds for both large and small-scale projects to improve overall connectivity and function of the thoroughfare network.
- Identify funds for roadway maintenance throughout the city.
- Prioritize and phase transportation investments to maximize the use of available and programmed funds.
- Identify and pursue private, regional, state and federal revenue sources for funding multimodal transportation improvements.

1.2 Provide transparency and meaningful public awareness, ongoing citizen input, and participation opportunities to implement and update the Plan.

Action and Performance Measures:

- Monitor funding agency websites for information on upcoming opportunities for funding and public-private partnerships that may benefit the city in terms of transportation and economics.
- Provide feedback on the development and implementation of the plan (even after adoption) to ensure it remains a part of future land use and transportation decisions.
- Incorporate plan recommendation, including, but not limited to, recommended functional classification and right-of-way, into the League City Design Criteria Manual and Subdivision Ordinance.
- Provide a plan feedback questionnaire on the City website and allow League City residents and developers the opportunity to download and provide feedback on the Plan once it is adopted.
- Coordinate a League City Transportation forum where city stakeholders can more effectively communicate transportation issues and concerns with League City staff and other decision-makers.

1.3 Plan for and preserve rights-of-way and other properties for future multimodal transportation and supporting infrastructure investments.

Action and Performance Measures:

- Identify future transportation corridors within the city to preserve the right-of-way for future transportation projects.
- Maintain City thoroughfare standards to ensure available right-of-way for future transportation projects.
- Identify existing corridors that may need to be widened and/or updated in functional class to accommodate future transportation needs.
- Identify potential multimodal corridors that may accommodate automobiles, rail, bicyclists, and/or pedestrians.
- Identify truck/shipping corridors that may need wider designated rights-of-way to accommodate more truck traffic.

GOAL 5 | ENHANCE ECONOMIC VITALITY

The tenets of Enhancing Economic Vitality include:

- Identify opportunities for linkages to employment centers and support job creation and retention.
- Provide seamless and efficient connectivity to support residential and business development.

Guiding Principles: Offers travel options
Respects and enhances context and character
Adds to community marketability

1. **Invest in transportation improvements that support the physical and economic vitality of League City and its, businesses, employment, and education districts.**

    1.1 Invest in transportation improvements that support the physical and economic vitality of League City neighborhoods, businesses, and commercial centers.
    Action and Performance Measures:
    - Identify future transportation infrastructure improvements that improve the connectivity between residential areas and planned commercial developments.
    - Develop a phasing plan for improvements in the western sector of the city as development unfolds.
    - Identify potential commercial corridors for the implementation of roadway design standards that are more conducive to commercial development.

    1.2 Provide for safe and effective trucking, railroad and air freight movement to, from and through League City, including supporting facilities, while minimizing their impact on quality of life.
    Action and Performance Measures:
    - Identify alternative truck routes through and around communities that avoid residential areas and enter commercial areas via adequate facilities.
    - Provide for effective trucking and freight rail movements to, from and within the city.
    - Develop criteria for alternative/ recommended routes throughout the City.
    - Install “no truck traffic” signs in residential areas.
    - Review pavement conditions and overall congestion levels on roadways currently experiencing high levels of truck traffic to determine the long-term feasibility of the facilities to accommodate trucks.

    1.3 Promote integration between transportation and land use development.
    Action and Performance Measures:

- Leverage transportation investments to enhance land use and economic benefit decisions within the city.
- Implement backage roads where possible along both sides of IH-45 and SH 99 to enhance existing and proposed land use along the corridor and facilitate economic development.

1.4 Identify and implement policies and programs to support and incentivize development initiatives within the city that encourage public-private partnerships and timely implementation of transportation improvements to reduce overall cost.

Action and Performance Measures:

- Identify transportation projects from future development plans that may be submitted for federal, state, and/or regional funds.
- Partner with TxDOT, H-GAC, and other agencies to fund the construction and/or enhancement of commercial corridors within the city.

Chapter 3: Issues and Needs Identification

Mobility and Connectivity Issues

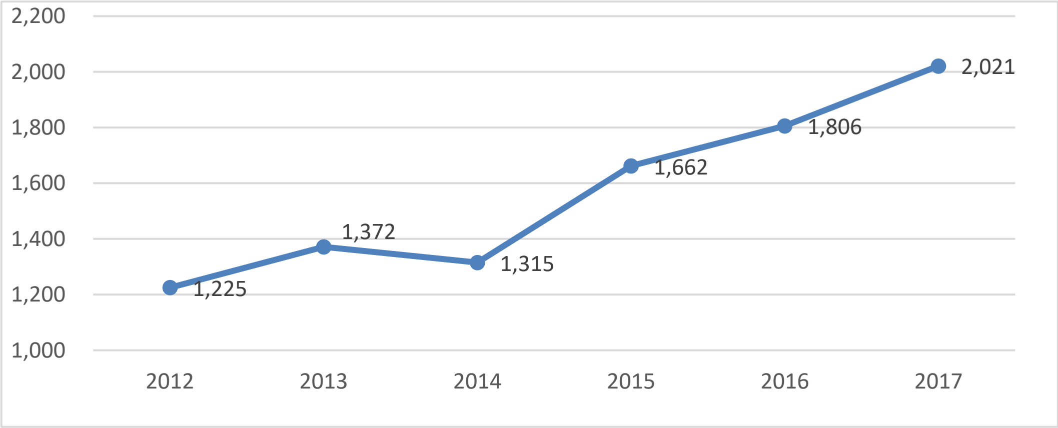
Mobility is one of the most important goals of a transportation plan. The ability of commuters to safely and efficiently travel between destinations is not only a transportation issue, but a quality of life issue as well. Important transportation measures, such as vehicle miles traveled (VMT) or hours of congestions delay, not only indicate congestion levels, but how much time it takes commuters to get to work or family activities. The following section summarizes mobility and congestion issues within League City.

Safety Issues

High Collision Areas

The number of annual traffic collisions is important because it provides a real-life illustration of the impacts of operational and congestion issues in a city. The location, timing, and conditions of the collisions are also pivotal when assessing critical locations. **Figure 7** illustrates growth in the annual number of traffic collisions between 2012 and 2017. There was a total of 9,401 collisions in League City during this time; 25 resulted in fatalities. Annually, the number of traffic collision in League City was relatively consistent between 2012 and 2014, averaging about 1,300 collisions per year. Since then, the annual number of collisions has increased to over 2,000.

Figure 7. League City 2012-2016 Traffic Collisions



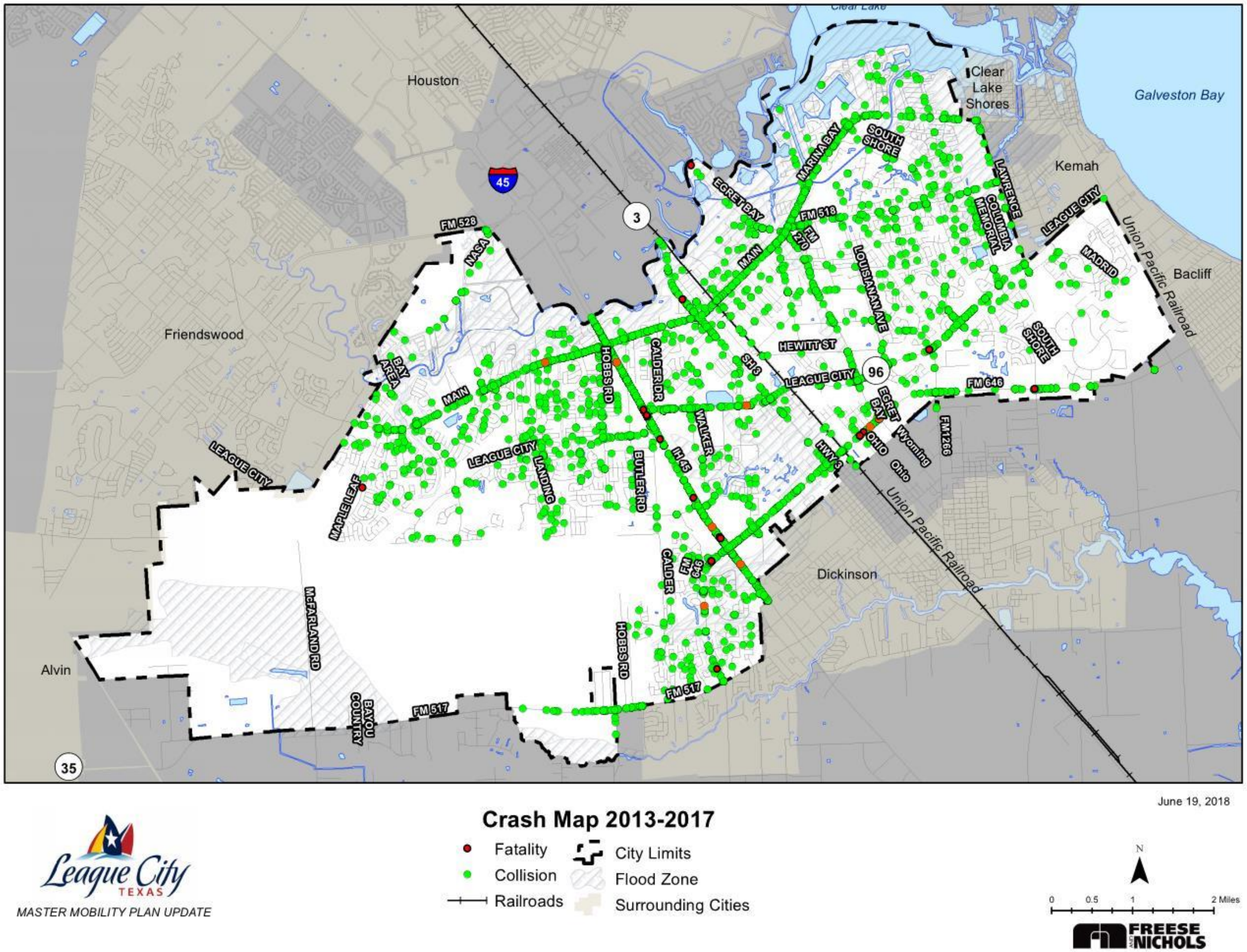
Some of the causes reported by on-scene police officers include failure to control speed, failure to yield on a left turn or intersection, and following too closely.

Table 3 highlights League City Corridors with the highest number of traffic collisions between 2012 and 2017. During this same period, the highest number of collisions in League City occurred along the IH 45, Main Street (FM 518), and FM 646 corridors. IH 45, as expected, experienced the highest number of traffic collisions with 2,257. The collision rate was 16 per 100 million vehicle miles traveled (VMT). Main Street followed with 1,774 collisions. Despite the high number of collisions, Main Street had the second lowest collision rate of the roadways analyzed with about seven per 100 million VMT. This is an indicator that the roadway may be operating over capacity – which increases the chances of a traffic collision. Other high collision corridor included FM 646 and League City Parkway with 1,145 and 948 collisions respectively. Interestingly, Marina Bay Drive (FM 2094) had the highest collision rate of the roadways analyzed (24 per 100 Million VMT), but only experienced 470 collisions. A full display of all League City traffic collisions from 2012 to 2017 is available in **Map 1.**

Table 3. League City High Collision Corridors

Streets	2012	2013	2014	2015	2016	2017	Total	Rate Per 100 M VMT
Main Street (FM 518)	235	276	255	319	352	337	1,774	6.81
FM 646	148	172	201	181	216	227	1,145	15.75
IH 45 (Gulf Freeway)	242	295	283	420	424	593	2,257	16.71
League City Parkway (SH 96)	119	151	123	161	168	226	948	4.22
Marina Bay Drive (FM 2094)	91	88	73	72	82	64	470	24.22
SH 3	53	46	60	98	90	100	447	12.68
Egret Bay Boulevard (FM 270)	49	41	54	74	80	79	377	14.90
Total (all collisions)	1,225	1,372	1,315	1,662	1,806	2021	9,401	0.24

Map 1. League City 2013-2017 Traffic Collisions

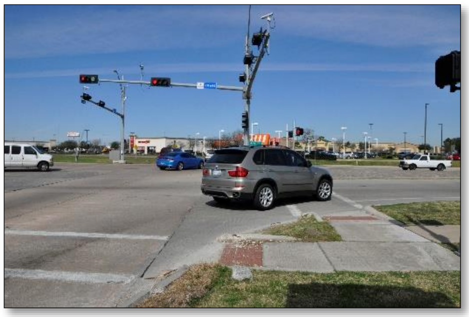


Chapter 4: Existing Conditions

The existing conditions section of a mobility plan provides the foundation from which plan recommendations are developed. It provides a baseline description of the city's transportation network as it stands today regarding capacity, functional classification and modal accommodations, and provides a benchmark to gage the impact of implemented plan recommendations.

Existing Roadway Functional Classification

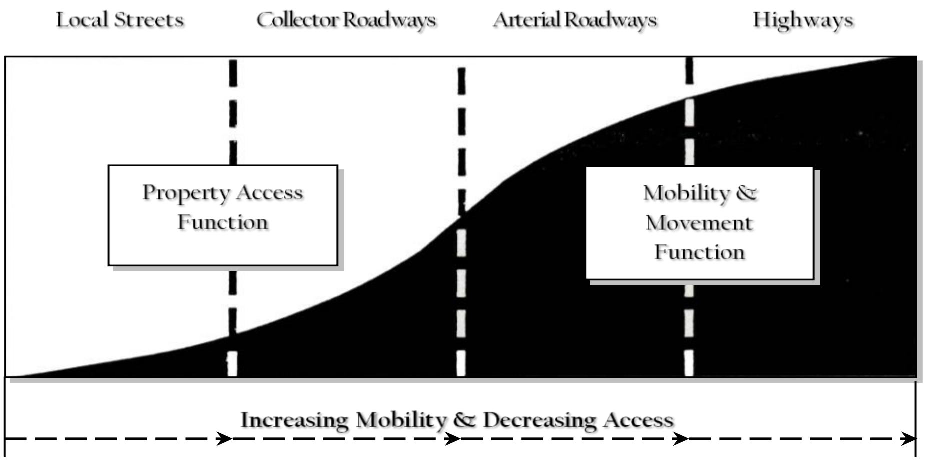
The functional classification of streets is used to identify the hierarchy, function, and dimensions of a roadway. Streets and highways are grouped into classes based on facility characteristics, such as geometric design, speed, and traffic capacity. The roadway functional class allows travelers ease of access to origins and destinations through a combination of streets. Functional class can be updated over time if surrounding land uses change significantly.



Typical functional classifications include: freeway/ highways, principal arterials, minor arterials, and collectors. Local or residential roads are not typically included in thoroughfare plans. League City's existing functional classifications include: major arterials, minor arterials, minor collectors, and residential streets.

A facility will move up in hierarchy as the surrounding area becomes denser and additional cars are attracted to the area. Population and land use densification may also decrease the functional class of a roadway as the area becomes more walkable. Typically, the higher the roadway's classification, the lower the access to adjacent land uses. Freeways, for instance, typically provide no direct access to land uses, but allow continuous connectivity between regional destinations. **Figure 8** illustrates the relationship between functional class and land use.

Figure 8. Land Use Access and Functional Classification



The following functional classification descriptions were taken from the League City Traffic and Transportation Standards and Guidelines. The City's 2011 Master Mobility Plan Thoroughfare Map is depicted in **Map 2.** It displays the existing functional classification of League City roadways classified as collectors or higher.

Table 4. Existing League City Functional Classification

Functional Classification	Minimum Right-of-Way *	Lanes
Major Arterial	120	2 to 6
Minor Arterial	100	2 to 4
Divided Collector	90	2 to 4
Collector	80	2 to 4
Residential Street	60	2

Major Arterials

Major arterials are continuous street system serving moderate to long trip lengths that distributes traffic from the freeway/expressway system through the community. The focus of major arterials is to provide cross town mobility rather than land access.

Major arterials, according to the City's 2013 General Design and Construction Standards, include four to six 12-foot lane divided facilities within 120 feet of right-of-way (ROW). This is inconsistent with the 2011 mobility plan, which allows two-lane major arterials within a minimum of 100 feet of ROW. Examples of League City Major Arterials include, but are not limited to Main Street, Bay Area Boulevard, and League City Parkway.

Minor Arterials

Minor arterials accommodate moderate trip lengths at a somewhat lower level of mobility. Minor arterials provide a lower level of mobility and distribute traffic to smaller geographic areas than major arterials.

The design specifications in the City's 2013 General Design and Construction Standards are not consistent on the design criteria for minor arterial facilities. The description for minor arterials allows two-lane sections, but the pavement width specifications require a minimum of four 12-foot lanes with a median. The minimum right-of-way for a minor arterial is 100 feet. Current examples of minor arterials include Hobbs Road, South Shore Boulevard, and Walker Street.

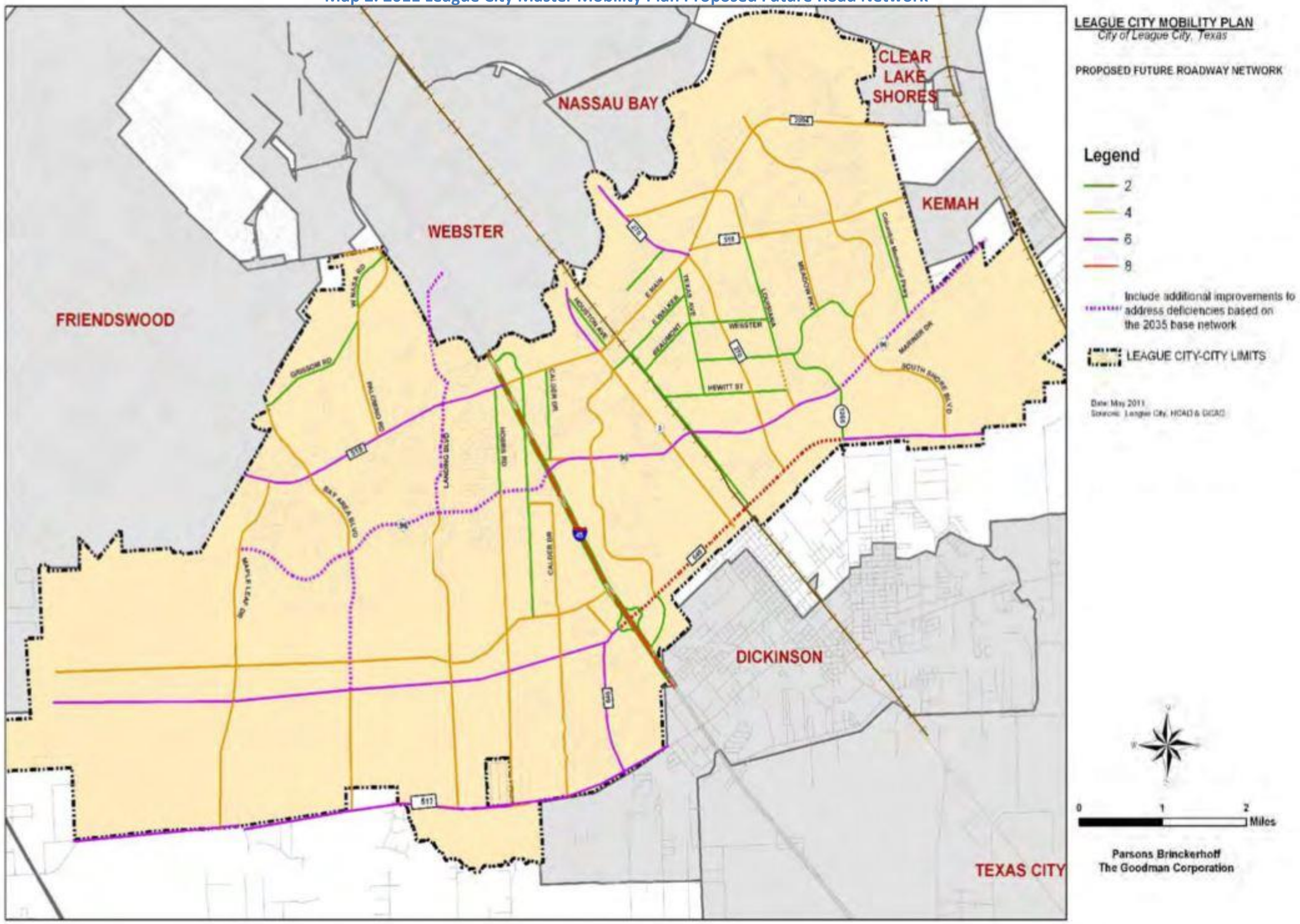
Collector Streets
Collector streets are designed to provide both local access and traffic circulation within residential neighborhoods, commercial and industrial areas. Collector streets distribute traffic between the arterial and local street system. Collectors in the current functional classification system include a minimum of two divided or undivided lanes and allow for on-street parking.

Undivided collectors consist of two 12-foot travel lanes and allow for two 12-foot un-striped on-street parking lanes. Divided collectors include two 12-foot travel lanes and allow for nine to 10-foot parallel parking lanes. Both cross-sections include a wide enough pavement width to convert the outside parking lanes into travel lanes if development and traffic conditions demand it. The minimum right-of-way for two lane undivided collectors is 80 feet; the minimum ROW for divided collectors is 90 feet. Current examples include Louisiana, Maple Leaf Drive, and Landing Boulevard.

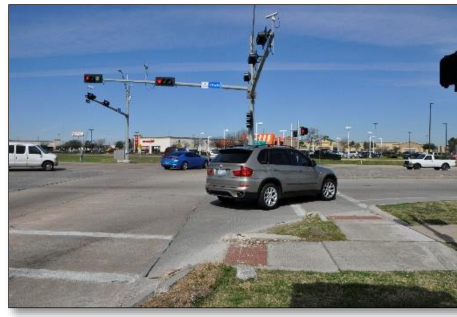
Local/Residential Streets
Local streets are designated to serve the local needs of neighborhoods and to provide access from abutting residential properties to other streets. League City's residential streets, according to the General Design and Construction standards, are two lane facilities within 60 feet of ROW.

Interestingly, the cross-section has a provision for eight-foot parking lanes, but only requires 28 feet of pavement. This is to allow at-least one unobstructed travel lane – even when vehicles are parked on both sides of the street.

Map 2. 2011 League City Master Mobility Plan Proposed Future Road Network



Existing Transportation Framework



League City's existing transportation network is relatively multi-modal in nature. It includes automobile, non-motorized, and transit options, and is only a few miles from Hobby Airport. The network is relatively robust, providing access to all developed areas of the city, and is, under current conditions, capable of accommodating most of the traffic. Below is a summary of League City's existing transportation network. A more detailed analysis is available in **Chapter 5.**

Existing Operational Conditions

Understanding current traffic volumes on a road network is an important step in determining if facilities are functioning at capacity under current conditions. The Annual Average Daily Traffic (AADT) provides information on traffic history. AADT is the total volume of vehicle traffic divided by 365 days. This method, average daily traffic (ADT), is the number of vehicles traveling in a 24-hour period, greater than a day – but less than one year. Traffic counts, collected over a specific time period, may be used to supplement this data to provide more specific results. The H-GAC travel demand model network is calibrated to illustrate traffic conditions at the regional level and not individual cities. As such, only certain roadways were included in the travel demand model for the analysis of existing volumes and level-of-service. Because the model is calibrated for regional traffic flows, it does not take into account the impact of access management issues like tuning movements and traffic signalization, or special generators like concert venues or athletic stadiums that cause periodic peaks in traffic congestion. To compensate for this, micro-level simulations (SYNCHRO) were conducted to analyze existing conditions at key intersections located throughout the city. Additional information the limitations of the travel demand model are available in Chapter 5.

2015 Traffic Volumes

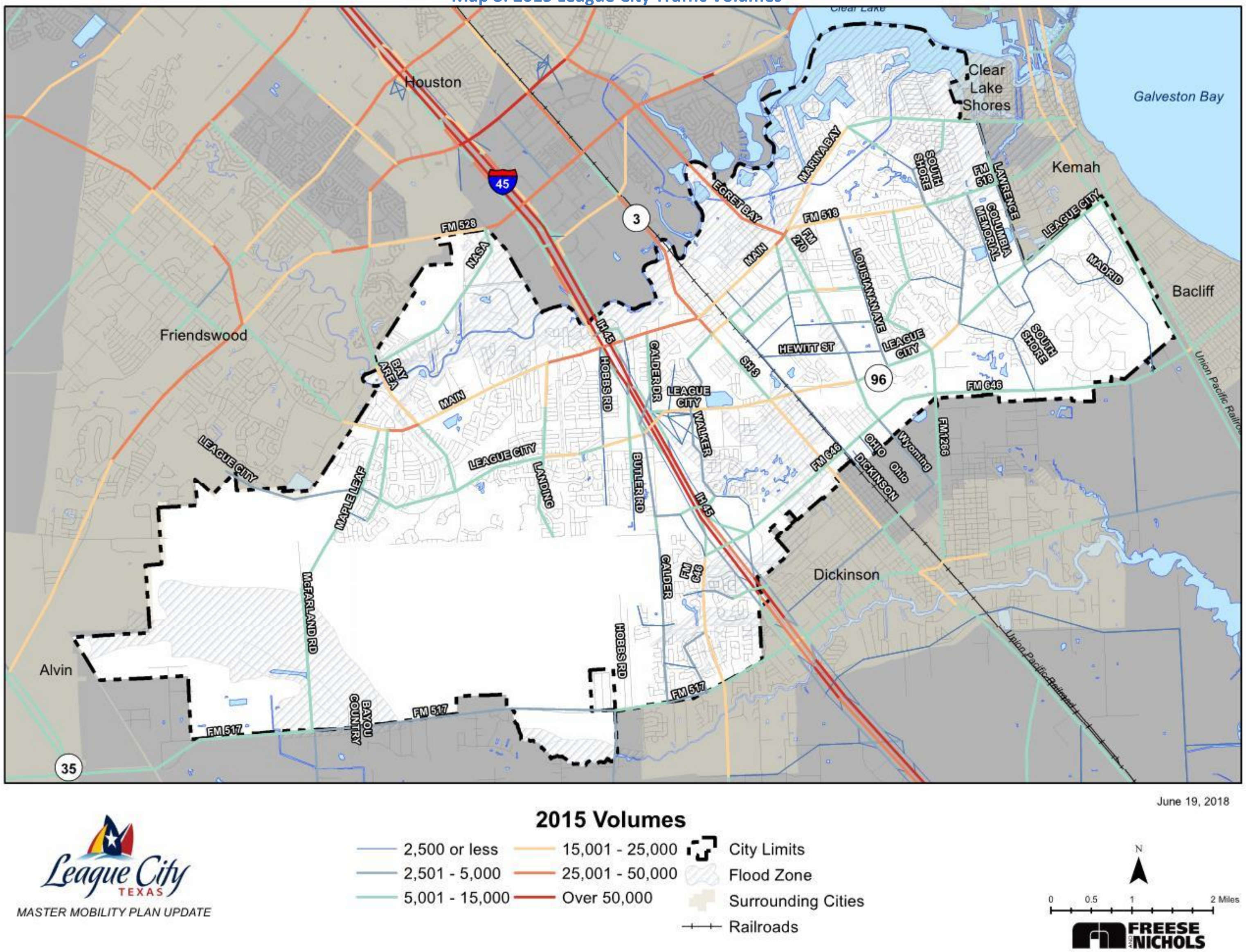
Traffic volumes within the city currently range from as few as 100 vehicles per day to nearly 85,000. The lowest volumes are along Cross Colony drive at just over 100 vehicles per day, and the highest are on IH 45 at nearly 85,000. These are, however outliers, and most facilities, such as Main Street (FM 518) or League City Parkway, carry between 5,000 and 45,000 vehicles per day. Outside of IH 45, the highest volumes are found on FM518. The segment between FM 2094 and Egret Bay Boulevard carries over 42,000 vehicles per day.

Interestingly, the lowest volume facilities, depicted in blue on **Map 3**, are primarily concentrated in the eastern sector of city – south of downtown. Many of these facilities, such as Madrid Lane, are collector class roadways providing access to residential areas. Other low volumes facilities, such as Dickinson Avenue, Texas Avenue, and Hewitt Street, provide alternative access to the downtown area, but have very low volumes.

Table 5. League City 2015 Traffic Volumes

Road	Limits	2015 Daily Volumes	AM Peak	PM Peak
IH 45 NB	Wesley Rd to North City Limits	84,491	19,225	19,370
IH 45 SB	Wesley Rd to North City Limits	69,309	8,842	22,299
FM 518 (Main Street)	FM 2094 to Egret Bay Blvd	42,170	8,274	12,118
FM 518 (Main Street)	IH 45 to Williamsport St	36,304	7,140	10,250
Egret Bay Boulevard	7th St to North City Limits	33,341	5,561	10,287
FM 518 (Main Street)	Wesley Rd to Calder Rd	33,337	6,929	8,100
Galveston Road	FM 518 to Walker St	32,329	5,214	8,612
FM 518 (Main Street)	Bay Area Blvd to Country Ln	32,164	6,605	9,542
FM 518 (Main Street)	Calder Rd to SH 3	30,831	6,524	7,614
SH 96	Walker St to SH 3	22,944	5,179	6,953
Dickinson Avenue	FM 646 to Hewitt St	1,115	281	330

Map 3. 2015 League City Traffic Volumes

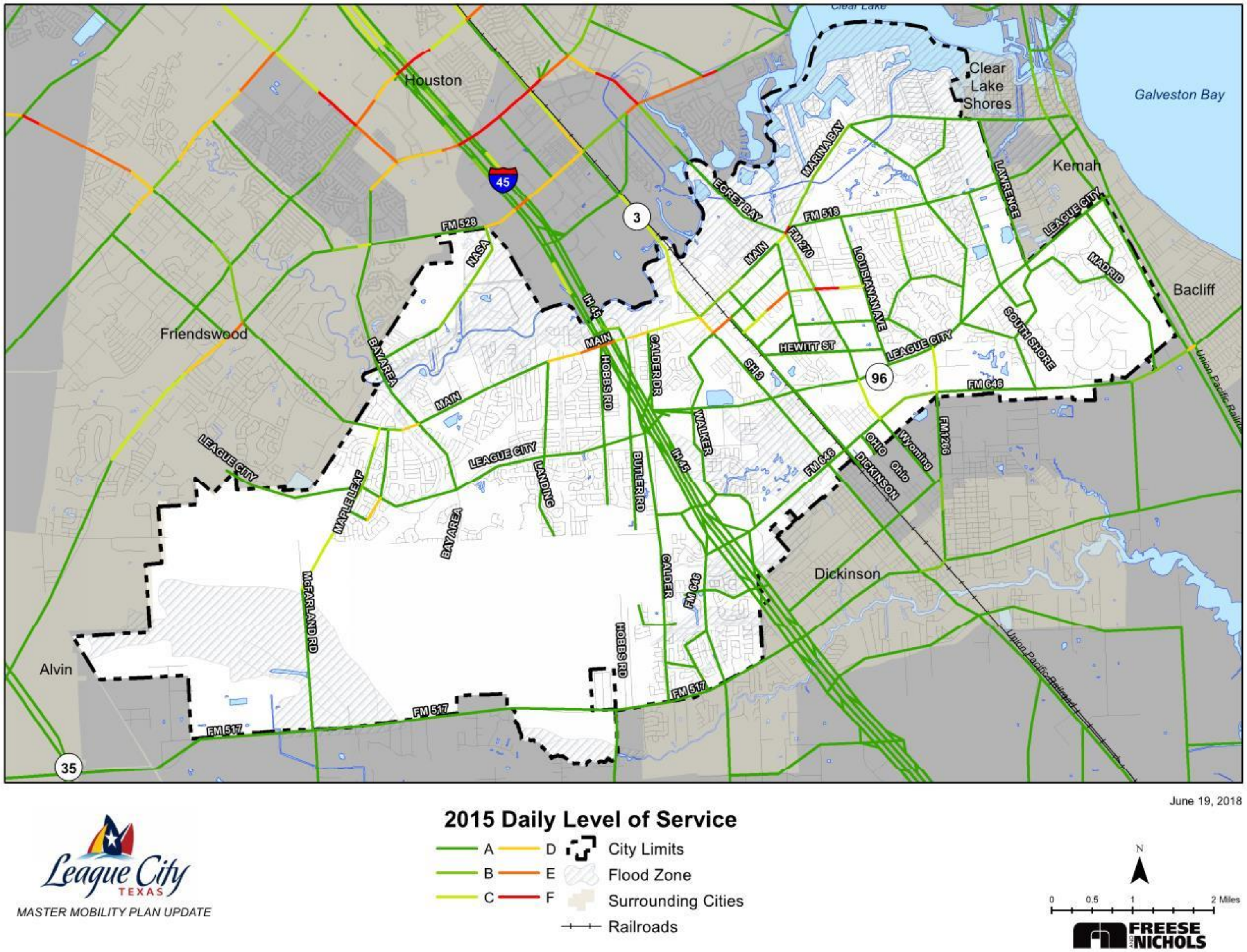


2015 Level-of-Service

The H-GAC model is designed to assess level-of-service (LOS) at the regional level using a roadways volume to capacity ratio. The volume to capacity ratio gages roadway congestion based on the ratio of designed roadway capacity and traffic volumes. As mentioned above, its ability to assess localized traffic inhibitors is limited. This is an issue on roadways such as Main Street, which exhibits higher levels of congestion than indicated in the model LOS output. To compensate for this, an additional Synchro analysis was conducted on the corridor to determine roadway LOS. The travel demand model was used to illustrate the high-level operation and performance of the network. 2015 level-of-service is illustrated in **Map 4.**

League City's thoroughfare network performs adequately on daily basis during peak hour operations. There are few highly congested areas, and commuters can easily traverse the city without too much congestion delay. Major roadways, such as SH 96 and Bay Area Boulevard, operate at LOS ABC. Other roadways, such as FM 518 (Main Street) operate at level of Service DE – but spike to LOS F at intersections. The five-points intersection, for instance, which is at the junction of FM 518, FM217 (Egret Bay Boulevard), and FM 2094, operates at LOS F.

Map 4. League City 2015 Daily Level-of-Service



Intersection Operational Conditions

A number of intersections and corridors were identified as congested by League City staff and other stakeholders. These intersections are not only characterized by a high number of traffic incidents, but geometric issues, high speeds, congestion, and/or poor maintenance as well. The following sections details identified critical intersections within League City.

This analysis was completed to determine current conditions for the following intersections:

1. IH 45 and FM 518
2. IH 45 and FM 646
3. FM 518, Marina Bay Drive, and Egret Bay Boulevard (Five Points)
4. FM 518 and Landing Boulevard
5. League City Parkway and Brittany Lakes Drive/ Finnegan Lane
6. FM 518 and Bay Area Boulevard
7. Bay Area Boulevard and League City Parkway

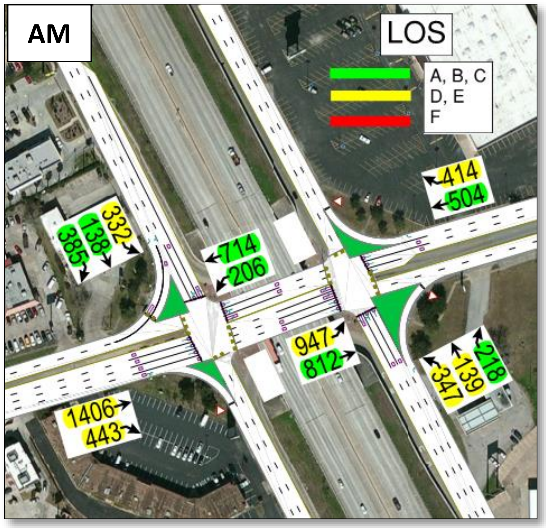
Micro-level simulation was used to analyze operational conditions at each intersection listed above. Further analysis was completed using SimTraffic. Synchro is used to analyze high-level issues is more suited for large network analysis. SimTraffic analyses is track each individual vehicle in the network and provides a more detailed analysis. For the analyses, one-hour simulations were conducted, and results obtained by averaging the outcomes from three separate simulations. SimTraffic results were derived for each zone, as opposed to each intersection. Also, SimTraffic simulations were used to paint an overall picture of the zone and to see where traffic was queueing up the most.

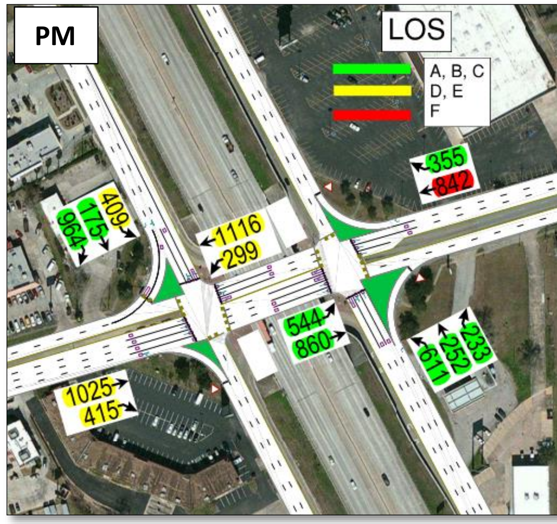
IH 45 and FM 518

The intersection of the IH 45 frontage road and FM 518 currently accommodates about 4,300 vehicles per day during the AM peak hour and performs adequately at LOS C. AM peak hour traffic is primarily generated west of the intersection, heading north on I-45 or east on FM 518 at LOS C. There is capacity for additional traffic.

PM peak hour conditions are worse, accommodating about 5,300 vehicles at LOS D. The westbound segment of FM 518 is most negatively affected. As development increases, PM peak hour congestion may become a serious issue. A summary intersection performance is detailed below in **Table 6**. A full analysis is available in the **Appendices.**

Figure 9. IH 45 and FM 518: AM LOS and Volume; PM LOS and Volume





IH 45 Widening

It is important to note that construction is currently underway to expand the IH 45 corridor from the Harris County line to the area about 2,000 feet north of League City Parkway. The project will expand IH 45 from six to 10 lanes and widen the intersection to include six through lanes, dual left-turn lanes, and dual right-turn lanes on Main Street. The IH 45 frontage road will also be widened from two to three lanes in each direction, and include dual left-turn lanes, dual right-turn lanes, and a Texas U-turn. This should relieve some of the projected congestion at the intersection. The project is estimated to be completed in 2020.

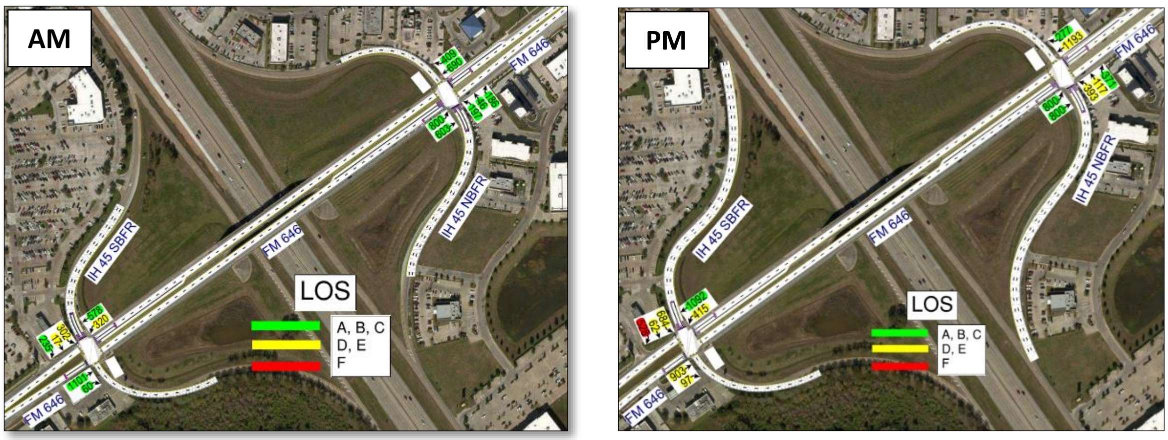
Table 6. AM IH 45 and FM 518 Intersection Evaluation

AM FM 518 and IH 45 - Synchro Optimized Cycle Length								
Intersection	**SBFR**				**NBFR**			
Cycle length	60				60			
Approach	EB	WB	SB	**Overall**	EB	WB	NB	**Overall**
Delay	61.2	17.4	14.1	**38**	42.2	32.9	15.5	**33.4**
LOS	E	B	B	**D**	D	C	B	**C**
AM FM 518 and IH 45 - Alternative Cycle Length								
Intersection	**SBFR**				**NBFR**			
Cycle length	90				90			
Approach	EB	WB	SB	**Overall**	EB	WB	NB	**Overall**
Delay	45.1	13.1	23.9	**31.4**	37	31.5	30.2	**33.9**
LOS	D	B	C	**C**	D	C	C	**C**
PM FM 518 and IH 45 - Synchro Optimized Cycle Length								
Intersection	**SBFR**				**NBFR**			
Cycle length	65				65			
Approach	EB	WB	SB	**Overall**	EB	WB	NB	**Overall**
Delay	48.7	61.6	31.7	**46.7**	21.6	62.9	20.2	**34.5**
LOS	D	E	C	**D**	C	E	C	**C**
PM FM 518 and IH 45 - Alternative Cycle Length								
Intersection	**SBFR**				**NBFR**			
Cycle length	135				135			
Approach	EB	WB	SB	**Overall**	EB	WB	NB	**Overall**
Delay	65.9	55.5	41.9	**53.8**	11	83.3	47.6	**45.5**
LOS	EB	E	D	**D**	B	F	D	**D**

IH 45 and FM 646

This intersection of IH 45 and FM 646 accommodates about 3,200 vehicles during the AM peak hour at LOS C. Level-of-service drops to D during the PM peak hour, carrying about 4,600 vehicles. Despite the increase in congestion, the intersection can handle additional traffic as development unfolds in the area. During simulation, there was a slight back up on the SB frontage road, on FM 646 westbound, and FM 646 eastbound. The long ramp off SB frontage road, the queue would most likely not affect the frontage road.

Figure 10. IH 45 and FM 646: AM LOS and Volume; PM LOS and Volume



Please note that the segment of IH 45, from north of League City Parkway to about 750 feet south of Deats Road will be widened from six to eight lanes. The frontage lanes that intersect with FM 646 will not be altered with the IH 45 widening.

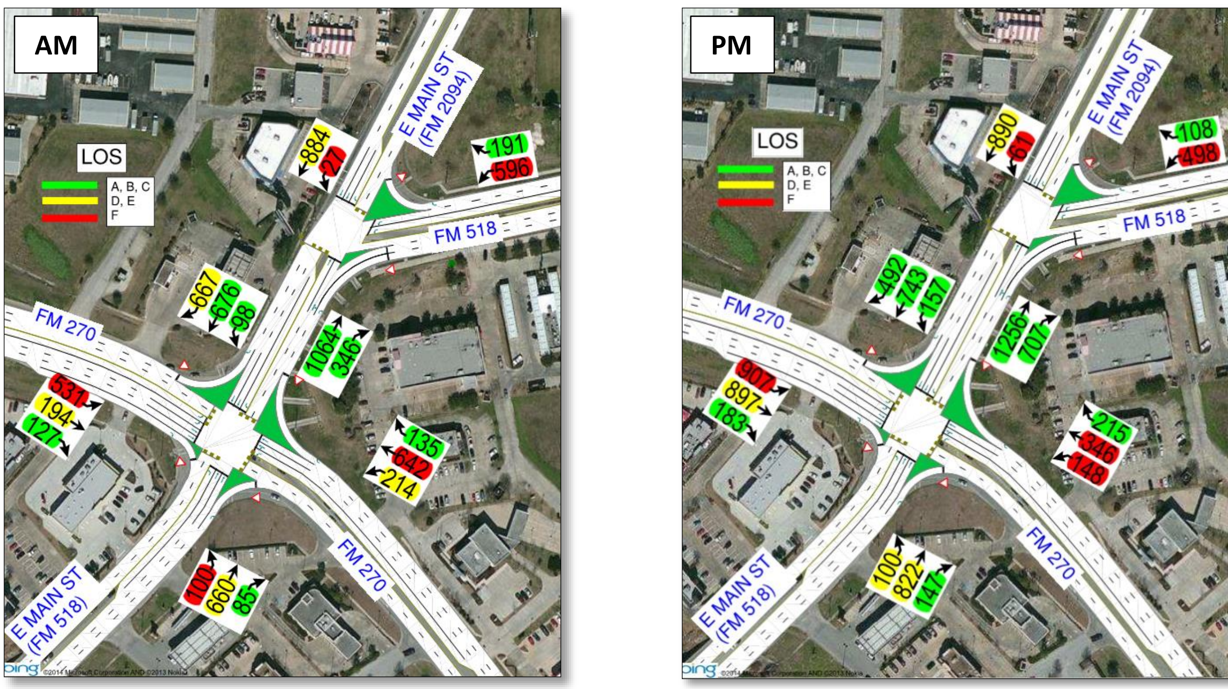
Table 7. IH 45 and FM 646 Intersection Evaluation

AM FM 646 and IH 45 - Synchro Optimized Cycle Length								
Intersection	**SBFR**				**NBFR**			
Cycle length	90				70			
Approach	EB	WB	SB	**Overall**	EB	WB	NB	**Overall**
Delay	28.5	21.5	33.2	**27.3**	22.3	17.1	21.2	**20.1**
LOS	C	C	C	**C**	C	C	B	**C**
AM FM 646 and IH 45 - Alternative Cycle Length								
Intersection	**SBFR**				**NBFR**			
Cycle length	100				100			
Approach	EB	WB	SB	**Overall**	EB	WB	NB	**Overall**
Delay	29.5	10.2	39.5	**25.5**	9.6	21.3	34.5	**17.9**
LOS	C	B	D	**C**	C	A	C	**B**
PM FM 646 and IH 45 - Synchro Optimized Cycle Length								
Intersection	**SBFR**				**NBFR**			
Cycle length	100				90			
Approach	EB	WB	SB	**Overall**	EB	WB	NB	**Overall**
Delay	69.8	34.4	61.8	**53.1**	38.8	35.9	51.2	**40.6**
LOS	E	E	C	**D**	D	D	D	**D**
PM FM 646 and IH 45 - Alternative Cycle Length								
Intersection	**SBFR**				**NBFR**			
Cycle length	120				120			
Approach	EB	WB	SB	**Overall**	EB	WB	NB	**Overall**
Delay	76.9	21.3	59.7	**49.1**	23	37.1	58	**36.3**
LOS	E	E	C	**D**	E	C	D	**D**

Five Points – Marina Bay Drive (FM 2094), Main Street (FM 518), Egret Bay Boulevard (FM 270)

The initial five points analyses assessed the intersection under its previous configuration (see **Figure 11**), which was included an off-set five-point intersection with eastern segments converging at FM 2094 (Main Street) and FM 518, and western segments converging at FM 270 and FM 518. The five points intersection accommodates about 4,400 vehicles during the AM peak hour operates at LOS D and E. Simulation showed the most delay at the intersection of Main Street and FM 270, especially commuters making a left turn from the eastbound Egret Bay Boulevard onto Main Street. The congestion caused by the intersection impacted the entire corridor. Additional information on the initial the performance on the Five Points intersection in its previous configuration is available in the **Appendix.**

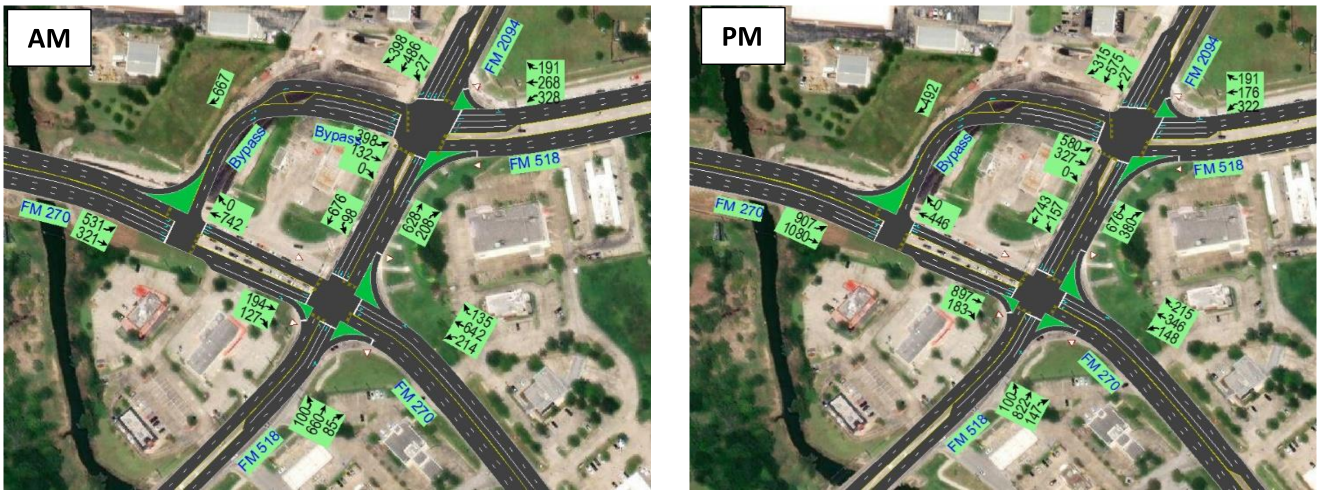
Figure 11. Five Points Intersection: AM LOS and Volume; PM LOS and Volume



Reconfigured Five-Points Intersection

In early 2018, bypass lanes were constructed at the Five Points intersection to improve operations (see **Figure 12** below). With this new configuration, traffic going between the western leg of FM 270, FM 2094, and the eastern leg of FM 518 utilize the bypass. This reduces the volume of vehicles traveling from the eastern legs of FM 518 and FM 2094 through the FM 518 and FM 270 intersection. This should help relieve some of the congestion and delay at the intersection. Without current turning movement counts, traffic counts collected from the previous intersection configuration in 2016 were utilized in the analysis. The turning movements that would utilize the bypass were distributed based on turning movement counts collected prior to the opening bypass.

Figure 12. Reconfigured Five Points Intersection Performance



Reconfigured Five-Points Intersection Capacity Analysis

Both existing and 2040 AM and PM peak hour conditions were analyzed for Five-Points intersection using SimTraffic. SimTraffic is a microscopic traffic model that simulates a network based on individual driver behaviors. This contrasts with Synchro, which is a macroscopic traffic model and is based on density and flow. While Synchro is good for determining delays and intersection performances of regular intersections (e.g. an isolated 4 leg intersection), SimTraffic is preferred for more complex geometric configurations. For these reasons, SimTraffic was used to analyze the Five Points intersections. 2040 population and employment data were used to develop an overall growth rate for traffic volumes. Using this data, a 25-year growth factor of 1.28 was calculated. Additional information on the effectiveness of SimTraffic is available in the **Appendix.**

SimTraffic does not calculate a LOS. For comparison's sake, the delay and corresponding LOS for a single intersection is shown in **Table 8.** An additional analysis was conducted to test 2040 conditions with Main Street widened to six lanes.

Table 8. LOS Criteria for a Signalized Intersection (HCM 2010)

Signalized Intersections	
Control Delay (sec/veh)	LOS
<=10	A
10-20	B
20-35	C
35-55	D
55-80	E
>80	F

Five Points Intersection without the Bypass

Table 9 summarizes the Five-Points intersection operations analysis under 2016 AM and PM peak hour conditions results. The SimTraffic output reports are provided the **Appendix**.

Table 9. 2016 Network Conditions Analysis Without Bypass

Scenario	Peak Hour	Denied Delay/veh (sec)	Total Delay (hr)*	Total Delay/veh (sec)*	Stop Delay/veh (sec)	Travel Time (hr)
2016 Conditions No Bypass	**AM**	10.7	326	219.4	187.5	460
	PM	9.7	266	225.9	134	418

***Includes denied delay**

The analysis shows that the intersections operated with significant delays before the bypass was constructed. During the AM peak period, drivers could expect an average of 208.7 seconds of delay. PM peak period conditions were better, but commuters still averaged 165.2 seconds of delay at the intersection.

Five-Points Intersection Performance with the Bypass
Table 10 summarizes the Five-Points intersection operations under 2016 traffic conditions with the addition of the bypass. The SimTraffic output reports are provided in the **Appendix**.

Table 10. 2016 Network Conditions with Bypass

Scenario	Peak Hour	Denied Delay/veh (sec)	Total Delay (hr)*	Total Delay/veh (sec)*	Stop Delay/veh (sec)	Travel Time (hr)
2016 Conditions with Bypass	**AM**	0.6	64	43.7	30.3	182
	PM	0.5	133	78.8	59.9	275

***Includes denied delay**

The analysis shows that the intersections operate at a tolerable level during the AM peak period with average delays of 43.7 seconds per vehicle. This is expected for a multi intersection layout during a peak period. The PM peak is significantly more congested than the AM Peak with delays of 78.8 seconds per vehicle. This amount of delay is high, but much lower than the previous intersection configuration.

Five Points Intersection Performance under 2040 Conditions
The network operations analysis results under the future 2040 AM and PM peak hour conditions are summarized in **Table 11**. The SimTraffic output reports are provided in the **Appendix**.

Table 11. 2040 Five-Points Intersection Performance

Scenario	Peak Hour	Denied Delay/veh (sec)	Total Delay (hr)*	Total Delay/veh (sec)*	Stop Delay/veh (sec)	Travel Time (hr)
2040 - No Mitigation	**AM**	0.8	170	91.4	71.4	320
	PM	110	617	309.4	172.5	774

***Includes denied delay**

The 2040 analysis shows that with increased traffic, the intersection will break down during PM peak period with delays of 309.4 sec/veh. Network performance is also diminished during the AM peak period, but delay is only 91.4 sec/veh. The increased congestion results in increased travel time through the network and forms queues that denies vehicles entry into the network.

Recommendations

Given the level of projected congestion within in the intersection, the development of sound mitigation strategies is crucial. One strategy is widening Main Street to six lanes. This scenario was tested in SimTraffic. The results are summarized in Analysis of this scenario was performed and shown in **Table 12.**

Table 12. 2040 Five-Points Intersection Performance with Six Lane Main Street

Scenario	Peak Hour	Denied Delay/veh (sec)	Total Delay (hr)*	Total Delay/veh (sec)*	Stop Delay/veh (sec)	Travel Time (hr)
2040 with 6 Lanes	**AM**	0.6	119	63.6	47.1	269.8
	PM	41.2	381	182.8	116.2	552

***Includes denied delay**

The analysis shows that this improvement would help with the delay during both AM and PM peaks periods. With the improvements, the delay in the AM peak is reduced to 63.6 seconds per vehicle, which is acceptable for a peak period. PM peak delay is reduced with the addition of lanes on Main Street, but still poor performing with average delays of about 182.8 seconds per vehicle.

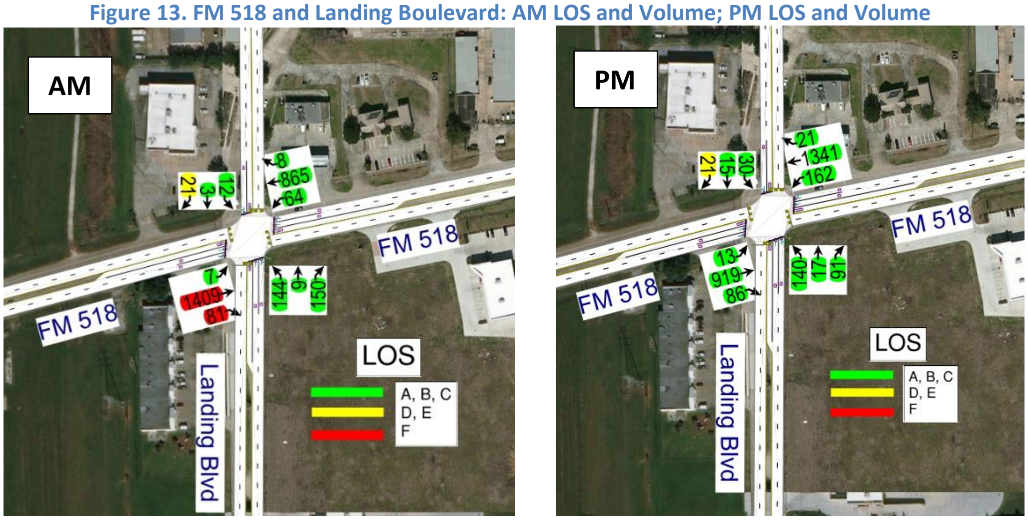
While this mitigation option will improve the delay at the intersection, other possibilities, such as developing parallel roadways as an option, should be explored. This may reduce congestion within the Five-Points intersection.

Main Street (FM 518) and Landing Boulevard

The intersection if Main Street and Landing Boulevard is currently signalized. The eastbound, westbound, and northbound approaches have two thru-lanes and one left-turn lane while the southbound approach has one thru-lane and one left-turn lane. There is also a wide shoulder on Main Street that is wide enough to accommodate right-turning vehicles. The shoulder, however, was not included in the analysis.

Volumes are heavily skewed from the west approach during the AM peak, with 1,500 eastbound vehicles compared to 950 vehicles westbound. The opposite is true for the PM peak, which accommodates 1,500 vehicles in the westbound approach and 1,000 heading east.

Figure 13. FM 518 and Landing Boulevard: AM LOS and Volume; PM LOS and Volume



The intersection currently performs adequately during the morning and evening peak hours with an overall delay of 26.9 seconds during the AM period and 27.7 seconds during the PM period. Overall, the intersection operates and daily LOS C, and there is capacity for additional vehicles.

Future growth analysis of the AM peak period indicates operational conditions at the intersection will start diminishing around 40 percent growth and reach LOS F at 50 percent growth. PM peak hour projections indicate intersection operations will diminish to LOS D with 50 percent growth. Most of the delay occurs in the eastbound approach as commuters travel towards IH 45 and downtown League City. Depending on growth trends, this may differ in the future.

It will be important to watch the distribution of future volumes as growth and development occur in the northwest and southwest sectors of the city. Because volumes are heavily skewed from one approach, the other approaches have longer delays, which ensures the approach with the highest volume does not breakdown.

Table 13. FM 518 and Landing Boulevard Intersection Evaluation

FM 518 and Landing Boulevard AM					
Cycle length	120 Seconds				
Approach	NB	SB	EB	WB	**Overall**
Delay	42	46.9	30.6	15.3	**26.9**
LOS	D	D	C	B	**C**
FM 518 and Landing Boulevard PM					
Cycle length	100 Seconds				
Approach	NB	SB	EB	WB	**Overall**
Delay*	24.1	35.3	28.1	27.7	**27.7**
LOS	C	D	C	C	**C**

* Delay in seconds per vehicle

Table 14. FM 518 and Landing Boulevard Future Intersection Delay

FM 518 and Landing Boulevard Future Delay and LOS						
	Current	**10% Growth**	**20% Growth**	**30% Growth**	**40% Growth**	**50% Growth**
AM						
Delay*	26.9	30.2	33.7	47.3	64.1	83.6
LOS	C	C	C	D	E	F
PM						
Delay*	26.9	31.4	32	33.7	38.8	42.4
LOS	C	C	C	C	D	D

* Delay in seconds per vehicle

League City Parkway at Brittany Lakes Drive /Fennigan Lane

The League City Parkway and Brittany Lakes Drive/Fennigan Lane intersection is the junction of two unsignalized intersections. League City Parkway is a four-lane divided roadway and Brittany Lakes Drive/Fennigan Lane is a two-lane facility. Intersection traffic is controlled by four-way stop signs and a queuing area with stop signs between the League City Parkway medians. The connection between the two intersections is about 40 feet from stop bar to stop bar where about two vehicles can queue.

AM peak hour volumes are much higher in the EB approach on League City Parkway with about 1,000 vehicles compared to 400 in the WB approach. PM peak hour volumes are more balanced with 1,100 westbound vehicles and 900 eastbound vehicles. However, it is important to note that about 200 vehicles come from the east and turn left into the subdivision.

Figure 14. League City Parkway at Brittany Lakes Drive and Fennigan Lane: AM LOS and Volume; PM LOS and Volume

Synchro analysis shows that under current conditions, the intersection is close to capacity during the peak hours. During the AM peak hour, the average delay in the intersection is 50 seconds per vehicle, which pushes the overall intersection LOS to E. Vehicles traveling east on League City Parkway have delays as high as 63 seconds, which drives eastbound congestion to LOS F. Westbound traffic flows at LOS A during the AM peak hour with a delay of about 10 seconds per vehicle.

Overall intersection delay during the PM peak hour is about 30 seconds per vehicle, or LOS D. This is driven, in part, by vehicles traveling west on League City Parkway, which experience up to 44 seconds of delay (at LOS E) when traveling in the left lane. Overall PM delay in the eastbound lanes of League City Parkway is 19 seconds per vehicle at LOS C.

Table 15. League City Parkway and Brittany Lakes Drive/ Finnigan Lane Intersection Evaluation

League City Parkway AM										
	Brittany Lakes Drive					Fennigan Lane				
Cycle length	Unsignalized					Unsignalized				
Approach	NB	SB	EB left lane	EB right lane	**Overall**	NB	SB	WB left lane	WB right lane	**Overall**
Delay*	13.8	10.7	63.1	59.6	**50**	9	8.5	10.4	9.9	**9.9**
LOS	B	B	F	F	**E**	A	A	B	A	**A**
League City Parkway PM										
	Brittany Lakes Drive					**Fennigan Lane**				
Cycle length	Unsignalized					Unsignalized				
Approach	NB	SB	EB left lane	EB right lane	**Overall**	NB	SB	WB left lane	WB right lane	**Overall**
Delay*	10.9	12.9	22.5	21.5	**19**	10.6	9.5	43.8	17.5	**29.5**
LOS	B	B	C	C	**C**	B	A	E	C	**A**

* Delay in seconds per vehicle

An analysis of projected 2040 conditions indicate that conditions will deteriorate to LOS F with as little as 10 percent growth in congestion during the AM period for eastbound traffic and PM period for westbound traffic. If volumes increase, mitigation strategies, such as signalization or LT bays should be considered.

Table 16. League City Parkway and Brittany Lakes Drive/ Finnigan Lane Intersection Delay

League City Parkway and Brittany Lakes Drive Future Delay and LOS – Eastbound						
	Current	10% Growth	20% Growth	30% Growth	40% Growth	50% Growth
	AM					
Delay*	50	81	119.7	163.1	211.4	258
LOS	E	F	F	F	F	F
	PM					
Delay*	19	24.4	33.6	48.8	70.7	96.3
LOS	C	C	D	E	F	F
League City Parkway and Fennigan Lane Future Delay and LOS - Westbound						
	Current	**10% Growth**	**20% Growth**	**30% Growth**	**40% Growth**	**50% Growth**
	AM					
Delay*	9.9	10.3	10.8	11.3	12	12.7
LOS	A	B	B	B	B	B
	PM					
Delay*	29.5	44	64.5	89.8	119.2	152.3
LOS	D	F	F	F	F	F

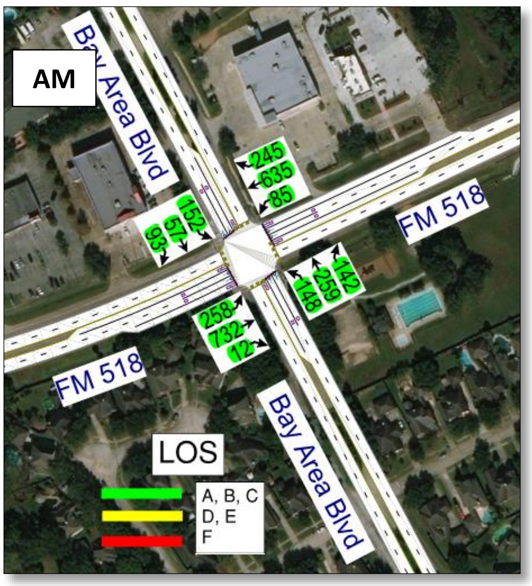
* Delay in seconds per vehicle

FM 518 and Bay Area Boulevard

The FM 518 and Bay Area Boulevard intersection is the signalized junction of two major arterial facilities. All four approaches have two thru-lanes and one left turn-lane; the FM 518 approaches also have a right-turn bay. The AM volumes are relatively even with 1,000 eastbound and 950 westbound peak hour vehicles respectively. PM volumes are skewed towards the westbound approach with 900 eastbound and 1300 westbound peak hour vehicles.

The northbound and southbound volumes on Bay Area Boulevard are skewed to the northbound approach with 550 vehicles compared to 300 during the AM peak hour. Conversely, volumes are heavier in the southbound approach during the PM peak hour with 800 vehicles compared to 350.

Figure 15. FM 518 and Bay Area Boulevard: AM LOS and Volume; PM LOS and Volume



Analysis shows that the intersection performs at a LOS of C during both the AM and PM peak hours. The delay is evenly distributed during the AM peak hour, with an average of about 25 seconds of delay per vehicle. PM peak hour delay occurs primarily in the southbound approach of Bay Area Boulevard, with about 40 seconds of delay per vehicle (LOS D). The conditions are aided by a high left-turn volume from Main Street. Delay on Main Street is about 30 seconds per vehicle.

Table 17. FM 518 (Main Street) and Bay Area Boulevard Intersection Evaluation

FM 518 and Bay Area Boulevard AM					
Cycle length	70				
Approach	NB	SB	EB	WB	**Overall**
Delay*	22.7	18.7	25.6	27.7	**24.8**
LOS	C	B	C	C	**C**
FM 518 and Bay Area Boulevard PM					
Cycle length	75				
Approach	NB	SB	EB	WB	**Overall**
Delay*	23.2	40.1	24.8	29.4	**30.2**
LOS	C	D	C	C	**C**

* Delay in seconds per vehicle

The analysis of 2040 volumes indicate the intersection has capacity for additional congestion. AM peak hour congestion will not reach LOS F until it surpasses 50 percent growth. PM peak hour congestion will not reach LOS F until the intersection reaches 40 percent growth.

Table 18. FM 518 (Main Street) and Bay Area Boulevard Intersection Delay

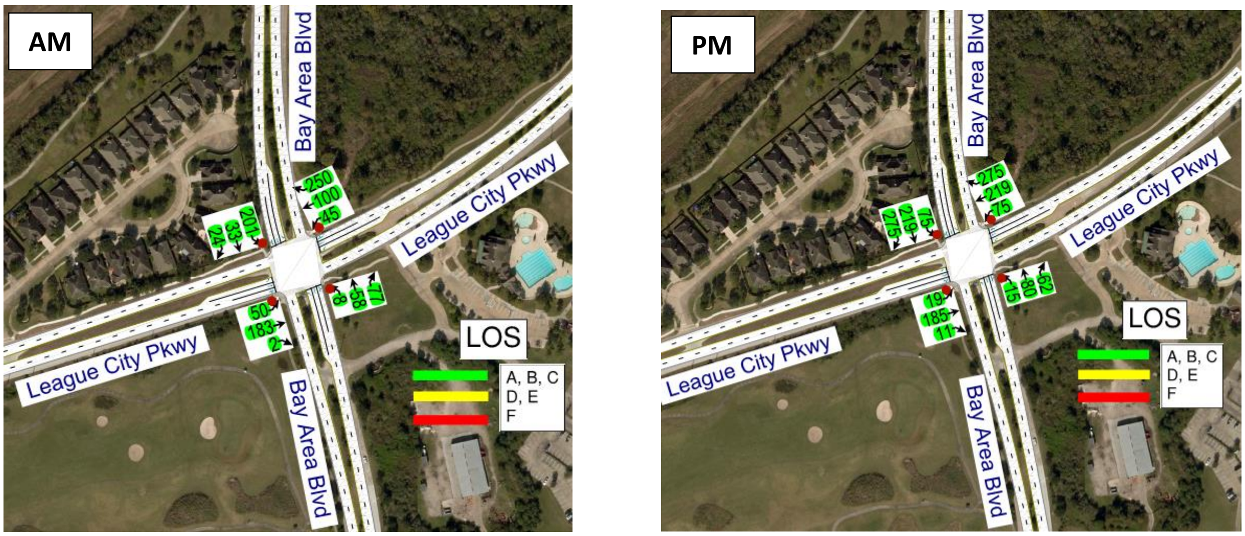
FM 518 and Bay Area Boulevard Future Delay and LOS						
	Current	**10% Growth**	**20% Growth**	**30% Growth**	**40% Growth**	**50% Growth**
	AM					
Delay	24.8	28.1	33.9	42.5	57.1	75.1
LOS	C	C	C	D	E	E
	PM					
Delay	30.2	37.8	50.3	65.9	84.9	106.9
LOS	C	D	D	E	F	F

* Delay in seconds per vehicle

League City Parkway and Bay Area Boulevard

This intersection of League City Parkway and Bay Area Boulevard is a stop-controlled junction of two four-lane divided arterials. All four approaches have two thru-lanes and one left-turn bay. The volumes are low, with roughly 1,000 and 1,500 total vehicles in the AM and PM peak hours, respectively. However, there are large tracts of undeveloped land to the south and west that many significantly increase demand on the intersection.

Figure 16. League City Parkway and Bay Area Boulevard: AM LOS and Volume; PM LOS and Volume



Currently, the intersection performs at LOS C during the AM peak hour and LOS D during the PM peak hour. The southbound and westbound approaches have the highest volume during the PM hour and the greatest delay at 36 seconds and 46 seconds respectively.

Table 19. League City Parkway and Bay Area Boulevard Intersection Evaluation

League City Parkway and Bay Area Boulevard AM					
Cycle length	Unsignalized				
Approach	NB	SB	EB	WB	**Overall**
Delay*	12.4	18.1	13.7	16.5	**15.7**
LOS	B	C	B	B	**C**
League City Parkway and Bay Area Boulevard PM					
Cycle length	Unsignalized				
Approach	NB	SB	EB	WB	**Overall**
Delay*	16	36.4	19.8	46.1	**35**
LOS	B	C	B	C	**D**

* Delay in seconds per vehicle

Analysis of 2040 volumes indicate the intersection will reach LOS F during the PM peak hour with a 10 percent increase in congestion. AM Peak hour congestion will not reach LOS F until congestion increases

50 percent. With anticipated population and employment growth in the area, signalization is recommended to mitigate increasing demand and improve the intersection.

Table 20. League City Parkway and Bay Area Boulevard Congestion Delay

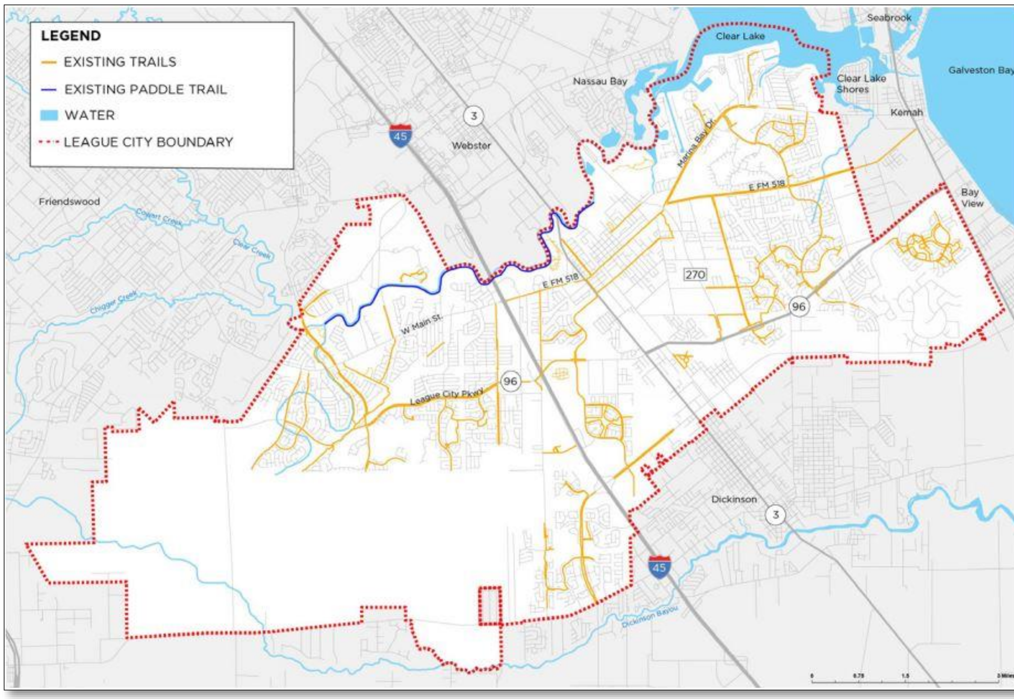
League City Parkway and Bay Area Boulevard Future Delay and LOS						
	Current	**10% Growth**	**20% Growth**	**30% Growth**	**40% Growth**	**50% Growth**
	AM					
Delay*	15.7	18.5	23.4	31.3	44.8	62.9
LOS	C	C	C	D	E	F
	PM					
Delay*	35.0	56.4	83.5	115	151.2	191.4
LOS	D	F	F	F	F	F

* Delay in seconds per vehicle

Non-Motorized Network

Map 5 illustrates League City's existing trail network. The network, comprised primarily of on-street trails, spans nearly 23 miles, and provides access to most developed areas in the city. The existing League City Trails Master Plan, illustrated in **Map 6**, was updated in 2017 and is closely aligned with the 2011 planned thoroughfare network.

Map 5. Existing Trail System Map

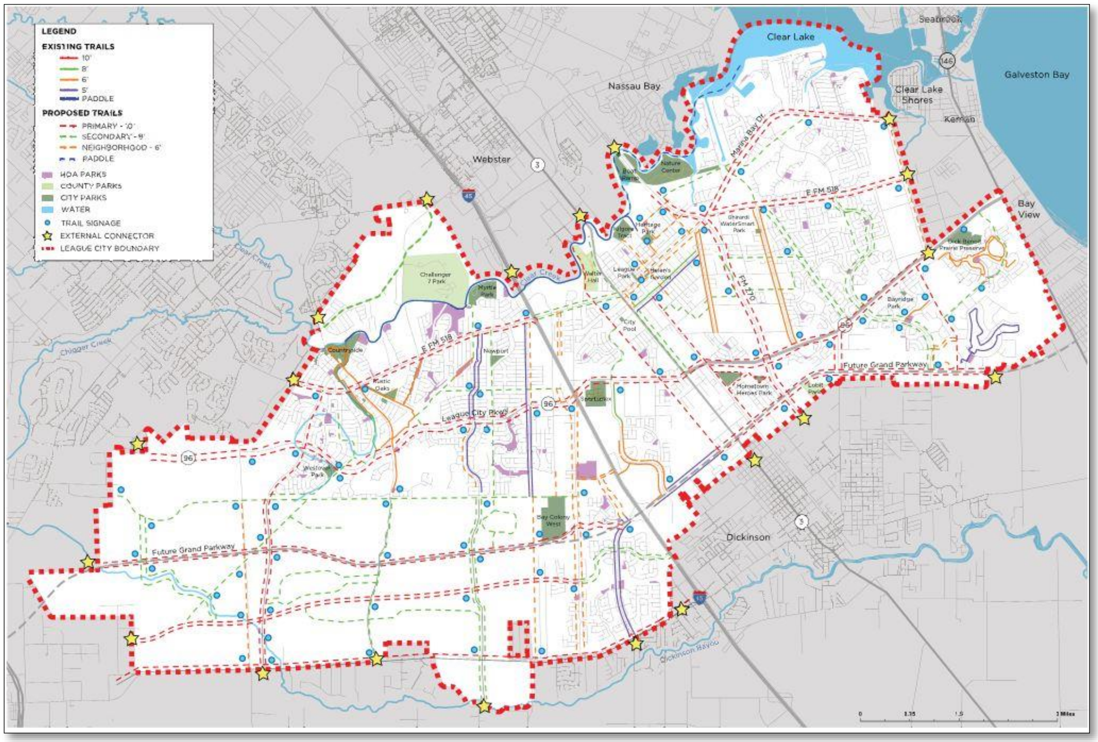


The plan includes 212 miles of proposed and existing off-street trails and provides guidelines on non-motorized connectivity and stresses the importance of connecting parks, schools, residential areas, and business centers.

The network includes proposed and existing 6-foot, 8-foot, and 10-foot trails, and high lights major and minor trail heads, proposed bridges, and underpasses. One of the most extensive trails areas is the city's southwest sector, which is largely undeveloped. This section of the trail, in particular, will need to be amended to comport with the thoroughfare alignments recommended for the Master Mobility plan update.

In addition to revised trail alignments, the type of trail (on-street, off-street, signed route, etc.) will need to be added to each proposed trail to preserve ROW and better integrate with the Master Mobility plan and Engineering and Design Standards.

Map 6. League City 2017 Trails Plan



Aviation, Freight, and Goods Movement

In addition to the movement of commuters between origins and destinations within a city, aviation, freight, and goods movement are critical components of a City's transportation network. Sadly, they are often left out of the planning process. They do not involve the direct movement of individuals from one destination to another, but they do impact a city's transportation network and overall quality of life. Aviation is just as important as mass transit (bus or rail) because it moves both people and goods between destinations.

Evaluating a city's freight and goods movement are important because trains and large trucks are essential to the movement of manufactured and raw materials that people and businesses need to create and maintain a thriving economy. An illustration of League City's existing aviation, freight, and goods movement network is available in **Map 7.**

Aviation

There are currently no airports located within League City, but William P Hobby Airport and George Bush Intercontinental Airport are located about 16 and 46 miles away from the city respectively. There are also a number of smaller local landing strips and private airfields, such as Polly Ranch, Laseair, Clover, Ellington Field, and Pearland Regional Airports located within a few minutes of the city.

Freight

Union Pacific (UP) operates the only active rail line in League City. The line runs parallel to Dickinson Avenue with crossings at FM 646, Olive Street (unprotected), Walker Street, SH 96, and FM 518. UP also owns a second abandoned rail line parallel to SH 146 along the eastern limits of the city. There are no rail crossings within the city along the corridor, but it might be a candidate for a future Rails to Trails project.

Goods Movement

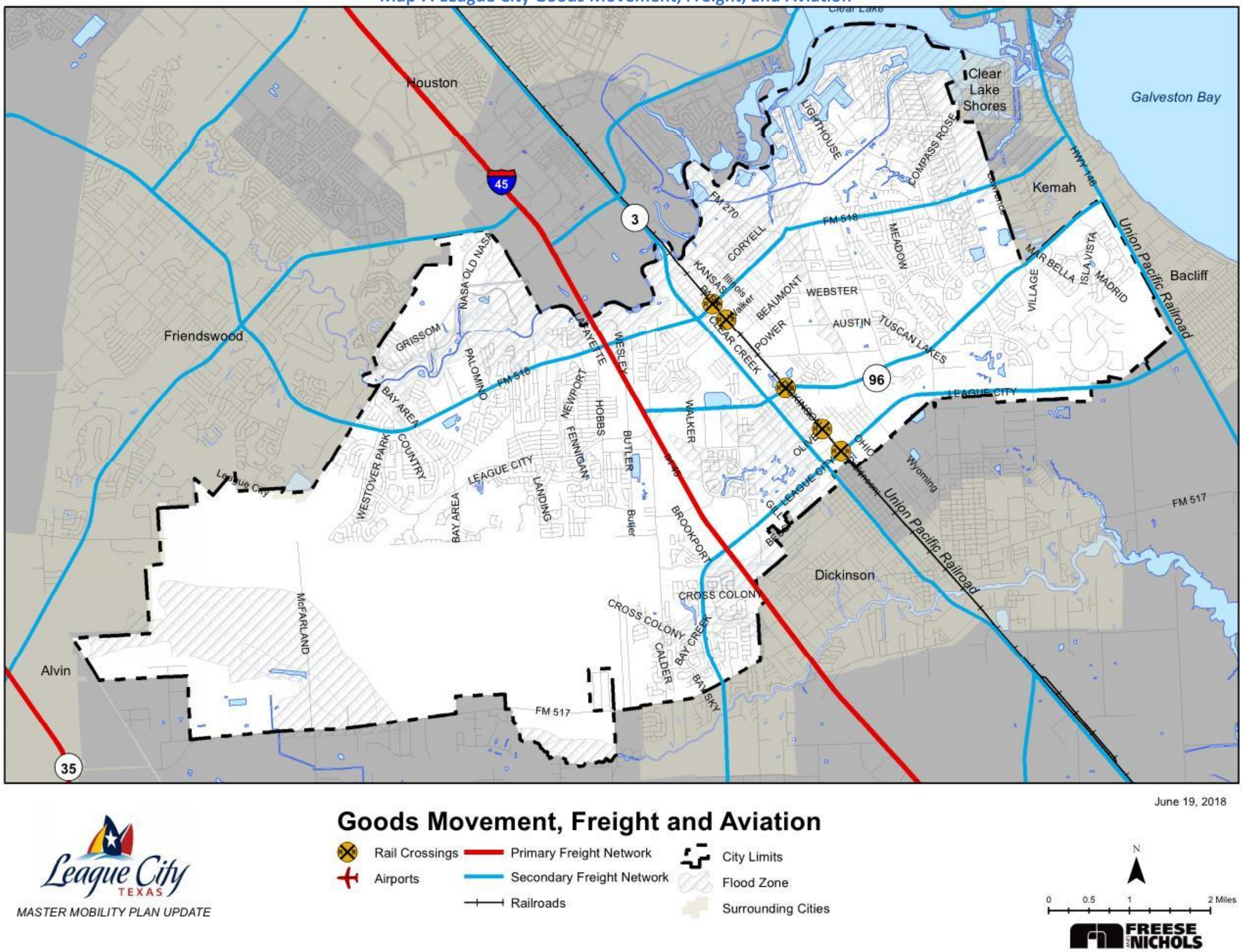
The Federal Highway Administration (FHWA) divides truck routes into primary and secondary tiers. Primary routes include roadways that connect to major gateways, ports of entry, and freight generators. Most of these routes are listed among FHWA's highways of national significance.

Table 21. League City Truck Routes

Roadway	Classification	Average Daily Truck Percent
IH 45	Primary Network	4.30%
SH 146	Secondary Network	8.60%
SH 96	Secondary Network	8.60%
FM 646	Secondary Network	2.60%
FM 518	Secondary Network	5.20%
FM 528	Secondary Network	5.20%

There are currently six designated truck routes in League City, according to TxDOT. IH 45 is currently the only primary route located within the city. Secondary routes within the city include SH 146, SH 96, FM 646, FM 518, and FM528. Additional details on League City's Truck Routes is available in **Table 21.** It is important to note that although not listed on FHWA's list of designated truck routes, most city streets are accessible to trucks making deliveries within the city. General truck thru-traffic may be limited by no truck signage and ordinances and/or roadway weight limitations.

Map 7. League City Goods Movement, Freight, and Aviation



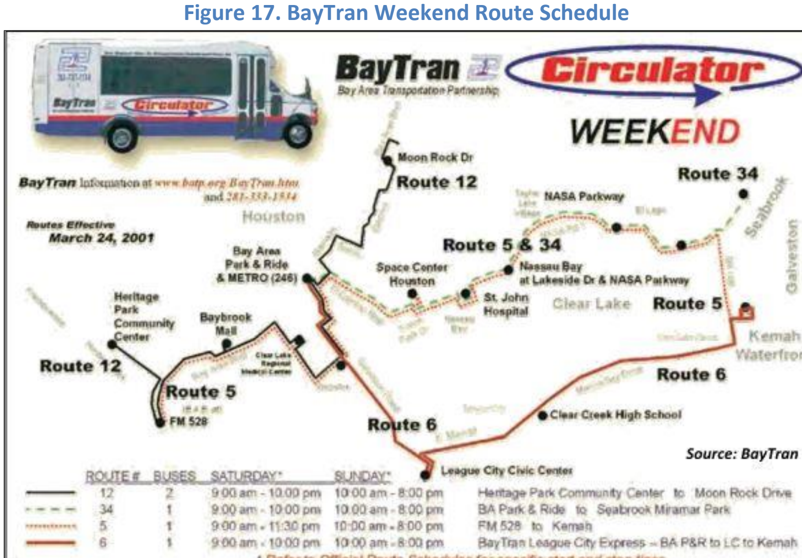
Existing Mass Transit Network

Transit service is an important supplementary component in League City' thoroughfare network. As the City's population grows and demand increases for additional roadway capacity, the availability of transit connections between League City and major destinations will become more crucial as a modal choice for travelers. Among benefits to mass transit include; enhanced network carrying capacity, improved traveling safety, generation of economic opportunity, reduced carbon footprint, cost savings, and personal choice. According to the American Public Transportation Association, commuters are 90 percent less likely to be involved in a traffic collision while utilizing mass transit than a single occupancy vehicle. Additionally, home values performed 42 percent better on average when located near high-frequency public transportation.

Fixed Route Service

BayTran was a fixed route transit service that operated in the city from 2000 to 2001. Service was provided between major destinations in and around the city, but routes were not planned with enough consideration for commuter origins and trip purposes. They focused on where people might go for entertainment and/or work, but not enough emphasis was placed on why or when commuters traveled to these destinations. Additionally, there were not enough busses to provide sufficient headways. According to the 2011 Master Mobility Plan, headways for most BayTran routes were as high as two hours. Additional considerations and resources were needed to develop more efficient transit routes and service times. BayTran weekend routes and times are illustrated in **Figure 17**.

Figure 17. BayTran Weekend Route Schedule



Source: League City 2011 Master Mobility Plan. Taken from BayTran

Table 22. League Existing Means of Travel to Work

Mode	Percent
Car, Truck, or Van - Drove Alone	83.4%
Carpool	9.3%
Public Transportation (Excluding Taxicabs)	1.4%
Walked	0.7%
Other Modes	1.2%
Work from Home	4%

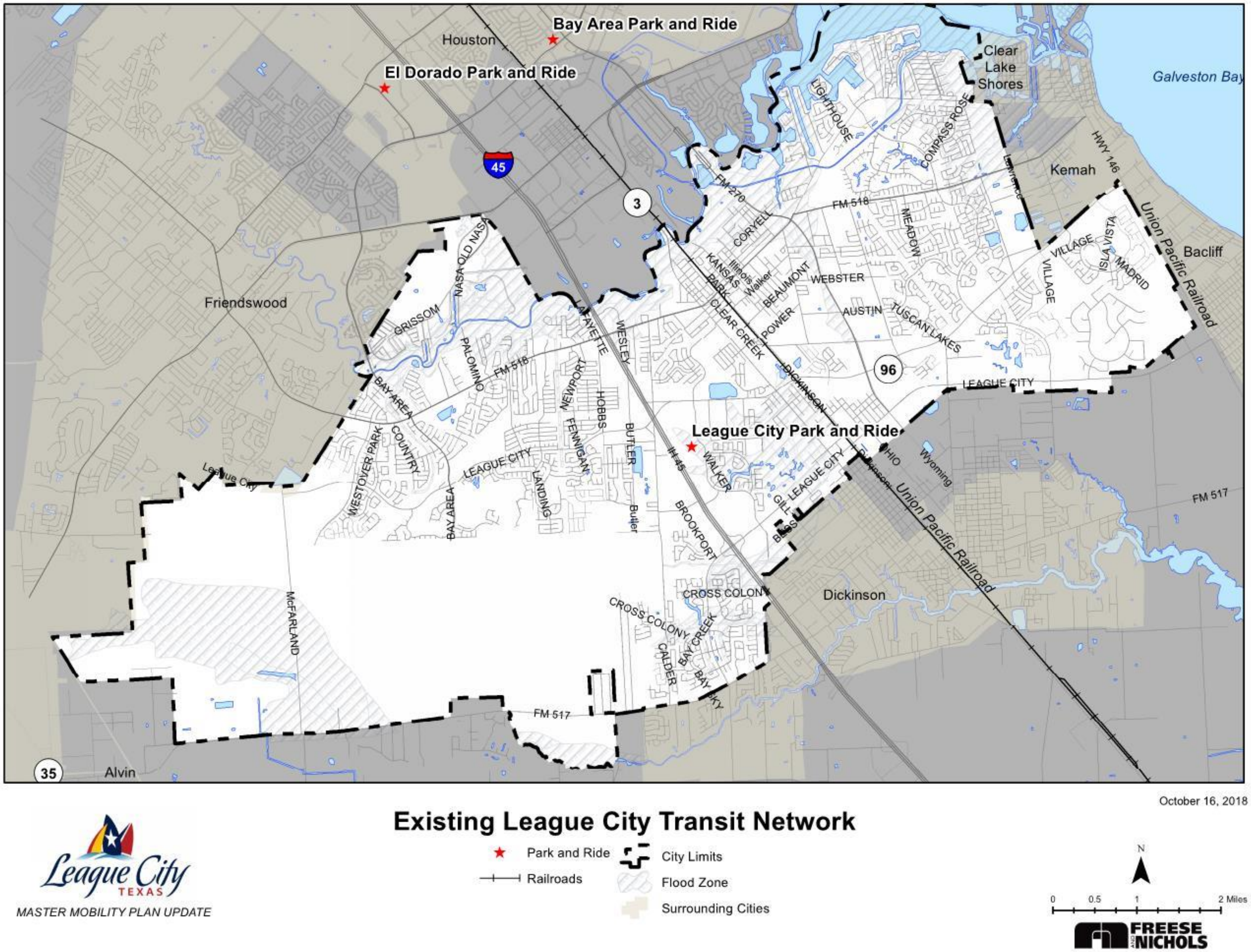
Source: 2016 American Community Survey

A number of transit modes are available around the Greater Houston area including; fixed route bus service, express and demand response bus, commuter rail, light rail transit, bus rapid transit, and in planning, high speed rail. The feasibility of these modes is not only dependent upon the demand for services, but adjacent land uses and the cost implementation, operations, and maintenance as well. Express bus and demand response are the only mass transit modes currently available in the city. This is reflected in the low percentage of League City residents utilizing public transportation in **Table 22.**

League City transit service is currently provided via Connect Transit and includes both express bus and demand response service. Express bus service is available between the League City Park-and-Ride or Victory Lakes Town Center to the University of Texas Medical Branch (UTMB) Waverly Smith Pavilion in Galveston. Demand response service is available to destinations in Brazoria and Galveston Counties, as well as the Veterans Affairs Hospital in Houston.

Additionally, Houston Metro Star provides van pool service to from League City to various locations in Harris and Galveston Counties. League City residents may also utilize express bus service from the El Dorado and Bay Area Park and Ride stations. League City Park and Ride locations are illustrated in **Map 8.**

Map 8. League City Existing Transit Network



Chapter 5: Growth Factors and Projected Conditions

Travel Forecast Modeling

A Travel Demand Model (TDM) is a computerized representation of a community or region's transportation system. TDMs use land use and demographic forecasts to simulate the movement of commuters throughout a transportation network under various conditions. Model results are used by transportation planners to display current network conditions and predict what impact changes to the system and/or the environment in which it operates will have on future travel demand.

TDMs can be programmed to model all the modes of travel utilized in a regional transportation system; however, most TDMs - including the one used for this analysis- only include the roadway and the transit networks. Bicycle and pedestrian travel are rarely included in TDMs because of the relatively small number of trips generated by these travelers.

Basic Model Theory

A travel forecast model is comprised of a series of mathematical models that simulate travel on the transportation system. The model divides the city into Travel Analysis Zones (TAZs) which have specific demographic and land use data associated with them and are used to determine trip demand and travel patterns. The modeling process encompasses the following four primary steps:

- Trip Generation – the number of trips produced and attracted to a destination or TAZ based on trip purpose.
- Trip Distribution – the estimation of the number of trips between each TAZ, i.e., where the trips are going.
- Modal Split – the prediction of the number of trips made by each mode of transportation between each TAZ.
- Traffic Assignment – the amount of travel (number of trips) loaded onto the transportation network through path-building. This is used to determine network performance.

Methodology

The key demographic data inputs for this TDM were population, households, and employment. Using sociodemographic projections from H-GAC as a base, the project team worked with the League City Staff to help identify any known future growth and development patterns. The City provided feedback on H-GAC's 2015, 2025, and 2040 demographics (household population and employment), and helped incorporate planned residential and employment developments into the TAZs for the travel demand model.

After considering League City's feedback, projections for League City were refined to more accurately reflect where people were expected to live and work in 2040. The project team achieved this by increasing and redistributing the population and employment projection data across the identified TAZs, based on where growth was anticipated to occur.

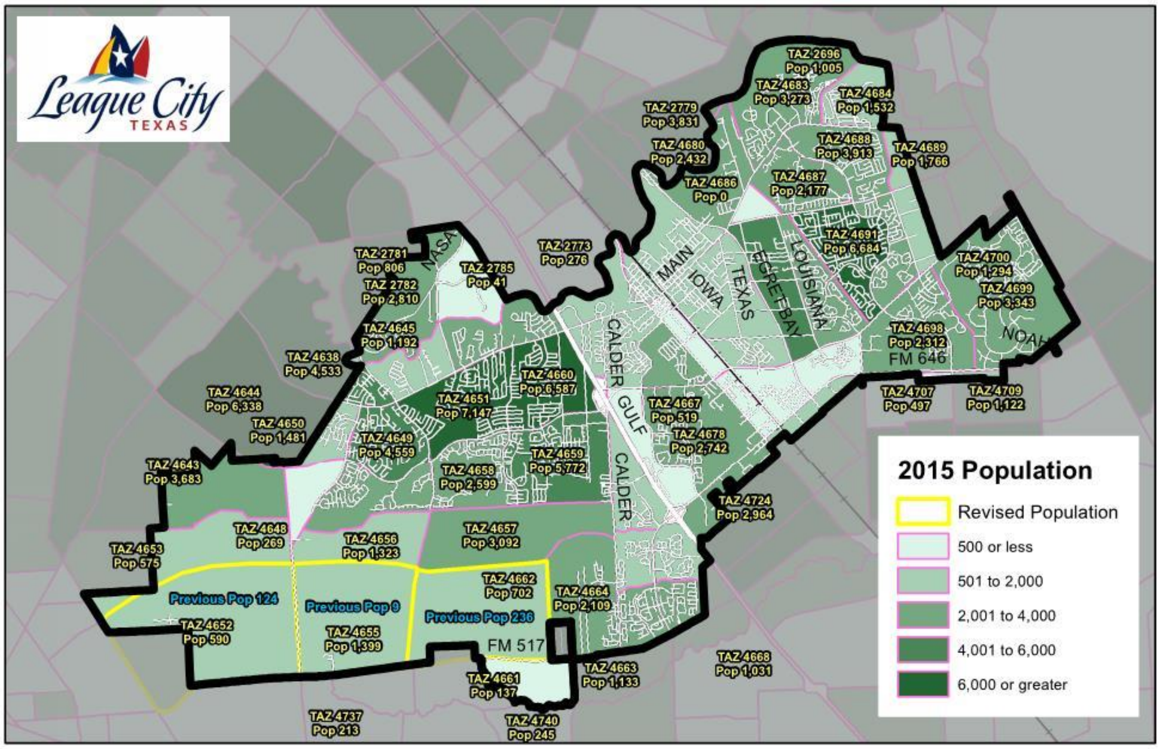
TAZ refinements east of IH 45 closely followed H-GAC projections with only small increases in population and household growth for few TAZs and slight increases in overall employment. Population additions were based on an estimated 2.84 residents per dwelling unit. Employment was based 304 square foot of office per employee, and 383 square foot of retail per employee.

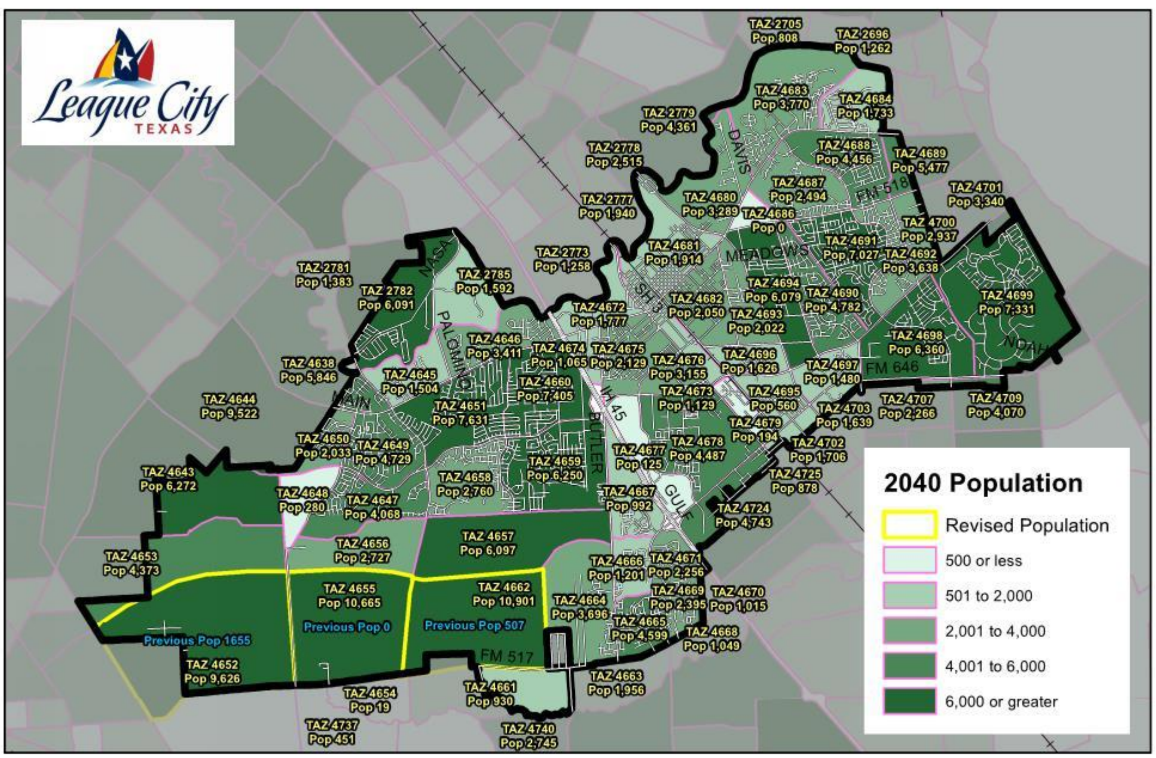
Larger population increases were projected in the southwest sector of the city where planned developments, such as Lakes of Quail Point, and River Bend Master Plan, and the Southwest Side PUD are located. H-GAC projected TAZ 4655, for instance, to have a population of zero by 2040. The refined population projection for the TAZ is 10,665. Likewise, the projected population for TAZs 4652 and 4662 were increased to 9,626 and 10,901 respectively. **Map 9** illustrates projected population refinements for 2015 and 2040.

Refined employment projections were not as dramatic, and included developments such as grocery stores, hospitals, and commercial strips. The largest 2040 employment amendment was TAZ 4678, which increased by nearly 5,000 jobs. Interestingly, the projected employment for TAZ 4672 decreased by nearly 150 jobs. A comparison of employment distribution is illustrated in **Map 10**.

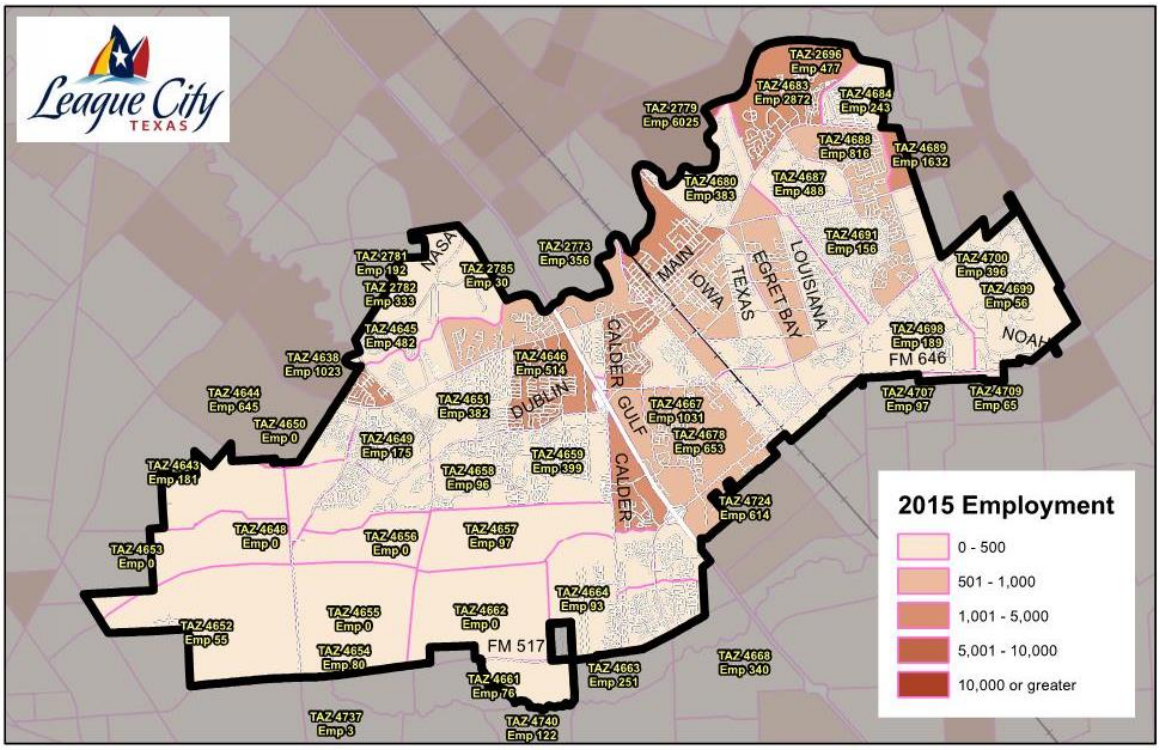
It is important to note that population and employment projections were further refined after the travel demand modeling process and included additional growth and development not considered in the travel demand modeling process. The refined numbers are reflected in the existing conditions section of the plan document in **Figure 1** and **Table 1.**

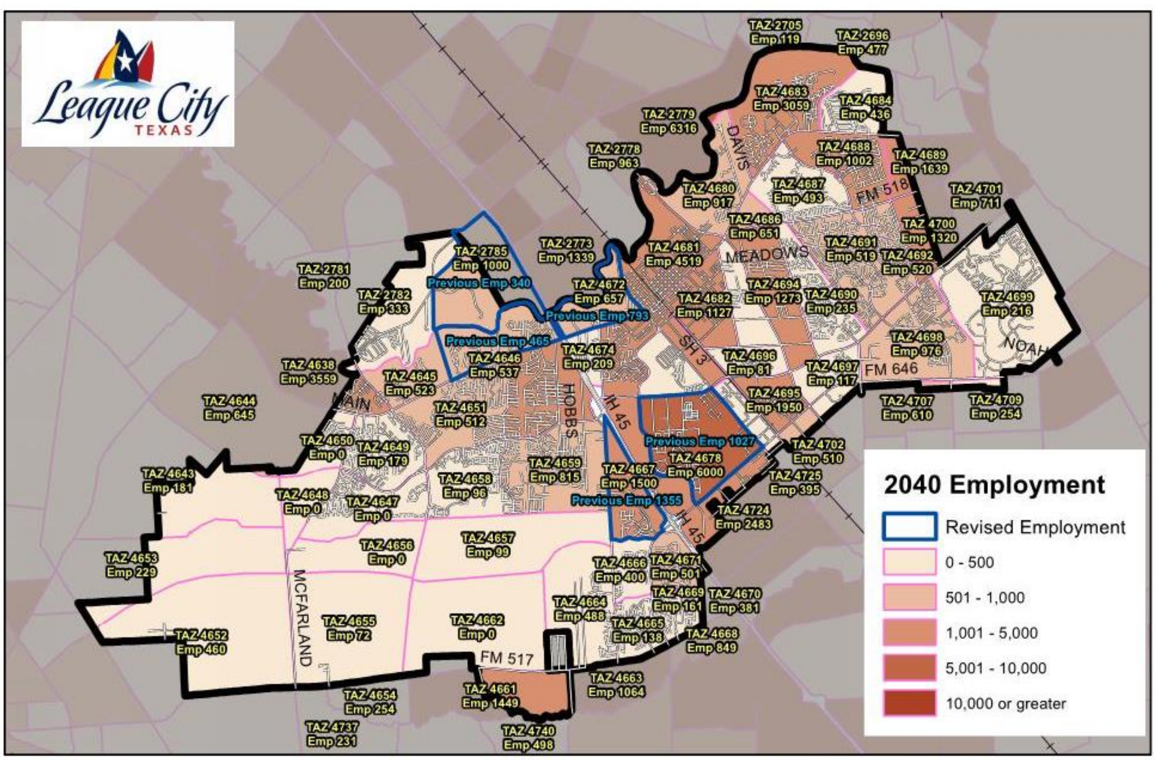
Map 9. League City 2015 and 2040 Population Comparison





Map 10. League City 2015 and 2040 Employment Comparison





Travel Demand Model Limitations

As previously noted, the Cube Voyager Model H-GAC uses for the regional travel demand model is regional in nature and not specifically calibrated to assess small area networks or specific corridors. Additionally, the level-of-service derived from the model is a volume to capacity ratio, and does not account for intersection queuing, turning movements, or other operational factors. This is acceptable for a broader view of the network performance, but highly congested arterial facilities may need additional analysis. To better assess the network, crucial facilities, such as Main Street (FM 518), League City Parkway, and key intersections were analyzed using SYNCHRO (see Chapter 4). A SYNCHRO analysis was also conducted to assess the Main Street corridor. It is also important to note that roadways extended in the travel demand model are not based on city limits, but the overall regional network.

2015 Network Additions

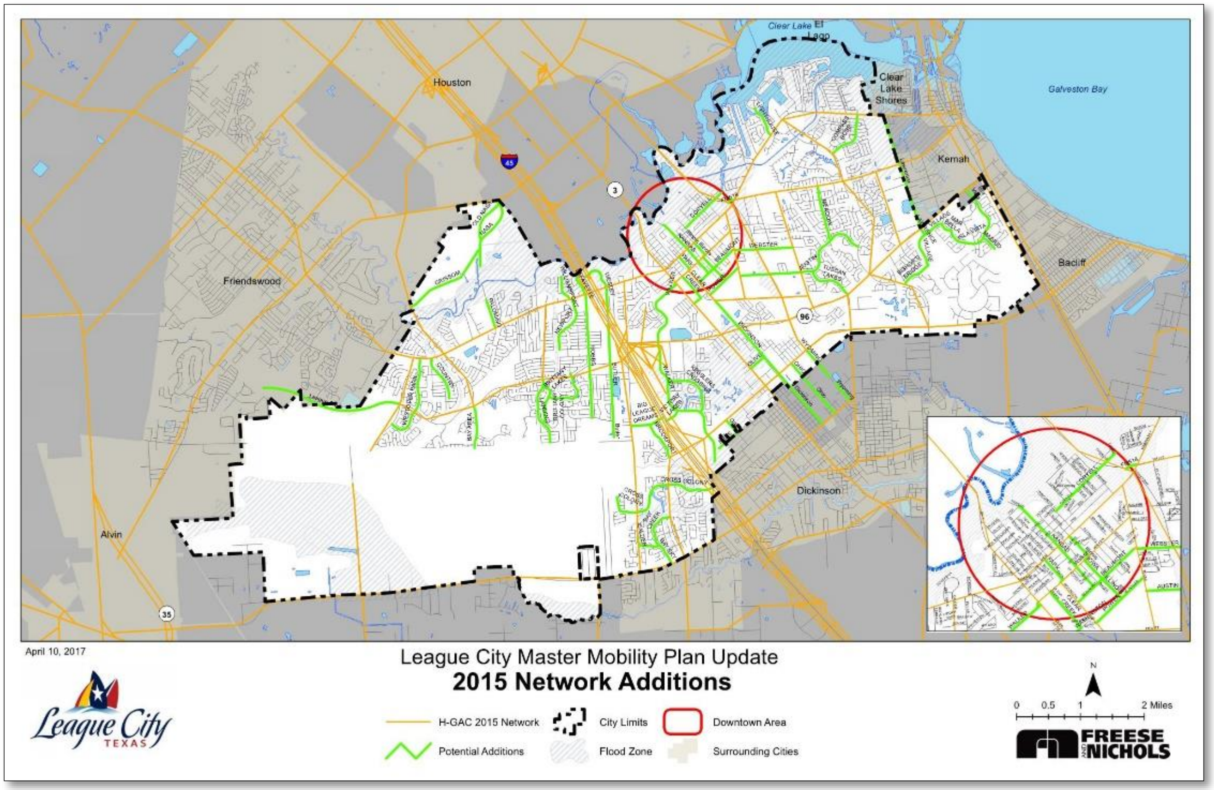
In order to better assess the existing thoroughfare network, League City staff recommended the existing 2015 road network be upgraded with several existing arterial and collector facilities that were not initially included in H-GAC's 2015 network. An abbreviated summary of key 2015 network additions is available in **Table 23.** A full summary of network additions is available in the Appendices.

Table 23. 2015 H-GAC Network Additions

Roadway	Limits	Lanes	Volumes
Walker Street	League City Parkway to South of FM 646	4D	4,586
League City Parkway Extension	Extend from Maple Leaf Dr to the east city limits	4D	3,576
Big League Dreams Parkway	From Calder Rd to IH45 Frontage Rd	3D (Center Turn Lane)	5,894
Landing Boulevard	League City Parkway to Sandvalley Way	2U	11,645
Dickinson Avenue	Deats Rd to Hewitt St	2U	584

Map 11 illustrates the H-GAC road network used for the 2015 base model run Roadways added to the network are highlighted in green.

Map 11. H-GAC 2015 Network Additions



Walker Street
Walker Street, from SH 3 to FM 646, was added to the network because it provides an alternate north to south route through central League City and an important connection to the downtown area. The amount of traffic pulled from parallel facilities, such as the IH 45 frontage road and SH 3, onto Walker Street will help provide a better illustration of capacity improvements needed to improve traffic operations in central League City. In 2015 the traffic volumes along Walker Street were over 4,500 vehicles per day (VPD).

League City Parkway Extension
League City Parkway provides a pivotal east to west connection through League City. The alignment currently spans westward from SH 146 and terminates at Maple Leaf Drive in the H-GAC 2015 network. The western segment of the roadway, from Maple Leaf Drive to the City limits is under construction and should be added to the network to gage its performance. The League City Parkway Extension carried roughly 3,500 VPD in 2015.

Big League Dreams Parkway
Big League Dreams Parkway was added to the network because it provides access to IH 45 for the emerging development area in the western segment of the City. Additionally, the roadway connects a proposed arterial facility (to be added in the 2040 network) to IH 45; the current performance of Big League Dreams Parkway will provide a baseline for the analysis of the future connection. The roadway accommodated about 5,900 vehicles per day in 2015.

Bay Area Boulevard Extension
Bay Area Boulevard was extended through the Magnolia Creek subdivision to reflect its current alignment. The roadway currently provides a north to south connection from the existing residential development in northwest League City to FM 518 and League City Parkway. The roadway will eventually be extended to the city's southern limits.

Landing Boulevard Extension
In order to reflect its current alignment, Landing Boulevard was extended from League City Parkway to its current terminus at Sandvalley Way. The roadway will be extended to the city's southern limits in the 2040 network. In 2015, the traffic volumes along Landing Boulevard Extension were roughly 11,600 VPD.

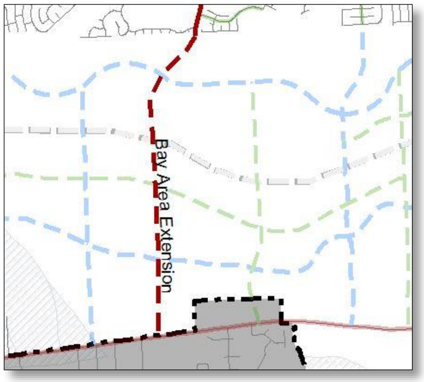
Dickinson Avenue
Dickenson Avenue was added to the network because it provides an alternative north to south connection through the city and provides additional access to the downtown area. The roadway accommodated about 584 vehicles per day in 2015.

2025 Network Additions

The 2025 mid-term network includes a number of new alignments and roadway extensions to improve overall connectivity and mobility within in the city. The following section provides a summary of the alignments added to the network H-GAC's 2025 Network.

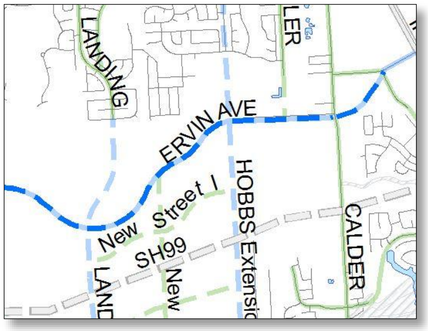
Bay Area Boulevard Extension

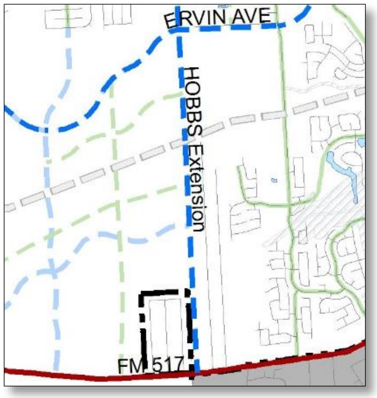
Bay Area Boulevard will be extended from its current terminus at Magnolia Green Lane to FM 517. The roadway will provide a regionally significant north to south connection in the western sector of the city, providing alternate access to the planned SH 99 alignment and potential congestion relief for IH 45. In addition to improving connectivity and reducing overall congestion, the Bay Area Boulevard Extension will also improve the overall development framework in the city's southwest sector.



Ervin Avenue

Ervin Avenue, for instance will extend from Hobbs Road to the extended Landing Boulevard alignment. The roadway will improve east to west connectivity in the western segment of the city and add to the overall development framework of the city's southwest sector. The roadway (see below) will eventually extend west across the southwestern sector of the city. The proposed functional classification for the roadway is a four-lane divided minor arterial within 80 to 100 feet of right-of-way.



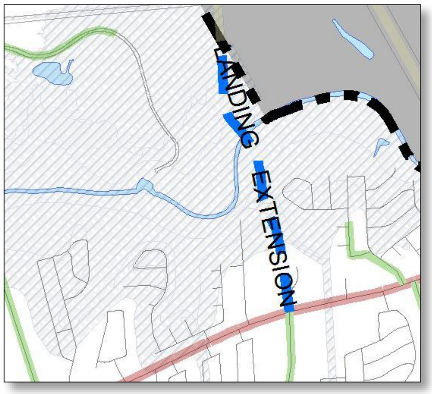


Hobbs Road

Hobbs Road will be extended from Ervin Avenue to FM 517 at the southern limits of the city. The roadway extension will improve north to south connectivity within the city, improve overall circulation, and facilitate development in the southern sector of the city. The roadway will be a two to four-lane minor arterial within 80 feet of right-of-way.

Landing Boulevard – Northern Extension

The northern segment of Landing Boulevard will be extended from Main Street to the future extended Kobayashi Road in Webster. The extension will improve north to south connectivity and provide an alternative connection to IH 45. The northern extension will also provide congestion relief for the IH 45 and Main Street intersection and help open the area in the northeast sector of the city - north of Main Street - for development. This segment will be a two to four-lane minor arterial facility within 80 to 100 feet of right-of way.

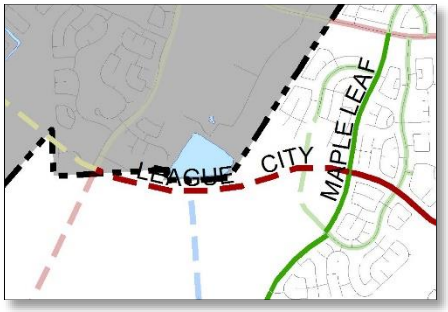


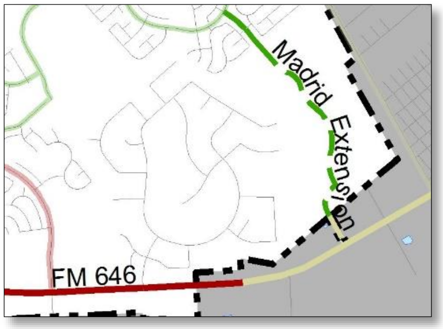
Landing Boulevard – Southern Extension

The southern segment of Landing Boulevard will be extended south from Sand Valley Way to FM 517. The extension will improve north to south connectivity in the southern sector of the city and add to the overall development framework of the area. This segment will be a two to four-lane minor arterial facility within 80 to 100 feet of right-of-way.

League City Parkway

League City Parkway will be extended from its current terminus at Maple Leaf Drive to the western City Limits. The roadway, according to the H-GAC network will be extended to FM 528 in Friendswood. The extension will improve overall east to west connectivity within the city and provide an alternative connection into Friendswood. The roadway will also help open the southwest sector of the city for development. League City Parkway will be a two to six-lane major arterial within 120 feet of right-of-way.



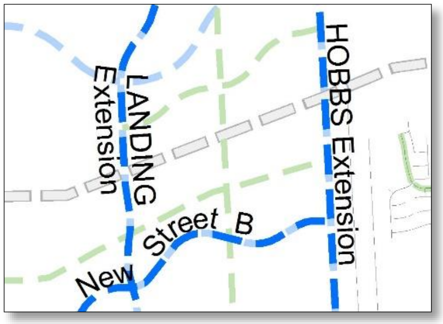


Madrid Lane

Madrid Lane will be extended from its existing terminus to FM 646. The extension will improve north to south connectivity and open the southeast corner of the city for development. The roadway will be a two-lane collector within 80 feet of right-of-way.

New Street B

New Street B will stretch from the Landing Boulevard Extension to the Hobbs Extension. The roadway will improve east to west connectivity in the southern sector of the city and provide a pivotal linkage in the city's southern roadway network. The alignment will also provide part of the framework for the development proposed in the southern sector of the city. The roadway will be a two to four-lane minor arterial within 80 feet of right-of-way.



Palomino Lane Extension

The Palomino Lane Extension will stretch from the existing Palomino Lane alignment to Clear Creek. The roadway will transition into Beamer Road north of Clear Creek and continue into the cities of Webster and Friendswood. In addition to bolstering the development framework in northern League City, the alignment will also improve north to south connectivity on the west side of the city. The Palomino Extension will be a two (2) to four (4) - lane collector facility within 80 feet of right-of-way.

Beamer Road Extension.

The Beamer Road Extension will extend north from Palomino Lane at Clear Creek to the existing Beamer Road alignment in the city of Webster. The roadway will provide alternative north to south connectivity and improve the overall development framework in the northern sector of the city. Additionally, the alignment will provide back access to the Eldorado Park and Ride Station in the city of Friendswood. The roadway is will be a two (2) to four (4) - lane collector facility within 80 feet of right-of-way.

Table 24. 2025 Network Additions

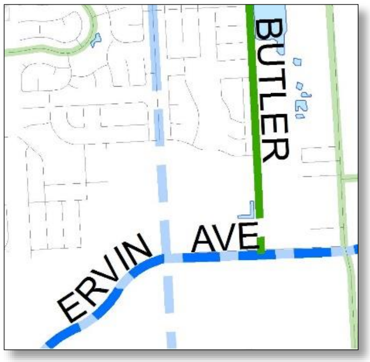
Roadway	Limits	Lanes
Bay Area Boulevard	Magnolia Greens Ln to FM 517	4D
Hobbs Road Extension	Ervin Ave to FM 517	4D
Landing Boulevard Extension	Sandvalley Way to FM 517	4D
League City Parkway Extension	Maple Leaf Dr to FM 528	4D
Madrid Lane Extension	Existing alignment to FM 646	2U
Walker Street Extension (Southern Segment)	South of FM 646 to IH45 Frontage	3D
Walker Street Extension (Eastern Segment)	Texas Ave to FM 270	2U
Ervin Avenue	Calder Rd to Landing Blvd (Extension)	4D
New Street B	Landing Blvd Extension to Hobbs Rd Extension	4D
Palomino Lane Extension	Palomino Ln to Grissom RD	2U
Beamer Road Extension	Grissom Rd to North City Limits	2U

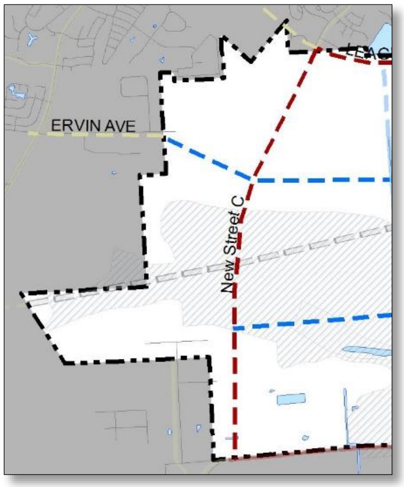
2040 Network Additions

League City's 2040 network includes a number of long-term network additions to improve overall connectivity within the city of League City. The recommended improvements should be implemented as development unfolds rather than on a specific planning horizon. It is also important to note that volumes were not available for smaller roadways, such as New Street F. Volumes for these facilities are captured by the centroid connectors between TAZs and are not assigned to the roadway links.

Butler Road Extension

Butler Road will be extended from its existing terminus north of Ervin Street Ervin Avenue. The extension, though small, will improve connectivity in the western segment of the city and improve north to south connectivity. The proposed functional classification of the roadway is a two-lane collector facility within 80 feet of right-of-way. The extension is projected to accommodate about 1,200 vehicles per day in 2040.



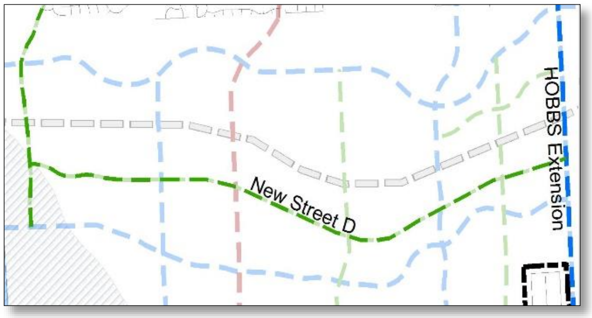


New Street C

New Street C will provide the primary north to south connection in the western sector of the stretching from FM 517 to the League City Parkway Extension. Through coordination with the City of Friendswood, the roadway may eventually be extended to FM 518. The roadway will be functionally classified a four (4) lane divided Major Arterial within 100 – 120 feet of right-of-way. In addition to providing a north to south connection, the roadway will help open the city's western most land for development and improve connectivity between League City, Friendswood, Alvin, and the Algoa area. New Street C is projected to carry approximately 14,300 VPD in 2040.

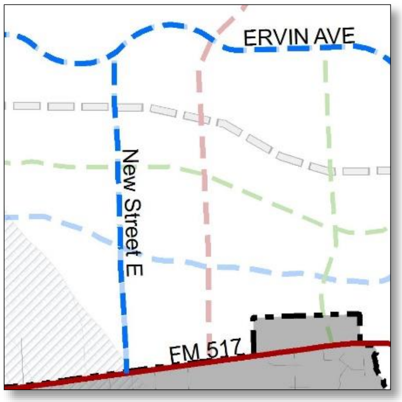
New Street D

New Street D will provide backage support for SH 99 and improve connectivity and development potential in the Southwest sector of the city. The east to west facility, located south of SH 99, will stretch from the Hobbs Extension to the Maple Leaf Drive Extension. The roadway will be classified a two to four lane collector facility within 80 feet of right-of-way.



New Street E

New Street E will provide a north to south connection in southwest League City and support proposed commercial and residential development in the area. The roadway, stretching from Ervin Avenue to FM 517, will be a four-lane divided minor arterial within 80 to 100 feet of right-of-way. New Street E is projected to carry about 11,152 vehicles per day in 2040.

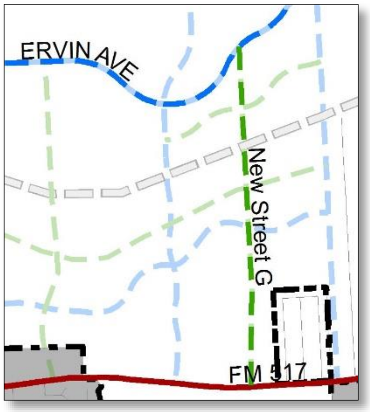


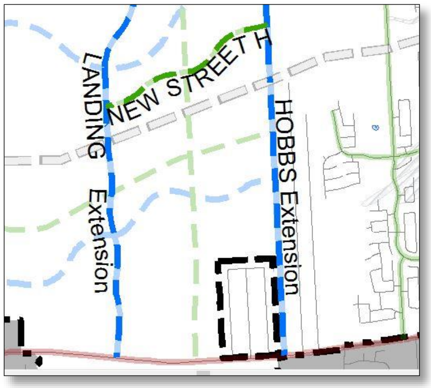
New Street F

New Street F will provide an additional north to south route in the southwestern sector of the city and improve overall connectivity in League City's thoroughfare network. Additionally, the roadway will help facilitate commercial and residential development south of SH 99. New Street F will stretch from Ervin Avenue to FM 517. The functional classification of the roadway will be a two to four lane collector facility within 80 feet of right-of-way.

New Street G

New Street G, located in the southern sector of League City, provides a north to south connection between FM 517 and Ervin Avenue. The roadway will help facilitate commercial and residential development in the southern sector of the city by improving connectivity and access in thoroughfare network. New Street G will be classified a two to four lane collector facility within 80 feet of right-of-way.





New Street H

New Street H will improve connectivity and access in the southwest sector of the city by providing an additional backage road for SH 99. The connection will add to the overall development framework of the area and help facilitate economic development along the SH 99 corridor. The roadway will be classified a two-lane collector facility within 80 to 90 feet of right-of-way. As a connection within a planned development area, the roadway may include on-street parking.

Ervin Avenue Extension

The Ervin Avenue Extension will extend Ervin Avenue from its 2025 (estimated) terminus at Landing Boulevard (see above) to West Parkwood Avenue (Friendswood). The roadway will further extend development opportunities in the southwest sector and provide backage road support for SH 99. The functional classification for the roadway will remain a four-lane minor arterial within 80 to 100 feet of right-of-way. In 2040, the projected traffic volume for Ervin Avenue is around 13,650 VPD.

New Street B Extension

The New Street B Extension will extend New Street B from Landing Boulevard to New Street C (see description above). The roadway will help support future development north of SH 99 and provide backage road support for the roadway. The extended roadway will continue as a four-lane minor arterial within 80 to 100 feet of right-of-way. The roadway is projected to accommodate about 25,000 vehicles per day in 2040.

SH99 (Grand Parkway)

Grand Parkway, an east to west limited access freeway/ tolled facility, will not only provide the foundation of the city's southeastern road network, but a crucial alignment in the region's overall thoroughfare network. Utilizing the existing FM 646 alignment as a basis, the roadway will bisect the entire city before veering south in the city of Alvin – eventually circumventing circling entire region. League City's alignment was previously programmed as a four-lane major arterial facility in the 2011 plan but was updated to a freeway/toll road in the 2018 plan.

League City's segment of the roadway will be a four-lane, tolled facility within 400 feet of right-of-way. It is important to note that this section of the roadway is not currently considered viable by the Texas Department of Transportation. Despite this, it is important for the City to preserve right-of-way for the long-term development of this sector of the city. Grand Parkway is projected to carry about 26,000 vehicles per day in 2040.

Table 25. 2040 Network Additions

Roadway	Limits	Lanes	Volumes
Butler Road (Extension)	Ervine Ave to Cross Colony	2U	1,200
Ervin Avenue (Extension)	Landing Blvd (Extension) to FM 528	4D	13,650
New Street B (Extension)	Landing Blvd (Extension) New Street C	4D	25,000
New Street C	FM 518 to FM 517	4D	14,300
New Street D*	Hobbs Extension to New Street E	4D	
New Street E	Ervine Ave to FM 517	4D	11,152
New Street F*	Ervine Ave to FM 517	4D	
New Street G*	Ervine Ave to FM 517	2U	
New Street H*	New Street D to FM 517	2U	
SH99 (Grand Parkway)	FM 646 to League City Limits	4D	26,000

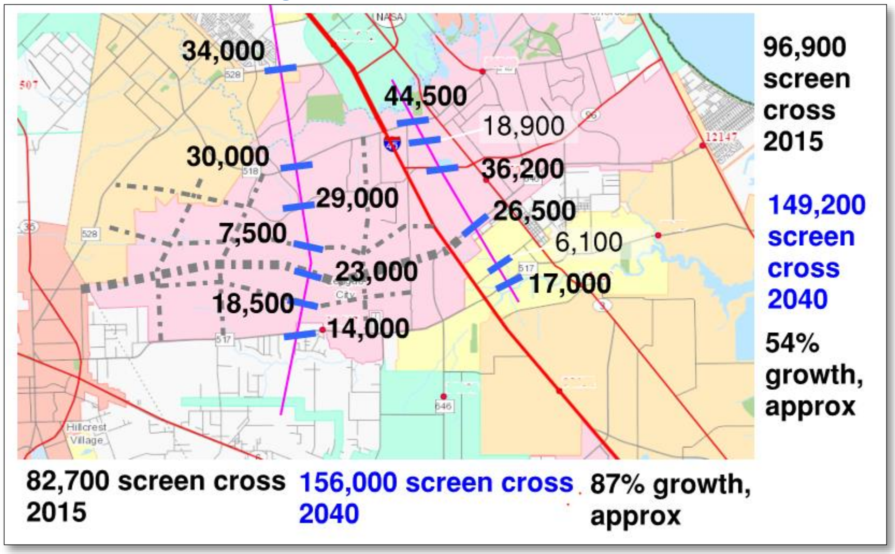
*Not included in the travel demand model. Volumes not available.

2040 Volumes and Level-of-Service

Analysis of the 2040 thoroughfare network included a review of League City's existing and committed network coupled with new alignments provided by City staff, the 2011 Master Mobility Plan, and future development plans within the city. 2040 traffic volumes are illustrated in **Figure 18**. Overall, the network operates at an adequate LOS, with commuters able to easily travel to destinations within the city with little congestion. There are, however a few segments, detailed below that warrant further examination as development unfolds within the city.

The revised 2040 network incorporates a number of network additions, most notably the addition of SH 99 as an access-controlled facility in the southwest sector of the city. The roadway, a tolled facility, will be bolstered by a surrounding network of arterials forming a grid pattern for the western half of League City. Eastern League City shows improvements to some roadways, and a select few additions of roadway links to reinforce the existing grid network.

Figure 18. 2040 Network Screen Lines



Network Operations

The model run conducted by H-GAC for the League City Master Mobility Plan shows general growth and increases of traffic volumes that follow the existing pattern of travel flow – focused volume to and from I-45. Travel flows east of IH 45 are generally expected to increase by about 54 percent, given assumptions in growth and traffic distribution for this part of the city – which already has a significant amount of development and roadways in place. Generally, four-lane arterials are anticipated to maintain flows at level-of-service D or better. Other segments, such as Egret Bay Boulevard north of FM 518, SH 3 North of Main, FM 518 between SH 3 and I-45, and League City Parkway between I-45 and Walker Street, indicate a demand for more than four lanes. These segments, described below in **Table 26**, will require six lanes or more to maintain a level-of-service D or better.

Table 26. Eastern League City Critical Corridors

Road	Segment	Lanes	2015 Volume	2015 LOS	2040 Volume	2040 LOS
Egret Bay Boulevard	North of FM518	6	31,472	E	37,709	F
SH-3	North of FM 518	4	24,419	F	31,488	F
FM518 (Main Street)	IH45 to SH 3	4	36,697	F	48,132	F
League City Parkway	IH45 to Walker	4	23,554	F	42,477	F

Roadways west of I-45 are anticipated to develop steadily as the network and development unfold. Generally, growth for this area is anticipated to be about 87 percent. This is due to the sparse road network and high number of large undeveloped parcels. **Table 27** details volumes and level-of-service for roadways located in the western sector of the city. Model results indicate demand for most arterial roadways are within acceptable daily levels of service (D or better). There are, however a few segments projected to operate at a poor LOS.

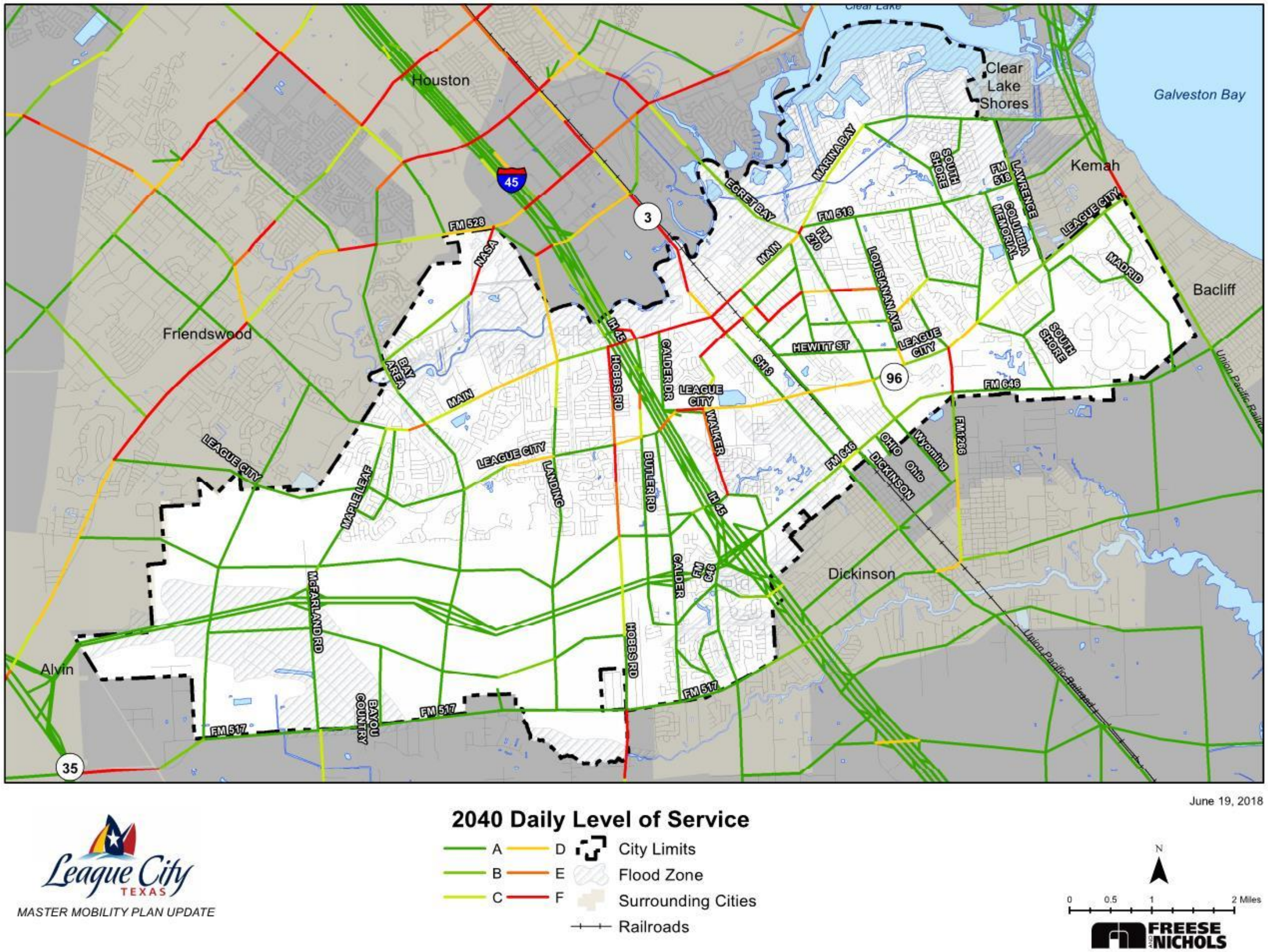
The segments of FM 518 between Newport Boulevard and the IH 45 frontage road, a critical intersection according to City staff, is projected to carry as many as 65,000 vehicles per day in 2040 at level-of-service F. This would also be the case if the roadway were widened to six lanes. Fortunately, traffic significantly decreases as road segment get further from IH 45. This intersection, which currently operates at LOS F, will need to be evaluated as growth occurs for alternative, supportive routing or other network improvements such as auxiliary lanes or operational improvements for this small, but critical, link of the network.

Other high congestion areas include, but are not limited to, FM 518, from Landing to Magnolia Estates, League City Parkway from Landing Boulevard to Creeksage Lane, and Landing Boulevard, from FM 518 to Fredericksburg Drive. With the exception of Landing Boulevard, LOS would be improved to E with two additional lanes. This segment of Landing Boulevard, however, is a collector facility located in a residential area, and there is not enough ROW to accommodate two additional lanes. Other measures such as improved traffic signal timing and turning lanes may help improve congestion. High level level-of-service and volumes are Illustrated in **Map 12** and **Map 13** respectively.

Table 27. Western Sector Roadway Volumes and Level-of-Service

Road	Segment	Lanes	2015 Volume	2015 LOS	2040 Volume	2040 LOS
FM518 (Main Street)	Newport Blvd to Hobbs Rd	4	36,303	F	65,721	F
FM518 (Main Street)	Landing Blvd to Magnolia Estates	4	18,651	E	30,658	F
Landing Boulevard	FM 518 to Fredericksburg Dr	4	17,335	E	28,344	F
FM518 (Main Street)	Ellis Rd to Bay Area Blvd	4	21,008	E	27,971	F
Bay Area Boulevard	FM 518 to NASA Blvd	4	21,112	E	21,826	E
Bay Area Boulevard	FM 518 to League City Pkwy	4	7,889	AB	12,002	C
League City Parkway	IH 45 Frontage Rd to Butler Rd	4	16,573	D	22,384	E
League City Parkway	Landing Blvd to Creeksage Ln	4	28,457	F	32,063	F
Bay Area Boulevard (Extended)	League City Pkwy to New Street A (2040)	4	N/A	N/A	17,977	D
Bay Area Boulevard (Extended)	New Street A to SH 99 (2040)	4	N/A	N/A	12,006	C
Ervin Avenue	IH 45 Frontage to Brookport Dr	4	N/A	N/A	23,912	F
Ervin Avenue	Hobbs Rd to Landing Blvd	4	N/A	N/A	16,943	C
Ervin Avenue	Bay Area Blvd to Maple Leaf Dr (Extended)	4	N/A	N/A	11,342	AB
New Street B	Hobbs Rd to Landing Blvd	4	N/A	N/A	13,683	C
New Street B	Landing Blvd to New Street F	4	N/A	N/A	25,457	E
New Street B	Bay Area Blvd to New Street E	4	N/A	N/A	10,055	AB
SH99 (Grand Parkway)	IH 45 to Calder Rd	4	N/A	N/A	26,009	AB
SH99 (Grand Parkway)	Butler Rd to New Street F	4	N/A	N/A	23,297	AB
SH99 (Grand Parkway)	Bay Area Blvd to Maple Leaf Dr (Extended)	4	N/A	N/A	18,356	AB
Maple Leaf Drive	New Street A to SH99 (2040)	4	N/A	N/A	17,365	D
Hobbs Road (4 Lanes in 2040)	FM 518 to League City Pkwy	2	671	AB	34,697	F
Hobbs Road (4 Lanes in 2040)	League City Pkwy to Sedona Dr	2	551	AB	44,741	F
Hobbs Road (4 Lanes in 2040)	New Street A to SH 99	4	N/A	N/A	26,716	F

Map 12. League City 2040 High Level Level-of-Service



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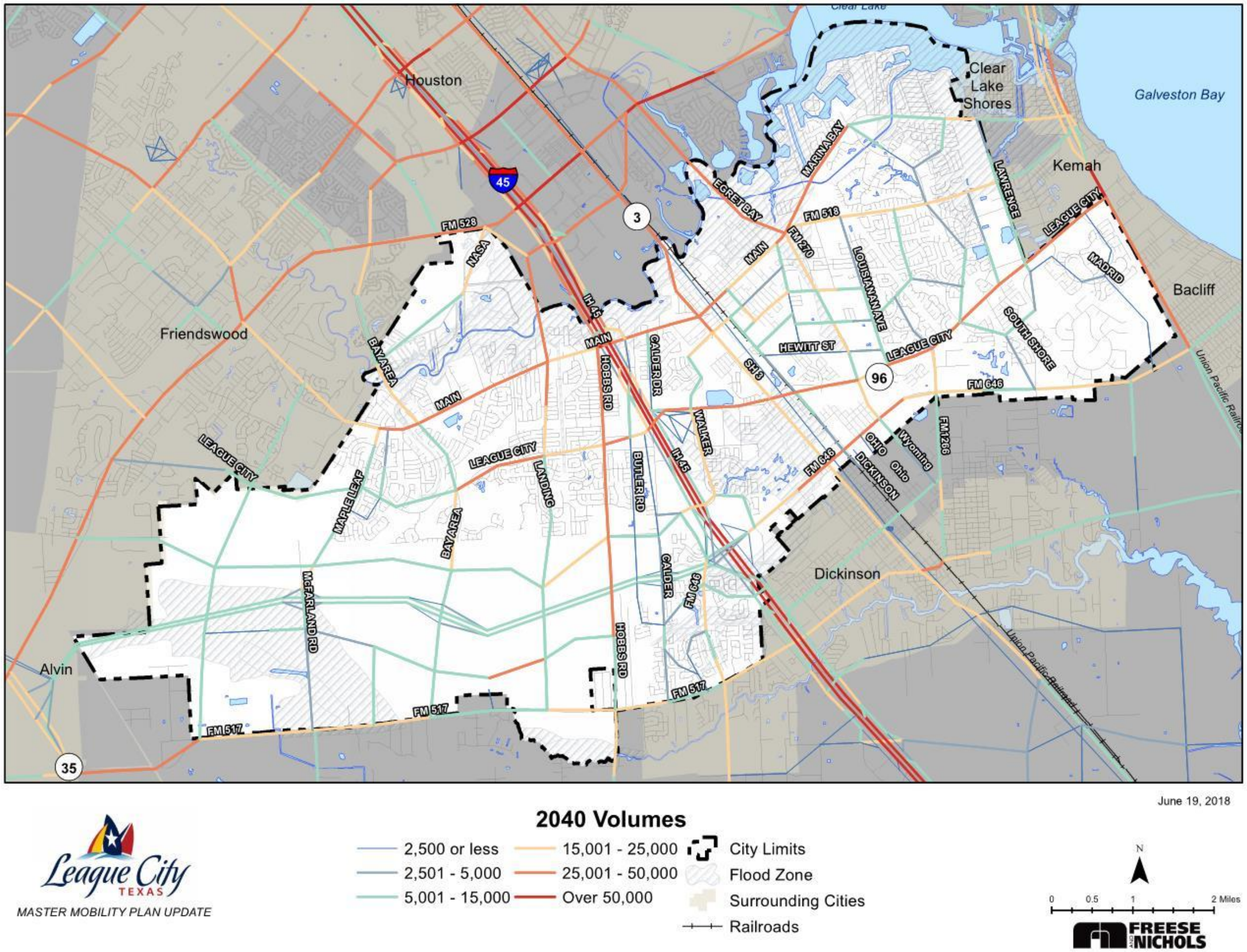
Map 13. League City 2040 Traffic Volumes



Main Street Analysis

As mentioned above, a separate analysis was conducted to assess traffic along the Main Street corridor. The travel demand model is not calibrated to capture corridor level issues such as turning movements and intersection spacing that may lead to congestion on a roadway. To better assess traffic conditions along Main Street, a SYNCHRO analysis was conducted to assess the impact of seven key intersection along the corridor:

- Main Street at Wesley Street
- Main Street at Calder Road
- Main Street at Interurban Street
- Main Street at SH 3
- Main Street at Park Avenue
- Main Street at Iowa Avenue
- Main Street at Texas Avenue

To better conform to the overall network analysis, the same 2040 demographics used in the travel demand model run were used to inform the Main Street corridor analysis. Using this data, a 25-year growth factor of 1.28 was calculated. Each intersection was reviewed to determine current and 25-year (2040) intersection conditions. Finally, the 2040 conditions were reanalyzed with recommended intersection treatments in place.

Base Year Main Street Intersection Performance

Table 28 and **Table 29** illustrate base 2040 traffic conditions on Main Street (FM 518). All but one of the Main Street intersections analyzed in this exercise currently operate at LOS C or better during both peak hours. The exception was SH 3, which accommodates about 30,000 vehicles per day at LOS D. There are, however, congestion spikes during peak hour conditions. Traffic spikes to LOS D in the northbound lanes of Calder Road, southbound lanes of Interurban Street, and both directions on Main Street during the AM peak hour.

Table 28. Main Street Intersections Base Year AM Peak Hour Conditions

Peak	Intersection	Control	MOE	Eastbound			Westbound			Northbound			Southbound			Intersection
				Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
AM Peak Hour	Wesley St	Signal	Delay	20.4	33.2	33	21.7	28.2	28	30.5	30.3		30.4	29	31.1	**30.2**
			LOS	C	C	C	C	C	C	C	C		C	C	C	**C**
	Calder Dr	Signal	Delay	19	32.8	32.7	22	24.4	24.4	35.6	38.3		33.1	33.1		**29.7**
			LOS	B	C	C	C	C	C	D	D		C	C		**C**
	Interurban St	Signal	Delay	12.5	23.7	23.6	14.3	17.2	17.1	18.6			43.3			**20.8**
			LOS	B	C	C	B	B	B	B			D			**C**
	SH 3	Signal	Delay	29.8	39.7	39.8	30.2	51	51.6	30.3	24.6	27.4	31.2	21.1	11.5	**35**
			LOS	C	D	D	C	D	D	C	C	C	C	C	B	**C**
	Park Ave	Signal	Delay	10.9		11.3	12.8		12.5	12.7			11.7			**11.9**
			LOS	B		B	B		B	B			B			**B**
	Iowa Ave	Signal	Delay	11.8	17.8	17.8	11.7	17.1	17	13.4			13			**17**
			LOS	B	B	B	B	B	B	B			B			**B**
	Texas Ave	Signal	Delay		19.4	19.3	11.9	10.4		13.8						**14.3**
			LOS		B	B	B	B		B						**B**

Table 29. Main Street Intersections Base Year PM Peak Hour Conditions

Peak	Intersection	Control	MOE	Eastbound			Westbound			Northbound			Southbound			Intersection
				Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
PM Peak Hour	Wesley St	Signal	Delay	24.1	25.5	25.5	19.5	33	33	38	41.1		40.6	36.8	41	**30.4**
			LOS	C	C	C	B	C	C	D	D		D	D	D	**C**
	Calder Dr	Signal	Delay	21.3	39.2	39.2	31.7	25.8	25.7	40	43.7		39.1	39.9		**33.4**
			LOS	C	D	D	C	C	C	D	D		D	D		**C**
	Interurban St	Signal	Delay	15.4	21.4	21.4	14.5	22.9	22.7		25.1			46.3		**22.5**
			LOS	B	C	C	B	C	C		C			D		**C**
	SH 3	Signal	Delay	39.3	64.4	65.2	53.9	33.9	34	51.4	34.2	37.8	48.9	26.3	29.2	**42.8**
			LOS	D	E	E	D	C	C	D	C	D	D	C	C	**D**
	Park Ave	Signal	Delay	12.4		13.5	12		12.9		12			11.5		**12.6**
			LOS	B		B	B		B		B			B		**B**
	Iowa Ave	Signal	Delay	12.1	17.8	17.7	11.9	17.1	17		14.4			14.2		**17.1**
			LOS	B	B	B	B	B	B		B			B		**B**
	Texas Ave	Signal	Delay		19.2	19.2	13.1	9.2			20.7					**15**
			LOS		B	B	B	A			C					**B**

Conditions are slightly worse during the PM peak hour. Traffic is slowed to LOS D in the northbound and southbound lanes of the Wesley Street and Calder Road intersections. The southbound lanes in the Interurban Street Intersection also operate at LOS D. The eastbound lanes on Main Street are slowed to LOS E during the PM hour. This is aided by the high volumes of vehicles turning left onto Main Street from SH3. The overall performance of this intersection is LOS D.

2040 Base Intersection Performance

In order to assess the long-term impact of increased congestion along Main Street, traffic volumes were projected to 2040. The traffic operations analysis results for the intersections under 2040 growth conditions for AM and PM peak hours are provided in **Table 30** and **Table 31**.

Table 30. Main Street Intersections Base AM 2040 Conditions

Peak	Intersection	Control	MOE	Eastbound			Westbound			Northbound			Southbound			Intersection
				Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
AM Peak Hour	Wesley St	Signal	Delay	21	32.2	32.2	24.4	27.8	27.7	40.2	39.8		41.3	38.7	42.8	**30.9**
			LOS	C	C	C	C	C	C	D	D		D	D	D	**C**
	Calder Dr	Signal	Delay	18.4	36.8	37.1	25.9	24.6	24.5	47.6	54.9		41.2	41.2		**33.5**
			LOS	B	D	D	C	C	C	D	D		D	D		**C**
	Interurban St	Signal	Delay	12.1	23.3	23.5	15.9	16.5	16.5		28.2			52.7		**20.8**
			LOS	B	C	C	B	B	B		C			D		**C**
	SH 3	Signal	Delay	49.3	41	41.3	37.4	66.6	68	50.8	44.2	54.9	53.6	28.9	18.2	**48.4**
			LOS	D	D	D	C	F	F	D	D	D	D	C	B	**D**
	Park Ave	Signal	Delay	8.7		8.9	12.8		10.6		25.6			22.4		**11**
			LOS	A		A	B		B		C			C		**B**
	Iowa Ave	Signal	Delay	12.3	18.6	18.5	12.6	17.7	17.6		19.3			18.4		**18**
			LOS	B	B	B	B	B	B		B			B		**B**
	Texas Ave	Signal	Delay		21	20.9	13.6	9.6			19.1					**15.7**
			LOS		C	C	B	A			B					**B**

The analysis shows increased congestion throughout the corridor during both AM and PM peak hour conditions. Overall, Main Street performs adequately during the AM peak hour. Traffic, however, is projected to bog down at the Main Street and SH 3 intersection, where performance is forecasted to decreases to LOS F in the westbound lanes, and LOS D in the eastbound lanes. All of the other intersections reviewed in the analysis perform at LOS C. Approaches on Wesley Street, Calder Road, and Interurban Street are also projected to have delays at LOS D.

Table 31. Main Street Intersections Base PM 2040 Conditions

Peak	Intersection	Control	MOE	Eastbound Left	Eastbound Thru	Eastbound Right	Westbound Left	Westbound Thru	Westbound Right	Northbound Left	Northbound Thru	Northbound Right	Southbound Left	Southbound Thru	Southbound Right	Intersection
PM Peak Hour	Wesley St	Signal	Delay	34.2	25.3	25.2	21.6	34.7	35.6	53	60.4		60	51.2	61	**33.8**
			LOS	C	C	C	C	C	D	D	E		E	D	E	**C**
	Calder Dr	Signal	Delay	20.7	42.2	43.4	60.7	23	22.9	63.8	83.6		55.9	55.7		**39**
			LOS	C	D	D	E	C	C	E	F		E	E		**D**
	Interurban St	Signal	Delay	18.4	22.4	22.8	17.5	26.2	26	40.1			62.3			**25.7**
			LOS	B	C	C	B	C	C	D			E			**C**
	SH 3	Signal	Delay	82.2	122.2	128	140.2	68.8	69.7	140.9	44.8	51.5	70.1	69.5	87.1	**86.8**
			LOS	F	F	F	F	E	E	F	D	D	E	F	F	**F**
	Park Ave	Signal	Delay	11.7		12.5	11.5		12	20.3			19.3			**12.3**
			LOS	B		B	B		B	C			B			**B**
	Iowa Ave	Signal	Delay	12.1	18.2	18.1	12.3	17.4	17.2	20.8			20.4			**17.8**
			LOS	B	B	B	B	B	B	C			C			**B**
	Texas Ave	Signal	Delay		25.6	25.9	18.2	9.4		29						**19**
			LOS		C	C	B	A		C						**B**

Conditions worsen during the PM peak hour, but the overall flow of traffic in the corridor is adequate. The intersection of Main Street and SH 3 performs at LOS F. Eastbound approaches are particularly congested, performing at LOS F. Westbound approaches perform and LOS E. Southbound approaches perform at LOS F, and northbound lanes perform at LOS D. The side street approaches at Wesley and Interurban also operate at LOS E.

2040 Intersection Performance with Intersection Improvements

Main Street intersection performance was also analyzed with recommended intersection improvements. Main Street, from IH 45 to SH 3 was widened to 6 lanes; the segment northeast of SH 3 remained 4 lanes. The traffic operations analysis for this scenario are provided in **Table 32** and **Table 33.**

Table 32. Main Street AM Peak Hour Intersection Performance with Recommended 2040 Improvements

Peak	Intersection	Control	MOE	Eastbound Left	Eastbound Thru	Eastbound Right	Westbound Left	Westbound Thru	Westbound Right	Northbound Left	Northbound Thru	Northbound Right	Southbound Left	Southbound Thru	Southbound Right	Intersection
AM Peak Hour	Wesley St	Signal	Delay	21.5	30.8	33.2	23.2	27.6	28.7	29.8	29.5		30.8	29	31.8	**29.6**
			LOS	C	C	C	C	C	C	C	C		C	C	C	**C**
	Calder Dr	Signal	Delay	19.4	30.2	32.8	22.3	24.4	24.9	34.9	38.8		31	30.9		**29**
			LOS	B	C	C	C	C	C	C	D		C	C		**C**
	Interurban St	Signal	Delay	12.7	19.5	21.3	14.1	16.4	16.8	18.7			42.3			**18.7**
			LOS	B	B	C	B	B	B	B			D			**B**
	SH 3	Signal	Delay	62.7	28.5	34.1	28.5	29.8	36.9	37	25.9	30.6	59.7	19.7	21.2	**32.3**
			LOS	E	C	C	C	C	D	D	C	C	E	C	B	**C**
	Park Ave (NB)	Signal	Delay	8.7		8.9	12.8		10.6	25.6			22.4			**11**
			LOS	A		A	B		B	C			C			**B**
	Iowa Ave (NB)	Signal	Delay	12.3	18.6	18.5	12.6	17.7	17.6	19.3			18.4			**18**
			LOS	B	B	B	B	B	B	B			B			**B**
	Texas Ave (NB)	Signal	Delay		21	20.9	13.6	9.6		19.1						**15.7**
			LOS		C	C	B	A		B						**B**

Analysis shows that with a few exceptions, widening Main Street to 6 lanes may alleviate most of the serious delay within the corridor. During the AM Peak, all the intersections operate at LOS C or better with a few turning movements and side streets operating at LOS D or E. Eastbound vehicles turning left from Main Street onto SH 3, for instance, may experience delays as the lane is projected to operate at LOS E.

Table 33. Main Street PM Peak Hour Intersection Performance with Recommended 2040 Improvements

Peak	Intersection	Control	MOE	Eastbound			Westbound			Northbound			Southbound			Intersection
				Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
PM Peak Hour	Wesley St	Signal	Delay	24.6	25.3	26	20.3	29.8	32.4	36.3	40.7		39.1	34.4	39.6	**29.3**
			LOS	C	C	C	C	C	C	D	D		D	C	D	**C**
	Calder Dr	Signal	Delay	22.3	38.7	44	41.2	24.2	24.9	40	45.8		37.6	38.6		**34.1**
			LOS	C	D	D	D	C	C	D	D		D	D		**C**
	Interurban St	Signal	Delay	16	22	24.5	15.6	22.3	25.3	23.1			44.9			**23.4**
			LOS	B	C	C	B	C	C	C			D			**C**
	SH 3	Signal	Delay	35.4	64.6	78.4	96.7	32.5	39.4	84.6	25.9	29.8	91.1	74.4	94.8	**61.5**
			LOS	D	F	F	F	C	D	F	C	C	F	F	F	**E**
	Park Ave	Signal	Delay	11.7		12.5	11.5		12	20.3			19.3			**12.3**
			LOS	B		B	B		B	C			B			**B**
	Iowa Ave	Signal	Delay	12.1	18.2	18.1	12.3	17.4	17.2	20.8			20.4			**17.8**
			LOS	B	B	B	B	B	B	C			C			**B**
	Texas Ave	Signal	Delay		25.6	25.9	18.2	9.4		29						**19**
			LOS		C	C	B	A		C						**B**

The intersection of Main Street and SH 3 performs at an overall LOS E during the PM peak hour. Westbound approaching lanes are projected to operate a LOS F – with the exception of the SH 3 intersection during the PM peak hour – which is projected to operate at LOS F. Southbound approaching traffic, along SH 3, also operates and LOS F. Special attention should also be paid to eastbound traffic at the Calder Road intersection, which is projected to operate at LOS D.

Summary

If no improvements are made by 2040 to the Main Street Intersections, many of the side approaches may experience significant delays – which can significantly impact adjacent roads in the network due to spillover traffic. The worst intersection is SH 3, which may need additional left and right-turn lanes, improved signalization, and other treatment as congestion increases as projected. Further assessment will be needed as development unfolds within the corridor to ensure accurate growth projections. Also, new developments will have to be monitored to see if the side street approaches need improvements.

Chapter 6: Thoroughfare Plan Recommendations

Recommended Functional Classification

Versatility is a strength in any policy document because it gives decisionmakers flexibility to address unforeseen issues that may arise during the implementation phase. To provide flexibility in the thoroughfare network, recommended functional classifications (see **Table 34**) were developed with variable rights-of-way and lane configurations. This is a change from the previous mobility plan, which recommended specific right-of-way designations for each functional classification. Variable rights-of-way, within a designated range, will allow the City more flexibility in terms of roadway function and land use compatibility. Varying lane configurations will help transportation continuity and connectivity despite environmental impediments, such as flood plains and constrained corridors. The range of lane configurations will facilitate multiple land uses within the prescribed right-of-way.

Thoroughfare Design Standards

Functional classification not only dictates the function and relationship between roadways in a transportation network but provides minimum design standards as well. The combination of the design elements in a roadway and the associated spacing between facilities directly impact the right-of-way widths needed to accommodate them adequately. The right-of-way widths are then targets for corridor preservation through county, city, and state action. The following section outlines the targeted details of each functional classification developed for the League City Master Mobility Plan. **Table 34** summarizes the specifications of each functional classification. The recommended League City thoroughfare network is illustrated in **Map 14**.

Table 34. League City Recommended Thoroughfare Standards

Functional Classification	Area Type	Lanes*	General Spacing (Miles)	ROW	Pavement Width (feet)	Design Speed (mph)	Median
Freeway/ Highway		4 to 8		400' - 500'			Yes
Major Arterial	Urban	2D	1	100' - 120'	2 @ 13	40-50	Yes
	Urban	4D	1	100' - 120’	2 @ 25	40-50	Yes
	Urban	6D	1	100 - 120’	2 @37	40-50	Yes
Minor Arterial	Urban	2-4D	½	80'-100'	2 @ 25	40-50	Yes
	Urban	4D	½	120’	2 @25	40-50	Yes
Collector	Urban	2-4D	¼	90'	2 @ 25	35	Yes
	Urban	2U	¼	80'	42	35	No
	Rural*	2-4D	¼	100’	2 @ 25	35	Yes
	Rural*	2U	¼	90	42	35	No
Residential	Urban	2	¼	60	28	25	No
	Rural	2	¼	70	28	25	No

* Rural open ditch sections require 10 additional feet of ROW

Recommended Roadway Cross-Sections

The following cross-sections were developed to illustrate the roadways design standards recommended for the League City Master Mobility Plan. Recommendations include urban sections with curb a gutter, sidewalks, and where applicable, parkways, on-street parking, and/or bike lanes. It is important to note that roadways should be expanded as traffic and development warrant it. ROW, however, should be immediately identified and preserved to avoid future conflicts with development.

Several roadways, such as Main Street, were identified as primary bike corridors. Cross sections with bike and pedestrian accommodations are available in the in the non-motorized transportation recommendations section.

Freeways/ Highways

Freeways and highways are designed for long distance travel with a high level of mobility and very limited land access. League City freeways/ highways include IH 45 and the proposed Grand Parkway (SH 99), which is a proposed as a tolled facility. Lane numbers vary from four (4) to six (8) lanes and right-of-way is 300 feet or greater.

Major Arterials
Major arterials are ideal for long distance trips and handling large volumes of traffic at a high level of mobility. Examples of major arterials include League City Parkway and Main Street. **Figure 19** and **Figure 20** illustrate the recommended cross-section for major arterial facilities. Additional recommended major arterial cross-sections – including intersections – are available in the **Appendices.**

Figure 19. Major Arterial - 6 Lane, 120' ROW, 12- Foot Lanes

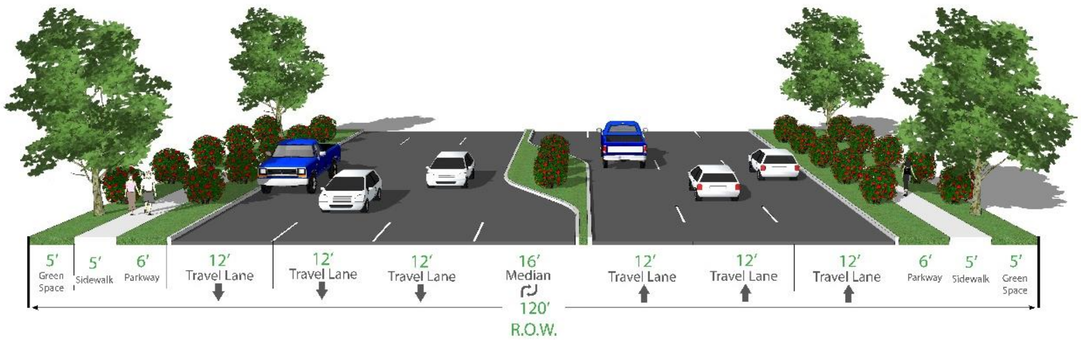
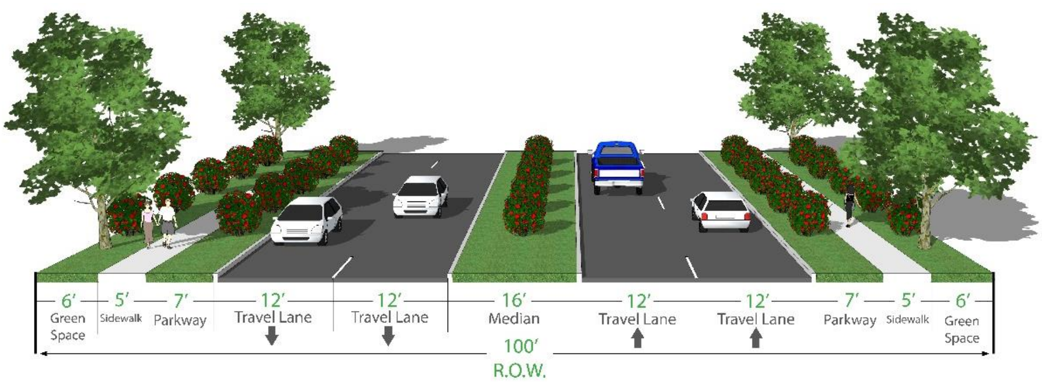


Figure 20. Major Arterial - 4 Lane, 100' ROW, 12-Foot Lanes

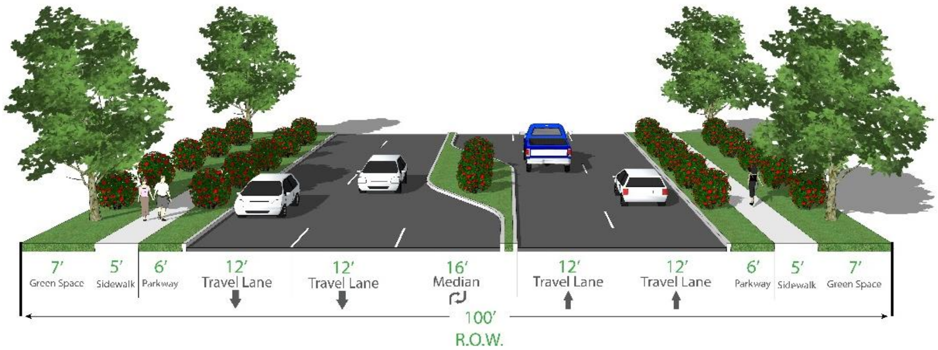


Major arterials should include two (2) to six (6) 12-foot lanes within 100 to 120 feet of right-of-way. This is more flexible than the 2011 Master Mobility Plan and 2013 General Design and Constructions standards which require a minimum of 120 feet of ROW. This allows roadways that function like major arterials to be managed and operated such – even when ROW is too constrained to accommodate them. Please note that permitting a narrower ROW does not indicate the ROW of existing facilities will be reduced. All major arterials should include 16-foot medians.

Major arterial intersections should be two or three lanes wider than the typical section to accommodate turning vehicles. Additionally, per the League City General Design and Construction Standards, all major arterial facilities shall include a median.

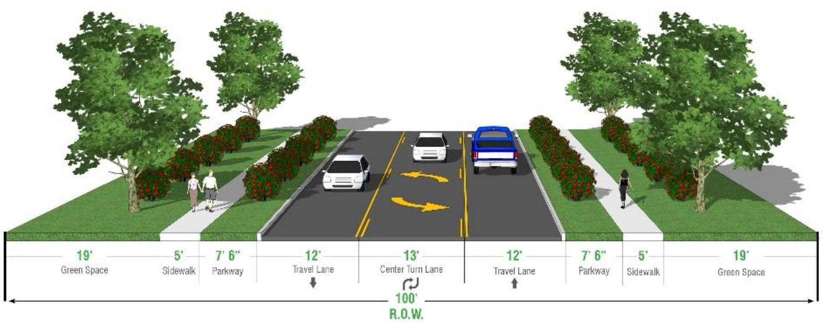
Minor Arterial
Minor arterials accommodate moderate traffic volumes at relatively low speeds and provide a link between major arterials and collectors. Examples of minor arterials include Hobbs Road and Louisiana Avenue. **Figure 21** and **Figure 22** illustrate the recommended cross-section for minor arterials. Additional minor arterial cross-sections including intersections – are available in the **Appendices**.

Figure 21. Minor Arterial - 4 Lane, 100' ROW, 12-Foot Lanes



Minor arterials are recommended to include two (2) to four (4) 12-foot lanes within 80 to 100 feet of right-of-way. Roadways should include a median, and high turning volume intersections should include turn lanes. The minimum ROW designation was reduced to allow more flexibility in terms of land use development, existing constraints, and ROW acquisition. Four-lane minor arterials should include medians

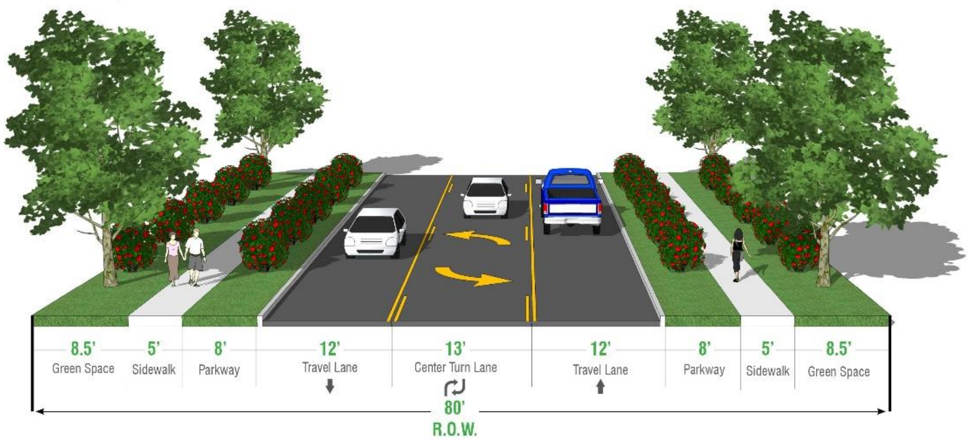
Figure 22. Minor Arterial - 3 Lanes, 100' ROW, 12-Foot Lanes



Collector

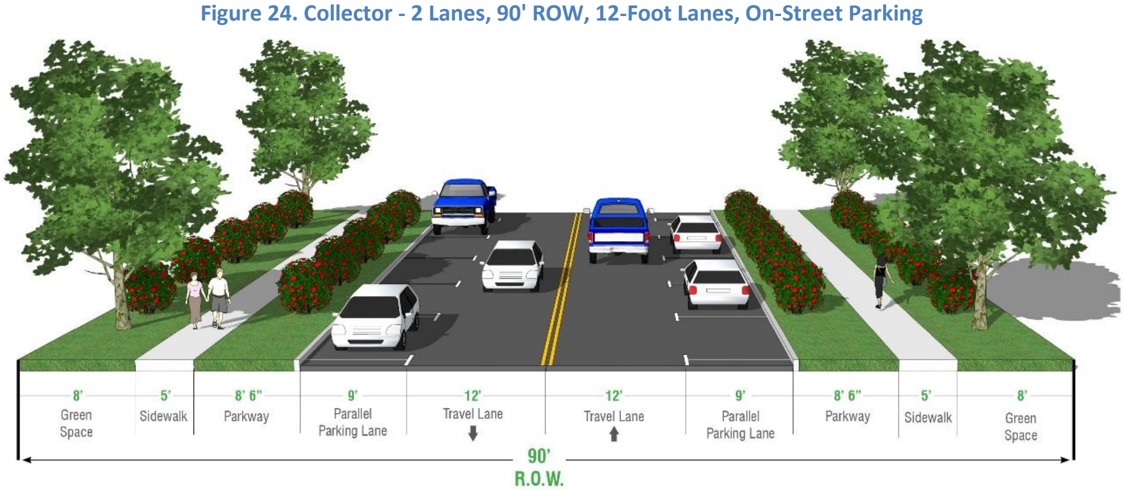
Collector facilities are designed for short trips at low speeds with a high level of access, and primarily connect commuters to higher functional class facilities. Examples of collectors include the northern segment of Landing Boulevard and Texas Avenue. **Figure 23** and **Figure 24** illustrate the recommended cross-section for a two-lane divided collector facility. Additional collector cross-sections are available in the **Appendices.**

Figure 23. Collector - 3 Lanes, 80' ROW, 12- Foot Lanes

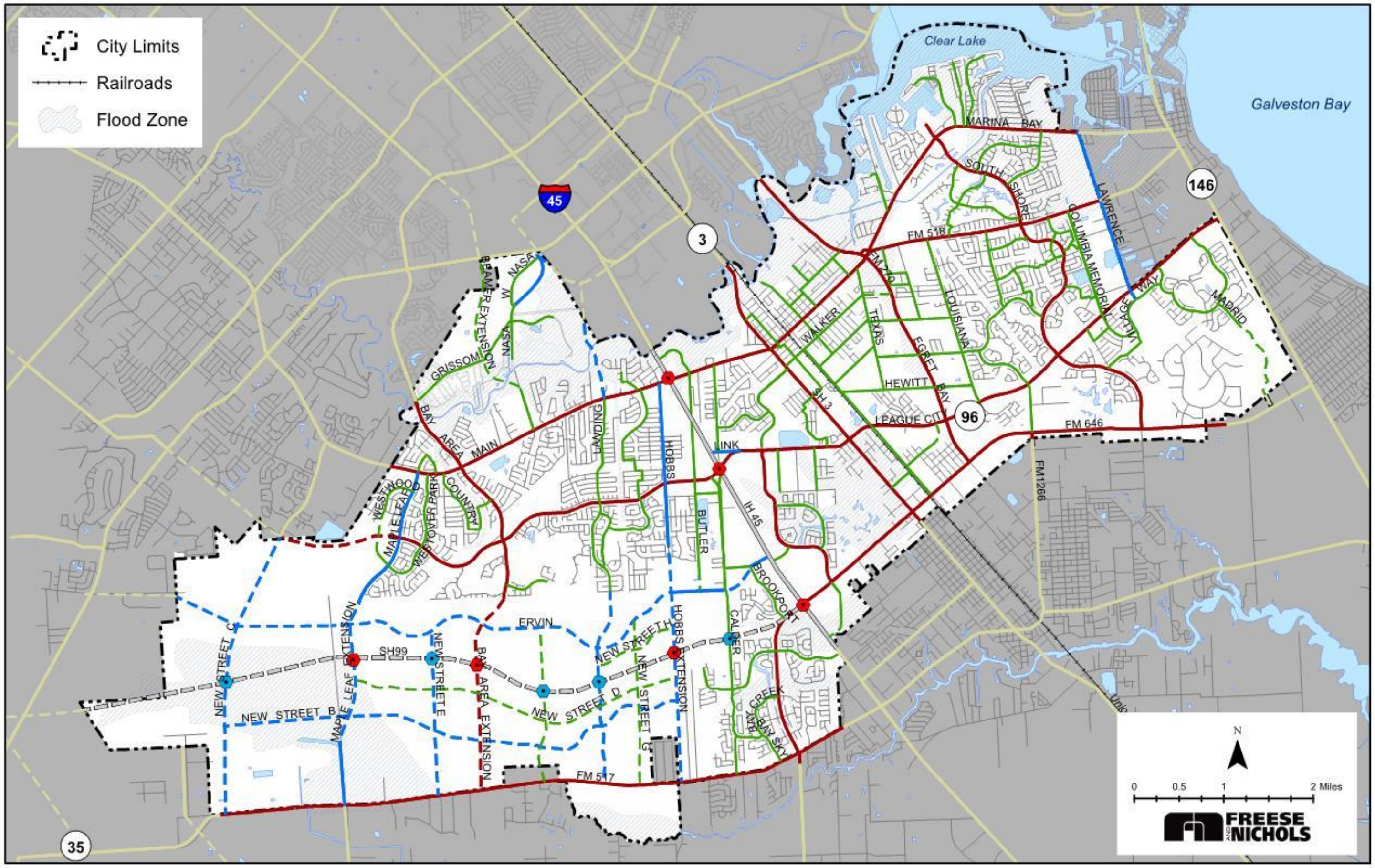


Urban collectors are recommended to include two (2) to four (4) 12-foot lanes within 80 to 90 feet of right-of-way. Rural collectors include an additional 10 feet of ROW. The ROW and pavement recommendations match the 2013 general design and construction standards, and can accommodate two-lane divided, two-lane undivided, and four-lane undivided sections.

Figure 24. Collector - 2 Lanes, 90' ROW, 12-Foot Lanes, On-Street Parking



Map 14. 2018 League City Recommended Thoroughfare Map



Draft Thoroughfare Map

October 3, 2018

League City TEXAS
MASTER MOBILITY PLAN UPDATE

- Interchange
- Grade Separation
- Freeway
- Proposed Freeway
- Major Arterial (100'-120' ROW, 2 to 6 lanes)
- Proposed Major Arterial
- Minor Arterial (80'-100' ROW, 2 to 4 lanes)
- Proposed Minor Arterial
- Collector (80' ROW, 2 to 4 lanes)
- Proposed Collector
- Outside City Limits (existing)
- Outside City Limits (proposed)

Alignments for proposed roadways are only conceptual and serve to identify right-of-way for preservation. Specfic alignments will be designed as development unfolds within the city.

Recommended Network Amendments

The following recommendations were developed to improve connectivity and reduce congestion in League City's thoroughfare network. New alignments, lane additions, intersection improvements were incorporated into the network to improve its overall operational efficiency.

New Network Alignments

The majority of League City's thoroughfare network is complete, having an adequate amount of arterial and collector facilities to meet land use and travel demands. The southwest sector of the city, however, is largely vacant with little roadway infrastructure to accommodate new development. In order to facilitate development in this area, several new roadway alignments were developed to form the basis of the southeast thoroughfare network. **Table** 35 details the functional classifications and number of lanes for each of the recommended alignments. The network was developed to mimic the eastern sector of the city, which has a more grid-like block structure which helps bolster both residential and commercial development and encourages pedestrian activity.

Table 35. Recommended New Roadway Alignments

NAME	Functional Class	Recommended Lanes
Bay Area Boulevard Extension	Major Arterial	4
Beamer Road Extension	Collector	2
Butler Road Extension	Collector	2
Hobbs Road Extension	Minor Arterial	4
Landing Boulevard Extension	Minor Arterial	6
League City Parkway	Major Arterial	6
Madrid Lane Extension	Collector	2
Maple Leaf Drive Extension	Collector	4
Mulberry Street	Collector	2
Ervin Avenue	Major Arterial	4
New Street B	Minor Arterial	4
New Street C	Major Arterial	4
New Street D	Collector	4
New Street E	Minor Arterial	4
New Street F	Collector	4
New Street G	Collector	4
New Street H	Collector	4
New Street I	Collector	4
SH99 (Grand Parkway)	Freeway/ Toll Road	4
Tuscan Lakes Boulevard	Collector	2
Walker Street Northern Extension	Collector	3
Walker Street Southern Extension	Collector	3

Recommended Functional Classification Amendments

The following functional classification amendments were developed to ensure League City's roadways efficiently function in terms of land use accommodation and access, appropriate sizing, and/or overall connectivity. **Table 36** details recommended amendments.

Table 36. Recommended Functional Classification Amendments

Roadway	Limits	Existing Functional Class	Recommended Functional Class
Hobbs Road	FM 517 to League City Parkway	Minor Arterial	Major Arterial
Hobbs Road	League City Parkway to Main Street	Collector	Minor Arterial
Calder Road	Cross Colony to League City Parkway	Minor Arterial	Collector
Walker Street	FM 646 to League City Parkway	Minor Arterial	Major Arterial
Walker Street	League City Parkway to SH 3	Minor Arterial	Collector
Palomino Lane	Main Street to Grissom Rd	Minor Arterial	Collector
Main Street (FM 518)	SH 3 to FM Egret Bay Blvd (FM 270)	Minor Arterial	Major Arterial
Main Street	Marina Bay Dr to East City Limits	Minor Arterial	Major Arterial
Columbia Memorial Parkway (FM 1266)	League City Parkway to Main Street	Major Arterial	Collector
SH99 (Grand Parkway)	FM 646 to West City Limits	Major Arterial	Freeway
Louisiana Avenue	League City Parkway to Main Street	Major Arterial	Collector
Tuscan Lakes Boulevard	League City Parkway to FM 646	Major Arterial	Collector
Landing Boulevard	Sandvalley Way to FM 518	Minor Arterial	Collector

Hobbs Road

The segment of Hobbs Road, from League City Parkway to Main Street, was amended from a collector to a minor arterial because the corridor provides connections between multiple major arterials (FM 517 and League City Parkway) and links to an interchange on the Grand Parkway. This segment is also projected to accommodate as many as 47,000 vehicles per day by 2040.

Calder Road

Conversely, Calder Road was downgraded to from a minor arterial to a collector – in part – because the plan recommends moving the Calder Road interchange on Grand Parkway to Hobbs Road. The recommendation to move the interchange was made because its current planned location is too close to the Grand Parkway's IH 45 interchange. Additionally, the roadway primarily functions like a collector. It provides access to the residential areas to the north and south of the Grand Parkway alignment. The existing residential development also constrains the available ROW. Projected 2040 volumes also suggest the need for a lower functional classification. The roadway is only projected to accommodate fewer than 5,000 vehicles per day.

Walker Street
Walker Street was recommended to be upgraded to a major arterial due to the projected employment and commercial growth along the corridor. The facility also makes an important connection between League City Parkway and FM 646 for commuters trying to access the development from IH 45.

Palomino Lane
Palomino Lane was downgraded from a minor arterial to a collector because the facility primarily provides access to a residential area with some park and recreational development. It is geared towards more internal circulation than through traffic.

Main Street
The segment of Main Street between SH 3 and Egret Bay Boulevard was upgraded to a major arterial because the facility provides cross town mobility and is part of an arterial corridor which currently provides the primary access to IH 45. Additionally, the segment accommodates about 36,000 vehicles per day.

Grand Parkway
Grand Parkway was upgraded form a major arterial to a freeway because they roadway functions as a freeway in terms of land access, capacity, speed, and regional connectivity. The roadway is projected to accommodate over 30,000 vehicles per day as a tolled freeway facility.

Recommended Roadway Sizing

Like the key economic principle, League City's thoroughfare network relies on the principle of supply and demand. If a municipality does not appropriately plan for and designate enough capacity (supply) for increased population or employment growth (demand), the transportation network may perform poorly. This principle not only applies to roadway capacity, but transit, bicycle and pedestrian capacity as well. In contrast, a city with decreasing population growth may experience lower levels of congestion in the future and need less capacity to accommodate demand.

The main goal of the thoroughfare planning process is to plan for a future transportation system that balances the supply and demand so that resources are maximized and the system functions safely and efficiently. The results of the technical analysis provide an opportunity for the transportation network to be "right-sized" in locations and along corridors that are available for expansion (or reduction). The adjustments to the network and the thoroughfare plan were based on the following issues related to system needs and sizing:

- A corridor that is expecting volumes greater than the capacity may be adjusted.
- A corridor that is planned for increased capacity but does not have the projected demand to justify the increased capacity.
- A corridor may need additional capacity as a result of the projected volumes, but expansion is constrained.
- Increased use of alternate modes such as biking, walking and riding transit could reduce vehicle demand on the corridor.

Roadway Widenings

Despite the available capacity in the overall thoroughfare network, a number of roadways should be widened to accommodate future traffic demand. Segments of Main Street (FM 518), for instance, currently accommodate between 18,000 and 36,000 vehicles per day at LOS E. Congestion is projected to worsen along the corridor by 2040, reducing LOS to F throughout the majority of the corridor. One solution is constructing two additional lanes. This will not fix the intersection of Main Street and IH 45, which is projected to accommodate over 65,000 vehicles per day in 2040 but may improve conditions throughout the rest of the corridor. It is important to note widening roadways, such as Main Street, may not improve conditions to an acceptable level-of-service. Congested commercial corridors will also need to utilize access management practices in order to achieve optimal operational conditions. Chief among these practices is the consolidation of driveways through sharing or cross-access easements.

Table 37 summarizes recommended lane additions for existing facilities. Other roadways recommended for lane additions include Hobbs, League City Parkway, and Bay Area Boulevard. Ervin Avenue was included because it is currently under construction as a two-lane minor arterial but will need to be widened to four lanes as development unfolds in the area and congestion increases. Additionally, the ROW on Bay Area Boulevard between Candlewood and Main Street may be too constrained to accommodate additional lanes.

Table 37. Recommended Lane Additions to Existing Facilities

Road	Current Lanes	2015 Vol	2015 LOS	2040 Volume	2040 LOS	Rec Lanes	Updated LOS	Functional Classification
FM 518	4	18,651	E	30,658	F	6	E	Major Arterial
Bay Area Boulevard	4	21,112	E	21,826	E	6	C	Major Arterial
League City Parkway	4	28,457	F	32,063	F	6	E	Major Arterial
Hobbs Road	4	671	A	34,697	F	6	F	Minor Arterial
Ervin Avenue*	2	N/A	N/A	23,912	F	4	B	Minor Arterial

*Currently under construction

Recommended Intersection Improvements

One of the key components of a thoroughfare network is the ability of intersections to efficiently process traffic. Poor intersection geometry, capacity, and/or spacing often have as great an impact on congestion as traffic volumes. The following intersection recommendations were developed to address both corridor-wide and specific intersection congestion and safety.

Turn Lanes

Operational conditions typically diminish when insufficient turn-lane capacity is available to absorb turn movements from the traffic stream. To mitigate this issue, an additional 22 feet should be provided at key major and minor arterial intersections to ensure the ability to provide channelized turn movements, such as a second left-turn or right-turn lane. A traffic analysis should be conducted before facility implementation to determine the exact dimensional requirements of specific intersections.

As currently defined, divided roadways have the ability to accommodate a separate left-turn lane. Additionally, the 12-foot travel lanes provide sufficient roadway width for turn movements. Twelve-foot wide lanes, however, may not be sufficient at intersection with high levels of existing and/or projected turning movements. By adding 22 feet of width, a second left-turn lane and separate right-turn bay can be added where volumes indicate demand for additional intersection capacity. This would be especially beneficial at intersections such as Bay Area Boulevard and FM 518 where there is not enough capacity to accommodate projected turning movement volumes.

Table 38 identifies necessary distances by roadway class for storage and transition requirements. The distances identified allow for minimum turn-lane storage and lane transitions. In high intensity development areas, such as Main Street, a traffic analysis should be conducted to determine appropriate intersection requirements.

Table 38. Critical Intersection Right-of-Way Designations

Classification	Major Arterial	Minor Arterial	Collector
Major Arterial	350'	350'	300'
Minor Arterial	300'	300'	260'
Collector	300'	260'	

Roundabouts

Roundabouts, illustrated in **Figure 25,** are a type of intersection characterized by a generally circular shape, yield control on entry, and geometric features that create a low-speed environment through the intersection. Modern roundabouts have been demonstrated to provide a number of safety, operational, and other benefits when compared to other types of intersections. The improve safety by reducing the number of conflict points between vehicles, and reduce congestion by providing a constant, but controlled, traffic flow.

Figure 25. Modern Roundabout Elements

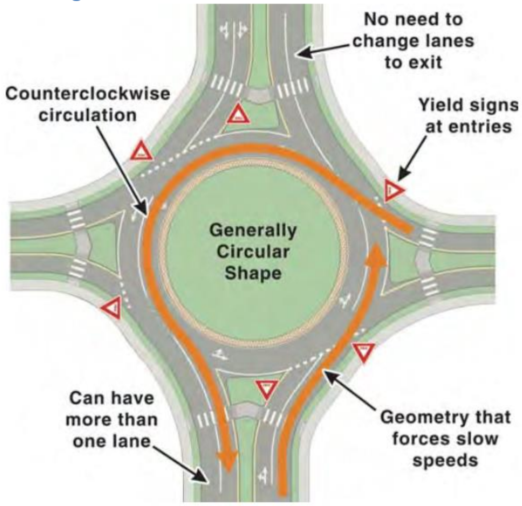


Table 39 details average delay per vehicle at intersections for each level of service for various types of intersection control. Roundabout controlled intersections average 30 fewer seconds of delay during LOS F traffic conditions.

Table 39. Intersection Delay by Traffic Control System

LOS	Signalized Intersection	Unsignalized Intersection	Roundabout Intersection
A	< 10 seconds/vehicle	< 10 seconds/vehicle	< 10 seconds/vehicle
B	10-20 seconds/vehicle	10-15 seconds/vehicle	10-15 seconds/vehicle
C	20-35 seconds/vehicle	15-25 seconds/vehicle	15-25 seconds/vehicle
D	35-55 seconds/vehicle	25-35 seconds/vehicle	25-35 seconds/vehicle
E	55-80 seconds/vehicle	35-50 seconds/vehicle	35-50 seconds/vehicle
F	> 80 seconds/vehicle	> 50 seconds/vehicle	> 50 seconds/vehicle

Source: HCM 2010, Exhibit 18-4 and Exhibit 21-1

Roundabouts should be considered for new minor arterial to minor arterial, collector to collector, or minor arterial to collector intersections – particularly in the southwest sector of the city where there is little to no network in place. Roundabouts may be appropriate at intersections that may have geometric issues, such as the proposed Landing Extension and the NASA Bypass. Mini-roundabouts may be a potential intersection solution at local to local street intersections for traffic calming and improve aesthetics. Retrofitting roundabouts into existing intersections may also be a possibility where right-of-way is available and existing conditions warrant them.

Signalized Intersection Spacing and Timing

Signalized intersections, if properly timed, can significantly reduce the start and stop traffic along a corridor. Too many intersections in a short span and/or poor signal timing, however, can cause delays and headaches for drivers. According to TxDOT access management guidelines, every traffic signal added per mile reduces travel speeds 2 to 3 mph. This can lead to serious corridor congestion and delays.

Table 40 describes the increase in travel time for every traffic signal added within a mile span. Increasing from two (2) to three (3) traffic signals can increase travel time nine percent. If multiple traffic signals are warranted within a short span along a corridor, signal maintenance and timing should be prioritized to ensure efficient traffic movement. The segment of Main Street between the IH 45 Frontage Road and SH 3 is a little over a mile long and projected to accommodate over 41,000 vehicles per day at level-of-service F by 2040. The five traffic signals currently along this segment are necessary given the number of businesses along the corridor, but conditions may be exacerbated by the number of traffic signals in such a short distance.

To improve traffic signal optimization, League City should develop and maintain a traffic timing plan to interconnect traffic signals along key commercial corridors, such as Main Street, League City Parkway, and other emerging commercial corridors. According to the Federal Highway Administration (FHWA), every dollar invested in traffic signal optimization saves $40 in time and fuel savings.

Table 40. Travel Time Increase per Traffic Signal

Signal Per Mile	**Percent Increase in Travel Time** (Compared to 2 Signals per mile)
2	0
3	9
4	16
5	23
6	29
7	34
8	39

Source: TxDOT Access Management Manual, 2011

In addition to the above intersection recommendations, the mitigation strategies summarized in **Table 41** were recommended for critical intersections identified by League City Staff.

Table 41. Critical Intersection Mitigation Strategies

Intersection	Potential Mitigation
FM 518 and IH 45	• Improved signal timing • Dual left and right-turn lanes at all approaches • Develop alternate routes
FM 518 and FM 270; FM 518 and FM 2094	• Widen Main St to 6 through lanes
FM 646 and IH 45	• Widen FM 646 to 6 through lanes
FM 518 and Landing Boulevard	• Right turn bays on FM 518 (100' recommended)
League City Parkway at Brittany Lakes Drive / Finnegan Lane	• Signalization • Left turn bays on League City Pkwy (100' recommended) • Trim brush at corners to improves sight-distance
FM 518 and Bay Area Boulevard	• Widen FM 518 to 6 lanes; • Dual left turn lanes from SB Bay Area Blvd (100' recommended)
League City Parkway and Bay Area Boulevard	• Signalization

Access Management Recommendations

Access management refers to the practice of coordinating access connection points onto a roadway by considering specific design criteria for the location, spacing, design and operation of driveways, median openings and intersections. Generally, as the mobility and capacity of a roadway increase, the level of access decreases. This is particularly important for major roadways intended to provide efficient service to through-traffic movements.

Access Connection Spacing

Access connections are facilities for entrance and/or exit from a roadway such as a connecting street (intersection) or driveway. They have a major impact on the relative flow of traffic through a corridor. It is not only based on the distance between intersections, but the speed in which commuters travel through a corridor. As mentioned above, speed differentials can have a negative impact on level-of-service in a corridor.

Table 42. Recommended Access Connection Spacing

Minimum Connection Spacing			
Speed Limit MPH)	State Facilities *	One-Way Frontage Road	Two-Way Frontage Road
≤30	200	200	200
35	250	250	300
40	305	305	360
45	360	360	435
≥50	425	425	510

Proper intersection spacing can limit speed differentials and improve traffic flow within a corridor. **Table 42** details TxDOT's recommended access connection spacing for state managed (off-system) facilities below the freeway functional classification. These recommendations can be applied to non-state managed (off-system) roadways as well. reducing the number of access connections along an existing commercial corridor, such as Main Street is difficult – if not impossible – as the number of driveways and intersection are already in place.

The average space between intersections on the eastern segment of Main Street between the IH 45 Frontage Road and SH 3 is about 670. This is well above the recommended intersection spacing for state-system facilities. There are, however, over 80 access connections within this segment located an average of 141 feet apart. The high overall number of access connections increase delay within the corridor and decrease level-of-service. One solution is auxiliary lanes.

Auxiliary Lanes

Auxiliary lanes are designed to facilitate turning movements outside the general flow of traffic. Rather than commuters turning right or left from the main lanes, traffic is funneled to an auxiliary right or left turning lane or entrance ramp. This reduces the number of speed differentials in the corridor by separating the slowing or halting traffic from the main lanes.   Turning lanes are usually installed at busy intersections or the entrances of major traffic generators. In addition to providing a separate lane for right and left turning traffic, raised turn lanes can provide a pedestrian refuge and reduce traffic accidents. Dual right or left turning lanes are good for extremely busy intersections, such as the Main Street and Bay Area Boulevard and Main Street and Hobbs, that have a high number of vehicles making the same turning movements.

Preserve the Functional Area of Intersections and Interchanges

The functional area of an intersection or interchange is the area that is critical to its safe and efficient operation. This is the area where motorists are responding to the intersection or interchange, decelerating, and maneuvering into the appropriate lane to stop or complete a turn. Access connections too close to intersections or interchange ramps can cause serious traffic conflicts that result in crashes and congestion. A current example is the intersection of Main Street and Hobbs Road, which is located about 500 feet from the IH 45 and Main Street intersection. The volume of traffic loading onto Main Street, coupled with traffic flowing from the western is a major contributor to the congestion at Main Street and IH 45. It will only get worse as traffic volumes increase on Hobbs Road. Intersections for recommended roadways should be spaced adequately (see **Table 34**) to reduce congestion. This principle is also the basis for the plan recommendation to move the SH 99 and Calder Road interchange to Hobbs Road.

Median Improvements

A median is right-of-way designated for the space between opposing directions of traffic on a divided roadway. Depending on the roadway setting, medians can be striped, raised (with a curb), and/or landscaped, and range can vary in width. Medians improve safety and traffic operations by physically separating traffic and/or providing a shelter for roadway crossing. Where access is needed, directional median openings can be used to restrict some turning movements while simultaneously improving access for others.

Shared Access or Consolidated Parking
Shared access allows multiple adjacent businesses to utilize a single parking entrance. This improves congestion by reducing the number of turning movements within a corridor and facilitates a more pedestrian friendly environment.

Key System Improvements

Many of the issues in League City's thoroughfare network are not singular issues, but entire corridor or system wide issues. Addressing an issue, such as Main Street congestion, may not be as simple as adding additional lanes because congestion may be caused by a number of interrelated or unrelated factors. Because of this, corridors need to be holistically evaluated. The following section details corridor or system-wide improvements needed to improve mobility and congestion in League City. The improvements are illustrated in **Map 15.**

Main Street (FM 518) Corridor
Main Street is impacted by a number of issues that cause congestion. The travel demand model, which provides a high-level analysis of congestion in the corridor, was unable to detect this because it assigns level-of-service based on volumes and general capacity. It does not take into account the 20 intersections and 74 drive-ways between SH 3 and Egret Bay Boulevard. These access connections not only increase delay within the corridor but may increase the number of traffic collisions as well. The number and spacing of traffic signals may also add to the delay in the corridor and increase congestion. The western segment of the corridor has similar issues. To mitigate these conditions, the following corridor-wide recommendations were developed for Main Street.

Main Street Corridor Wide Recommendations
- Encourage consolidated parking for adjacent businesses.
- Construct raised medians with left-turn lanes between Wesley Street and SH 3 to better facilitate left-turn movements.
- Develop a traffic signal timing plan for consistently and efficiently move traffic through the corridor.
- Widen major arterial intersections an additional 40 feet to accommodate single and dual left-turn lanes.

The intersection of the northbound IH 45 frontage road and Main Street has been a point of contention in the City for several years. As previously mentioned, TxDOT is mitigating the issues with the IH 45 widening project, which includes widening the intersection to include six through lanes on Main Street, dual left turn lanes, and dual right turn lanes. The IH 45 frontage road will also be widened from two to three lanes in each direction, and include dual left-tun lanes, dual right-turn lanes, and a Texas U-turn.

League City Parkway

League City Parkway is one of the primary corridors with in League City. It does not have as much commercial development as Main Street but provides an essential east to west connection thorough the city and access to several residential communities. Additionally, the corridor intersects with five major arterial facilities and projected traffic volumes range between 30,000 and 35,000 vehicles per day.

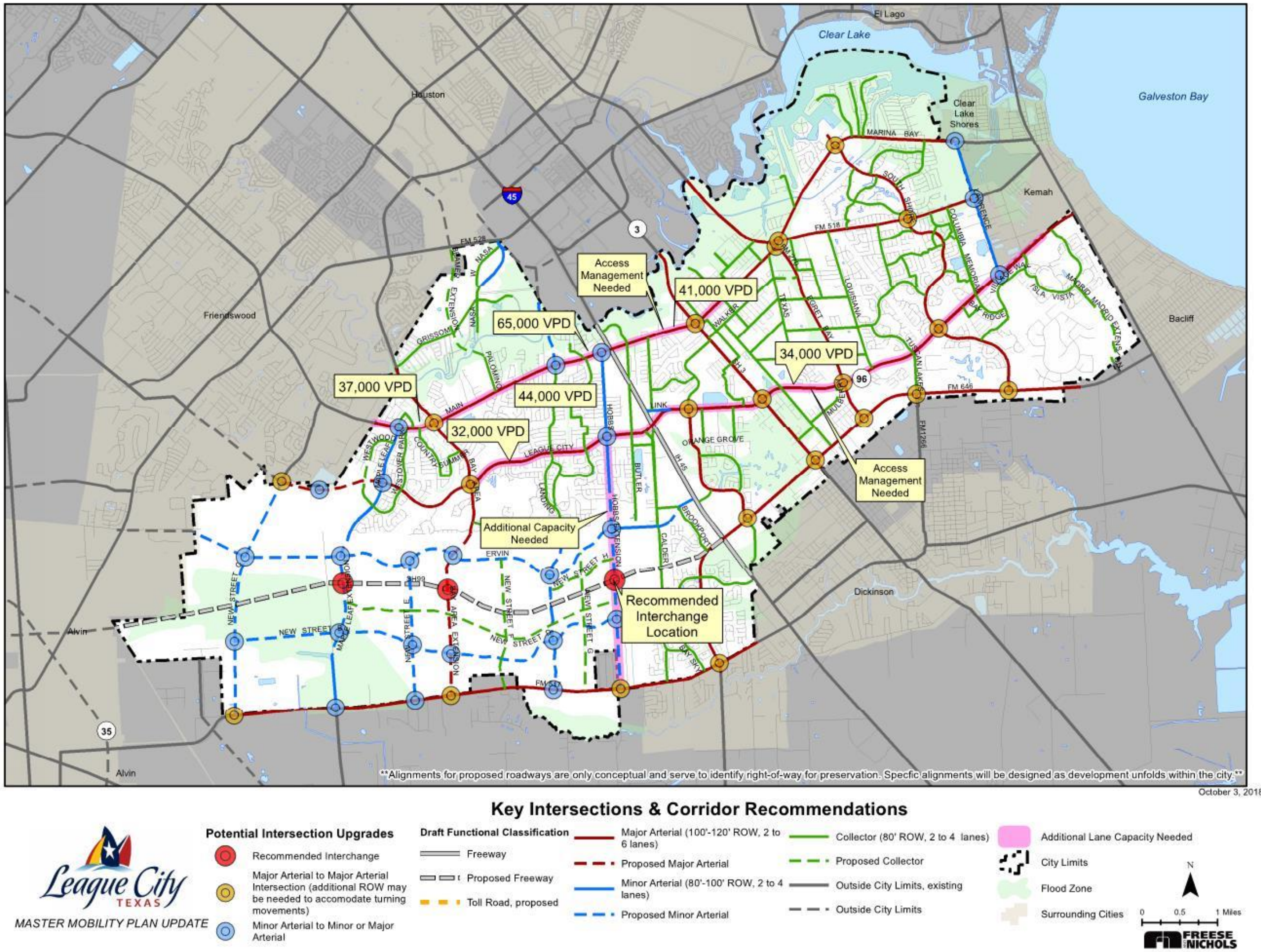
League City Parkway Corridor Recommendations

- Additional right-of-way may be needed at major arterial to major arterial intersections, such as Bay Area Boulevard and SH 3 to accommodate left- and/or right-turn lanes.
- Other intersections, such as Finnegan Lane/Brittany Lakes Drive, Landing Boulevard, and Calder Road may need left- and/or right-turn lanes to mitigate intersection congestion.

SH 99 (Grand Parkway) Interchange Relocation

The Calder Road and SH 99 interchange should be moved from Calder Road to Hobbs Road. The Calder Road interchange is located too close to the IH 45 and SH 99 interchange, which may increase congestion and lead to more traffic accidents. Commuters traveling north on IH 45 and merging on to SH 99 will have a very limited amount of time and space to travel from IH 45 interchange to the Calder Road interchange/ exit. Calder Road is also a collector class facility that does not have the capacity to accommodate the traffic that may be generated from the interchange. Additionally, Hobbs Road will provide a connection from SH 99 to Main Street.

Map 15. Key Intersection and Corridor Recommendations Map



Non-Motorized Recommendations

The following Non-motorized recommendations are based on the alignments developed in 2017 Trails Master Plan and enhanced to fit the 2018 recommended thoroughfare network. **Map 16** illustrates planned and existing bike pedestrian trails and/or routes by trail type. The majority of the planned trails are either on-street facilities or shared use pathways.

The planned on-street facility running along the Grand Parkway (SH 99) was changed to an off-street facility because the roadway was upgraded to the freeway/ tolled facility in the 2018 Master Mobility Plan and is not conducive to bike and pedestrian activity. An off-street trail may be viable in the area adjacent to SH 99, but may be hindered by planned development unless incorporated into the site design process. Removing SH 99 from the list of future trails will not significantly limit bike and pedestrian connectivity in the area because parallel on-street facilities on Ervin Avenue and New Street B provide the same east to west mobility and will provide better and safer access to adjacent land uses and destinations.

The 2017 Trails Master Plan should be updated to comport with the recommended thoroughfare network defined herein. Similar changes will need to be made to H-GAC's planned bike and pedestrian network.

Non-Motorized Transportation Elements

There are a number of on-street and off-street options that can be used in the development of a non-motorized transportation network. The following non-motorized elements may be constructed on most roadways as long as the level-of-service and available right-of-way are conducive to their application. Please note that the non-motorized transportation elements are general in nature and specific recommendations for roadways are available in the 2017 Trails Master Plan.

Signed Routes

Given the relatively low traffic volumes along many road segments within the city, some bike facilities should be signed routes with bicyclists riding on the roadway or utilizing shoulders where available. Bike signs not only guide bicyclists along designated routes, but alert drivers to the potential presence of bicyclists. This will improve bicycle safety and alert bicyclists where it is safer to ride. Signed routes may be appropriate on smaller roadways lower traffic volumes, such as Louisiana Avenue and Texas Avenue.

Paved Shoulder Routes

Shoulder routes are important because they separate bicyclists from automobile traffic and facilitate long distance trips between major destinations. Paved shoulders routes should be at least five (5) feet wide, according to AASHTO Guidelines. League City does not have many roadways with paved shoulders, but FM 646, FM 270 and FM 517 may be feasible paved shoulder routes under current roadway conditions.

Shared Lanes

Shared lanes or sharrows may be considered within city limits where there is limited right-of-way for wide shoulders and low traffic volumes. This may be ideal for the on-street routes. Share use lanes are typically painted with the sharrow emblem or "share the road" signs. Sharrows may be more appropriate on local roads, such as Pebble Beach Drive or Reynolds Avenue.

Shared Use Path

A shared use path is an on or off-street facility separated by a barrier or open space that is designed to accommodate all non-motorized modes including pedestrians, bicyclists, skaters, and joggers. According to AASHTO guidelines, shared use paths should be at least 10 feet wide. Wider facilities (up to 14 feet) may be needed in areas with a higher level of pedestrian activity. Due to right-of-way constraints, there are some trails in the 2017 Bike plan with eight-foot shared use paths.

Sidewalks

Sidewalks are primarily pedestrian off-street facilities located between the curb line of the roadway and the adjacent property. They are an integral part of the thoroughfare network, improving pedestrian access to business and residential development, and improving overall mobility. Sidewalks are recommended for both sides of recommended roadways   Sidewalks are located throughout League City, but occasionally on only one side of the street. The current minimum sidewalk width for local streets, according the to the City's 2013 General Design and Construction Standards is four (4) feet. This width is adequate, according to AASHTO guidelines, but a minimum of five (5) feet is encouraged to meet Safe Routes to School minimum guidelines. Minimum sidewalk width on collector or higher classified facilities is five (5) feet.

Cross-Sections with Non-Motorized Elements

The following cross-sections were developed to illustrate how the non-motorized network can be incorporated into the existing and proposed right-of-way for recommended cross-sections. Additional cross-section with non-motorized elements are available in the Appendices.

Figure 26. Six Lane Major Arterial with Shared-Use Pathway

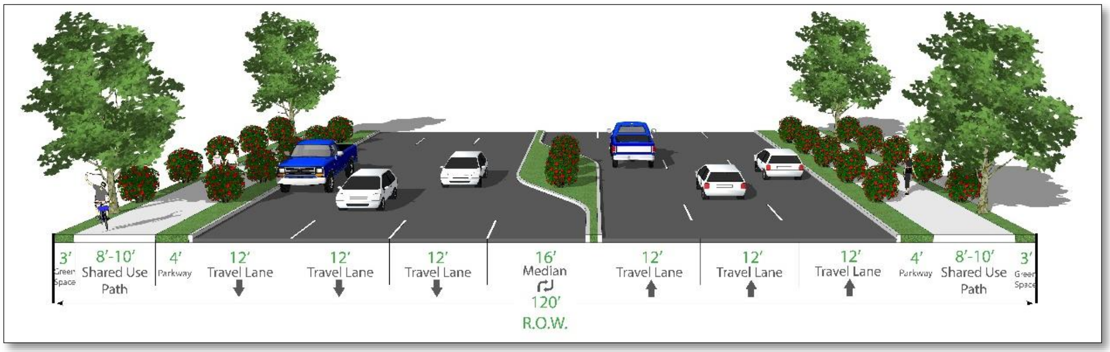


Figure 27. Four Lane Minor Arterial with Shared-Use Pathway

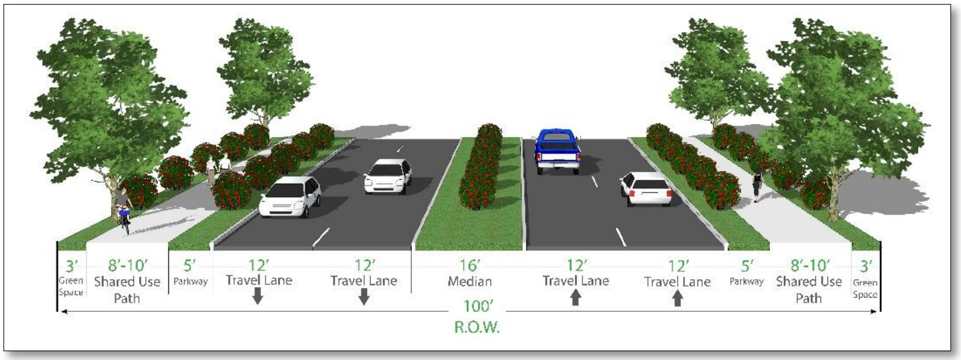
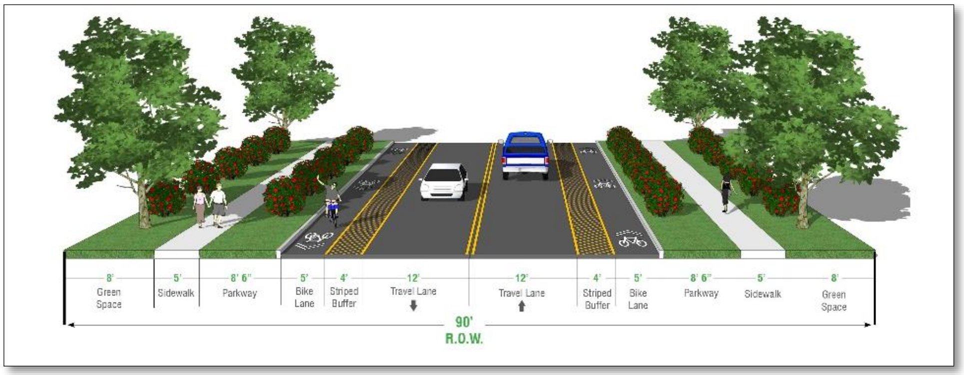
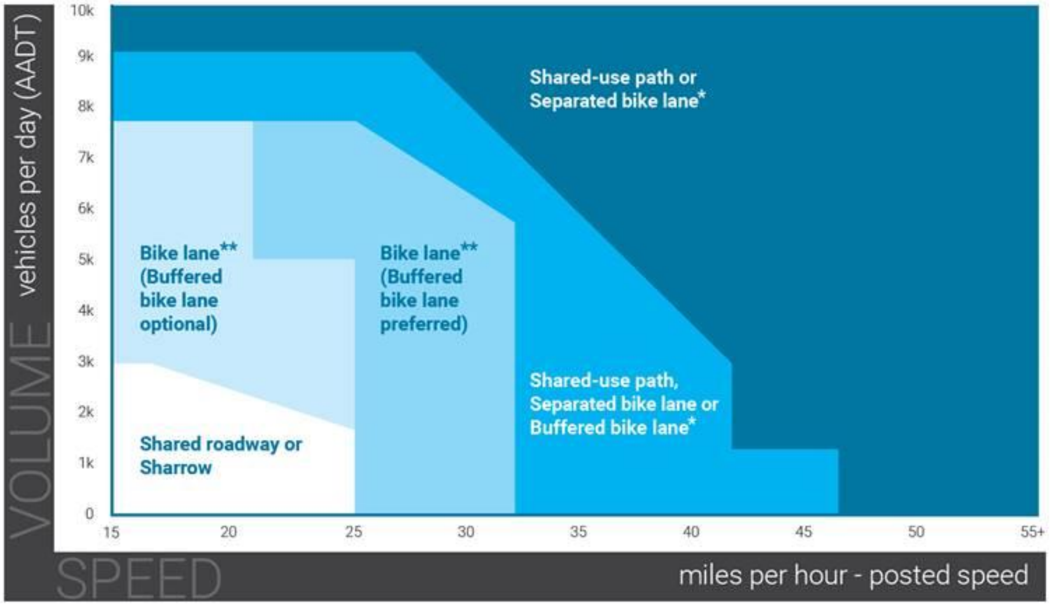


Figure 28. Two Lane Collector with Buffered Bike Lane



Not every roadway is designed to accommodate bicycle activity. The traffic volumes, level-of-service, and speed limit have a significant bearing on the level of safety and perceived bikeability of a roadway. **Figure 29** illustrates traffic volume thresholds for various on-street bike facilities. Note that the index is not geared toward towards avid cyclists and caters towards middle of the road cyclists and beginners who may bike to parks, schools, or other local destinations for leisure.

Figure 29. Bike Facility Safety Index



Source: Colorado Springs Bike Master Plan. Appendix B: Bike Facility Toolbox, 2017.

*Treatment determined by bicycle and pedestrian volumes or land use when volumes are unavailable.

**Includes the use of shoulders as a bikeway.

Sharrows or share the road facilities have the lowest threshold in terms of traffic volume and speed for any type of bike trail, having a maximum volume of 3,000 vehicles per day and a maximum speed limit of 25 miles per hour. Bike lanes (buffered or not) are ideal for roadways accommodating up to 7,000 vehicles per day at speeds approaching 45 miles per hour. Shared use pathways have the highest threshold of conducive volumes and speed because the bicycles are completely separated from automobiles. These facilities are useful in high traffic areas, but ROW may be difficult to come by in more built out areas.

The following bike and pedestrian treatments may be used to enhance the overall non-motorized framework within the League City. In addition to enhancing the city's non-motorized network, the following treatments may also add to the livability and economic vitality of the city. Please note that treatments should be utilized on a case by case basis. Not all treatments are suitable for every land use/ roadway context.

Pedestrian Signage

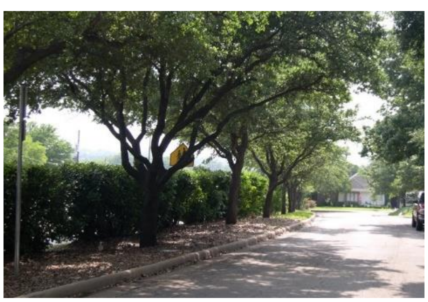
Bollards

Buffered Bike Lanes

Shared Use Pathways

Landscaping

On-Street Parking



Street Trees

Ramps/ ADA Elements

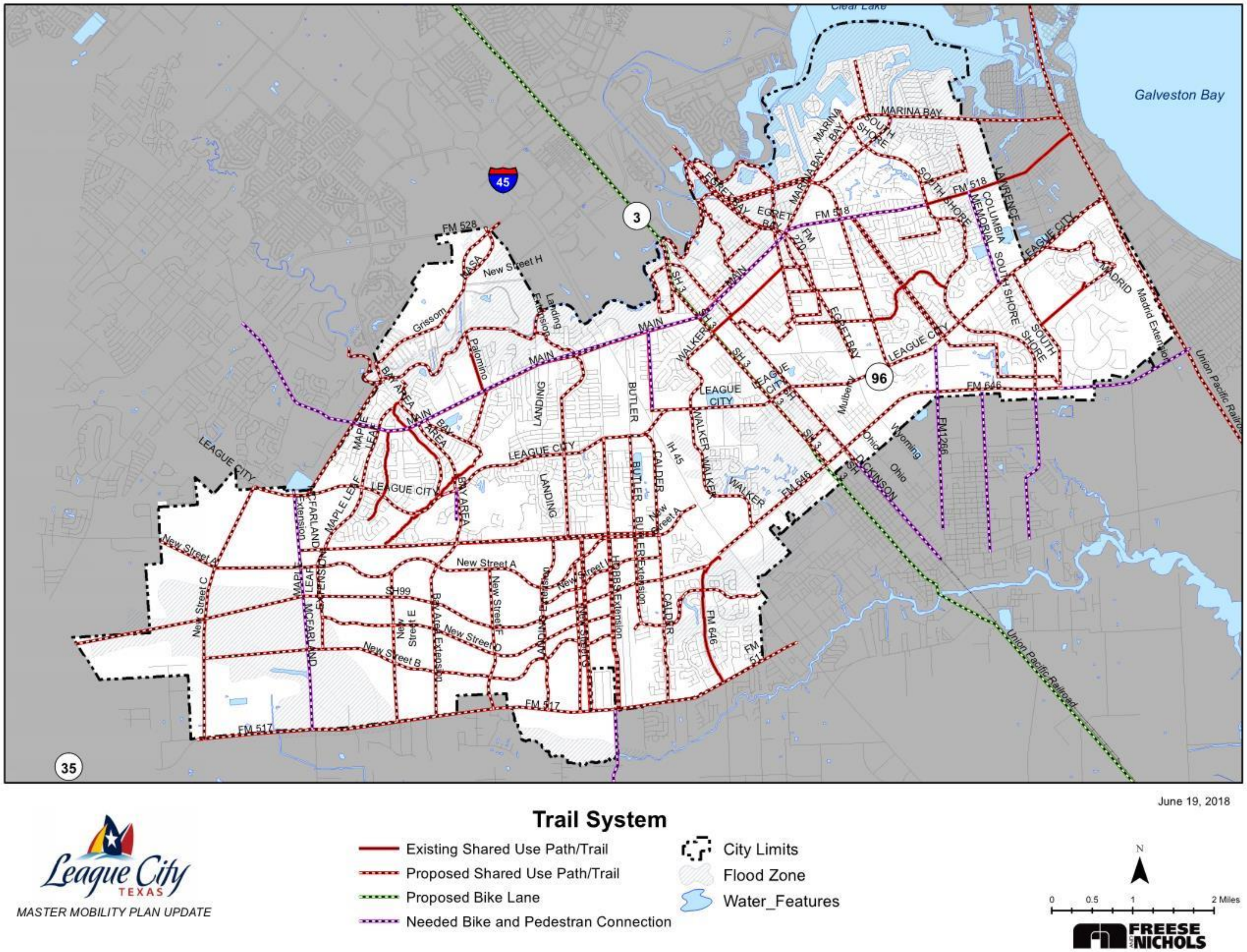
Pedestrian Plazas

Cycle Tracks

Raised/Unraised Crosswalks

Roundabouts

Map 16. Trail System Adaption to Recommended Thoroughfare Network



Transit Recommendations

The following transit recommendations were developed to supplement enhancements to roadway network. Additional transit recommendations were based on recommendations developed from the 2011 League City Master Mobility Plan. Potential transit corridors are illustrated in **Map 17**.

Identify Potential Transit Corridors and Station Locations for a Transit Feasibility and Demand Analysis
The 2011 Master Mobility Plan indicated that League City may be a viable option for a station location along the Galveston, Houston, and Henderson (GH&H) freight line, which runs parallel to SH 3 between Galveston, League City and Houston. The corridor was identified in the H-GAC 2008 Regional Commuter Rail Study as only one of the top five commuter rail corridors in the region. Among the top five corridors, the GH&H corridor had the highest forecasted ridership. With IH 45 being a key regional corridor, it should be leveraged for express bus service to Houston and Galveston. Such service would not only provide an important regional connection but help relieve congestion around future developments along the corridor as well. A study should be conducted to identify the most feasible and effective commuter rail and express bus station locations and corridors within the city.

Transit Friendly Network
As the city continues to develop, the demand for more transit options may also increase. The feasibility of transit options, however, will largely be dependent on a transit network and land use/population density. To better accommodate transit demand, a supporting grid network should be considered. Such layout is not only more conducive to high-density residential and commercial development but is more pedestrian friendly as seen in some of the newer active mixed-use centers with walkable corridors and desirable block lengths. Both density and pedestrian connectivity are essential to transit feasibility.

Preserve Rights-of-Way for Potential Commuter Rail Alignments and Station Area Development
Proactive right-of-way preservation is an essential strategy to successful mobility planning. Not only does this approach establish a framework ahead of development, but also from a cost perspective in advance of increased property values from unfolding development. Within station area development, additional right-of-way should be considered to accommodate for parking and other active transportation within the development area. Station area development, sometimes referred to as transit-oriented developments (TOD), may not only increase ridership to the station, but could be a catalyst for economic development by creating value add to the city in both new and/or targeted redevelopment areas.

Negotiate Express Bus Service from League City to Downtown Houston

There is currently no express bus service from League City north to employment centers in Houston. Residents must drive to either the El Dorado or Bay Area Park-and-Ride station for service. The League City Park-and-Ride is not only easily accessible from IH 45 but could serve as a regional connection point for Connect Transit riders coming from Galveston and headed towards Houston as well. Express service from the League City Park-and-Ride may be a sound replacement for the Island Express, which closed in September 2018 due to low ridership. The number of commuters coming from Galveston, coupled with League City Commuters, may increase the ridership potential to feasibility thresholds. This should continue to be investigated.

General Fixed Route Service Criteria
League City does not currently have the land use and population density to support a standalone fixed route transit service. This is evidenced by the failure of previous fixed route services, such as BayTran. This may, however, change in the future as the western sector of the city develops and residents seek alternatives to private vehicular travel. Should a fixed route service be developed within the city, the following criteria should be considered in route development. **Table 43** provides a summary of general transit modes.

- The four-step travel model should be considered when developing transit routes: trip generation, trip distribution, modal split, and trip assignment. Transit considerations include; travel time, frequency of trips, and reasons why commuters may be more likely to ride the bus, (trip generation), their origin and destination (trip distribution), if other modes of transportation are available, and the likelihood commuters will travel via bus to destinations (modal split), and optimal routing between compatible destinations (trip assignment). Using the four-step modeling process, as part of route planning, will help transit planners determine optimal routes and service schedules.

- Identify potential transit corridors based on existing and planned transit compatible land uses, such as retail, educational, service, and mixed-use, that may be denser in nature, and may attract a variety of different users. The City's future land use map identified several pockets of development in the western sector of the city and along the IH-45 corridor that may be conducive to fixed route service. At a minimum, residential density should be at least five to 10 dwelling units per acre; employment should be about two to five employees per acre.

- The transit system should have enough busses to ensure adequate headways within the service area throughout the day. Headways should be shorter during morning and afternoon peak periods to accommodate higher transit demand. The optimal headway for bus service is 15 – 20 minutes, but this period may be extended during off-peak hours to 30-minutes. According to the Transit Capacity and Quality of Service Manual (TCQSM), transit service becomes unattractive to choice riders after 30-minutes and all riders after an hour. The bus schedule should be posted at all stops to inform commuters of anticipated wait times. If operating and maintaining fixed route service within desired headways becomes too costly, the city may consider reducing the service area and operating times.

- Fixed routes should be visible and easily accessible for pedestrians and automobiles. Ideal fixed route corridors may include; landscaping, street trees, pedestrian scale lighting, benches, and other pedestrian amenities to create a more pedestrian friendly environmental. Sheltered bus stops are beneficial along routes with longer headways and fewer street trees for shade. Mid-block crossings, pedestrian signals, and illuminated signage may also be appropriate for bus stops not located at intersections.

- Prior to implementation of fixed route service, a transit feasibility analysis should be conducted to determine both the demand and feasibility of fixed route service. If fixed route service is not feasible, a flex route program may suffice until density and demand warrant fixed route service. Flex route service is a combination of fixed route service and demand response service and may be implemented in two ways: point deviation and route deviation. With point deviation, service is available at specific points within the city at specified times, but not on a fixed route. Route deviation service operates along a fixed route, but vehicles may deviate from the route to pick-up or drop-off passengers upon request. Flex service is cheaper than fixed route service and requires fewer vehicles.

Table 43. General Characteristics of Transit Modes

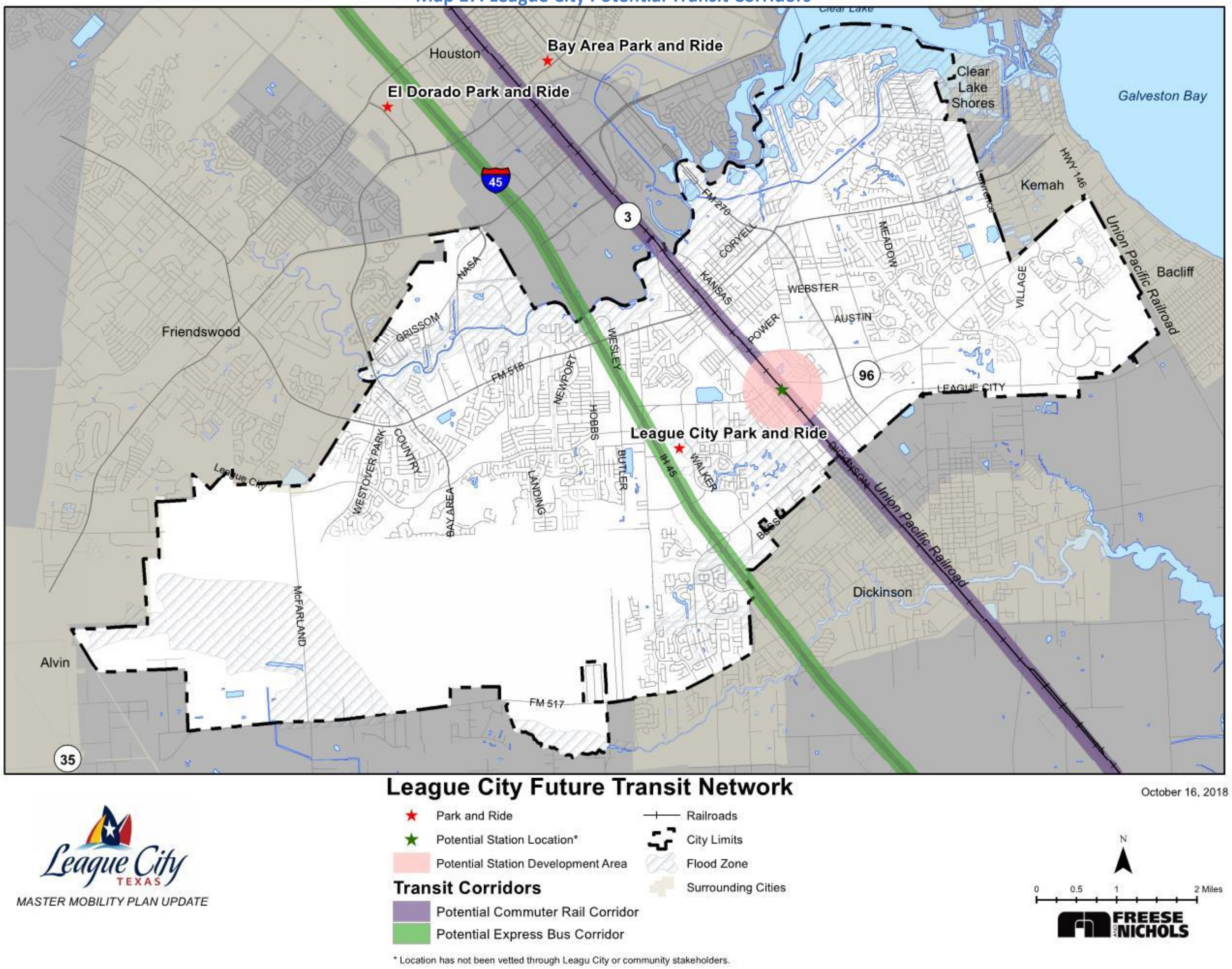
	Location							
	Urban Core		Neighborhood Center and Industrial Corridor		Suburban Corridors and Centers			
Transit Mode	Res. DU/Acre	Emp/ Acre	Res. DU/Acre	Emp/ Acre	Res. DU/Acre	Emp/ Acre	Ideal Spacing	Peak Headway
Bus	20+	200	10 - 20	2 - 5	5 - 10	2 to 5	1/4 Mile	10 - 15
Light Rail Transit	35+	500	25 - 35	100 -150	12 - 25	30 - 40	1 Mile	5 to 15
Bus Rapid Transit	35+	500	25 - 35	100 -150	12 - 25	30 - 40	1 Mile	3 - 30
Heavy Rail	35+	500	25 - 35	100 -150	12 - 25	30 - 40	2 Mile	3 - 10
Commuter Rail	35+	500	25 - 35	100 -150	12 - 25	30 - 40	3 Mile	20 - 20

Source: Planning for Transit Supportive Development: A Practitioners Guide, FTA. 2014

Additional Transit Recommendations

- Ensure pedestrian and bicycle connectivity (last mile) to local and regional transit service – including bike racks on buses.
- Increase the marketing of Connect Transit demand-response service.
- Coordinate with municipalities on the GH&H corridor to develop a potential multi-city agreement to support the development and implementation of the GH&H rail corridor.
- Ensure connectivity between any interim local transit services and all existing and future park-and-ride facilities.
- Increase marketing of currently available Connect Transit demand-response service.
- Remain engaged in the ongoing alternatives analysis process to select a regional mobility solution for the Gulf Freeway corridor.
- Evaluate and identify a preferred commuter rail station location for advanced planning and potential right-of-way preservation for transit-oriented development.

Map 17. League City Potential Transit Corridors



Other System and Policy Recommendations

A number of other system-wide improvements were developed to maintain and improve the overall contiguity and flow of the thoroughfare network.

- Incorporate recommended functional classifications and designated rights-of-way into the City's General Design and Construction Manual and Subdivision Regulations to ensure plan recommendations are taken into consideration and/or incorporated into future developments.

- Update the 2017 Trails Master Plan to include the non-motorized cross-sections recommended in the thoroughfare plan document.

- Develop an on-line mapping system with the Master Mobility Plan Map, current and future land use map, zoning map, and other pertinent City Maps that developers and residents can access for information on planned system-wide improvements.

- Assess the update the Master Mobility Plan document every five-years to ensure the plan network comports with community transportation vision and opportunities for leveraging future regional transportation initiatives and continued community growth.

Chapter 7: Thoroughfare Plan Implementation

Projects recommended for implementation in the League City Master Mobility Plan will be prioritized based on available funding, potential to leverage additional transportation improvements, and economic benefit. Projects selected for implementation range from new road construction and realignments to rehabilitation and intersection improvements. In addition to prioritizing recommended projects, several funding sources were identified and categorized based on the types of transportation projects eligible for the funds.

Plan Implementation

Project Prioritization

Projects selected for implementation in the League City Master Mobility Plan were prioritized based on their overall impact of the transportation network, position to leverage for additional transportation funds, feasibility, and funding. The following tables illustrate recommended roadway construction and enhancement prioritization for the League City Master Mobility Plan.

Timing for recommended projects is based on available or identified funding for recommended projects, overall network impact, and/or the ability of the project to facilitate additional transportation improvements. Short-range projects include projects recommended for the zero (0) to five (5) year term, medium-term projects are recommended for the five (5) to 15-year term, and long-term projects are envisioned for the 15-plus year horizon. Implementation timing is illustrated in **Map 18.**

Short-term Project Implementation (0 – 5 Years)

Table 44. Recommended Short-Term Project Implementation

Project	Limits	Functional Class	Priority
League City Parkway Extension	Maple Leaf Dr to Western City Limits	Major Arterial	0 - 5 years
Madrid Lane Extension	Existing alignment to FM 646	Collector	0 - 5 years
Right Turn-bays on FM 518	FM 518 and Landing Blvd Intersection	Major Arterial	0 - 5 years
Traffic Signal	League City Pkwy and Bay Area Blvd	Major Arterial	0 - 5 Years
Traffic Signal	League City Pkwy and Brittany Lakes Dr Intersection	Major Arterial	0 - 5 Years
Traffic Signal	Landing Blvd and League City Pkwy Intersection	Major Arterial	0 - 5 Years
Ervin Avenue	Calder Rd to Hobbs Rd Extension	Major Arterial	0 - 5 Years
Landing Boulevard Extension	Sandvalley Way to FM 517	Minor Arterial	0 - 5 Years
Turn Bays at SB SH 3 and FM 518 Intersection	SH 3 and FM 518 Intersection	Major Arterial	0 - 5 Years
Walker Street Extension (Northern Segment)	Texas Ave to FM 270	Collector	0 - 5 Years

Many of the short-term projects, such as the League City Parkway Extension, are currently being designed or under construction. Other roadways, such as the Madrid Lane Extension are dependent upon development in the area.

Medium-term Project Implementation (5 – 15 Years)

Table 45. Recommended Medium-Term Project Implementation

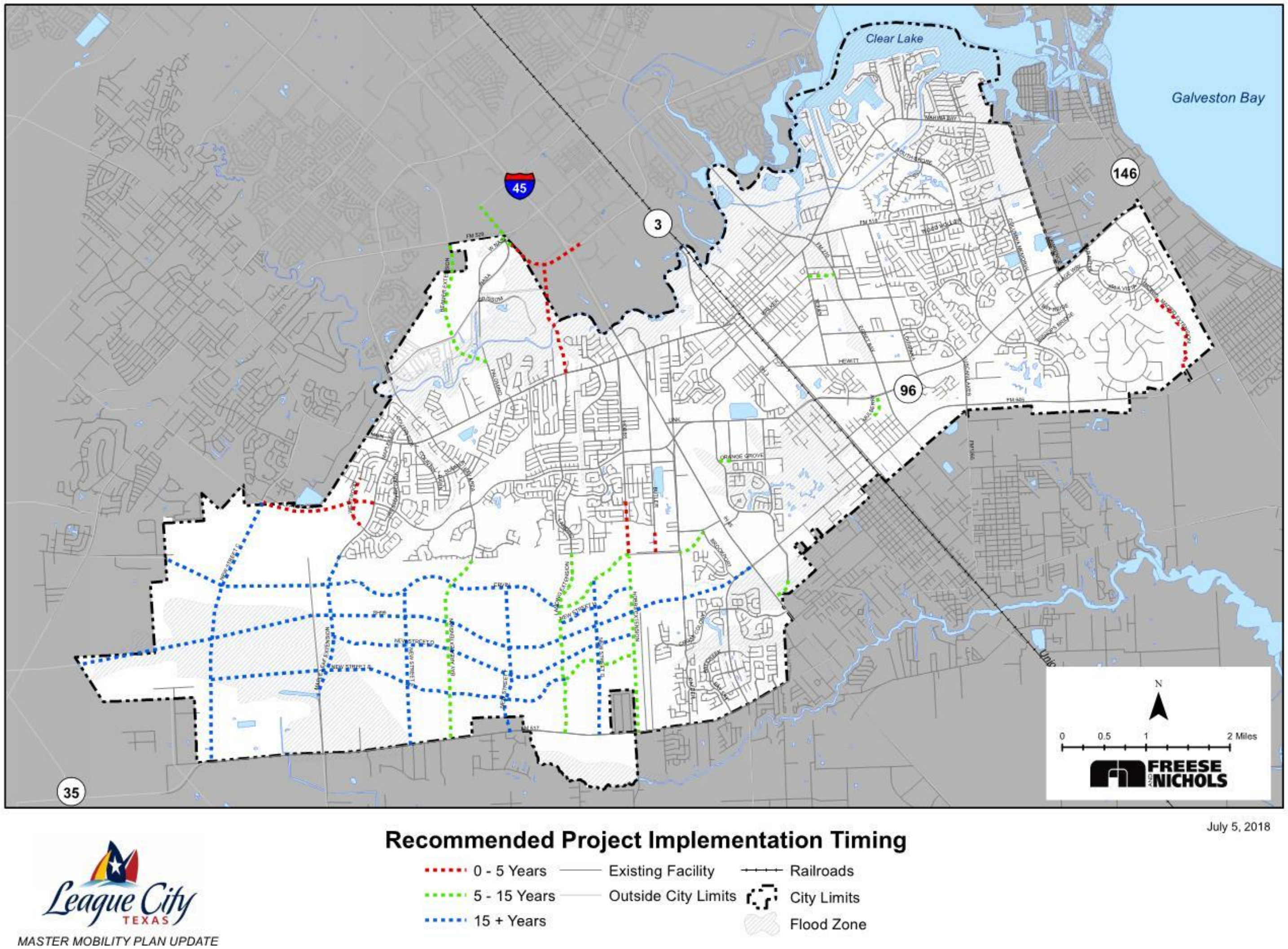
Project	Limits	Functional Class	Priority
Walker Street Extension (Southern Segment)	South of FM 646 to IH 45 Frontage Rd	Major Arterial	5 - 15 Years
Ervin Avenue (Extension)	From Hobbs Rd to Landing Blvd (Extension)	Minor Arterial	5 - 15 Years
New Street B	From Landing Blvd Extension to Hobbs Rd Extension	Minor Arterial	5 - 15 Years
Hobbs Road (Extension)	Ervin Ave to FM 517	Minor Arterial	5 - 15 Years
Palomino Bridge	Clear Creek	Collector	5 - 15 Years
Widen FM 518 to Six Lanes	IH 45 Frontage Rd to SH 3	Major Arterial	5 - 15 Years
Right-turn bays at League City Parkway	League City Pkwy and Brittany Lakes Dr Intersection	Major Arterial	5 - 15 Years
Palomino Lane Extension	Clear Creek to Grissom Rd	Collector	5 – 15 Years
Beamer Road Extension	Grissom Rd to North City Limits	Collector	5 – 15 Years

Long-term Project Implementation (15 + Years)

Table 46. Recommended Long-Term Project Implementation

Project	Limits	Functional Class	Time Frame
Ervin Avenue (Extension)	Landing Blvd to Western City Limits	Minor Arterial	15 + Years
Ervin Avenue Widening to Four Lanes	Brookport Dr to Western City Limits	Minor Arterial	15 + Years
New Street B (Extension)	Landing Blvd (Extension) to New Street C	Minor Arterial	15 + Years
New Street C	FM 518 to FM 517	Major Arterial	15 + Years
New Street D	Hobbs Rd Extension to New Street E	Collector	15 + Years
New Street E	Ervin Ave to FM 517	Minor Arterial	15 + Years
New Street F	Ervin Ave to FM 517	Collector	15 + Years
New Street G	Ervin Ave to FM 517	Collector	15 + Years
New Street H	New Street D to FM 517	Collector	15 + Years
Grand Parkway	FM 646 to Western League City Limits	Freeway/ Toll Road	15 + Years
Walker Street Extension (Northern Segment)	Texas Ave to FM 270	Collector	15 + Years

Map 18. Recommended Project Implementation Timing



Alignments for proposed roadways are only conceptual and serve to identify right-of-way for preservation. Specfic alignments will be designed as development unfolds within the city.

Funding Strategies

Implementation Matrix

The funding and implementation matrix was developed to identify potential funding sources for Plan recommendations. For this section of the document, the matrix was broken into four (4) categories:

- Roadway Construction
- Roadway Rehabilitation
- Intersection Improvements
- Miscellaneous

Roadway Construction

Roadway construction funding sources, such as Category 12: Strategic Priority Funds, are geared towards new road roadway construction, roadway realignments, and interchange construction. **Table 47** provides a list of funding sources that can be used to roadway fund construction. Category 12 Funds, specifically, are obligated to projects that promote economic development and improve interstate connectivity. Eligible projects include additional lanes and new roadways, grade separations, interchanges, bottleneck removal, and safety improvements. These funding sources would be instrumental in the construction of recommended projects such as the SH 99 if it is not constructed as a tolled facility. Additional details on all funding sources are available in the Appendices.

Roadway Rehabilitation

Table 47. Potential Funding Sources for Roadway Construction

Roadway Construction		
Recommendation	**Problem Addressed**	**Potential Funding Source(s)**
Street Construction	Improved Access Capacity Improvement Congestion Relief Economic Development	Category 12: Strategic Priority Funds Category 4E: Rural Mobility/Rehabilitation Category 11: Texas Mobility Fund Category 8B: Texas FM Road Expansion Proposition 7 Funds Roadway Impact Fees
Frontage Road Construction	Congestion Relief Economic Development Capacity Improvement	Category 12: Strategic Priority Funds Category 11 Proposition 7 Funds
Roadway Realignment	Safety Improved Traffic Flow Congestion Relief	Category 12 Category 4E Category 11 Proposition 7 Funds
Interchange Construction	Capacity Improvement Congestion Relief	Category 12 Category 11 Texas Mobility Fund Proposition 7 Funds

Roadway rehabilitation projects include investments in transportation improvements that increase capacity, improve safety, or facilitate economic development. It includes enhancements such as grade separations, roadway resurfacing, lane additions, road diets, and right-of-way acquisitions. Funding options for roadway rehabilitation include, but are not limited to, Category 4F: Rehabilitation in Urban and Rural Area and Category 3C: Rehabilitation funds. Category 4F funds are geared towards the rehabilitation of on-system roadways, such as FM 518 (Main Street) that are functionally classified higher than minor collectors. Category 3C funds are geared towards funding lower functionally classified on-system facilities. **Table 48** provides a list of funding sources that could be used to fund roadway rehabilitation improvements.

Table 48. Potential Funding Sources for Roadway Rehabilitation

Roadway Rehabilitation		
Recommendation	**Problem Addressed**	**Potential Funding Source(s)**
Grade Separation	Congestions Relief Safety	CMAQ Category 2: Metro Corridor Funds Category 11 Texas Mobility Fund
Lane Addition	Congestion Relief Improved Capacity	STP-MM Category 12: Strategic Priority Funds Category 11 Texas Mobility Fund Roadway Impact Fees
Roadway Widening	Congestion Relief Improved Capacity Accommodates wider vehicles	STP-MM Category 12 Category 4F Category 3C Category 11: State Discretionary Funds Texas Mobility Fund Roadway Impact Fees
Narrower Lanes	Traffic Calming Safety	Category 11 Category 4E
Right-of-Way Acquisition	ROW for future Road Expansion	Category 2 Category 4E: Rural Mobility/Rehabilitation Proposition 7 Funds
HOV Lane	Congestion Relief Capacity Improvement	Texas Mobility Fund
Road Dieting	Traffic Calming Safety Economic Development	Category 11 Category 4E

Intersection Improvements

Intersection improvement funds are geared towards intersections safety improvement and access management projects that improve the overall flow of traffic within a corridor. Intersection improvements include traffic signalization, intersection lighting, roundabouts, turn lanes, and intersection geometry improvements. These funds would be pivotal in the financing intersection improvements along IH 45, FM 518, and League City Parkway. Intersection improvement funding sources include, but are not limited to, Category 10A Traffic Control Devices and Category 11: Texas Mobility Funds. Category 10A funds can be used for the installation or rehabilitation of traffic signals and intersection lighting on on-system roadways. Category 11 funds can be used to fund intersection geometry improvements. Eligible projects include right and left turn lanes, intersection geometry improvements, and roundabouts. **Table 49** includes a list of funding sources that can be used to fund intersection improvements. Additional information on the funding sources is available in the appendices.

Table 49. Potential Funding Sources for Intersection Improvements

Intersection Improvements		
Recommendation	**Problem Addressed**	**Potential Funding Source(s)**
Traffic Signalization	Congestion Relief Safety	CMAQ Category 10A: Traffic Control Devices Category 10B: Rehab of Traffic Management Systems Category 11
Intersection Geometry Improvements	Safety Congestions Relief Capacity Improvement Accommodates Wider Vehicles	CMAQ Category 4E Category 11
Intersection Lighting	Safety	Category 12 CMAQ Category 11
Left and Right Turn Lanes	Safety Congestions Relief Capacity Improvement	CMAQ Category 11 Category 4E
Round-A-Bout	Congestion Relief Capacity Improvement Safety Traffic Calming	CMAQ STEP Funds Category 11 Category 4E

Miscellaneous Projects

Miscellaneous improvements range from bridge construction to pedestrian amenities and traffic impact assessments. Some of the eligible funding sources for these improvements include Green Ribbon Funds and Statewide Transportation Enhancement Program (STEP) funds. Green Ribbon Funds are geared towards improving the visual or aesthetic appeal of corridors. STEP funds are available for non-traditional transportation projects such as bike and pedestrian initiatives, landscaping, and special studies. These funds would be instrumental in implementing the City's bike plan. Although federally sourced, these funds are not restricted to on-system facilities. **Table 50** provides a list of funding options available for miscellaneous projects. Additional information on the funding sources is available in the appendices.

Table 50. Potential Funding Sources for Miscellaneous Transportation Projects

Miscellaneous		
Recommendation	**Problem Addressed**	**Potential Funding Source(s)**
Bridge Construction/ Reconstruction	Safety Capacity Improvement Accommodate Wider Vehicles	Category 6A: On System Bridge Program Funds Category 6B: Off System Bridge Program Funds Category 11 Roadway Impact Fees
Street Lighting	Safety Economic Development	CMAQ STEP Funds Green Ribbon Funds Category 11
Railroad Grade Separation Repair/ Construction	Congestion Relief Safety	Category 4G: Railroad Grade Separation Category 11
Pedestrian Amenities/ Landscaping	Traffic Calming Safety Economic Development Beautification	CMAQ STEP Funds Green Ribbon Funds Category 11
Transit Expansion	Transit Needs Multimodal Connectivity	CMAQ STEP Funds Category 11
Traffic Impact Assessment	Congestion Relief Traffic Calming Safety Improved Access	CMAQ
Miscellaneous	Safety Congestion Relief Capacity Improvement	Category 4F: Rehabilitation in Urban and Rural Areas Category 4E Category 3C: NHS Rehabilitation Category 8A: Rehabilitation of FM Roads Category 11 Texas Mobility Fund

Appendices

Intersection Analysis

This analysis was completed to determine the current conditions and potential future conditions of four intersections: FM 518 at Landing Boulevard, W League City Parkway at Brittany Lakes Drive/Fennigan Lane, FM 518 at Bay Area Boulevard, and League City Parkway at Bay Area Boulevard.

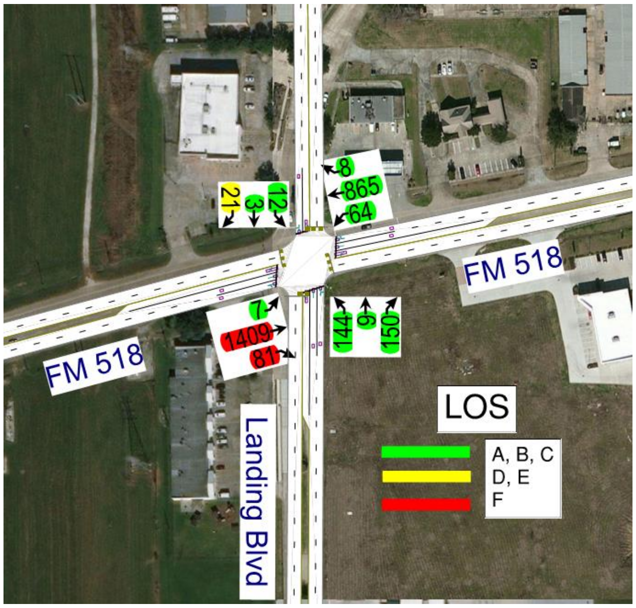
Methodology:
Using Synchro, the amount of delay (seconds/vehicle) and the Level of Service (LOS) at each intersection was calculated. The delay and LOS were calculated by Synchro using the 2010 Highway Capacity Manual's methodology.

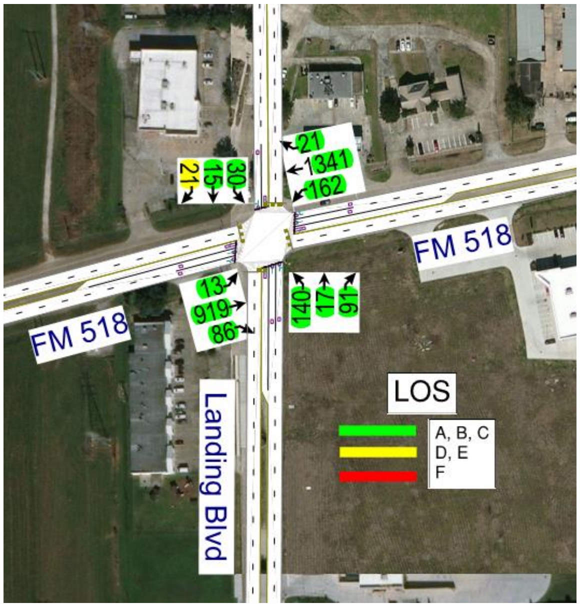
Future volume analysis was also completed to determine how the intersection would perform with additional volume. Without site specific growth trends to perform an in-depth analysis, a uniform growth rate was used to perform a rough analysis. The volumes were increased in increments of 10% up to 50%.

FM518 and Landing Boulevard – Site 1
The intersection between FM 518 (Main St) and Landing Boulevard is currently signalized. The eastbound, westbound, and northbound approaches have 2 thru lanes and 1 left turn lane while the southbound approach has 1 thru lane and 1 left turn lane. There is also a wide shoulder on FM 518 that is wide enough that it could be used by right turning vehicles. However, for this analysis, this was not used.

In the AM, the volume is heavily skewed from the WB approach, with 1500 vehicles compared to 950 vehicles from the EB approach. The opposite is true for the PM peak, with the heaviest volume in the WB approach.

Currently, the intersection performs adequately in the morning and evening peak periods. With an overall delay of 26.9 seconds in the AM and 27.7 seconds in the PM and an overall LOS of C, there is still room for growth.





Base Conditions - AM LOS and Volume; PM LOS and Volume

Growth – AM LOS and Volume; PM LOS and Volume

Future growth analysis shows that in the AM peak period, the intersection starts to break down around 40% growth and reaches LOS F at 50% growth. Most of the delay occurs in the eastbound approach and those turning left from the northbound approach. Depending on growth trends, this may differ in the future. In the PM peak period with 50% growth, the intersection still functions with a LOS of D. However, it will be important to watch the distribution of future volume. Because the volume is heavily skewed from one approach, the other approaches have longer delays to ensure the approach with the most volume doesn't breakdown.

FM 518 and Landing Boulevard AM					
Cycle length	120				
Approach	NB	SB	EB	WB	**Overall**
Delay	42.0	46.9	30.6	15.3	**26.9**
LOS	D	D	C	B	**C**

FM 518 and Landing Boulevard PM					
Cycle length	100				
Approach	NB	SB	EB	WB	**Overall**
Delay	24.1	35.3	28.1	27.7	**27.7**
LOS	C	D	C	C	**C**

FM 518 and Landing Boulevard Future Delay and LOS						
	Current	**10%**	**20%**	**30%**	**40%**	**50%**
	AM					
Delay	26.9	30.2	33.7	47.3	64.1	83.6
LOS	C	C	C	D	E	F
	PM					
Delay	26.9	31.4	32.0	33.7	38.8	42.4
LOS	C	C	C	C	D	D

League City Parkway at Brittany Lakes Drive and Fennigan Lane – Site 2 and 3

The intersection of League City Parkway at Brittany Lakes Drive and Fennigan Lane is a combination of two unsignalized intersections. League City Parkway is a four-lane divided road while both Brittany Lakes Drive and Fennigan Lane are two-lane roads. The connection between the two intersections is about 40 feet from stop bar to stop bar so about two vehicles can queue up there.

In the AM, the volume is much greater in the EB approach with about 1000 vehicles compared to 400 in the WB approach. In the PM, the volumes are more balanced, but it is important to note that about 200 vehicles come from the east and turn left into the housing subdivision.

Synchro analysis shows that this intersection is already close to capacity during the peak hours. In the AM, the overall delay at the EB intersection is 50 seconds per vehicle and has a LOS of E. In the PM, the overall delay at the WB intersection is 29.5 sec/veh and has a LOS of D.

Base Conditions - AM LOS and Volume; PM LOS and Volume

Future analysis shows that even a 10% growth would push both peaks to LOS F levels. If volumes are expected to increase, mitigations such as signalization or LT bays should be considered.

League City Parkway AM										
	Brittany Lakes Drive					Fennigan Ln				
Cycle length	Unsignalized					Unsignalized				
Approach	NB	SB	EB left lane	EB right lane	**Overall**	NB	SB	WB left lane	WB right lane	**Overall**
Delay	13.8	10.7	63.1	59.6	**50**	9.0	8.5	10.4	9.9	**9.9**
LOS	B	B	F	F	**E**	A	A	B	A	**A**

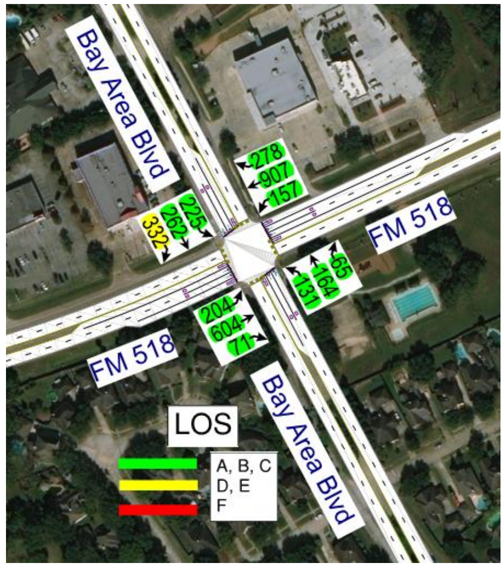
League City Parkway PM										
	Brittany Lakes Drive					Fennigan Lane				
Cycle length	Unsignalized					Unsignalized				
Approach	NB	SB	EB left lane	EB right lane	**Overall**	NB	SB	WB left lane	WB right lane	**Overall**
Delay	10.9	12.9	22.5	21.5	**19**	10.6	9.5	43.8	17.5	**29.5**
LOS	B	B	C	C	**C**	B	A	E	C	**A**

FM 518 and Brittany Lakes Drive Future Delay and LOS						
	Current	**10%**	**20%**	**30%**	**40%**	**50%**
	AM					
Delay	50.0	81	119.7	163.1	211.4	258
LOS	E	F	F	F	F	F
	PM					
Delay	19	24.4	33.6	48.8	70.7	96.3
LOS	C	C	D	E	F	F

FM 518 and Fennigan Lane Future Delay and LOS						
	Current	**10%**	**20%**	**30%**	**40%**	**50%**
	AM					
Delay	9.9	10.3	10.8	11.3	12.0	12.7
LOS	A	B	B	B	B	B
	PM					
Delay	29.5	44	64.5	89.8	119.2	152.3
LOS	D	F	F	F	F	F

FM 518 and Bay Area Boulevard – Site 4

The intersection at FM 518 and Bay Area is between two arterials. All four approaches have 2 thru lanes and 1 left turn lane, while the FM 518 approaches also have a right turn lane bay. The eastbound and westbound volumes on FM 518 are balanced during both the AM and PM peak periods. The northbound and southbound volume on Bay Area Boulevard are skewed to the northbound approach in the AM and to the southbound approach in the PM.



Base Conditions - AM LOS and Volume; PM LOS and Volume

Analysis shows that the intersection performs at a LOS of C in both the AM and PM. The delay is distributed evenly in the AM. In the PM, the most delay occurs in the southbound approach, due to its high left turning volume.

Future volume analysis shows that this intersection doesn't reach LOS F until 40% growth so there is still capacity for the future.

FM 518 and Bay Area Boulevard AM					
Cycle length	70				
Approach	NB	SB	EB	WB	**Overall**
Delay	22.7	18.7	25.6	27.7	**24.8**
LOS	C	B	C	C	**C**

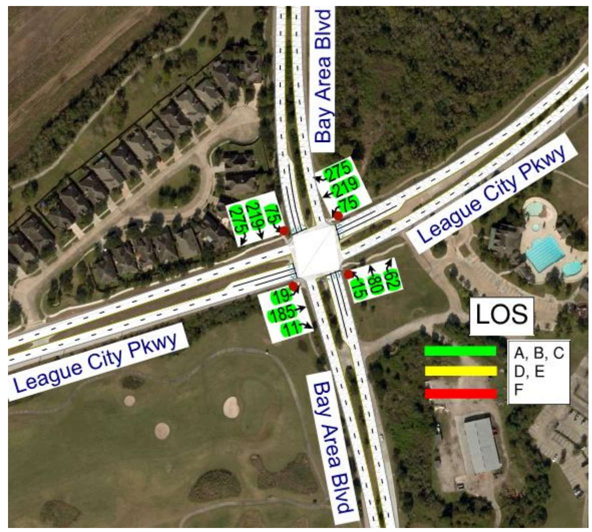
FM 518 and Bay Area Boulevard PM					
Cycle length	75				
Approach	NB	SB	EB	WB	**Overall**
Delay	23.2	40.1	24.8	29.4	**30.2**
LOS	C	D	C	C	**C**

FM 518 and Bay Area Boulevard Future Delay and LOS						
	Current	**10%**	**20%**	**30%**	**40%**	**50%**
	AM					
Delay	24.8	28.1	33.9	42.5	57.1	75.1
LOS	C	C	C	D	E	E
	PM					
Delay	30.2	37.8	50.3	65.9	84.9	106.9
LOS	C	D	D	E	F	F

League City Parkway and Bay Area Boulevard – Site 5

This intersection at League City Parkway and Bay Area Boulevard is a stop-controlled intersection between two divided arterials. All four approaches have 2 thru lanes and 1 left turn bay. The volumes are low, with only 1000 and 1500 total vehicles in the AM and PM peak hour, respectively. However, there are large tracts of undeveloped land to the south and west that will greatly increase demand on the intersection.

Currently, the intersection performs at LOS C in the AM and LOS D in the PM. The southbound and westbound approaches have the most volume in the PM and have the greatest delay.



Base Conditions - AM LOS and Volume; PM LOS and Volume

Future volume analysis shows the intersection reaching LOS F in the PM with only 10% growth. With expected growth in the area, signalization is recommended to improve the intersection.

League City Parkway and Bay Area Boulevard AM					
Cycle length	Unsignalized				
Approach	NB	SB	EB	WB	**Overall**
Delay	12.4	18.1	13.7	16.5	**15.7**
LOS	**C**				

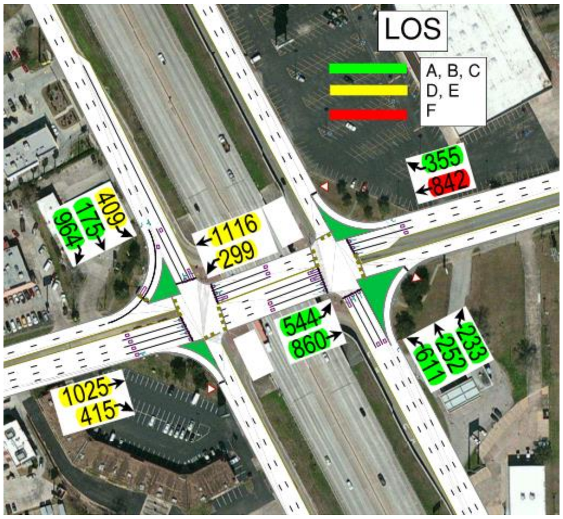
League City Parkway and Bay Area Boulevard PM					
Cycle length	Unsignalized				
Approach	NB	SB	EB	WB	**Overall**
Delay	16	36.4	19.8	46.1	**35**
LOS	**D**				

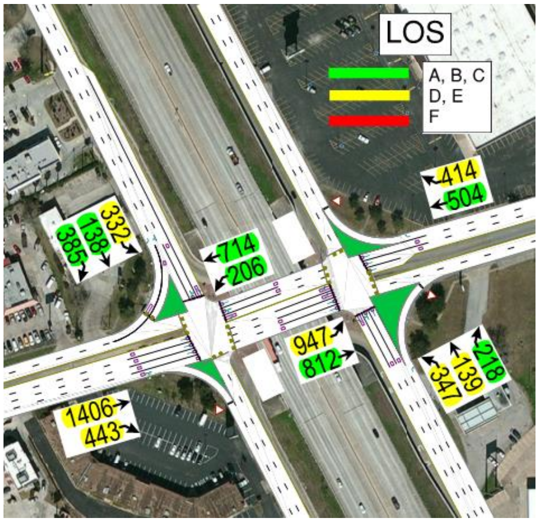
League City Parkway and Bay Area Boulevard Future Delay and LOS						
	Current	**10%**	**20%**	**30%**	**40%**	**50%**
	AM					
Delay	15.7	18.5	23.4	31.3	44.8	62.9
LOS	C	C	C	D	E	F
	PM					
Delay	35.0	56.4	83.5	115	151.2	191.4
LOS	D	F	F	F	F	F

This analysis was completed to determine what the current conditions were like for three intersections: FM 518 at IH45 frontage roads, FM 518 and FM270/FM2094, and FM 646 at IH45 frontage roads.

Methodology:
Using Synchro, the amount of delay and the Level of Service (LOS) at each intersection was calculated. The delay and LOS were calculated by Synchro using the volumes and signal timing.
Further analysis was completed using SimTraffic. Where Synchro analysis looks at a bigger picture and is more suited for analysis of large networks, SimTraffic analysis is based on tracking each individual vehicle in the network and can provide more detailed analysis. For the analyses, one-hour simulations were conducted, and results were obtained by averaging the results from 3 separate simulations. SimTraffic results were for each zone, as opposed to each intersection. Also, in SimTraffic the simulation was observed to get an overall picture of the zone and to see where traffic was queueing up the most.

FM518 and IH45 – Zone 1
The frontage road intersection at FM 518 and IH45 performs adequately during the morning peak. During the morning, the traffic comes mostly from the west and travels north on I-45 or east on FM 518. With a LOS of C, there is room for more traffic.



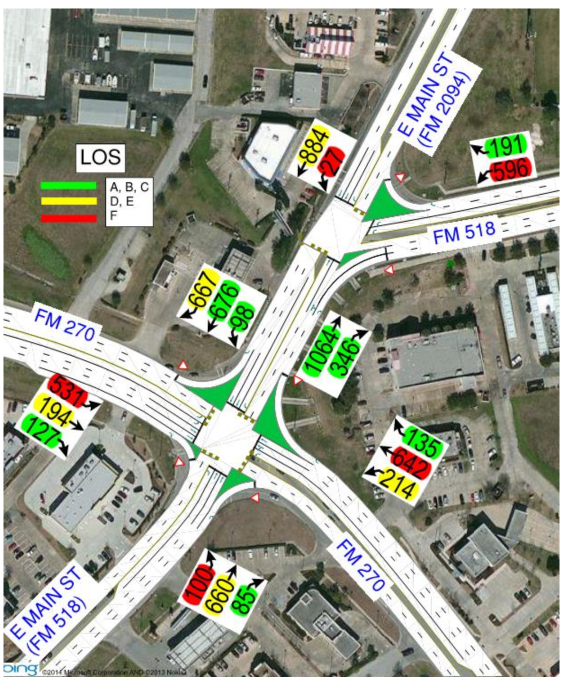


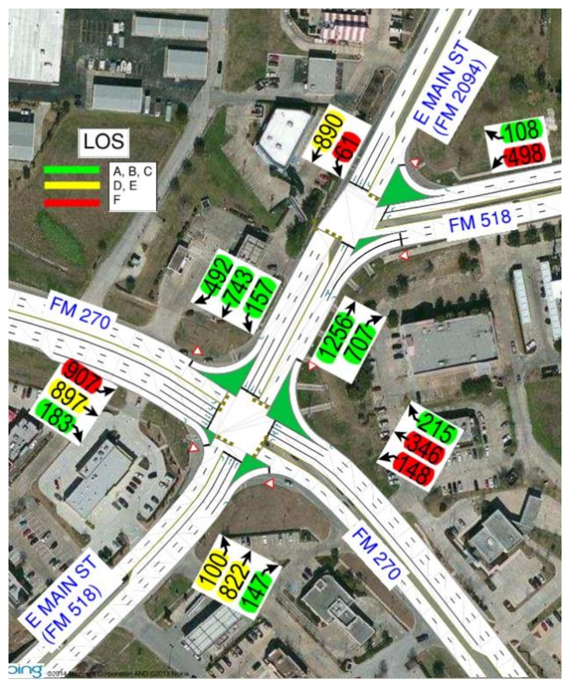
AM LOS and Volume; PM LOS and Volume

During the evening peak, the intersections gets closer to breaking down. The intersections start to reach a LOS of D and simulation shows traffic getting backed up on westbound FM 518. This could affect adjacent intersections. If the area continues to grow, the traffic in the evening could become an issue.

FM518 and FM270/FM2094 – Zone 2

This intersection performed the worst of the three intersections and currently operates at a LOS of E during the AM peak and LOS D during the PM peak. The main issue with this zone is the proximity of the intersections. Because the two signals are located approximately 400 feet apart, there is no room for storage in between the two signals. Therefore, the signals need to be timed to move traffic into and immediately out of the center area. However, with five approaches to the two intersections that need to be serviced, each approach will have significant delays. The figures below show the turning volumes during the two peak hours. The volumes highlighted in red are turning movements with a LOS of F, yellow volumes have a LOS of D or E, while green volumes have a LOS of A, B or C.





AM LOS and Volume; PM LOS and Volume

AM FM 518 and FM 270 - FM 518 and FM 2094 - Synchro Optimized Cycle length									
Intersection	**FM 518 and FM 270**					**FM 518 and FM 2094**			
Cycle length	130					130			
Approach	EB	WB	NB	SB	**Overall**	WB	NB	SB	**Overall**
Delay	84.6	81.2	63	35.9	**63.3**	83	7.3	75.4	**45.5**
LOS	F	F	E	D	**E**	F	A	E	**D**

AM FM 518 and FM 270 - FM 518 and FM 2094 - Alternative Cycle length									
Intersection	**FM 518 and FM 270**					**FM 518 and FM 2094**			
Cycle length	180					180			
Approach	EB	WB	NB	SB	**Overall**	WB	NB	SB	**Overall**
Delay	86.8	84.8	68.9	39.1	**66.9**	88.1	4.7	85.7	**48.5**
LOS	F	F	E	D	**E**	F	A	F	**D**

PM FM 518 and FM 270 - FM 518 and FM 2094 - Synchro Optimized Cycle Length									
Intersection	**FM 518 and FM 270**					**FM 518 and FM 2094**			
Cycle length	130					130			
Approach	EB	WB	NB	SB	**Overall**	WB	NB	SB	**Overall**
Delay	68.3	69.9	67	18.2	**54.9**	74.3	5.9	51.9	**30.3**
LOS	EB	E	E	B	**D**	E	A	D	**C**

PM FM 518 and FM 270 - FM 518 and FM 2094 - Alternative Cycle Length									
Intersection	**FM 518 and FM 270**					**FM 518 and FM 2094**			
Cycle length	180					180			
Approach	EB	WB	NB	SB	**Overall**	WB	NB	SB	**Overall**
Delay	75.8	78	69.6	18.3	**59.4**	82.9	4.5	63.9	**34.3**
LOS	E	E	E	B	**E**	F	A	E	**C**

SimTraffic simulation confirmed Synchro results and showed the most delay at the intersection of FM 518 and 270, especially those making a left turn from the eastbound FM270 onto Main St. Even with 2 left turn lanes, queues became very long. Queues also developed for those making a left from westbound FM 518 onto Main St.

From aerials, there are a few parcels of land nearby on FM 518 that haven't been developed yet. If they get developed, it will be important to account for the new traffic as the intersection may be breaking down due to the volume.

FM 646 and IH45 – Zone 3
This intersection performs fine during the AM peak with a LOS C. During the PM peak hours, the LOS drops to D, which is acceptable for a peak period. With a LOS of C and D there is some room for more traffic in the area. During simulation, there was a slight back up on the SB frontage road, on FM 646 westbound, and FM 646 eastbound. Because of the long ramp off SB frontage road, the queue most likely wouldn't affect the frontage road.

Simulation Results

FM518 and IH45 – Zone 1

Assumptions:

- TTI 4-phase
- 0.5 sec all red times

AM FM 518 and IH 45 - Synchro Optimized Cycle Length								
Intersection	**SBFR**				**NBFR**			
Cycle length	60				60			
Approach	EB	WB	SB	**Overall**	EB	WB	NB	**Overall**
Delay (sec)	61.2	17.4	14.1	**38**	42.2	32.9	15.5	**33.4**
LOS	E	B	B	**D**	D	C	B	**C**

AM FM 518 and IH 45 - Alternative Cycle Length								
Intersection	**SBFR**				**NBFR**			
Cycle length	90				90			
Approach	EB	WB	SB	**Overall**	EB	WB	NB	**Overall**
Delay (sec)	45.1	13.1	23.9	**31.4**	37	31.5	30.2	**33.9**
LOS	D	B	C	**C**	D	C	C	**C**

PM FM 518 and IH 45 - Synchro Optimized Cycle Length								
Intersection	**SBFR**				**NBFR**			
Cycle length	65				65			
Approach	EB	WB	SB	**Overall**	EB	WB	NB	**Overall**
Delay (sec)	48.7	61.6	31.7	**46.7**	21.6	62.9	20.2	**34.5**
LOS	D	E	C	**D**	C	E	C	**C**

PM FM 518 and IH 45 - Alternative Cycle Length								
Intersection	**SBFR**				**NBFR**			
Cycle length	135				135			
Approach	EB	WB	SB	**Overall**	EB	WB	NB	**Overall**
Delay (sec)	65.9	55.5	41.9	**53.8**	11	83.3	47.6	**45.5**
LOS	EB	E	D	**D**	B	F	D	**D**

SimTraffic Results

	AM		PM	
	Synchro (60 seconds)	**Alternative (90 seconds)**	**Synchro (65 seconds)**	**Alternative (135 seconds)**
Denied Delay (hr)	0.5	0.6	33.7	86.6
Total Delay (hr)	32.4	39.3	144.3	173.2
Total Delay/Veh (s)	1914.4	1967.1	1816.4	2135.7
Total Stops	3673	3471	5653	5554
Travel Time (hr)	56.7	63.4	218.1	298.0
Avg Speed (mph)	12	10	6	5

FM518 and FM270/FM2094 – Zone 2
Assumptions:
- Used Kimley Horn timing

AM FM 518 and FM 270 - FM 518 and FM 2094 - Synchro Optimized Cycle Length									
Intersection	**FM 518 and FM 270**					**FM 518 and FM 2094**			
Cycle length	130					130			
Approach	EB	WB	NB	SB	**Overall**	WB	NB	SB	**Overall**
Delay (sec)	84.6	81.2	63	35.9	**63.3**	83	7.3	75.4	**45.5**
LOS	F	F	E	D	**E**	F	A	E	**D**

AM FM 518 and FM 270 - FM 518 and FM 2094 - Alternative Cycle Length									
Intersection	**FM 518 and FM 270**					**FM 518 and FM 2094**			
Cycle length	180					180			
Approach	EB	WB	NB	SB	**Overall**	WB	NB	SB	**Overall**
Delay (sec)	86.8	84.8	68.9	39.1	**66.9**	88.1	4.7	85.7	**48.5**
LOS	F	F	E	D	**E**	F	A	F	**D**

PM FM 518 and FM 270 - FM 518 and FM 2094 - Synchro Optimized Cycle Length									
Intersection	**FM 518 and FM 270**					**FM 518 and FM 2094**			
Cycle length	130					130			
Approach	EB	WB	NB	SB	**Overall**	WB	NB	SB	**Overall**
Delay (sec)	68.3	69.9	67	18.2	**54.9**	74.3	5.9	51.9	**30.3**
LOS	EB	E	E	B	**D**	E	A	D	**C**

PM FM 518 and FM 270 - FM 518 and FM 2094 - Alternative Cycle Length									
Intersection	**FM 518 and FM 270**					**FM 518 and FM 2094**			
Cycle length	180					180			
Approach	EB	WB	NB	SB	**Overall**	WB	NB	SB	**Overall**
Delay (sec)	75.8	78	69.6	18.3	**59.4**	82.9	4.5	63.9	**34.3**
LOS	E	E	E	B	**E**	F	A	E	**C**

SimTraffic Results

	AM		PM	
	Synchro (130 seconds)	**Alternative (180 seconds)**	**Synchro (130 seconds)**	**Alternative (180 seconds)**
Denied Delay	0.7	2.4	0.7	17
Total Delay (hr)	187.4	344.9	198.6	263.2
Total Delay/Veh (s)	1522.7	2261.4	2031.1	2915.8
Total Stops	7231	9293	8658	9029
Travel Time (hr)	260.8	419.1	279.5	358.8
Avg Speed (mph)	8	5	8	7

FM 646 and IH45 – Zone 3

Assumptions: 0.5 sec all red times

AM FM 646 and IH 45 - Synchro Optimized Cycle Length								
Intersection	**SBFR**				**NBFR**			
Cycle length	90				70			
Approach	EB	WB	SB	**Overall**	EB	WB	NB	**Overall**
Delay (sec)	28.5	21.5	33.2	**27.3**	22.3	17.1	21.2	**20.1**
LOS	C	C	C	**C**	C	C	B	**C**

AM FM 646 and IH 45 - Alternative Cycle Length								
Intersection	**SBFR**				**NBFR**			
Cycle length	100				100			
Approach	EB	WB	SB	**Overall**	EB	WB	NB	**Overall**
Delay (sec)	29.5	10.2	39.5	**25.5**	9.6	21.3	34.5	**17.9**
LOS	C	B	D	**C**	C	A	C	**B**

PM FM 646 and IH 45 - Synchro Optimized Cycle Length								
Intersection	**SBFR**				**NBFR**			
Cycle length	100				90			
Approach	EB	WB	SB	**Overall**	EB	WB	NB	**Overall**
Delay (sec)	69.8	34.4	61.8	**53.1**	38.8	35.9	51.2	**40.6**
LOS	E	E	C	**D**	D	D	D	**D**

PM FM 646 and IH 45 - Alternative Cycle Length								
Intersection	**SBFR**				**NBFR**			
Cycle length	120				120			
Approach	EB	WB	SB	**Overall**	EB	WB	NB	**Overall**
Delay (sec)	76.9	21.3	59.7	**49.1**	23	37.1	58	**36.3**
LOS	E	E	C	**D**	E	C	D	**D**

SimTraffic Results

	AM		PM	
	Synchro (90, 70 seconds)	**Alternative (100 seconds)**	**Synchro (100, 90 seconds)**	**Alternative (120 seconds)**
Denied Delay	0.7	0.6	0.5	1.1
Total Delay (hr)	41.8	38.9	136.3	143.4
Total Delay/Veh (s)	39.7	37.4	93.2	98.4
Total Stops	4200	3488	7862	6892
Travel Time (hr)	99.6	96.1	249.4	256.9
Avg Speed (mph)	16	16	13	12

Main Street Intersection Performance with the previous configuration.

Table 51. Five Points Intersection Evaluation

AM FM 518 and FM 270 - FM 518 and FM 2094 - Synchro Optimized Cycle Length									
Intersection	**FM 518 and FM 270**					**FM 518 and FM 2094**			
Cycle length	130					130			
Approach	EB	WB	NB	SB	**Overall**	WB	NB	SB	**Overall**
Delay	84.6	81.2	63	35.9	**63.3**	83	7.3	75.4	**45.5**
LOS	F	F	E	D	**E**	F	A	E	**D**
AM FM 518 and FM 270 - FM 518 and FM 2094 - Alternative Cycle Length									
Intersection	**FM 518 and FM 270**					**FM 518 and FM 2094**			
Cycle length	180					180			
Approach	EB	WB	NB	SB	**Overall**	WB	NB	SB	**Overall**
Delay	86.8	84.8	68.9	39.1	**66.9**	88.1	4.7	85.7	**48.5**
LOS	F	F	E	D	**E**	F	A	F	**D**
PM FM 518 and FM 270 - FM 518 and FM 2094 - Synchro Optimized Cycle Length									
Intersection	**FM 518 and FM 270**					**FM 518 and FM 2094**			
Cycle length	130					130			
Approach	EB	WB	NB	SB	**Overall**	WB	NB	SB	**Overall**
Delay	68.3	69.9	67	18.2	**54.9**	74.3	5.9	51.9	**30.3**
LOS	EB	E	E	B	**D**	E	A	D	**C**
PM FM 518 and FM 270 - FM 518 and FM 2094 - Alternative Cycle Length									
Intersection	**FM 518 and FM 270**					**FM 518 and FM 2094**			
Cycle length	180					180			
Approach	EB	WB	NB	SB	**Overall**	WB	NB	SB	**Overall**
Delay	75.8	78	69.6	18.3	**59.4**	82.9	4.5	63.9	**34.3**
LOS	E	E	E	B	**E**	F	A	E	**C**

SimTraffic Effectiveness

SimTraffic reports several measures of effectiveness (MOEs) and the ones used for this analysis are detailed below in **Table 52**.

Table 52. SimTraffic Measures of Effectiveness

Measure of Effectiveness	Description
Denied Delay	The time spent by vehicles when they are unable to enter the network due to long queues
Total Delay	The difference between the travel time and the travel time if there were no other vehicles or traffic control devices (for this report it will include denied delay)
Total Delay/vehicle	Total delay divided by the total number of vehicles
Stop Delay/vehicle	The time spent when moving at less than 10 ft/s
Travel Time	The total amount of time spent in the network or denied being in the network

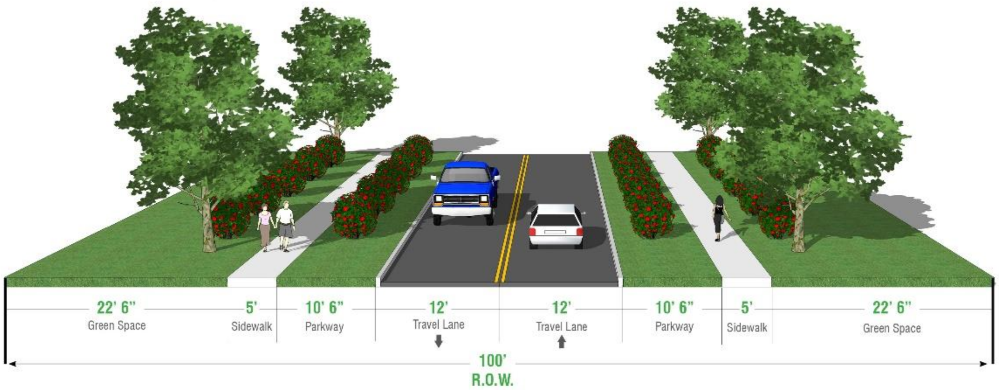
2015 Network Additions for H-GAC Model Run

AUSTIN ST
BAY AREA BLVD
BEAUMONT ST
BIG LEAGUE DREAMS PKWY
BROOKPORT DR
BUTLER RD
CHALLENGER PARK
DICKINSON AVE
GRISSOM RD
HOBBS RD
LAFAYETTE LN
LANDING BLVD
MEADOW PKWY
NASA BLVD
OLIVE ST
PALOMINO LN
WALKER ST
WEBSTER ST
WESLEY DR
WESTOVER PARK AVE

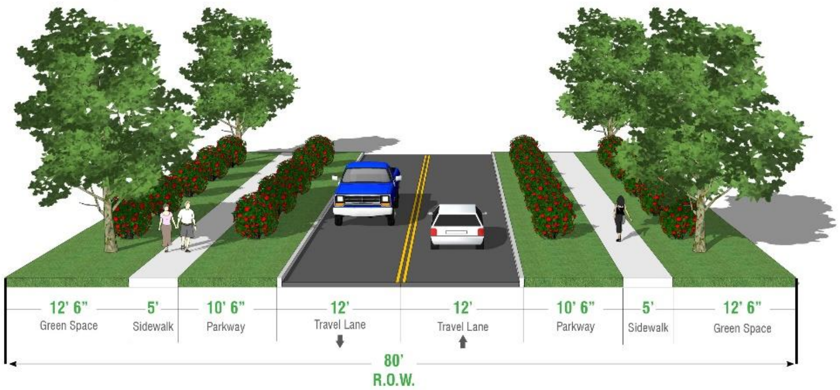
Additional Cross-Sections

Minor Arterials

Two-Lane Minor Arterial – 100 Feet of ROW

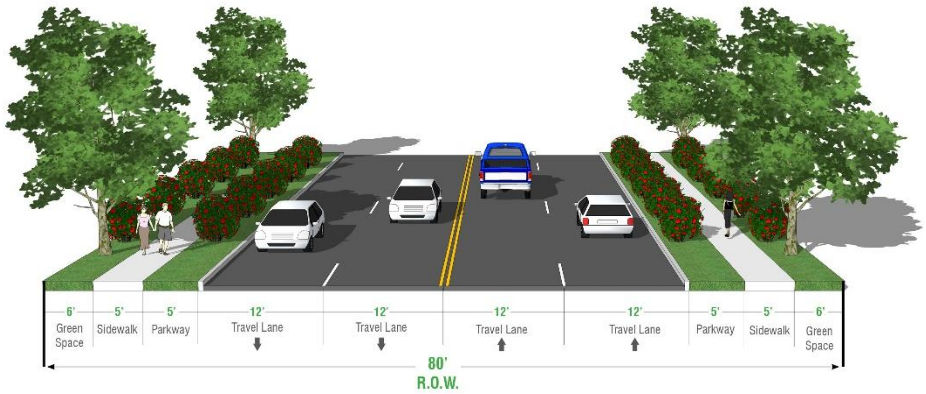


Two Lane Minor Arterial – 80 Feet of ROW

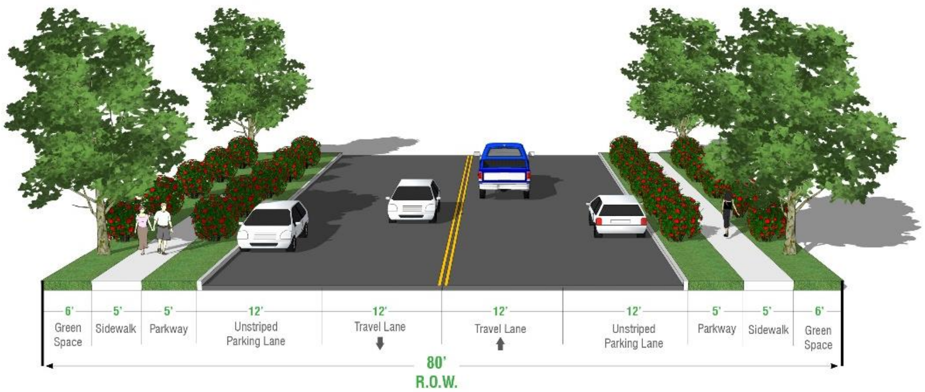


Collectors

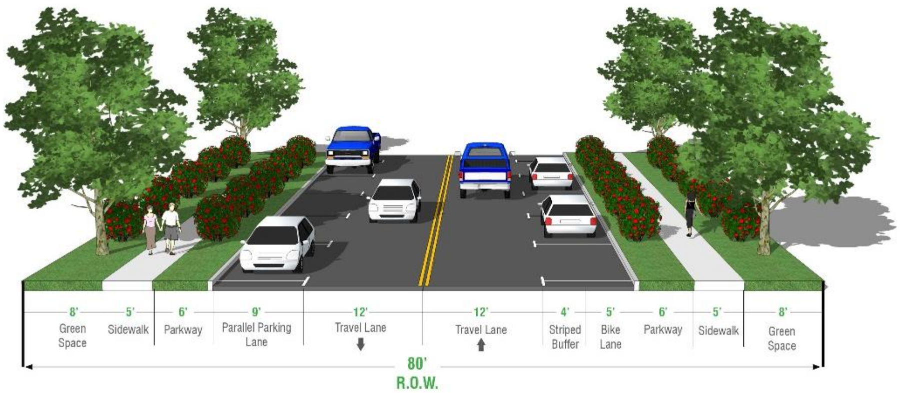
Four-Lane Collector – 80 Feet of ROW



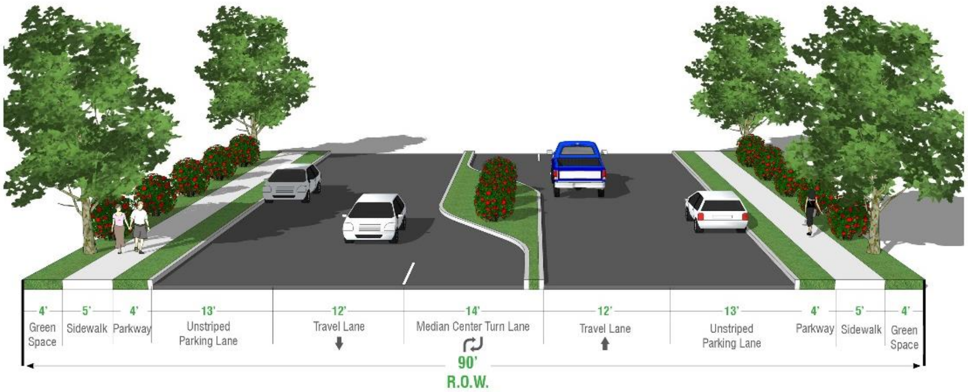
Two Lane Collector with Unstriped On-Street Parking – 80 Feet of ROW



Two Lane Collector with Striped On-Street Parking – 80 Feet of ROW

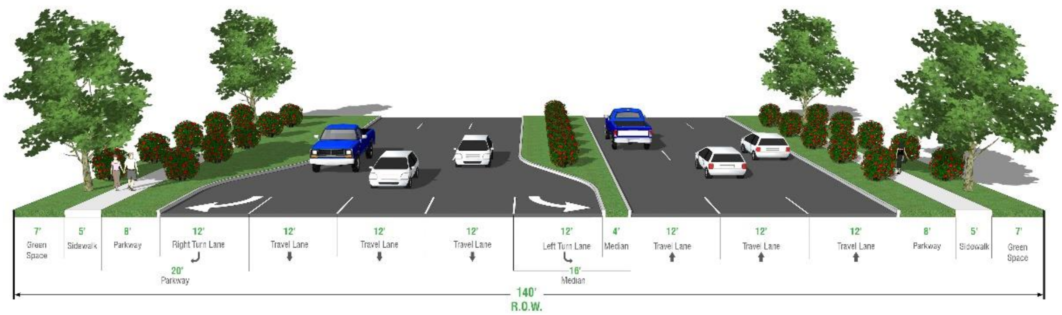


Two-Lane Divided Collector with On-Street Parking – 90 Feet of ROW

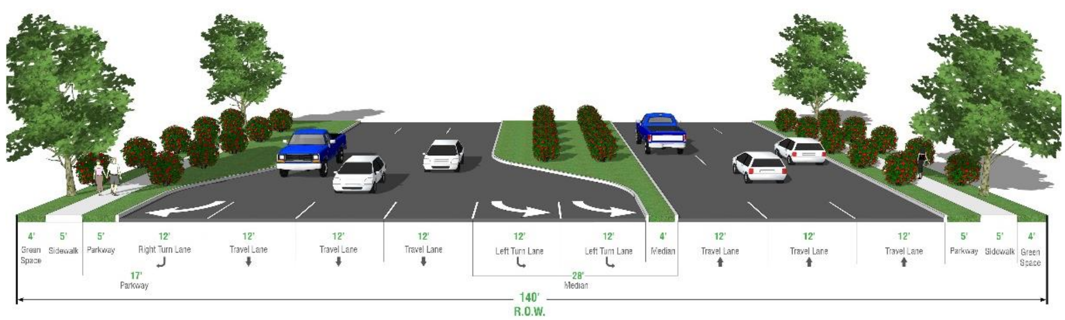


Intersection Cross Sections

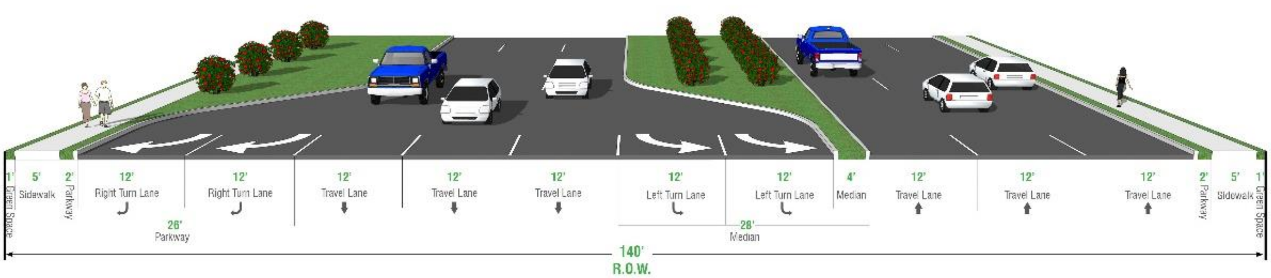
Six-Lane Major Arterial Intersection with Single Right and Left-turn Lanes - 140 Feet of ROW



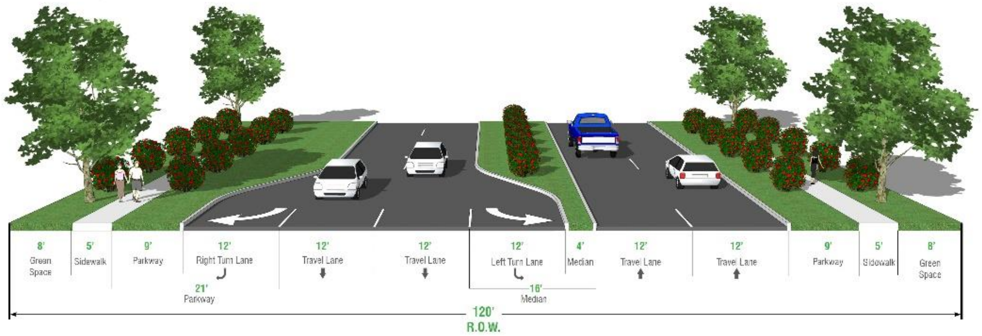
Six-Lane Major Arterial Intersection with a Single Right-Turn Lane and Dual Left-Turn Lanes - 140 Feet of ROW



Six-Lane Major Arterial Intersection with Dual Right and Left-turn Lanes - 140 Feet of ROW

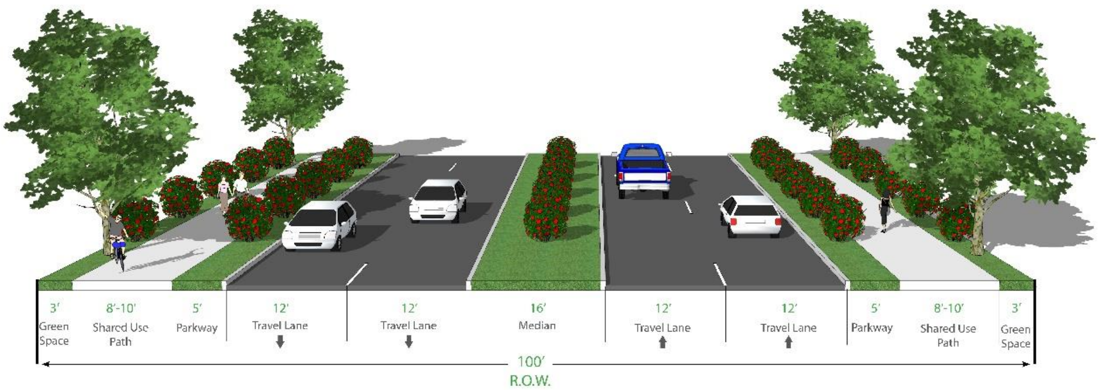


Four-Lane Major Arterial Intersection with Single Right and Left-Turn Lanes - 120 Feet of ROW

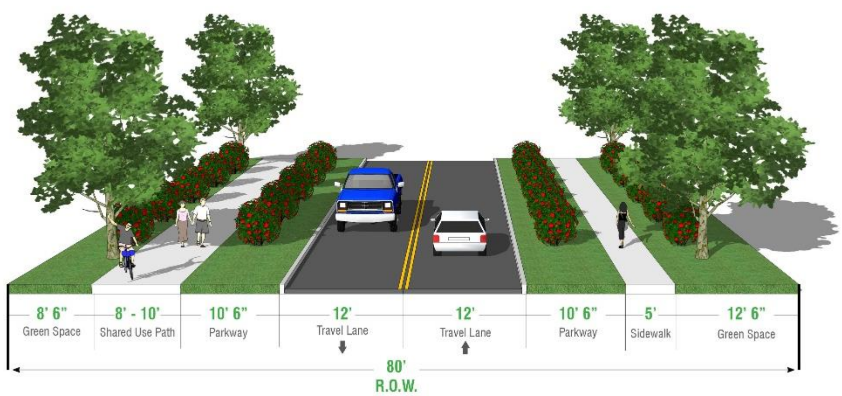


Additional Non-Motorized Network Cross-Sections

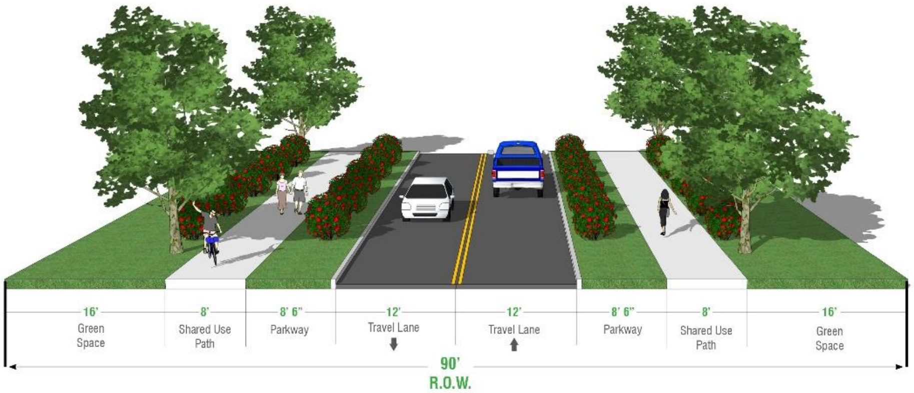
Four-Lane Major Arterial with Shared Use Pathway – 100 Feet of ROW



Two-Lane Minor Arterial with Shared Use Pathway on one side – 80 Feet of ROW



Two-Lane Collector with Shared Use Pathway – 80 Feet of ROW



Recommended Funding Source Descriptions

Bridge Program – Federal funds designated for the replacing or rehabilitating structurally deficient or functionally obsolete bridges on public roads.
Category 6A and 6B: On-system(6A) and Off-system (6B) Bridge Program Funds. Category 6 funds are federal dollars set aside to rehab or replace structurally deficient or functionally obsolete bridges.
Category 2: Corridor Funds. Funds allocated to mobility projects that add capacity to state facilities in metropolitan areas.
Category 3C: National Highway System Funds: Rehabilitation. Funds allocated towards the rehabilitation needs on non-interstate portions of the national highway system in Texas.
Category 4A: Surface Transportation Program (STP): Safety. Federal funds allocated to safety projects under the Federal Hazard Elimination Program (FHEP) and the Federal Railroad Signal Safety Program (FRSSP). FEHP funds can be used on all public roadway except interstate highways. FRSSP can be used to fund highway-rail grade crossing safety projects on any public road.
Category 4B: STP Transportation Enhancements. These funds are allocated to projects beyond the scope of typical highway project and include projects such as bike and pedestrian amenities, landscaping, historic preservation, highway environmental pollution mitigation, etc.
Category 4C: STP Metropolitan Mobility/ Rehabilitation. Funds allocated towards mobility projects in within MPO boundaries with populations above 200,000. These funds can only be used on roadways classified higher than a rural minor collector.
Category 4D: STP Metropolitan Mobility/ Rehabilitation. Funds allocated towards mobility projects in areas with populations between 5,000 and 200,000. These funds can only be used on roadways classified higher than a rural minor collector.
Category 4F: STP Rehabilitation in Urban and Rural Areas. Funds allocated to on-system facilities in rural and urban areas for the rehabilitation of main lanes and structures. Can be used on roadway classified higher than a rural minor collector in a non-urbanized area.
Category 4G: STP Railroad Grade Separations. Funds allocated towards the replacement of deficient railroad underpasses and construction of grade separations on state facilities. Can be used on roadway classified higher than a rural minor collector in a non-urbanized area.
Category 5: Congestion, Mitigation, and Air Quality (CMAQ). Funds allocated towards projects in non-attainment areas designed to improve air quality by reducing congestion. Projects selected for these funds must demonstrate an air quality benefit.
Category 10A: Traffic Control Devices. Funds allocated towards the installation and/or rehabilitation of non-interstate signs, pavement markings, lighting, and traffic signalization.
Category 10B: Rehabilitation of Traffic Management Systems. Funds allocated for the maintenance and rehabilitation of operation traffic management systems. These funds cannot be used to for the installation of new traffic management systems.
Category 11: State Discretionary Funds. Funds miscellaneous projects located on on-system facilities at the district’s discretion. These funds cannot be used for right-of-way acquisition.
Category 12: Strategic Priority Funds. Funding allocated to projects (selected by the transportation commission) that promote economic development, provide system connectivity with adjoining states and Mexico, or other strategic transportation needs.
Proposition 1: Texas Constitutional Amendment for Transportation Funds: Gas Tax Funds. State funds designated for the construction, maintenance, rehabilitation, and right-of-way acquisition for non-tolled public roads.

Proposition 7: Texas Constitutional Amendment for Transportation Funds: General Sales and Use Tax Funds. State funds designated for the construction, maintenance, rehabilitation, and right-of-way acquisition for non-tolled public roads.
Texas Mobility Funds. Funds allocated to projects that add capacity to state highway system corridors. Improvements include: additional lanes, bottleneck removal, grade separations, interchanges, HOV lanes, and new roadways.
Green Ribbon Funds. State funds allocated towards corridor beautification.