Sugar Land Town Center Pedestrian and Bicyclist Special District Study

September 2007

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

the CLIFFORD GROUP inc.

Nelson|Nygaard
consulting associates

Executive Summary

Introduction

The Houston-Galveston Area Council (H-GAC) is a voluntary association of local governments and local elected officials in the 13-county Gulf Coast Planning Region, an area of 12,500 square miles with almost 5.4 million people. Organized in 1966 by local elected officials after authorization by State enabling legislation, H-GAC now has 132 local government members, including all major general-purpose local governments in the 13-county region: 13 counties, 105 cities, and 14 school districts.

In 2004, H-GAC conducted a study to identify districts where there were high levels of existing or potential pedestrian and bicyclist activity, and where there were significant opportunities to replace vehicle trips with pedestrian or bicycle trips, and to improve pedestrian and bicyclist safety. Fifteen districts were identified throughout the region; one of these was the Town Center Area in the City of Sugar Land. The graphic at right shows the study area, which is centered on the intersection of US 59 (Southwest Freeway) and State Highway 6.

Study Process

The project team used a charrette process to solicit input from residents, business owners and patrons, city, county, and state representatives. Public input was gathered throughout the study process, through public meetings and the internet. At the beginning of the study, a project website was developed to collect and display information relative to meetings and other scheduled events, public feedback opportunities, and analysis products (www.sugarlandtowncenterpedbike.org). Two introductory meetings were held, one in the afternoon for public officials and one in the evening for the general public. This first public meeting was part of a planned meeting for the Hike & Bike Trail System Plan, conducted by the Parks & Recreation Department. Surveys were developed and posted to the website, forwarded to officials and organizations for their distribution, and e-mailed to persons who had attended the introductory meetings.

Two public input workshops were held to solicit improvement recommendations from the stakeholders and the community. Following the development of potential improvements, a meeting was held to present these improvements, as well as provide an initial opportunity for the public to vote on their preferred choices. In addition, another web-based survey was set up for the public to vote (select) their preferred improvements.

Survey of Potential Improvements

Using the input from the public meetings in June, a series of projects was developed based on the maps drawn at that meeting and the responses to the first public survey received over the previous month. These projects included sidewalk construction, stop bar and crosswalk striping, as well as hike-and-bike trails and bike racks. This list became the basis for the second survey posted to the project website. Nineteen physical projects developed from the public input were presented, as

shown below. The website survey received 27 responses, and 8 paper responses were received at the August public meeting, for a total of 35. One point was given to each of the five projects that each respondent selected. The projects receiving the largest number of points were deemed to be the ones respondents felt were the highest priority. A full listing of the statistics for this survey is located in Appendix F.

Number	Potential Improvement	Vote Count
1	SH 6 at US 59 Crossing Improvements	20
2	SH 6 Crossing Improvements: North of US 59	9
3	SH 6 Crossing Improvements: South of US 59	11
4	Pedestrian Improvements - Town Center Boulevard North	10
5	Pedestrian Improvements - Sugar Land Town Square	7
6	Pedestrian/Bicyclist Improvements near Fluor Daniel offices	5
7	Pedestrian Improvements - Meadow Lake Park area	1
8	Pedestrian Improvements - Southeast Quadrant of SH 6 and US 59	5
9	Pedestrian Improvements - Williams Trace Boulevard area	11
10	Pedestrian/Bicyclist Improvements - First Colony Boulevard area	6
11	Pedestrian Improvements - North Side of Mall	3
12	Pedestrian Improvements - Theatre and South Side of Mall	6
13	Pedestrian Improvements - Sweetwater Boulevard and Methodist Hospital	3
14	Pedestrian Improvements - Lexington and Austin	2
15	Bike Racks at Businesses/Destinations	14
16	Bicycle Improvements - Overall Study Area	21
17	Bicycle Signal on Lexington	9
18	Pedestrian Overpasses	11
19	Transit/Trolley Service	18

Summary of Recommendations

The vote totals from project ranking survey posted on the web, together with the assessments of probable cost and implementation time, were used to prioritize the most popular projects. The priority order of those projects was determined by the consultant team, who ranked the projects, based on votes, feasibility, cost, and relative demand, for the list of recommendations. A full description of the ranking system is located in Appendix F.

The Sugar Land City Council, at this time of this report writing, was scheduled to meet after the conclusion of the study, to consider the funding of the potential improvements identified in this report. Further information on the disposition of the funding is available from the City of Sugar Land.

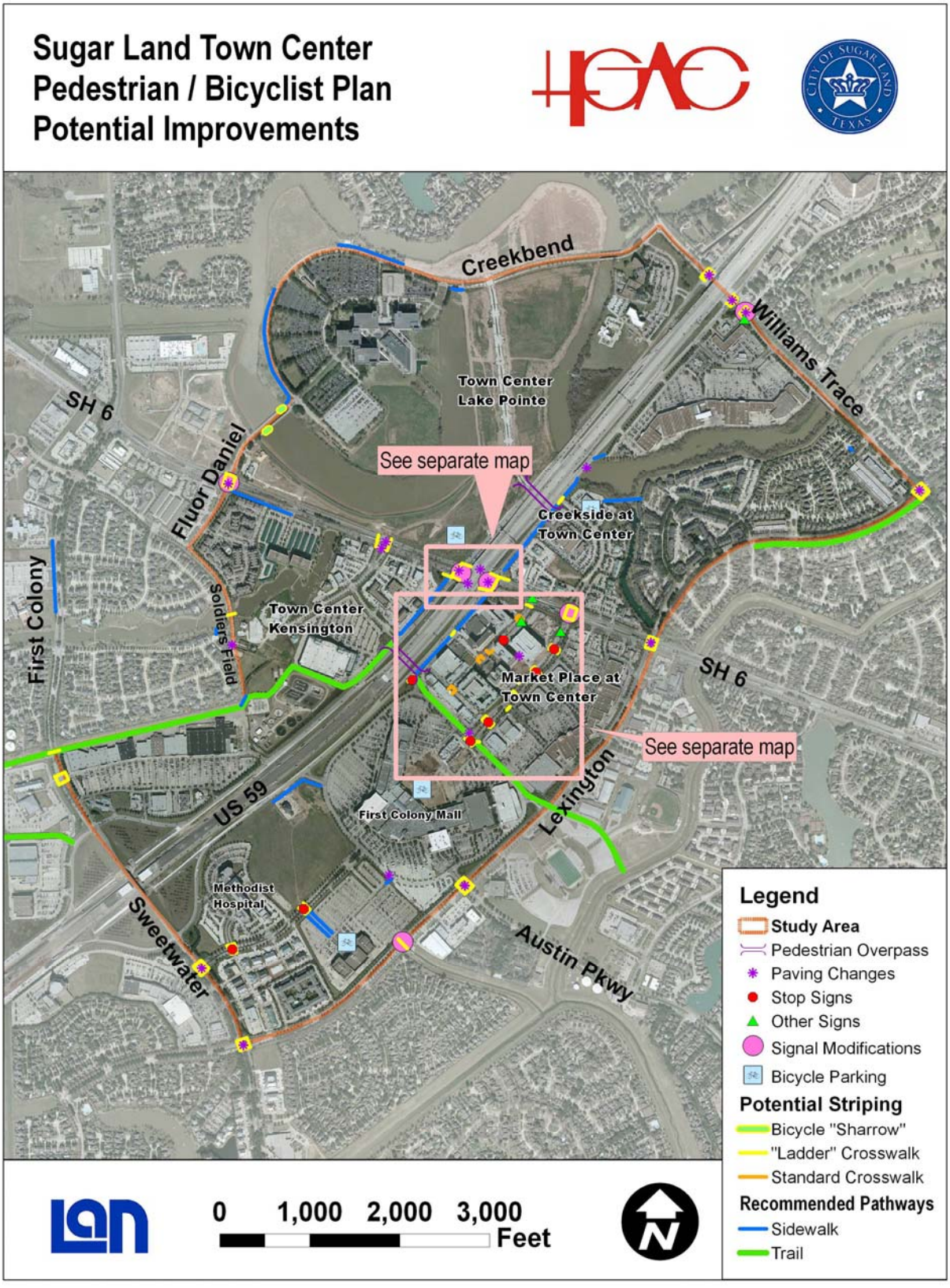
Additionally, the City of Sugar Land has proposed working with private developers to study the feasibility of a pedestrian walkway connecting various commercial areas, with clearly delineated wayfinding signage.

Final Rankings of Potential Improvements									
Code Number	POTENTIAL IMPROVEMENT	Relative Feasibility A	Relative Cost B	Safety Benefit C	Relative Demand D	Composite Rating E=A+B+C+D	Vote Count V	Overall Score E * V	Ranking
1	SH 6 at US 59 Crossing Improvements	2	1	2	2	7	20	140	1
15	Bike Racks at Businesses/Destinations	3	3	1	2	9	14	126	2
16	Bicycle Improvements - Overall Study Area	2	1	1	2	6	21	126	3
3	SH 6 Crossing Improvements: South of US 59	2	3	2	3	10	11	110	4
19	Transit/Trolley Service	2	1	1	2	6	18	108	5
4	Pedestrian Improvements - Town Center Boulevard North	2	3	2	3	10	10	100	6
9	Pedestrian Improvements - Williams Trace Boulevard area	3	2	1	2	8	11	88	7
17	Bicycle Signal on Lexington	2	2	2	3	9	9	81	8
5	Pedestrian Improvements - Sugar Land Town Square	3	3	2	3	11	7	77	9
2	SH 6 Crossing Improvements: North of US 59	2	2	2	2	8	9	72	10
18	Pedestrian Overpasses	1	1	1	2	5	11	55	11
12	Pedestrian Improvements - Theatre and South Side of Mall	2	2	2	2	8	6	48	12
10	Pedestrian/Bicyclist Improvements - First Colony Boulevard area	3	2	1	1	7	6	42	13
6	Pedestrian/Bicyclist Improvements near Fluor Daniel offices	3	2	1	2	8	5	40	14
8	Pedestrian Improvements - Southeast Quadrant of SH 6 and US 59	2	2	1	1	6	5	30	15
13	Pedestrian Improvements - Sweetwater Boulevard and Methodist Hospital	3	3	2	2	10	3	30	16
11	Pedestrian Improvements - North Side of Mall	2	3	2	2	9	3	27	17
14	Pedestrian Improvements - Lexington and Austin	3	3	1	3	10	2	20	18
7	Pedestrian Improvements - Meadow Lake Park area	3	3	1	1	8	1	8	19

A: Relative Feasibility: 3=Easy, 2=Average, 1=Difficult
B: Relative Cost: 3=Inexpensive (under $50,000), 2=Average ($50,000-130,000), 1=Expensive (over $130,000)
C: Safety Benefit: 2=High Benefit, 1=Low Benefit
D: Relative Demand: 3=Higher, 2=Average, 1=Lower (see full analysis in Appendix I)
E: Composite Rating: A+B+C+D
V: Vote Count (as detailed in previous section)
Overall Score: E multiplied by V

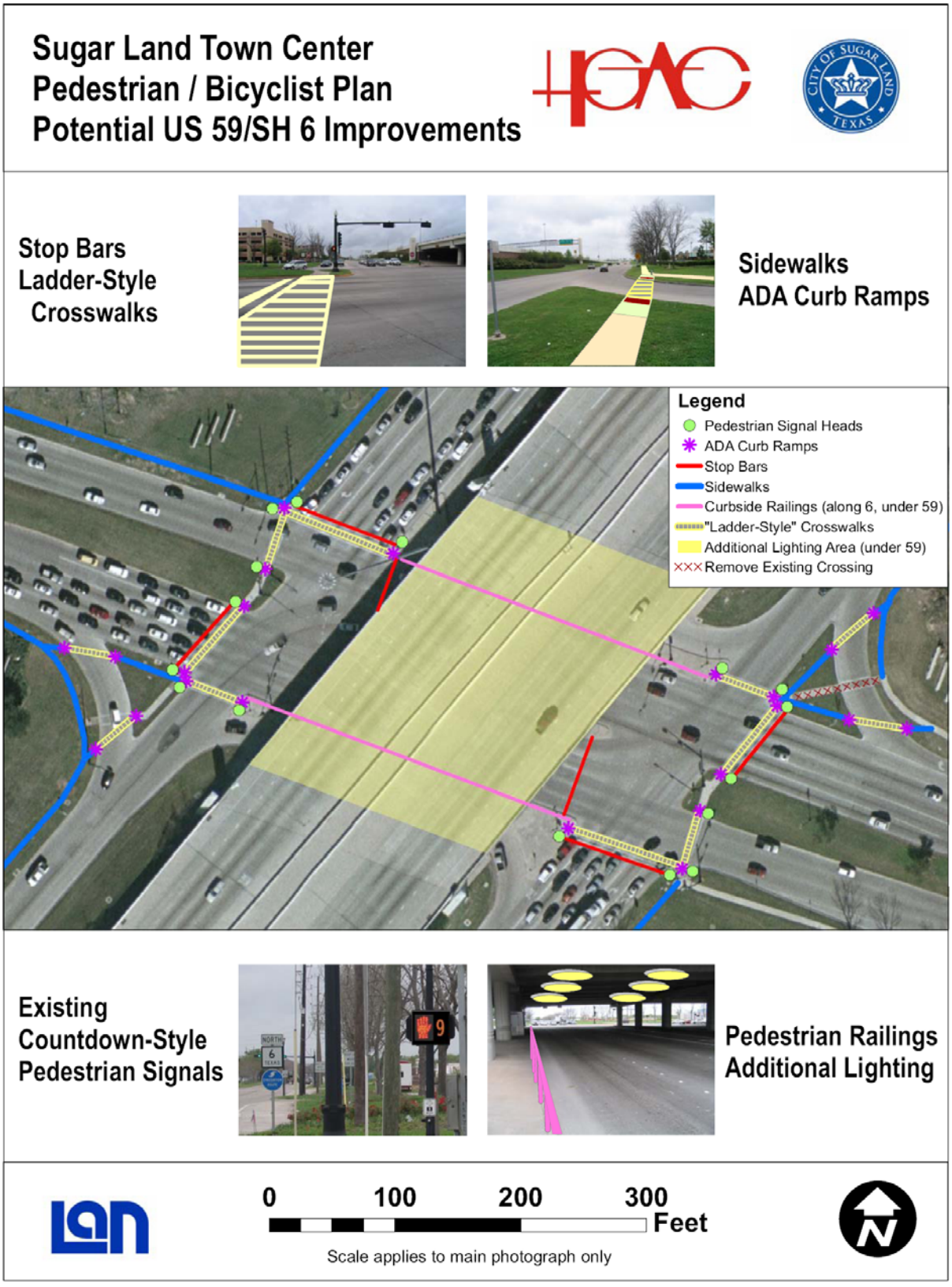
The maps on the following pages illustrate the recommended improvements at three different scales.

Map of All Recommendations



Map of Town Square Area Recommendations

Map of Recommendations at US 59 and SH 6



Cost Estimates

The total, shown below, is for all priced projects. By the terms of the federal grant by which H-GAC funds the Pedestrian and Bicycle Districts improvements, the sponsoring agency (in this case the City of Sugar Land) must pay for 20% of the cost of improvements. In-kind services are not countable towards this total; contributions must be actual dollars spent.

Sugar Land Pedestrian/Bicyclist Plan
Overall Cost Estimates

Code #	Description		Estimate
1	SH 6 at US 59 Crossing Improvements	$	220,000.00
2	SH 6 Crossing Improvements: North of US 59	$	77,000.00
3	SH 6 Crossing Improvements: South of US 59	$	31,000.00
4	Pedestrian Improvements - Town Center Boulevard North	$	21,000.00
5	Pedestrian Improvements - Sugar Land Town Square	$	7,000.00
6	Pedestrian/Bicyclist Improvements near Fluor Daniel offices	$	125,000.00
7	Pedestrian Improvements - Meadow Lake Park area	$	9,000.00
8	Pedestrian Improvements - Southeast Quadrant of SH 6 and US 59	$	114,000.00
9	Pedestrian Improvements - Williams Trace Boulevard area	$	113,000.00
10	Pedestrian/Bicyclist Improvements - First Colony Boulevard area	$	56,000.00
11	Pedestrian Improvements - North Side of Mall	$	13,000.00
12	Pedestrian Improvements - Theatre and South Side of Mall	$	84,000.00
13	Pedestrian Improvements - Sweetwater Boulevard and Methodist Hospital	$	47,000.00
14	Pedestrian Improvements - Lexington and Austin	$	13,000.00
15	Bike Racks at Businesses/Destinations	$	21,000.00
16	Bicycle Improvements - Overall Study Area	$	806,000.00
17	Bicycle Signal on Lexington	$	64,000.00
SUB-TOTAL		**$**	**1,822,000.00**
20% Contingency		$	364,000.00
GRAND TOTAL		**$**	**2,187,000.00**
FEDERAL SHARE (80%)		$	1,749,000.00
LOCAL MATCH (20%)		**$**	**437,000.00**

Pedestrian bridges are considered separately (see text on previous page).
Estimated cost for each pedestrian bridge is $6,000,000 +
Cost estimates were not generated for Improvement # 19, Transit Service, due to the number of variables involved for a long-term programmatic improvement.

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Chapter 1
Study Overview

Introduction

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H-GAC selected consultant Lockwood, Andrews & Newnam, Inc. (LAN), in association with sub-consultants Nelson\Nygaard Consulting Associates and The Clifford Group, to develop a conceptual master plan for comprehensive pedestrian and bicyclist improvements in the Sugar Land Study Area. The consultant team worked closely with the community to define the best possible overall plan that fits the needs of the residents, businesses and visitors.

Study Area Characteristics

Once a thriving sugar plantation founded in the mid 1800's, Sugar Land has grown into a suburban metropolis. Located 20 miles southwest of downtown Houston, Sugar Land has become home to almost 70,000 people. Citizens have seen its population nearly triple in number over the last 15 years. Sugar Land is the fastest growing city in Texas and the largest city and economic center of Fort Bend County. Sugar Land was ranked as one of the best places to live by Money Magazine in 2006.

The City has been developing steadily since its incorporation, and in 1996 began visualizing the idea for creating a vibrant, mixed use downtown. The Town Center was developed to be the center of government, major shopping, and entertainment. The four quadrants created by the SH 59 and SH 6 interchange comprise the area of the Town Center. The study area for this effort has been defined as the area surrounded by: First Colony Boulevard, Sweetwater Boulevard, Lexington Boulevard, Williams Trace Boulevard, Sugar Lakes Drive, Creek Bend Drive, and Fluor Daniel Drive. The Town Center was designed with pedestrians in mind, and has a public plaza along with sidewalk cafes, mid-rise offices and homes. It also serves as the central business district for the City with inclusion of the City Hall, and the Marriott Hotel and conference center.

Pedestrian Conditions

Sidewalk along Sweetwater Boulevard near Town Center

Sidewalks are abundant in the Town Center and throughout most of the surrounding neighborhoods. However, the sidewalks are frequently narrow, in places only three feet wide; pedestrians cannot easily pass each other on the sidewalks. The heart of the Town Center has wide sidewalks to accommodate larger pedestrian traffic flows. Streets within the Town Center accommodate two-way traffic with angled parking on each side. Development was designed for the pedestrian, but consistent signage and striping will heighten awareness of pedestrians and cyclists, therefore increasing safety.

An additional aspect of pedestrian safety in the Town Center is the parking lots, especially surrounding First Colony Mall and other large retailers like Target. Motorists may not be paying close enough attention to pedestrians, who may exit parked cars suddenly, and traffic patterns are unlike city streets, possibly distracting and endangering pedestrians. Many parking lots are also divided into smaller sections and screened from public streets by continuous hedges. Although this creates an attractive visual setting, pedestrians are often forced to squeeze through, or even create, gaps in the hedges in order to take the most direct route from one retail area to another.

Sugar Land's Land Development Code requires extensive landscaping and vegetation screening of parking lots and other non-residential uses. For example, all required trees must be seven feet tall at planting, with a mature crown spread of at least 15 feet. A number of major arterials, such as Lexington Boulevard, are lined with double rows of mature shade trees. In some locations without concrete sidewalks, there are decomposed granite paths.

Bicyclist Conditions

A heavily-used bicycle parking area at Colony Meadows Elementary, near the study area's southwest corner.

Bicycling activity in the area is currently somewhat limited, although in the City's 2003 Comprehensive Plan Update, the #1 request from the community was additional hike-and-bike trails. There are no bicycle lanes striped on major streets, other than an isolated half-mile section on one side of Creekbend Drive. A number of existing multi-use trails exist in the City, mostly outside the study area. Many more are proposed as part of the Parks & Recreation Department's 2007 Hike-and-Bike Trails Master Plan, connecting creeks and parkland throughout the City with residential neighborhoods and activity centers.

Area business owners have indicated that they do not observe a significant number of customers arriving on bicycles, and some have removed bicycle racks due to lack of use. However, nearby schools (outside the study area) exhibit a high level of bicycle usage, and there are several cycle shops in the study area. Sugar Land, like most of the Houston region, is relatively flat, and with the exception of a few high-volume roadways such as SH 6, is generally amenable to bicycle usage.

Benefits to Safety

Development of a comprehensive bicycle and pedestrian plan is essential to increasing bicycling and walking within the City of Sugar Land. Research shows that "where, or when, more people walk or bicycle, the less likely any of them are to be injured by motorists. There is safety in numbers" (Jacobsen: Injury Prevention 2003;9:205–209). The City's traffic crash data indicated only seven auto/pedestrian crashes in the study area from 2004-2006, and no auto/bicyclist

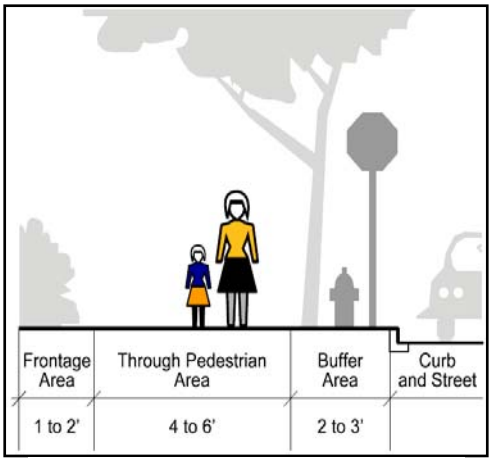
crashes. It should be noted, though, that this is potentially due to the low levels of pedestrian/bicycling activity, rather than the safety of such modes.

Developing policies and programs that increase walking and bicycling mode share are effective ways to improve the safety of those walking and bicycling. Focusing walking and bicycling on specific roadways through the development of a bicycle and pedestrian network is not likely to significantly decrease safety on other roadways, because overall biking and walking mode share will increase, using other roadways to access the network to and from their origins and destinations.

Proposed Facility Types

Sidewalks

All new sidewalks planned throughout the study area are standard five-foot wide sidewalks. They are to be constructed of concrete, and must conform to all geometric standards imposed by the Americans with Disabilities Act, as codified in the Texas Accessibility Standards (TAS). Curb ramps in particular, when proposed in Chapter 3, Recommendations, follow the new standard adopted in the TAS in 2006, namely that in addition to the length, width, and slope requirements previously in force, a "detectable warning strip" shall be installed at the street (lower) end of the ramp. These detectable warnings shall be 24" deep and extend the full width of the ramp, with the near edge 6" to 10" from the curb line. They shall comply with TAS 4.29.2, which required a profile of truncated domes. Previous standards required grooves or other tactile patterns.



Typical Sidewalk Section

(Adapted from Pedestrian Master Plan, Portland, Oregon)

The bicycle facility types discussed in Chapter 3 are all multi-use paths (called Class I bikeways). Sugar Land does have marked bicycle lanes (Class II bikeways) on some streets, including Creekbend Drive in the northern portion of the study area. No new marked lanes are proposed as part of this study. No bicycle routes and boulevards (Class III bikeways) currently exist in the study area, and none are proposed in the study recommendations. Complementary improvements such as bicycle parking and bicycle-oriented signage are discussed below.

Hike-and-Bike Trails

Multi-use paths, often called hike-and-bike trails, are off-street facilities for non-motorized vehicles and pedestrians. They provide the highest level of service for bicyclists because they are completely separate from vehicular traffic. Off-street paths are best located where there is little cross traffic, so as to minimize conflicts. Paths should be seen as complements to the on-street network; not as a substitute, as they are typically found in parkland or other less-developed areas. As such, they may not provide direct connectivity to schools, places of business, or entertainment facilities, and are generally intended as recreational amenities. The existing hike-and-bike trails and the majority of those being proposed in the City of Sugar Land Parks & Recreation Department's concurrent study fall into this category. Most of them are located along levees, drainage channels, utility easements, or other off-street locations.

U-type bicycle racks like these can be installed singly or in arrays of any number. They provide easier and more secure attachment of bicycles than other designs. U-type racks are available from numerous manufacturers throughout the country.

Bicycle parking

Lack of secure bicycle parking is a chief obstacle to bicycling. People will often not bicycle somewhere or commute via bicycle if they think there is a reasonable chance their bicycle will not be there when they return. Finding a bike rack that does not allow one to properly secure the bike or is inconveniently located can discourage future bike use. In addition to creating a basic network of bikeways, development of a program to install bicycle racks and other secure bicycle parking facilities throughout the city is essential.

Best practices to accommodate and encourage bicycle commuting include special zoning or permitting requirements for the provision of bike storage for new developments, including locker shower facilities at large centers of employment. Effective bicycle racks provide direct contact between the bicycle frame and the rack at two points for stability such as those shown.

Bicycle oriented signage

There are three types of bicycle oriented signage:

- Signage directed towards drivers with instructions related to bicycles. These may include signs such as "Share the Road," "Bicycles Allowed Use of Full Lane," or "Yield to Bicycles." These should be used sparingly in key locations. Overuse of warning signs such as these lead motorists to eventually ignore them.
- Numbered bicycle route signage should be used on all bikeways for designation and identification. These are essentially the bicycle equivalent of numbered highway systems. Some examples from California are shown in the photo at right.

Examples of bicycle route signage with route names and numbers.

- Wayfinding signage provides directions for bicyclists to key destinations such as business districts, schools, parks, and civic buildings, with the option to include distances for improved information. Wayfinding information can be included as part of the numbered bike route signage system.

The Four "E"s of Planning

Education, encouragement, enforcement and good **engineering** are the foundation for pedestrian and bicycle planning. Combined they take the concept from mere theory to good practice. **Education** provides pedestrians and potential riders with substantial knowledge of network usage. It provides the when, where, and how of the network. **Encouragement** increases the usage of the network by providing incentives and programs that promote safe and well informed usage. **Enforcement**, often thought of as pointing out bad cycling and pedestrian behavior ensures safe riding habits, understanding of the signage, personal responsibility as well as abiding by the rules are taught and maintained. It also includes motorist behavior that disregards cycling and pedestrian activity. This often causes a dangerous potential for conflict.

Most important of all the "four E's" is **engineering**. It supports education, encouragement and enforcement with good design. Good design can educate people to bicycle properly with traffic,

cross streets safely, encourage people to walk in the public right- of- way and provides a physical framework for proper enforcement.

Many engineering and design practices have been tried and tested throughout the country successfully. The most frequently used are pedestrian corridors, pedestrian signals, unsignalized pedestrian crossing treatments, Americans with Disabilities requirements and on-road bicycling.

Pedestrian Corridors

The most common pedestrian corridors are sidewalks. Sidewalks are also the preferred method of choice in an urban environment to accommodate pedestrian activity. However, in many areas of the city, traffic volumes and speeds are so low pedestrians share the street with motor vehicles, especially where discontinuous sidewalks make it simpler to walk in the street. In areas of high traffic volumes, buffers along sidewalks should be used to protect pedestrians from moving traffic. Furniture zones, planter strips, on-street parking, or a bike lane can also act as buffers; this increases pedestrian comfort and some buffers such as, planter strips help meet ADA cross-slope requirements at ramps, around posts and at other designations.

Sidewalks must meet minimum ADA standards, but should also be modified based on traffic conditions. Separated sidewalks should be 5 feet wide or greater and 6 feet is desirable for curbside sidewalks. Along commercial streets with planters, seating areas, or other furniture within the sidewalk, curbside sidewalks should be at least 10 feet wide. On curbside sidewalks a 6 feet wide clearance is desirable. Obstructions should be placed behind the sidewalk if this cannot be achieved. Mountable curbs, meaning curbs whose vertical face is at an angle of 45 degrees or less, facilitating vehicle access across them, are not recommended.

Continuous, connected and well maintained sidewalks are generally needed along both sides of the street to prevent unnecessary crossing.

Pedestrian Signals

Pedestrian signals provide safety and security from motor vehicles in the form of pedestrian signal heads, marked crosswalks, a WALK signal and push buttons. High volume multi-lane highways may benefit from a signal mid-block or at an existing unsignalized intersection for pedestrian crossing. High pedestrian crossing counts are needed for the MUTCD to warrant a signal installation. Pedestrians are more likely to cross when there is a signal, as they are afforded a protected gap in traffic. Estimating these counts will make it easier to meet MUTCD requirements. Signal operation and safety concerns must also be addressed as well as the distance to adjacent signals.

This pedestrian signal at SH 6 and Town Center Boulevard features a timer to indicate how much crossing time remains.

Pedestrian signal heads give the appropriate time to cross the street within a signal cycle. Without these signals, pedestrians may have a difficult time determining when to safely cross the street, especially at busy intersections, unusual geometry, or with complex signal phasing like split phasing. Pedestrian signals ensure a timely crossing before conflicting traffic proceeds.

Marked crosswalks at each leg of the intersection help warn motorists of possible pedestrian crossing and keep the crossing clear of vehicles. Closing a crosswalk to improve traffic flow can degrade pedestrian safety. Pedestrians crossing without a signal not only increase endangerment but also actually increase exposure and delay. To enhance visibility, crosswalks can be marked with ladder markings that are spaced to avoid the wheel paths of vehicles.

A WALK signal can provide pedestrians with a long enough clearance interval to get pedestrians started and crossed.

Push buttons placed where all pedestrians can access them, including those with disabilities should clearly indicate which crosswalk the button regulates. Mounting push buttons on separate pedestals is often necessary to achieve proper placement, rather than on the signal poles themselves.

In areas of high pedestrian use such as downtowns and central business districts, push buttons are rarely needed except as part of an audible pedestrian signal; the pedestrian phase of the signal should occur every cycle. Traffic delays can be reduced by using a median island and a 2-step pedestrian crossing where the push button stops only one direction of traffic.

Even with the above safety crossing measures, pedestrian crashes can occur at signalized intersections, most often when vehicles turn right on red as pedestrians are crossing the intersection. The following is a list of timing techniques and other treatment to reduce pedestrian-traffic conflict.

- Protected-only left-turn phasing allows pedestrians to cross without conflicts from left-turning drivers. Red arrows are displayed that prohibit left turns during the pedestrian WALK and clearance intervals.
- 1-2 second all red interval can help prevent crashes caused by high speed red light runners, as they are given a chance to clear the intersection before opposing traffic (and pedestrians) begin to cross.
- Leading pedestrian intervals provide WALK indication 2 to 5 seconds prior to the concurrent green indication; this allows pedestrians to enter the crosswalk before drivers. This increases the visibility of pedestrians and reduces conflicts with turning vehicles.
- Countdown Pedestrian Signals tell pedestrians how much time is left in the pedestrian clearance interval. Studies show that countdown signals reduce the number of pedestrians remaining in the street when conflicting traffic receives a green indication.

Unsignalized Pedestrian Crossings

Crossing at unsignalized locations can present difficulties for pedestrians, especially at multi-lane corridors. Pedestrians will cross at locations where there is an opportunity regardless of the location of the nearest signal. It is necessary to provide alternatives to assist pedestrians in safely crossing unsignalized intersections.

- Continuous raised medians or pedestrian crossing islands on two-way streets have been shown to reduce crashes up to 40%. The medians allow pedestrians to "cross and wait then cross again" instead of waiting for a gap in traffic long enough to clear the lanes. At intersections the median or median nose should extend past the crosswalk to provide a refuge for pedestrians as left turning vehicles are approaching.
- Curb extensions can be used where there is on-street parking to reduce the total crossing distance and improve visibility between motorist and pedestrians waiting to cross. These should extend the full width of the parking lane to ensure that sight lines are not obstructed. At intersections, curb extensions can be used to bring the crosswalk closer to the intersection, improve accessibility with additional space, and slow right turning vehicles on tight corners.
- Pedestrian crashes occur predominately at dusk and night. Illumination at crosswalks significantly increases the driver's and pedestrian's visibility.
- An advance yield sign is recommended at unsignalized crosswalks on multi-lane streets to reduce the occurrence of "multiple-threat" crashes. These are the most common and often fatal pedestrian crashes. It occurs when a driver in the outside lane stops to let a pedestrian cross unaware of the blocked sight line he has caused between the pedestrian and the driver in the next lane. The 2nd driver, without adequate time to react, strikes the pedestrian at high speed. The advance yield sign should be placed 20 to 50 feet from the crosswalk; this encourages drivers to stop further back, maintaining better sight lines and giving the 2nd driver and

pedestrian time to react if necessary. Advance warning signs should also be installed at mid-block crosswalks.

- At designated unsignalized crossings, high-visibility crosswalk marking is strongly recommended since there is no active control to stop motor vehicles. Longitudinal lines (ladder or continental style crosswalk markings) are preferred and the markings should be spaced to avoid the wheel paths of vehicles, significantly reducing maintenance needs.
- Intersections are safest for pedestrians when they are close to a right angle. Skewed intersections result in longer crosswalks, longer walking distance with more exposure to traffic, poor visibility for both pedestrians and motorists, and allow drivers to turn at high speeds.
- Small corner radii shorten the pedestrian crossing distance, allow for well-placed crosswalks, slow right turning vehicles and increase visibility of pedestrians. The size of the corner radius is determined by the appropriately-chosen design vehicle, and the street designation- residential, collector, or an arterial. An appropriate radius for each intersection corner should be designed even if this results in different size radii at the same intersection.
- A channelized island where an exclusive right-turn lane is provided shortens the distance across the through lanes. There is less pedestrian exposure and improved signal timing. The island between the right turn lane and the through lanes allows pedestrians and drivers to negotiate one conflict separate from another. A channelized island is asymmetrical with a longer tail pointing upstream toward the approaching driver turning right. The approaching driver is brought closer to a 90-degree angle at the cross street. The crosswalk should be placed one car length back from the edge of the cross street, to separate interactions between pedestrian-vehicle and vehicle-vehicle traffic.
- Crosswalk placement can accomplish several pedestrian-related goals: short crosswalks, crosswalks as close as possible to the intersection for better visibility by turning vehicles, and the need to properly locate two sidewalk ramps. Good crosswalk placement can be difficult, especially at intersections with large corner radii. Sidewalk ramps must be contained within the marked crosswalk area. Poorly placed sidewalk ramps and design can make a street crossing difficult since they may require wheelchair users to make long detours while crossing or where drivers do not expect them.

Americans with Disabilities Act (ADA) Requirements

The Americans with Disabilities Act (ADA) was passed in 1990, and "gives civil rights protections to individuals with disabilities similar to those provided to individuals on the basis of race, color, sex, national origin, age, and religion. It guarantees equal opportunity for individuals with disabilities in public accommodations, employment, transportation, State and local government services, and telecommunications," according to www.ada.gov, the U. S. Depart of Justice's ADA website. The ADA's provisions on "public accommodations" include public buildings as well as sidewalks, streets, and other public pedestrian routes. States may establish stricter standards than the Federal requirements; in Texas the standards are enforced and administered by the Texas Department of Licensing and Regulation, and are known as the Texas Accessibility Standards.

ADA requirements ensure the safety and convenience of travel by all pedestrians. The requirements that present challenges for this area are smooth surfacing, clear width, maximum cross slope, and proper ramp design and placement. These are absolute requirements of the ADA; they are not suggestions, recommendations, or guidelines.

ADA requires a smooth surface, with vertical changes in the level not exceeding 1/4". New concrete sidewalks are the best way to ensure this. Decorative surfaces such as brick or stamped concrete can be used, but may be difficult to maintain a smooth surface overtime. If decorative surfaces are requested, it is best to place them out of the primary walking area of the sidewalk, in the "furniture zone" near the curb, or in the "frontage zone" at the back of the sidewalk.

ADA standards currently require a minimum clear width of 3 feet but future requirements may add an additional foot. To provide the maximum convenience, a clear width of 5 feet is the best dimension. This ensures that all pedestrians, including those with disabilities, can walk side-by-side or pass each other with little interaction. Sidewalks that include a planter strip or furnishing zone make it easier to meet clear width requirements by providing a place where pools, posts, mailboxes, trees, and other obstructions can be placed.

Any cross-slope, such as for drainage, may not exceed 2% (1:50) across the required clear width of the entire accessible route, including all driveways, sidewalk ramps, and intersections. Separated sidewalks that allows sloped driveway apron and sidewalk ramps to be placed in the planter are the easiest way to achieve this requirement. Sidewalks directly adjacent to curbs require special techniques to maintain a level passage across driveways.

Maximum grade in the direction of travel cannot be steeper than 5% (1:20). Sidewalk ramps cannot exceed a maximum slope of 8.3% (1:12) and a 5x5 foot level (2% maximum slope) landing must be provided at the top of every ramp. At the bottom of each ramp truncated domes must be placed at a 2-foot depth, 6-8 inches from the face of the curb, and extending the full width of the ramp. The enables blind pedestrians to determine where the sidewalks ends and the street begins.

Each ramp must be placed completely within the crosswalk at intersections. Two ramps placed at each corner, one for each crosswalk, are generally recommended. This is easiest to achieve when the corner radius is relatively small. On large radius corners of 30 feet and above, placing 2 ramps may be disadvantageous. It will move the crosswalk too far from the intersection itself, forcing disabled pedestrians to make a detour and cross at locations where drivers may not expect them. Designing an intersection with good crosswalk placement is foremost; then decide the necessity of one or two ramps.

An example of an on-street bicycle lane in Palo Alto, California.

On-Road Bicycling

Bicyclists are roadway users, and fare best when operating according to motor vehicle laws, so that motorists can anticipate predictable bicyclist behavior. In urban environments with low traffic volumes and speeds, shared bicyclist and motor vehicle roadways are acceptable. There are no specific dimensions; there is also no special signage or road marking. However, local streets have a significant disadvantage for bicyclists when crossing major arterial streets with no protection or warnings such as islands and traffic signals. Signed shared roadways can be created by adding bike route signs but to be more effective, signage must include destination signing or named and numbered bike route destinations.

Levees, such as this one near Oyster Creek, can provide a simple solution for non-motorized connectivity.

Bike lanes are an effective way to travel with faster moving traffic. They also allow bicyclists to move at a constant speed when traffic is congested and moves at a stop and go pace. They are often developed on existing streets by narrowing travel lanes or removing a lane. They should be 5-6 feet wide with a minimum clear width of 5 feet from the center of the lane stripe to the curb or edge of pavement. In areas where bike lane continuity can not be provided, a wide outside lane of 13 to 15 feet will generally suffice. TxDOT standards specify a 14-foot lane; this allows motorists to pass cyclists without changing lanes.

Bicycle boulevards accommodate bicyclists by providing an alternative to arterial streets and turn a local street into a thoroughfare for bicyclists without encouraging motorists to use it as a through route. Bicycle boulevards work best in a system of connected streets such as a grid pattern. Many existing bike routes can be converted into bike boulevards while many bike boulevards can be created on other street as an alternative. Traffic calming techniques can be used to reduce motor vehicle speeds and through traffic. Priority is given to through bicycle movement at intersections with local streets. Special signage is used to increase street usage. Arterial streets are marked with traffic signals for bicyclist, median islands and other measures.

Shoulders, while generally not present in urbanized areas such as Sugar Land, are great locations for bicycling, as long as they are kept reasonably free of debris. Shoulders provide a continuous pathway further out of the way of motor vehicles, a benefit when bicycling along high-speed or rural roadways.

Chapter 2
Public Input and Project Selection

Summary of Public Process

Public input was solicited throughout the study process, through public meetings and the internet. At the beginning of the study, a project website was developed to collect and display information relative to meetings and other scheduled events, public feedback opportunities, and analysis products (www.sugarlandtowncenterpedbike.org). Two introductory meetings were held, one in the afternoon for public officials and one in the evening for the general public. This first public meeting was part of a planned meeting for the Hike & Bike Trail System Plan, conducted by the Parks & Recreation Department. Surveys were developed and posted to the website, forwarded to officials and organizations for their distribution, and e-mailed to persons who had attended the introductory meetings.

Two public input workshops were held to solicit improvement recommendations from the stakeholders and the community. Following the development of potential improvements, a meeting was held to present these improvements, as well as provide an initial opportunity for the public to vote on their preferred choices. In addition, another web-based survey was set up for the public to vote (select) their preferred improvements. These efforts are detailed in the following sections.

Project Introduction—Public Officials and Citizens

To kick off the project, H-GAC and the consultant team conducted stakeholder and public meetings in April 2007, to explain the background of the Pedestrian and Bicyclist Special Districts program, convey the schedule and scope of the project, define what the desired products would be, including the range of potential recommendations, and solicit general input.

An afternoon meeting was held Wednesday, April 25, 2007, to which were invited officials and representatives of the City of Sugar Land, Fort Bend County, Fort Bend Independent School District administration, Texas Department of Transportation, Planned Community Developers (owners of many commercial properties in the study area), institutional representatives, and social service organization representatives..

At an evening meeting the same day, the Town Center project team participated in a public meeting that had been planned by the Department of Parks and Recreation, whose Hike & Bike System study had started some months earlier, and who was presenting first drafts of their potential improvements to the public. This meeting welcomed the general public as well as neighborhood and community association representatives, bike and disabled persons advocates, media, and other organizations.

Full detail of the comments from these meetings is located in Appendix B.

Initial Project Survey

A survey was developed to gauge initial public interest and generate a profile of interested citizens, including generalized problem areas, location of residence and employment, number of persons, automobiles, and bicycles in the household, and current frequency of walking and bicycling. Printed surveys were made available at the public input workshop. In addition, the project website offered an automated version of the survey. A sample of the survey and the full compilation of results are located in Appendix C.

Public Input Workshop

On Wednesday, June 13, 2007, H-GAC and the consultant team conducted public input workshops to obtain specific and detailed recommendations from the public about their perception of problem areas, good examples, and potential improvements. The ideas and themes from the project introduction meetings and the initial field data collections were presented and the attendees were asked to illustrate on maps problems and potential improvement projects. Full details of the public input from this meeting are located in Appendix D.

Survey of Potential Improvements

Using the input from the public meetings in June, a series of projects was developed based on the maps drawn at that meeting and the responses to the first public survey received over the previous month. These projects included sidewalk construction, stop bar and crosswalk striping, as well as hike-and-bike trails and bike racks. This list became the basis for the second survey posted to the project website. Nineteen physical projects developed from the public input were presented, as shown below.

1	**SH 6 at US 59 Crossing Improvements** Add new crosswalks, curb ramps and stop bars; complete sidewalks west of SH 6 along US 59; add lighting; widen sidewalks under overpass and install railing; add new countdown pedestrian signals. *12 crosswalks, 22 curb ramps, 6 stop bars, 2000 linear feet of sidewalk along US 59, 400 linear feet of railing along SH 6 underpass, 18 lighting fixtures, 16 pedestrian signals*
2	**SH 6 Crossing Improvements: North of US 59** Add pedestrian signals, crosswalks, stop bars, and curb ramps at Fluor Daniel Drive. Add crosswalks and curb ramps and complete nearby sidewalks at Kensington Drive. *7 crosswalks, 14 curb ramps, 4 stop bars, 8 pedestrian signals, 700 linear feet of sidewalk along SH 6*
3	**SH 6 Crossing Improvements: South of US 59** Reprogram traffic signal at Town Center Boulevard; add new crosswalks, stop bars and pedestrian directional signage at City Walk at SH 6 and at SH 6 and Town Center Blvd.; add new crosswalks, stop bars, and curb ramps at Lexington Blvd. *9 crosswalks, 9 stop bars, 8 curb ramps, 1 traffic signal (labor only)*
4	**Pedestrian Improvements - Town Center Boulevard North** Add "Yield to Pedestrians in Crosswalk" signs to Town Center Blvd. southbound; add multiway stops, stop bars and crosswalks at Texas Garage Drive; add crosswalks across Town Center Blvd. at City Hall, across Plaza Drive at Town Center Blvd., and across major shopping center entryway on south side of Town Center Blvd. *1 yield sign, 12 stop signs, 12 stop bars, 15 crosswalks*
5	**Pedestrian Improvements - Sugar Land Town Square** Add stop sign to northbound City Walk at Plaza Drive; add stop bars and outline crosswalks on City Walk at Lone Star Drive, Town Square Place, Plaza Drive, and Texas Drive; add pedestrian direction sign at City Walk and Plaza; add speed hump to Plaza Drive; stripe new crosswalk across Town Square Place at US 59. *1 stop sign, 14 stop bars, 1 complete crosswalk, 12 crosswalk outlinings, 1 pedestrian directional sign, 1 speed hump*
6	**Pedestrian/Bicyclist Improvements near Fluor Daniel offices** Construct missing sidewalks along Creekbend Drive; add lane markings for bicycle shared lanes on Fluor Daniel bridge. *2 "sharrows," 2250 linear feet of sidewalk*

7	**Pedestrian Improvements - Meadow Lake Park area** Construct raised crosswalk on Soldiers Field Drive at playground; stripe new crosswalk across Soldiers Field between the two lakes; construct sidewalk from Colony Lakes Drive to lake. *1 raised crosswalk, 1 regular crosswalk, 100 linear feet of sidewalk*
8	**Pedestrian Improvements - Southeast Quadrant of SH 6 and US 59** Construct sidewalks along south frontage of US 59, including connections to Oyster Creek bridge, and a higher railing on the bridge. Add sidewalk from Chuck E. Cheese east to River Crest Drive. Stripe new crosswalk at Town Center Blvd. and US 59. *1 crosswalk, 1700 linear feet of sidewalk, 300 linear feet of railing*
9	**Pedestrian Improvements - Williams Trace Boulevard area** Construct gravel trail along Lexington Boulevard near Williams Trace; add crosswalks, stop bars, and curb ramps at US 59, Southwest Pkwy. and Lexington Boulevard; add new pedestrian signals and various signage at Southwest Pkwy.; construct sidewalk from Amesbury Lane to Englewood Place *14 crosswalks, 11 stop bars, 16 curb ramps, 4 pedestrian signals, 2000 linear feet of trail, 12 various signs, 50 linear feet of sidewalk*
10	**Pedestrian/Bicyclist Improvements - First Colony Boulevard area** Construct new sidewalks along First Colony near Triumph Hospital; add curb ramps, stop bars and crosswalks at First Colony and Colony Square. *4 crosswalks, 4 curb ramps, 4 stop bars, 800 linear feet of sidewalk*
11	**Pedestrian Improvements - North Side of Mall** Stripe crosswalk at Mall Ring Road exit onto US 59, remove channelized right turn from Town Center Boulevard onto Mall Ring Road; replace traffic signal with multiway stop; add crosswalks where missing *4 new crosswalks, 1600 square feet pavement demolition, 4 stop signs, 1 traffic signal removal*
12	**Pedestrian Improvements - Theatre and South Side of Mall** Construct sidewalks along theatre entry from Town Center Boulevard, from Mall Ring Road to east edge of theatre property, and from northeast corner of Mall Ring Road to Ruby Tuesday and adjacent restaurants. Add multi-way stop with stop bars and crosswalks at Town Center and theatre entry. *4 stop signs, 4 stop bars, 4 crosswalks, 1400 linear feet of sidewalk (of which 800 feet is on private property)*
13	**Pedestrian Improvements - Sweetwater Boulevard and Methodist Hospital** Add multi-way stop and crosswalks at Town Center Boulevard and Hospital entrance; add curb ramps, crosswalks, and stop bars at Sweetwater and Town Center and Sweetwater and Lexington. *4 stop signs, 12 stop bars, 12 crosswalks, 16 curb ramps*
14	**Pedestrian Improvements - Lexington and Austin** Construct new curb ramps at Lexington Boulevard and Austin Parkway. *8 curb ramps*
15	**Bike Racks at Businesses/Destinations** An allotment of bicycle racks would be installed at the request of businesses/citizens throughout the area. We recommend the U-type rack for better theft deterrence and a smaller footprint. *Locations could include these identified by the public: AMC Theatres, First Colony Mall, Chuck E. Cheese, Whole Foods Market*

16	**Bicycle Improvements - Overall Study Area** Construct hike-and-bike trails in the following locations: from east of Target, alongside Meadow Lake Park, behind Lowe's, across First Colony Boulevard (with crosswalk), to Ditch "H"; from First Colony/US 59 interchange west to Ditch "H" along tree line; from canal south of Lexington, east of FBISD stadium, across Lexington at new signal, along Mall Ring Road, ending at US 59 frontage (with stop sign for trail) *1 stop sign, 1 crosswalk, 9000 linear feet of trail*
17	**Bicycle Signal** Add traffic signal and stripe new crosswalks where canalside hike-and-bike trail ends at Lexington Boulevard behind AMC Theatre. *1 traffic signal, 2 crosswalks*
18	**Pedestrian Overpasses** Shorten walking distances by constructing grade-separated pedestrian walkways at one or more locations across the US 59 freeway; suggested locations include north of SH 6 at Lake Point Drive, and south of SH 6 at the Mall Ring Road. *1 or more overpasses with railings and approach ramps*
19	**Transit/Trolley Service** Purchase transit vehicles and operate a fixed-route shuttle to various locations in the study area. Possible routes include loops, a main line with spurs, or some combination of these. *Minimum of 4 vehicles, plus signage, operation/maintenance costs*

All meeting participants and website visitors who had left contact information at the website or a workshop or meeting were contacted and asked to select their five highest-priority projects, using the second survey form which was added to the website and replaced the introductory survey. Cost estimates were not included at this time, as the project team felt it would be more beneficial to select the true preferences of the public, and let cost be used later by the funding agencies when deciding the number and scope of improvements to be undertaken. If, for example, the public's number-one preference was so expensive that it precluded other investments, the City may decide to forego that one item in favor of lower-ranked preferences.

The website survey received 27 responses, and 8 paper responses were received at the August public meeting, for a total of 35. One point was given to each of the five projects that each respondent selected. The projects receiving the largest number of points were deemed to be the ones respondents felt were the highest priority. A full listing of the statistics for this survey is located in Appendix F.

Although the vote total is lower than the previous H-GAC special district studies in Montrose and Galveston, it should be noted that the Sugar Land study area, at 1.5 square miles, is less than half the size of the other two districts, and its land use profile is unique, consisting almost exclusively of commercial retail uses, with fewer than 2,000 residents actually within the study area boundaries, compared to approximately 40,000 for each of the previous studies.

In order to prioritize the recommendations, a rating system was developed to arrange the public selections by feasibility, cost, safety benefit, and user demand. In general, projects that were less expensive, more easily coordinated, or already begun in some manner were given higher scores. A description of the rating mechanism is located in Appendix F. The recommendations are listed in the following chapter.

Chapter 3
Recommendations

Summary

The vote totals from project ranking survey posted on the web, together with the assessments of probable cost and implementation time, were used to prioritize the most popular projects. The priority order of those projects was determined by the consultant team, who ranked the projects, based on votes, feasibility, cost, and relative demand, for the list of recommendations. A full description of the ranking system is located in Appendix F.

Final Rankings of Potential Improvements

Code Number	POTENTIAL IMPROVEMENT	Relative Feasibility A	Relative Cost B	Safety Benefit C	Relative Demand D	Composite Rating E=A+B+C+D	Vote Count V	Overall Score E * V	Ranking
1	SH 6 at US 59 Crossing Improvements	2	1	2	2	7	20	140	1
15	Bike Racks at Businesses/Destinations	3	3	1	2	9	14	126	2
16	Bicycle Improvements - Overall Study Area	2	1	1	2	6	21	126	3
3	SH 6 Crossing Improvements: South of US 59	2	3	2	3	10	11	110	4
19	Transit/Trolley Service	2	1	1	2	6	18	108	5
4	Pedestrian Improvements - Town Center Boulevard North	2	3	2	3	10	10	100	6
9	Pedestrian Improvements - Williams Trace Boulevard area	3	2	1	2	8	11	88	7
17	Bicycle Signal on Lexington	2	2	2	3	9	9	81	8
5	Pedestrian Improvements - Sugar Land Town Square	3	3	2	3	11	7	77	9
2	SH 6 Crossing Improvements: North of US 59	2	2	2	2	8	9	72	10
18	Pedestrian Overpasses	1	1	1	2	5	11	55	11
12	Pedestrian Improvements - Theatre and South Side of Mall	2	2	2	2	8	6	48	12
10	Pedestrian/Bicyclist Improvements - First Colony Boulevard area	3	2	1	1	7	6	42	13
6	Pedestrian/Bicyclist Improvements near Fluor Daniel offices	3	2	1	2	8	5	40	14
8	Pedestrian Improvements - Southeast Quadrant of SH 6 and US 59	2	2	1	1	6	5	30	15
13	Pedestrian Improvements - Sweetwater Boulevard and Methodist Hospital	3	3	2	2	10	3	30	16
11	Pedestrian Improvements - North Side of Mall	2	3	2	2	9	3	27	17
14	Pedestrian Improvements - Lexington and Austin	3	3	1	3	10	2	20	18
7	Pedestrian Improvements - Meadow Lake Park area	3	3	1	1	8	1	8	19

A: 3=Easy, 2=Average, 1=Difficult

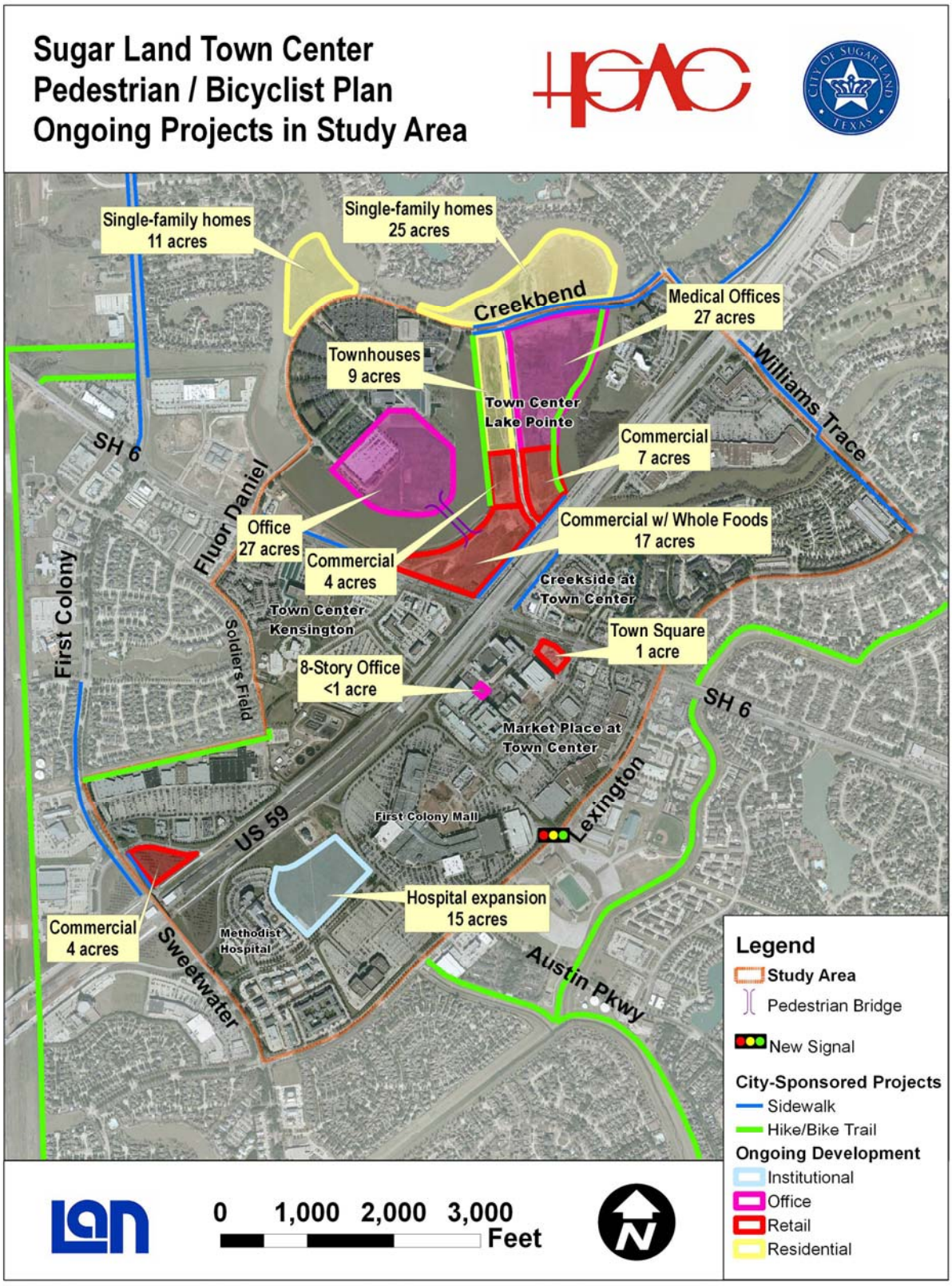
B: 3=Inexpensive (under $50K), 2=Average ($50-130K), 1=Expensive (over $130K)

C: 2=High Safety Benefit 1=Low Safety Benefit

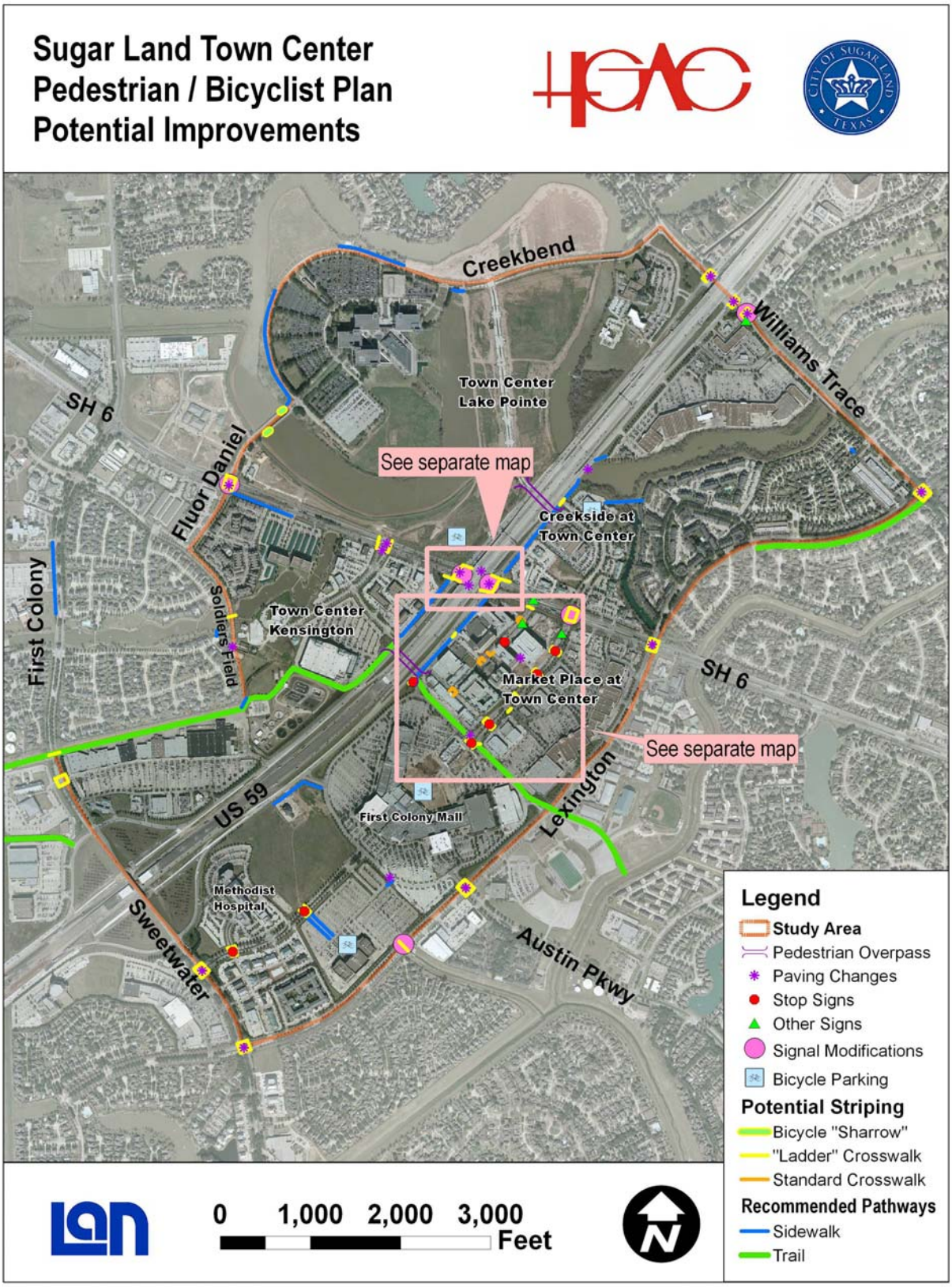
D: 3=Higher, 2=Average, 1=Lower (see full analysis in Appendix I)

The maps on the following pages illustrate the ongoing work in the study area, as well as the recommended improvements at three different scales. The development of the improvements, along with additional considerations for further study, are explained in the sections which follow.

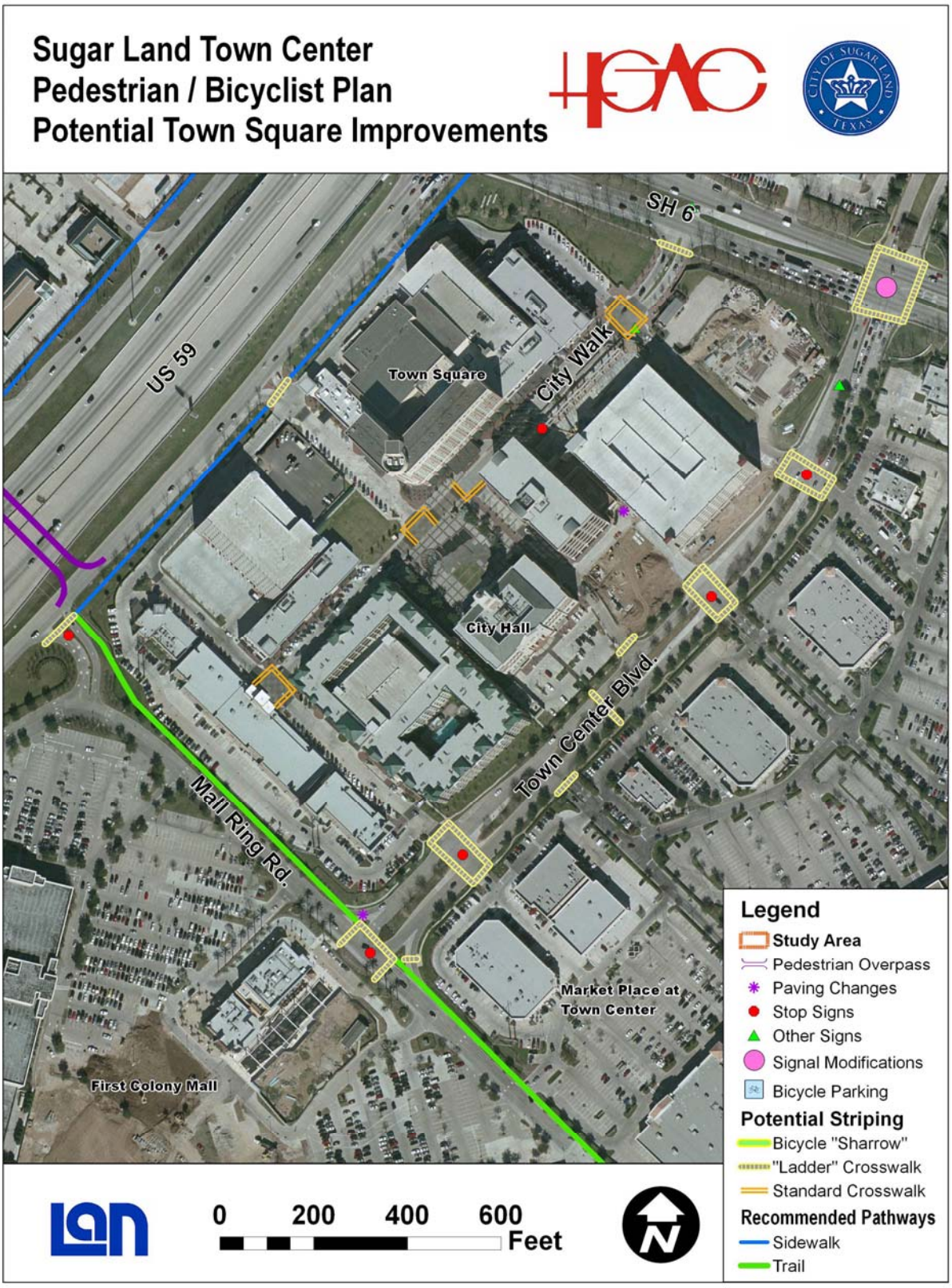
Map of Other Ongoing Work Near Study Area



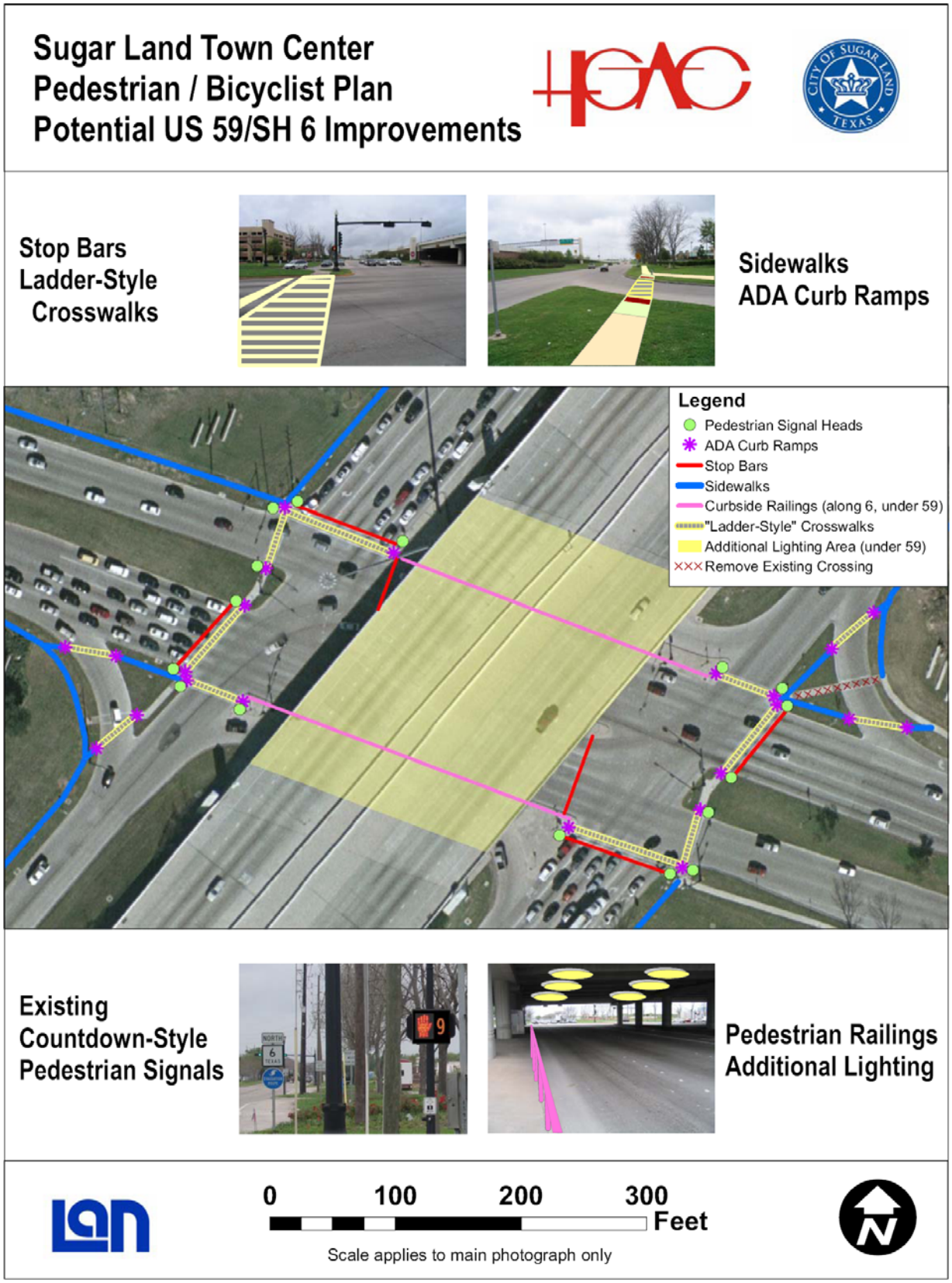
Map of All Recommendations



Map of Town Square Area Recommendations



Map of Recommendations at US 59 and SH 6



Discussion on Completing the Non-Motorized Network

The basic premise of this work is that the network for non-motorized travel largely already exists. The study area has many existing and proposed sidewalks, walkways and trails. Development is relatively dense and there is much activity within a small area. Much of the study area – First Colony Mall, Creekside at Town Center, Market Place at Town Center, Town Center Kensington - is within a one-half mile radius of City Hall. This is a 10 minute walking distance, a comfortable distance.

However, the roadway network in the study area is not always conducive to foot and bicycle traffic. First and foremost are US 59 and SH 6 which bisect the area. US 59 is crossable only at very separated intervals and both highways are challenging to pedestrians during rush hours. They divide the study area into four separate quadrants. This study is the first step towards stitching the quadrants together, which will continue to be a major task as Sugar Land grows and evolves. Below are discussed proposed improvements to facilitate walking and bicycling along and across the major roadways in the study area.

Secondly, each individual development is relatively self-contained, with connections generally limited to arterials. So while internal circulation is easy, traveling between developments is hard. There are many possible links in the network which, if opened, would provide an entirely new way to travel—one that avoids the congested arterials.

Signalized Intersection Survey

On March 29, 2007, the project team conducted a field survey of the signalized intersections in the study area. A number of the locations were found to have curb ramps that did not meet current ADA standards, some pedestrian signals did not have countdowns or were not present at all, and stop bars and crosswalks were frequently in poor condition or incomplete. Throughout the study area, it is recommended that these issues be corrected; they are included in the potential improvements list and in the cost estimates.

There are existing sidewalks around the intersection of US 59 and SH 6, but they are discontinuous.

Improvements to Intersection of SH 6 and US 59

The intersection of the Southwest Freeway (US 59) with State Highway 6 is the center of the study area and its busiest intersection. It is surrounded by the largest concentration of retail and commercial uses in the city. The four corners contain the Town Square, the Whole Foods center under construction, Target, and the Creekside shopping center. The intersection itself, though, is an obstacle to pedestrians who otherwise could access quite easily the shopping areas which are only a few hundred feet from one another. The US 59 overpass creates "dark spots" that can make it difficult to judge speeds and safe crossing opportunities. Sections of nearby sidewalks are missing, crosswalks are not at consistent locations, and some pedestrian signals lack countdowns.

Potential improvements to this intersection include completion of all nearby sidewalks. New ADA-compliant curb ramps should be added, as well as countdown heads to the existing pedestrian signals.

Crosswalks should be aligned with the main roads where they cross turning lanes. This will place the pedestrian movement in a location more in line with drive expectations, increasing pedestrian safety.

A railing is recommended along the curbside sidewalks under the overpass. Lighting fixtures would also increase pedestrian comfort and provide better visibility for motorists. These could be similar to those recently installed under a similar TxDOT roadway, the West Loop (IH 610) at Woodway and San Felipe. Under US 59, also consider widening the sidewalk by narrowing the U-turns, if the required geometry allows.

Longer-term improvements could include the addition of inviting brick detailing, wayfinding signage, and pigeon deterrents. The slip lanes could be redesigned with compound curves and a 300-foot island. This will improve merge visibility and increase pedestrian safety, yet process the same number of vehicles.

This crosswalk (far left) is so far into the turning lane that motorists will be speeding up before encountering pedestrians.

Improvements Elsewhere Along SH 6

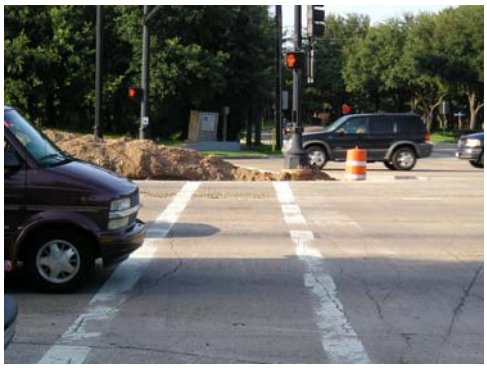
At Town Center Boulevard, reorganize signal phasing to allow a pedestrian phase in every cycle; this will require altering the Town Center phases. During the PM peak, southbound vehicles from Town Center receive 10 seconds of green time. When a pedestrian pushes the button, 55 seconds is provided (7 second walk, 48 second clearance interval). This adds 45 seconds to the cycle, which is largely unused. One solution is to begin the pedestrian phase along with the southbound Town Center movement and continue it during the northbound Town Center phase.

At Lexington Boulevard, add a crosswalk on southeast leg.

Construction should not block crosswalks and/or sidewalks as per TxMUTCD and ADA criteria.

Railings and lighting would make the US 59 underpass less intimidating to pedestrians.

The intersection of SH 6 and Lexington Boulevard lacks a full set of crosswalks.



Piles of soil from this street construction project have blocked the marked crosswalk.

Unlike most locations along SH 6, the Kensington Drive traffic signal does not have crosswalks.

Pedestrians may not be as visible to motorists when walking at night.

Pedestrians may suddenly appear from behind City Hall on the left. This is Plaza Drive between City Hall and the Texas Garage.

At Kensington Drive and the intersection to the north, crosswalks should be striped across SH 6. The existing curb ramps should also be realigned; currently they lead people with limited vision directly into the intersection (as opposed to the crosswalk).

Town Square Area Improvements

In general, the design of the Town Square area, including City Walk, provides a very high level of pedestrian accessibility, although striping features could be improved. The decorative brick crosswalks lack side delineations, and the intersections lack stop bars. During field visits, motorists were frequently observed stopping far further forward, often blocking the crosswalks entirely. In their 2006 study of the Town Square, Traffic Engineers, Inc. recommended thermoplastic striping- applied to form a stop bar and to outline the existing crosswalk at each stop-controlled intersection.

During public input, the question of the interaction between walkers and drivers at intersections was raised. Most of the sidewalk corners ramp down to street level, creating what appears to be a "shared" space. Signage should be added requiring drivers to yield to pedestrians in the Town Square area. The travel speeds are slow enough to facilitate this behavior.

The roadway that runs between City Hall and the Texas Garage presents several safety concerns: high speeds and limited sight distance. The project team recommends a raised crosswalk or speed hump on Plaza Drive to slow drivers approaching the pedestrian area of the Plaza. See illustration at left. From the plaza user's point of view, the plaza in front of City Hall appears to be bordered by three buildings and City Walk. It is not immediately apparent that there is a second road on the east side (Plaza Drive). The plaza typically appears auto-free, and during field visits children were observed running about. Occasionally a vehicle is driven down Plaza Drive at a higher than expected rate of speed, creating a potential hazard.

Town Center Boulevard North

There are two possibilities for the future function of Town Center Boulevard North: a pedestrianized Main Street or a traffic collector/bypass. Both options have benefits and concerns; the City should examine the possibilities to decide which is more appropriate. Town Center Boulevard currently functions as a collector roadway, gathering traffic from the various parking lots and garages and taking it to SH 6. Town Center Boulevard may also carry a significant amount of cut-through traffic, especially in peak periods. An Origin and Destination study is suggested, to better quantify and establish the travel patterns.

The parking lot at the mall, across from the end of the Town Center Boulevard, has recently been converted into a quasi-main street with parking and storefront shopping, mirroring the development

along City Walk. The City of Sugar Land may want to consider the same treatment for the entire length of Town Center Boulevard. For example, with stores located adjacent to the roadway, one could create a "Main Street" setting extending from the mall across SH 6 and into Creekside.

While the City of Sugar Land must determine the configuration and traffic controls of Town Center Boulevard, the stated purpose of the Pedestrian/Bicyclist Special Districts studies is to create conditions that encourage pedestrian activity, and to that end, there are changes that can be made to the street to enhance pedestrian and bicycle access and safety. Traffic volumes along Town Center Boulevard appear to suggest that only two travel lanes in each direction are needed, and that left and right turn lanes may not be required. Town Center Boulevard can be used to accommodate bypass traffic, but overall travel speed should be reduced in order for drivers to better recognize cross pedestrian traffic.

Adding stop signs (if warranted) and crosswalks to Town Center Boulevard North would slow drivers and discourage bypass traffic at Town Center Boulevard and Texas Drive. With a stop-controlled intersection, adjacent driveway widths can be reduced, as drivers will not have to queue while waiting for a gap in traffic. Likewise, one may remove the turn lanes, reducing pedestrian crossing distance across Town Center Boulevard North. At the entrances to City Hall, a crosswalk should be added, aligned with the front door of City Hall, a sidewalk exists leading out to the street (see photos below); this crosswalk would not require any stop-control.

Walkways and parking lots should better connect to the Town Center Boulevard sidewalks, as shown in the photo at left. Stop signs (if warranted) and crosswalks can be added at Lone Star Drive and Town Center Boulevard (see photo above right) to slow drivers and discourage bypass traffic As at Texas Drive, with a stop-controlled intersection, the driveways need not have multiple lanes, and the turn lanes on Town Center Boulevard may not be necessary, reducing the overall pedestrian crossing distance.

City Hall entry at Town Center Boulevard The brick sidewalk does not extend to the curb, where there is also no ramp or crosswalk.

The lack of crosswalks at Lone Star Drive makes it difficult to know the appropriate location to cross.

Mall Ring Road—North Side

Pedestrian movements could be more efficiently facilitated by converting the traffic signal to a multi-way stop or retiming the signal. The City of Sugar Land recently installed a two-phase signal with a button-activated all-pedestrian phase. Field surveys showed a high level of unused vehicle green time, which is likely to grow with more pedestrian traffic. The City may consider reverting to a stop-controlled intersection that would be consistent with the recommendations proposed along Town Center Boulevard North, and already existing at other locations on the ring road. The project team realizes this is a new signal, so the City should monitor its effectiveness and re-evaluate it periodically.

The City may also consider eliminating the slip lane from northbound Mall Ring Road onto eastbound Town Center Boulevard North. This slip lane facilitates through traffic, and contributes to higher speeds. The corresponding westbound-to-northbound slip lane has been eliminated, and this allows a shorter crossing distance for pedestrians.

The sidewalks should lead directly to the mall entrance; currently these sidewalks lead people along a circuitous path which, though attractively landscaped, has the effect of deterring pedestrian traffic. During field visits, several persons were observed walking (straight) through the grass rather than follow the sidewalk.

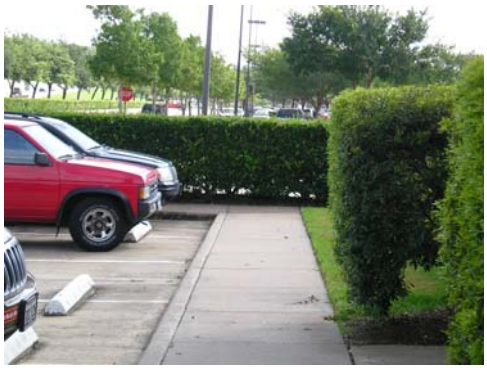
Other Pedestrian Improvements

US 59 near Oyster Creek

Connect the walkway on the bridge to the existing sidewalks in front of the shopping areas nearby. This will formalize a non-motorized link between Chuck E. Cheese and Home Depot. The comfort level for people walking on the bridge can be increased with a higher fence between the walkway and roadway.

Although this walkway is well-designed, it lacks essential connections to property on either side of the bridge. Also, pedestrian comfort would be increased by a taller barrier between the sidewalks and the high-speed traffic on the frontage road.

The hedges surrounding the nearby parking lots, such as shown in the photograph at right, form a barrier to pedestrians accessing the bridge. The current landscape ordinance forbids cuts in hedges. Exceptions should be allowed where hedges present a barrier to pedestrians.



Continuous hedges prevent easy sidewalk access, and pedestrians will often attempt to create and squeeze through small gaps.

Where Town Center Drive terminates at US 59, move the crosswalk away from the service road. It would be better aligned with the row of trees at the edge of the parking lots. In any case, there are no sidewalks connecting the crosswalks and curb ramps, so such sidewalks should be constructed to complete the pedestrian network in the area.

Town Center Boulevard South

Like Town Center Boulevard North, there are opportunities for traffic calming, both to reduce vehicle speeds and facilitate pedestrian activity. Town Center Boulevard South is different from Town Center Boulevard North in that it is clearly a collector street. It serves to move traffic from Sweetwater Boulevard to the hospital, mall, movie theatre and shopping centers. The following specific recommendations for pedestrian and bicycle infrastructure are offered.

Above and left: missing sidewalks on south side of US 59, east of SH 6.

Movie Theater Entrance

Add stop signs (if warranted) and crosswalks to slow drivers and discourage bypass traffic. With a stop-controlled intersection the driveways need not have multiple lanes, as drivers will not have queue for a gap in traffic. Likewise one may remove the turn lanes. Narrow the road to the movie theater to two lanes (from three) and add sidewalks. Connect walkways in the parking lots to the existing sidewalks.

This entrance to the movie theater from Town Center Boulevard has no provision for pedestrians.

Main Entrance to Methodist Hospital

Add a stop-controlled crosswalk across Town Center Boulevard South (if warranted). This will require striping of a crosswalk at the driveway opposite the hospital entrance, to make this into a more conventional intersection.

Driveway Design

Driveways should be constructed similar to the newer driveways along Town Center Boulevard South, with the drive ramping up to sidewalk level. From a pedestrian safety and access point of view, this is preferable, as foot traffic has priority. Even if drivers do not yield, the driveway ramp will slow the vehicle so that the severity of any impact will be less. The older driveways are designed like mini-intersections. The sidewalk ramps down to street level and vehicles clearly have priority.

Surrounding Roadways

On Lexington Boulevard between SH 6 and Williams Trace, there is an existing portion with no sidewalk. An ADA-compliant natural surface walkway is recommended. This can be a decomposed granite (gravel) path.

Where Soldiers Field Drive passes by Meadow Lake Park there is a playground. The entrance to the playground is just after a bend in the road, and sight distance is limited. A raised crosswalk at this location would increase pedestrian safety.

Where Soldiers Field Drive crosses the lake, there are paths on both sides of the roadway, along the lake. A crosswalk to connect the two circuits would provide a much longer paved route for recreational users, as well as facilitating access for nearby properties.

The older driveway at top is depressed to street level, requiring curb ramps and allowing motorists to enter at higher speeds. The newer driveway below is level with the sidewalk.

Mature trees line many major arterials in Sugar Land, like Williams Trace Boulevard.

A raised crosswalk would provide safer access to Meadow Lake Park

A short section of missing sidewalk on First Colony Boulevard.

Short lengths of sidewalk, like from this street to the lake to the left, can greatly improve pedestrian accessibility.

Pedestrians are able to pass through this fence opening behind Lowe's.

Along First Colony Boulevard near the Triumph Hospital, there is a missing sidewalk on the west side of the street. This critical piece of infrastructure should be completed.

Missing Links

To capture the relative ease by which one could walk between adjacent developments, as opposed to driving, the project team performed travel time surveys. Three different locations were chosen, connecting residential areas to shopping centers and between shopping centers, and surveys took place at mid-day and during the evening.

1530 Colony Lakes Drive to Taaza Market, 130 Kensington Drive

Tuesday, July 10, 2007 at noon and at 7 p.m.

Walk: 2 minutes

Drive: 4 minutes both times

Chuck E. Cheese to 1154 River Crest Drive

Tuesday, July 10, 2007 at 2 p.m. and at 7 p.m.

Walk: 3 minutes (via Oyster Creek levee)

Drive: 6 minutes at 2 p.m.

Drive: 5 minutes at 7 p.m.

JC Penney to Ruby Tuesday (northwest corner of Mall)

Tuesday, July 10, 2007 at 2:15 p.m.

Walk: 3.5 minutes

Drive: 3.5 minutes

The selected points were close together, and average results for an entire neighborhood would be more balanced. A potential future study could perform more surveys at other locations and at different times to obtain a statistically significant outcome. The exercise, though, demonstrates that one can travel between developments with relative ease. Several locations, described below, could benefit from the addition of very short, simple connections.

Cul-de-sacs should be designed so that sidewalk connections are made from the turnaround to adjacent streets or parks. Cul-de-sacs are found throughout the single-family residential neighborhoods of Sugar Land. Although they are popular for the traffic control and sense of privacy they achieve, the lack of connections to other streets can also serve as an obstacle to pedestrian movement, and make walking trips much longer.

There is an opening in the fence between Meadow Lake Park and the Lowe's shopping center. This is clearly not an official break in the fence, and will probably be

repaired soon. Nevertheless, it represents a desired travel path, and facilitates walking from the residential areas to the north and the shopping center to the south.

Pedestrians utilize an opening in the fence between Amesbury Lane and Englewood Place (west of Williams Trace, just south of the bridge south of US 59) to get to adjacent shopping without driving. This should be formalized with a paved connection. Similarly, northeast of the Kensington development there is a walkway along the lake that passes about 20 feet from the Colony Lakes Drive cul-de-sac. A connecting walkway here would facilitate pedestrian trips.

This short sidewalk section should be continued to Amesbury Place in the background.

Mall-to-Theater Connection

The mall ring road is signed 15 mph and has speed bumps. This contrasts to Town Center Boulevard, which has a 30 mph speed limit. A uniform speed limit, possibly 20 mph, would make for a more consistent environment for drivers and pedestrians. Speed bumps are generally not allowed on public streets; flat-top speed tables could be installed instead, and double as raised crosswalks. In addition, sidewalks and possibly bicycle lanes could be added along the ring road.

On the southern side of the ring road between the mall and movie theater is a yellow crosswalk sign and speed bumps. Cutting through the hedgerow there is a well worn path, used by patrons walking from mall to movie. In the pedestrian facility business this is called a "desire line". The desire line should be formalized with a sidewalk. To further facilitate this movement the installation of a raised crosswalk at the ring road is suggested, connected by a direct walkway to the mall entrance. This will require realigning the parking stalls to match the walkway. As a temporary measure the City could consider adding parking bumpers to the stalls in the area so that drivers cannot cut diagonally across the parking lot. The walkway should be well lit. A well-lit sidewalk should also be constructed along the internal road leading to the movie theater.

This walkway needs to connect to Colony Lakes Drive to the left rear.

Pedestrian activity is evidenced by the speed bumps and crossing sign on the mall ring road (above) and the break in the hedges (left).

Bicyclist Trail Additions

Additional Hike and Bike Trails were identified in the Comprehensive Plan as the #1 "want" of the citizens. An additional purpose to this study is to identify and link the Town Center to the Parks & Recreation Department's Citywide Hike-and-Bike Trail System Plan trail plan. While their plan addresses the vast majority of Sugar Land's needs, there are a few additional locations in the Town Center study area where the citywide plan can be augmented.

A path can be extended through the study area, using the existing and proposed paths under the high-tension powerlines. Specifically, it would pass through the stadium grounds, across Lexington Boulevard, along the Mall Ring Road, across US 59 (if an overpass is constructed—see "Other Long-Term Projects"), behind Target, through Meadow Lake Park, behind Lowe's, across Sweetwater Boulevard, and to Ditch H. Following are additional points about this proposed path:

A planned signal at this location on Lexington will allow a safer trail crossing.

- The trail would cross Lexington Boulevard at the corner of the Mall Ring Road. A traffic signal is already planned for this intersection, and the trail could use this signal.
- A new pathway would need to be created between Target and Meadow Lake Park, and from there to behind the Lowe's shopping center.
- A trail should be added along the powerlines between First Colony Boulevard and Ditch H, where there is already a volleyball court. A crosswalk should be placed where this trail crosses First Colony Boulevard (See photo at right.)

A traffic signal should be installed where potential future bicycle trails would cross First Colony Boulevard at this location.

If warranted, a signalized crosswalk should be installed on Lexington Boulevard where the bicycle plan proposes a trail, along the canal which ends at Lexington Boulevard near the movie theater). The crossing would include curb extensions, an extended median, and additional lighting.

Additional trail connections should be made to the FBISD stadium. The bicycle plan proposes trails along the canals near the FBISD stadium on the south side of Lexington Boulevard.

A connection to Ditch H and the proposed path along it can be made to the west of the US 59 and Sweetwater Boulevard intersection. There is an allee (a double line of trees) leading to Ditch H, which would be a suitable location for a connection to that path.

A trail connection from Ditch H to Sweetwater Boulevard could be made along this allee.

Bicycle facilities have been suggested on the Fluor Daniel bridge over Brooks Lake, just east of SH 6. Each span of the bridge has two travel lanes and a narrow, raised sidewalk. Given the restricted width of the bridge, it would not be feasible to add bike lanes. Instead the use of shared-lane markings, or "sharrows," is suggested.

Shared lane markings on the Fluor Daniel bridge would define a bicycle route without eliminating a vehicle travel lane.

Bicycle Racks

Providing safe, accessible locations for bicycle parking is another way to encourage bicycle use. This recommendation is for the purchase of an allotment of U-type bicycle racks, described in the previous chapter, which would then be installed at the request of businesses or other property owners. While some institutions and businesses, particularly schools, already provide bicycle racks, it is not always clear to the public where they are located. Some businesses in the course of the study reported that they have had bike racks in the past, but removed them due to lack of usage. A further refinement of this recommendation could be for institutions or other property owners to install additional signage identifying bicycle parking, similar to what is often done with motor vehicle parking, or to make pointing out those locations part of routine advertising. Making the public more aware of the bike racks could increase their usage.

Other Potential Long-Term Projects

Pedestrian Overpasses of US 59

Due to limited pedestrian comfort at US 59 and SH 6, additional connections across US 59 are desired. These would serve various purposes. First, a vehicle connection would alleviate pressure on the existing crossings (that are often congested); however, more roadways often induce additional traffic, thus negating any gain. Second, a transit system would benefit from direct connections between shopping centers, and the bus could avoid traffic. Third, the non-motorized network would be well served by additional connections. For example walking from Target to the First Colony Mall could become a five minute, not 15 minute, trip. Lastly, the parking concepts discussed below would become much more practical should the study area be better connected.

The clearance under this bridge appears too low to accommodate a pedestrian underpass.

In looking at possible connections, four locations along US 59 were considered: at Oyster Creek, at Town Center Drive and Lake Pointe Drive, directly across from City Hall, and at the high tension wires near Target. Each are discussed in turn below.

At the bridge over Oyster Creek a path along the creek has been suggested. During the team's site visit the water level was quite high, suggesting that this option was not feasible. This bridge is fairly low and visibility (security) issues are also a concern. The photo at right illustrates the constricted passage between the highway and the creek.

Town Center and Lake Pointe Drives are aligned almost exactly across from each other at US 59. As such it seems quite reasonable to connect these two roadways. A vehicle bridge was considered, but the ramps required to bridge the highway would severely impact the shopping centers. A tunnel would create transit, pedestrian and bicycle connectivity, but issues with the water table and the impact of the ramps on the shopping centers make this option unlikely. A ped-bike bridge would be less costly, create a gateway to Sugar Land, and have an iconic design.

US 59, seen in the distance, could be bridged at this powerline crossing southwest of SH 6.

A bridge aligned with City Hall is problematic because at that point US 59 is elevated to pass over SH 6. Any pedestrian overpass would have to be elevated higher than normal to clear the freeway, making the approach ramps prohibitively long. The US 59 approaches to SH 6 extend from Oyster Creek to the high-tension powerline to the southwest.

Where the high-tension wires cross US 59, near the western corner of Sugar Land Town Square, is an attractive option for a pedestrian overpass, as this connects with bicycle routes discussed elsewhere. Because the surrounding area is mainly parking lots, an overpass would not extensively impact existing development (the bridge could not be located directly under the wires). A ped-bike bridge could be a twin to the one suggested at Town Center and Lake Pointe Drives.

Transit System

Numerous public comments suggested possible scenarios for a local shuttle service, similar to what has recently begun in the Woodlands Town Center, north of Houston. Without further study, particularly origin-destination surveys, it is difficult to predict the viability of transit in Sugar Land. Nevertheless, local transit service supports the other recommendations discussed in this report. Service between various shopping centers could reduce vehicle trips and congestion in the area.

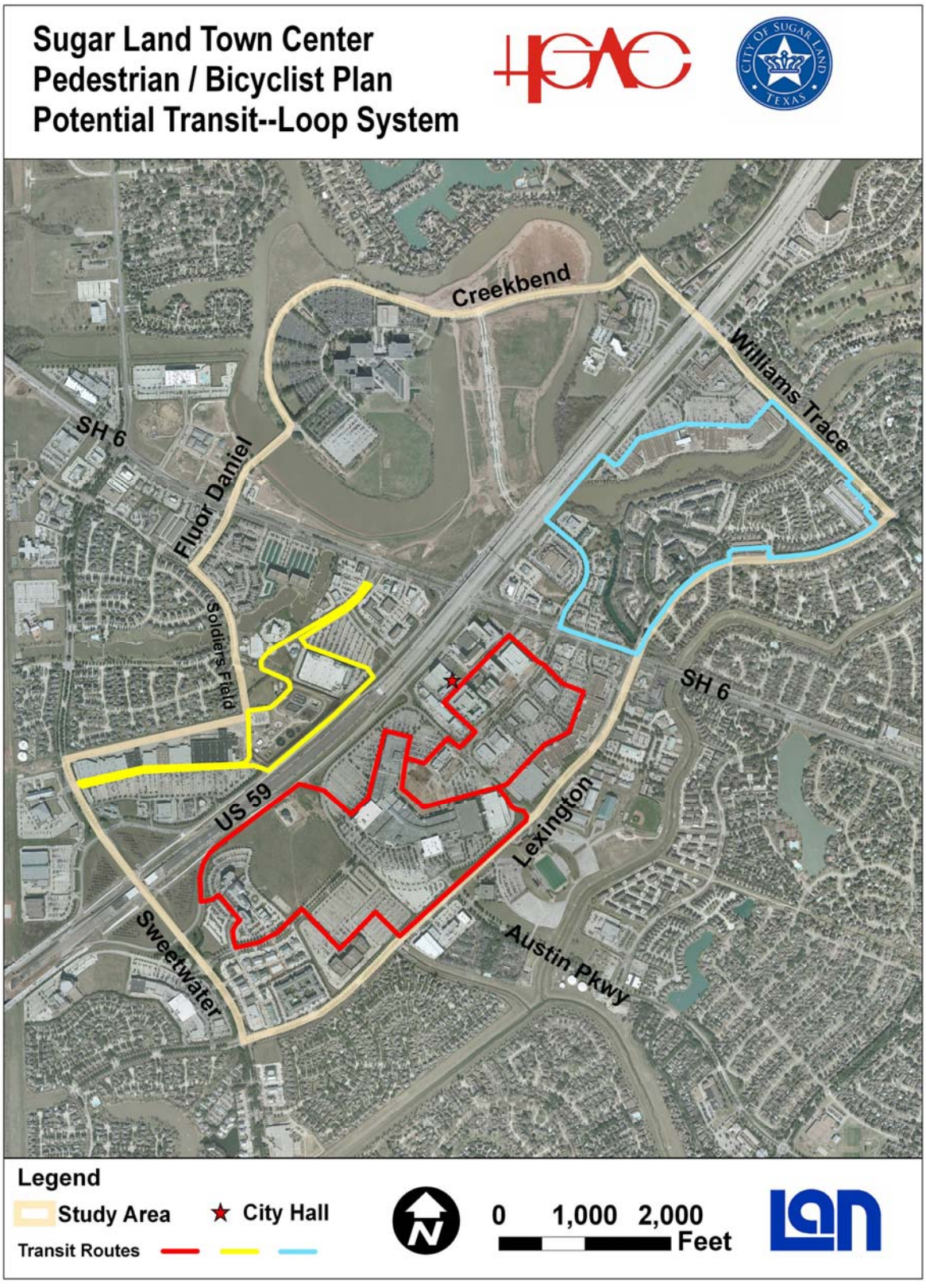
The process of designing local transit service for Sugar Land begins with identifying the locations that would generate service demand, which here are high-activity streets and major commercial buildings. Public input also suggested possible routes. The maps on the following pages illustrate conceptual plans for transit operations.

The first map, Transit Option 1, explores how a service would serve existing developments. Essentially one would use a one-way loop system which would not cross major roadways to avoid congestion. Note the double service at the mall. One-way loops, however, are inherently problematic in that patrons have to travel a complete circuit to return to their destination. It is questionable whether this type of service would be viable. Ridership potential is also limited by the routes not crossing major arterials (the major barrier to pedestrians).

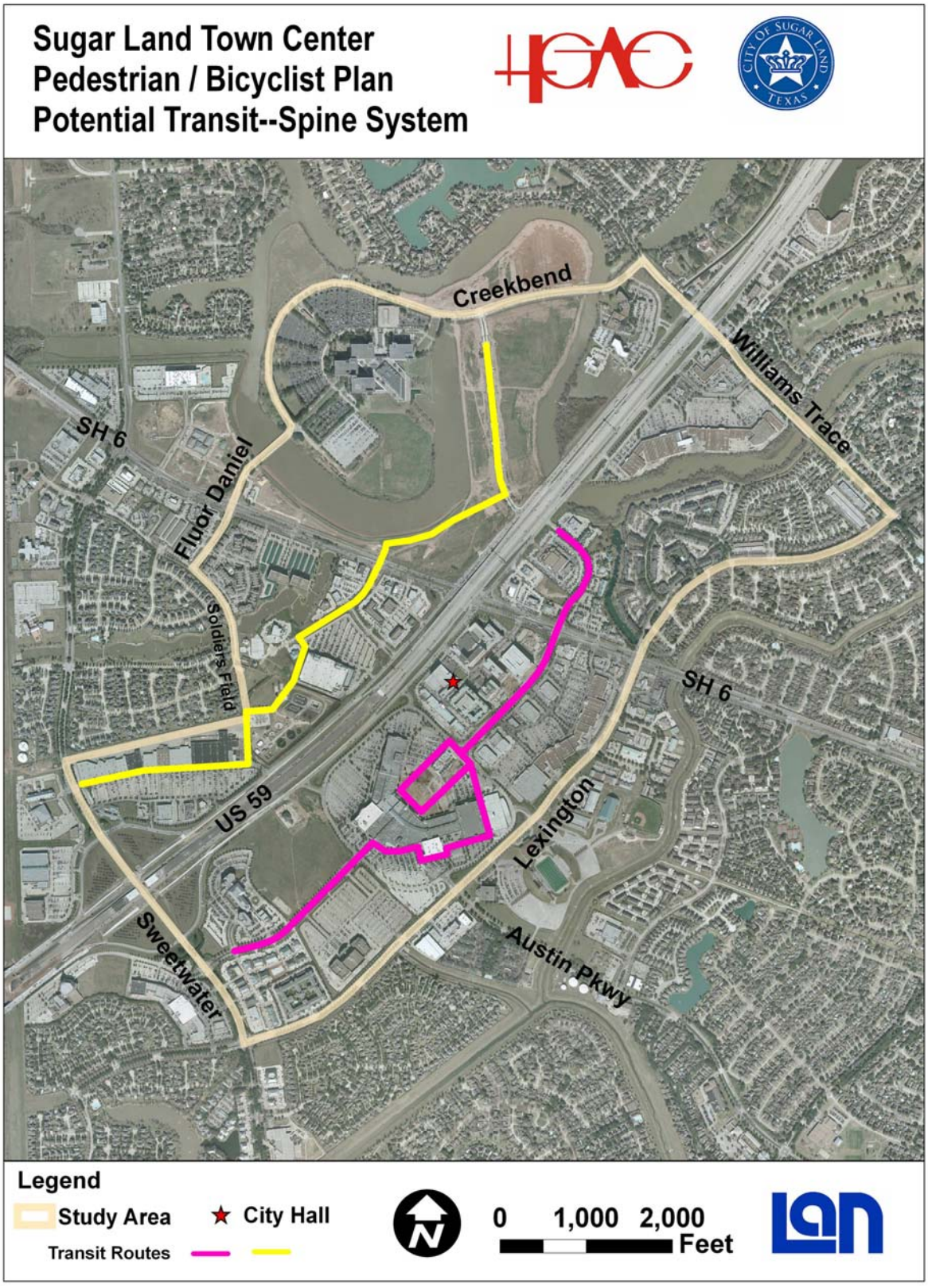
The second map, Transit Option 2, examines transit spines along the major streets into and out of developments: Town Center Boulevard, Town Center Drive, Kensington Drive, Lake Pointe Drive. Spines are preferable to loops for they create a recognizable, two-way corridor and businesses can locate accordingly. Two connections would need to be created: between Kensington Drive and the Lowe's shopping center, and around Brooks Lake to Lake Pointe Drive (behind the Whole Foods). Alternatively, transit connections across US 59 could be made at the locations of the potential pedestrian overpasses, perhaps with a combination transit-and-pedestrian overpass.

The last map, Transit Option 3, combines a loop and spine system to serve both existing and future development. There are four routes which all converge on City Walk and the First Colony Mall, providing short headways and easy transfers. As in the spine system, additional links across US 59 would provide improved routing options. This service plan is viable in the medium term and it is recommended that the city conduct a more detailed study.

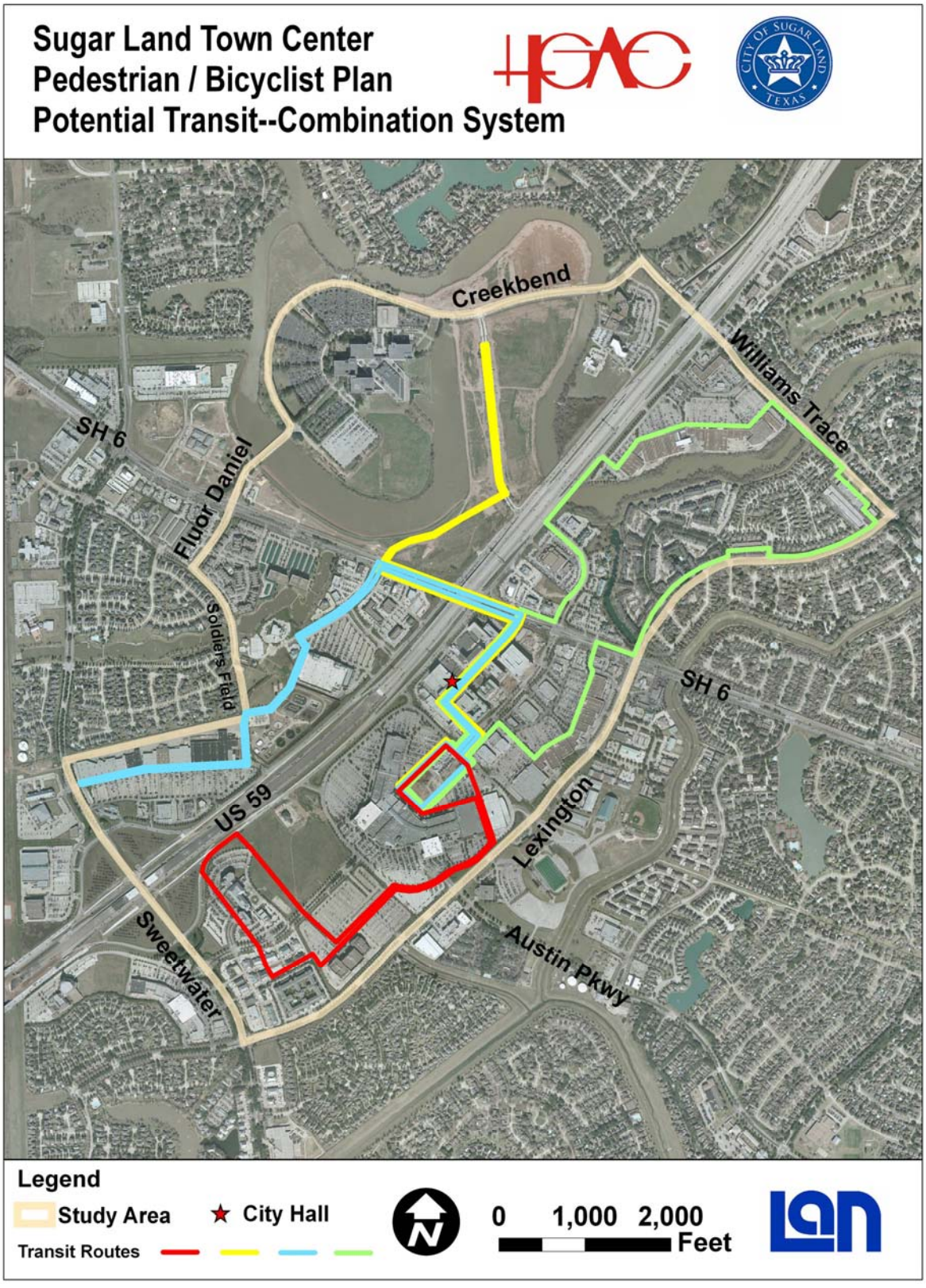
Transit Option 1: Loop-Based System



Transit Option 2: Spine-Based System



Transit Option 3: Combination Loop and Spine System



Development of Estimated Costs for Proposed Improvements

Planning-level cost estimates were developed for the potential improvements, based on the TxDOT Construction Average Unit Prices, compiled August 2007. The project team evaluated sidewalks, crosswalks, stop bars and curb ramps at intersections and other locations identified during the study. Those cost estimates are based on installing curb ramps where they are missing, refreshing striping of crosswalks at signalized intersections, and constructing new sections of sidewalks where they are missing.

Sugar Land Pedestrian/Bicyclist Plan
Cost Estimates--Unit Prices (2007 $)

All item descriptions are taken from the TxDOT Construction 12-Month Average Unit Price, August 2007
http://www.dot.state.tx.us/business/avgd.htm

	TxDOT Description	QTY	Unit	Unit Price	Total Price
Signage:					
Stop sign	INSTALL SMALL ROADSIGN		EA	$ 350.00	$ - /EA
"Yield to Pedestrians in Crosswalks" sign	INSTALL SMALL ROADSIGN		EA	$ 350.00	$ - /EA
Bike Route sign	INSTALL SMALL ROADSIGN		EA	$ 350.00	$ - /EA
Striping:					
Stop Bars	REFL PAV MRK (WHT) 24" (SLD 100 MIL)		LF	$ 6.20	$ 6.20 /LF
Standard Crosswalk Edges (but see below)	REFL PAV MRK (WHT) 12" (SLD 100 MIL)		LF	$ 3.75	$ 2.16 /LF
Bicycle arrow on street	REFL PAV MRK (WHT) (BIKE ARW)		EA	$ 76.51	$ 76.51 /EA
Bicycle stencil on street	REFL PAV MRK (WHT) (BIKE SYML)		EA	$ 80.17	$ 80.17 /EA
8" White Edgeline	REFL PAV MRK (WHT) 8" (SLD)		LF	$ 1.11	$ 1.11 /LF
Concrete Demolition:					
Sidewalks	REMOVING CONC (SIDEWALKS)		SY	$ 6.50	$ 6.50 /SY
Concrete Installation:					
Sidewalks:	CONC SIDEWALKS (6")		SY	$ 100.00	$ 100.00 /SY
Curb Ramp: 6" curb	CURB RAMP (TYPE 1)		EA	$ 1,600.00	$ 1,600.00 /EA
	DETECTABLE WARNING PAVERS				
Curb Ramp: 12" curb	calculated at twice the price of a 6" (twice the length)		EA		$ 3,200.00 /EA
Speed Hump*			EA	$ 1,800.00	/EA
Other:					
Decomposed Granite Trail	Per square foot (see note below)		SF	$ 5.00	$ 5.00 /SF
	Per linear foot if trail 5' wide		LF		$ 25.00 /LF
Light Fixture for Underpass			EA	$ 1,000.00	$ 1,000.00 /EA
Sidewalk Railing	RAIL (HANDRAIL)		LF	$ 60.00	$ 60.00 /LF
Ped Pole Installation	PED POLE ASSEMBLY		EA	$ 1,000.00	$ 1,000.00 /EA
Push Button Installation	PED DETECT (2 INCH PUSH BTN)		EA	$ 125.00	$ 125.00 /EA
Ped Signal Heads Installation	PED SIG SEC (12 IN) LED	2	EA	$ 500.00	$ 1,000.00 /EA
	PED XING PACKAGE TOTAL				$ 2,125.00 /EA
Push Button Removal	REMOVAL OF PED PUSH BTNS		EA	$ 100.00	$ 100.00 /EA
Remove Traffic Signal	REMOVING TRAFFIC SIGNALS		EA	$ 2,000.00	$ 2,000.00 /EA
High-Visibility Crosswalk					
For a ladder-style crosswalk, assume 24" striping 6' wide:		6	LF	$ 6.20	$ 37.20 /EA
24" stripe followed by a 24" space means each 24" stripe serves 4' of crossing distance.					
For 1' of linear crossing distance, divide the stripe price by 4:		4	LF/EA		$ 9.30 /LF
This is the price for the "ladder rungs." The sides are standard 12" stripes (2 sides)		2	LF/EA	$ 3.75	$ 7.50 /LF
Price per linear foot of crosswalk is the sum of the "rungs" and sides:					$ 16.80 /LF

Handrails have many types; average TxDOT cost is about $60.00/LF
Decomposed granite trail price estimated at $5.00/SF
City of San Antonio Park Plan estimated cost at $4.00/SF in 2005
Similar trails in California (state average per City of West Covina) cost $3.00/SF in 2003.

**No specific TxDOT pay item for speed humps; City of Corpus Christi estimates $1,500 to $2,000 each.*
Institute of Transportation Engineers estimates $2,000 each. City of Abilene estimates $1,000 to $2,000 each.

SH 6 Crossing Improvements -- 2007 $

New signage, crosswalks, curb ramps, stop bars, and pedestrian signals

Location 1
SH 6 at US 59 Intersection

Item	Number	Ft. Each	Total	$ Each	$ Total	
New Curb Ramp (count)			22	$ 1,600.00	$ 35,200.00	
New Sidewalk (linear ft)			2000	$ 55.56	$ 111,120.00	*
New Crosswalks across SH 6 (one side)	8	60	480	$ 16.80	$ 8,064.00	**
New Crosswalks across US 59 feeder	4	70	280	$ 16.80	$ 4,704.00	
Stop Bars across SH 6 (one side)	4	50	200	$ 6.20	$ 1,240.00	
Stop Bars across US 59 feeder	2	60	120	$ 6.20	$ 744.00	
Sidewalk Railing	2	275	550	$ 60.00	$ 33,000.00	
Underpass Light Fixtures			18	$ 1,000.00	$ 18,000.00	
Pedestrian Signal Heads			16	$ 500.00	$ 8,000.00	
TOTAL					**$ 220,072.00**	
				Rounded Total	**$ 220,100.00**	

Location 2
SH 6 North of US 59

Item	Number	Ft. Each	Total	$ Each	$ Total	
New Curb Ramp (count)			14	$ 1,600.00	$ 22,400.00	
New Sidewalk (linear ft)			700	$ 55.56	$ 38,892.00	*
New Crosswalks across SH 6	4	120	480	$ 16.80	$ 8,064.00	**
New Crosswalks across side street	3	50	150	$ 16.80	$ 2,520.00	
Stop Bars across SH 6	2	50	100	$ 6.20	$ 620.00	
Stop Bars across side street	2	25	50	$ 6.20	$ 310.00	
Pedestrian Signal Heads			8	$ 500.00	$ 4,000.00	
TOTAL					**$ 76,806.00**	
				Rounded Total	**$ 76,800.00**	

Location 3
SH 6 South of US 59

Item	Number	Ft. Each	Total	$ Each	$ Total	
New Curb Ramp (count)			8	$ 1,600.00	$ 12,800.00	
New Crosswalks across SH 6	4	120	480	$ 16.80	$ 8,064.00	**
New Crosswalks across City Walk	1	50	50	$ 16.80	$ 840.00	
New Crosswalks across Town Ctr or Lex.	4	100	400	$ 16.80	$ 6,720.00	
Stop Bars across SH 6 (one side)	4	50	200	$ 6.20	$ 1,240.00	
Stop Bars across City Walk	1	25	25	$ 6.20	$ 155.00	
Stop Bars across Town Ctr or Lexington	4	40	160	$ 6.20	$ 992.00	
Reprogram Traffic Signal			1	$ -	$ -	
TOTAL					**$ 30,811.00**	
				Rounded Total	**$ 30,800.00**	

**$100/sy for new sidewalks = $11.11/sf*
*sidewalks 5' wide, so 5 SF = 1 linear foot = $11.11 * 5 = $55.56/ft*
***24" striping, 6' wide = $6.20 * 6 = $37.20/stripe*
24" stripe followed by a 24" space means each 24" stripe serves 4' of crossing distance.
For 1' of linear crossing distance, divide the stripe price by 4. $37.20 / 4 = $9.30/ft
$9.30/ft for the "ladder rungs."
The "ladder sides" are standard 12" stripes at $3.75/ft, so $7.50/ft for both sides.
$9.30 (rungs) + $7.50 (sides) = $16.80/linear ft

Other Pedestrian Improvements -- 2007 $

New signage, crosswalks, curb ramps, stop bars, and pedestrian signals

Location 4
Town Center Boulevard North

Item	Number	Ft. Each	Total	$ Each	$ Total
New Crosswalks across Town Center	7	100	700	$ 16.80	$ 11,760.00
New Crosswalks across side street	8	40	320	$ 16.80	$ 5,376.00
Stop Bars across Town Center	6	40	240	$ 6.20	$ 1,488.00
Stop Bars across side street	6	20	120	$ 6.20	$ 744.00
Stop Signs			12	$ 350.00	$ 4,200.00
"Yield to Pedestrians" Sign			1	$ 350.00	$ 350.00
TOTAL					**$ 23,918.00**
				Rounded Total	**$ 23,900.00**

Location 5
Sugar Land Town Square

Item	Number	Ft. Each	Total	$ Each	$ Total
Stop Signs			1	$ 350.00	$ 350.00
"Yield to Pedestrians" Sign			1	$ 350.00	$ 350.00
Stop Bars	14	15	210	$ 6.20	$ 1,302.00
Speed Hump			1	$ 1,800.00	$ 1,800.00
New Full Crosswalk	1	40	40	$ 16.80	$ 672.00
New Crosswalk Outlines	12	30	360	$ 7.50	$ 2,700.00
TOTAL per intersection					**$ 7,174.00**
				Rounded Total	**$ 7,200.00**

Location 6
Near Fluor Daniel Offices

Item	Number	Ft. Each	Total	$ Each	$ Total
New Sidewalk (linear ft)			2250	$ 55.56	$ 125,010.00
Bicycle "Sharrow" markings			2	$ 80.17	$ 160.34
TOTAL per intersection					**$ 125,170.34**
				Rounded Total	**$ 125,200.00**

**$100/sy for new sidewalks = $11.11/sf*
*sidewalks 5' wide, so 5 SF = 1 linear foot = $11.11 * 5 = $55.56/ft*

***24" striping, 6' wide = $6.20 * 6 = $37.20/stripe*
24" stripe followed by a 24" space means each 24" stripe serves 4' of crossing distance.
For 1' of linear crossing distance, divide the stripe price by 4. $37.20 / 4 = $9.30/ft
$9.30/ft for the "ladder rungs."
The "ladder sides" are standard 12" stripes at $3.75/ft, so $7.50/ft for both sides.
$9.30 (rungs) + $7.50 (sides) = $16.80/linear ft

**** 12" stripe on each side of existing bricks = $3.75/ft, so $7.50/ft for both sides.*

Other Pedestrian Improvements -- 2007 $

New signage, crosswalks, curb ramps, stop bars, and pedestrian signals

Location 7
Meadow Lake Park area

Item	Number	Ft. Each	Total	$ Each	$ Total	
New Sidewalk (linear ft)			100	$ 55.56	$ 5,556.00	*
New Crosswalks	1	50	50	$ 16.80	$ 840.00	**
Raised Crosswalks	1	50	50	$ 55.56	$ 2,778.00	***
TOTAL					**$ 9,174.00**	
				Rounded Total	**$ 9,200.00**	

Location 8
Southeast Quadrant of SH 6 and US 59

Item	Number	Ft. Each	Total	$ Each	$ Total	
New Sidewalk (linear ft)			1700	$ 55.56	$ 94,452.00	*
New Crosswalks	1	100	100	$ 16.80	$ 1,680.00	**
Sidewalk Railing			300	$ 60.00	$ 18,000.00	
TOTAL					**$ 114,132.00**	
				Rounded Total	**$ 114,100.00**	

Location 9
Williams Trace Boulevard area

Item	Number	Ft. Each	Total	$ Each	$ Total	
New Curb Ramp (count)			16	$ 1,600.00	$ 25,600.00	
New Gravel Trail			2000	$ 25.00	$ 50,000.00	
New Sidewalk (linear ft)			50	$ 55.56	$ 2,778.00	*
New Crosswalks across US 59 feeder	4	70	280	$ 16.80	$ 4,704.00	
New Crosswalks across other street	10	100	1000	$ 16.80	$ 16,800.00	
Stop Bars across US 59 feeder	2	60	120	$ 6.20	$ 744.00	
Stop Bars across other street	9	40	360	$ 6.20	$ 2,232.00	
Various traffic signs			12	$ 400.00	$ 4,800.00	
Pedestrian Signal Heads, poles and buttons			4	$ 2,125.00	$ 8,500.00	
TOTAL					**$ 116,158.00**	
				Rounded Total	**$ 116,200.00**	

**$100/sy for new sidewalks = $11.11/sf*
*sidewalks 5' wide, so 5 SF = 1 linear foot = $11.11 * 5 = $55.56/ft*

***24" striping, 6' wide = $6.20 * 6 = $37.20/stripe*
24" stripe followed by a 24" space means each 24" stripe serves 4' of crossing distance.
For 1' of linear crossing distance, divide the stripe price by 4. $37.20 / 4 = $9.30/ft
$9.30/ft for the "ladder rungs."
The "ladder sides" are standard 12" stripes at $3.75/ft, so $7.50/ft for both sides.
$9.30 (rungs) + $7.50 (sides) = $16.80/linear ft

****Raised crosswalk priced as equivalent to sidewalk (as it is constructed on top of existing pavement)*

Other Pedestrian Improvements -- 2007 $

New signage, crosswalks, curb ramps, stop bars, and pedestrian signals

Location 10
First Colony Boulevard area

Item	Number	Ft. Each	Total	$ Each	$ Total	
New Curb Ramp (count)			4	$ 1,600.00	$ 6,400.00	
New Sidewalk (linear ft)			800	$ 55.56	$ 44,448.00	*
New Crosswalks across First Colony	2	100	200	$ 16.80	$ 3,360.00	**
New Crosswalks across Colony Square	2	40	80	$ 16.80	$ 1,344.00	
Stop Bars across First Colony	2	50	100	$ 6.20	$ 620.00	
Stop Bars across Colony Square	2	20	40	$ 6.20	$ 248.00	
TOTAL					**$ 56,420.00**	
				Rounded Total	**$ 56,400.00**	

Location 11
North Side of Mall

Item	Number	Ft. Each	Total	$ Each	$ Total	
New Crosswalks	3	100	300	$ 16.80	$ 5,040.00	**
Concrete demolition			1600	$ 3.61	$ 5,777.78	
Stop Signs			4	$ 350.00	$ 1,400.00	
Traffic Signal Removal			1	$ 2,000.00	$ 2,000.00	
TOTAL					**$ 14,217.78**	
				Rounded Total	**$ 14,200.00**	

Location 12
Theater and South Side of Mall

Item	Number	Ft. Each	Total	$ Each	$ Total	
New Crosswalks across Town Center	2	100	200	$ 16.80	$ 3,360.00	**
New Crosswalks across side street	2	40	80	$ 16.80	$ 1,344.00	
Stop Bars across Town Center	2	40	80	$ 6.20	$ 496.00	
Stop Bars across side street	2	20	40	$ 6.20	$ 248.00	
Stop Signs			4	$ 350.00	$ 1,400.00	
New Sidewalk (linear ft)			600	$ 55.56	$ 33,336.00	*
New Sidewalk (linear ft) PRIVATE PROPERTY			800	$ 55.56	$ 44,448.00	*
TOTAL					**$ 84,632.00**	
				Rounded Total	**$ 84,600.00**	

**$100/sy for new sidewalks = $11.11/sf*
*sidewalks 5' wide, so 5 SF = 1 linear foot = $11.11 * 5 = $55.56/ft*

***24" striping, 6' wide = $6.20 * 6 = $37.20/stripe*
24" stripe followed by a 24" space means each 24" stripe serves 4' of crossing distance.
For 1' of linear crossing distance, divide the stripe price by 4. $37.20 / 4 = $9.30/ft
$9.30/ft for the "ladder rungs."
The "ladder sides" are standard 12" stripes at $3.75/ft, so $7.50/ft for both sides.
$9.30 (rungs) + $7.50 (sides) = $16.80/linear ft

Other Pedestrian Improvements -- 2007 $

New signage, crosswalks, curb ramps, stop bars, and pedestrian signals

Location 13
Sweetwater Boulevard and Methodist Hospital

Item	Number	Ft. Each	Total	$ Each	$ Total	
New Curb Ramp (count)			16	$1,600.00	$ 25,600.00	
New Crosswalks across street	10	100	1000	$ 16.80	$ 16,800.00	*
New Crosswalks across driveway	2	40	80	$ 16.80	$ 1,344.00	
Stop Bars across street	10	40	400	$ 6.20	$ 2,480.00	
Stop Bars across driveway	2	20	40	$ 6.20	$ 248.00	
Stop Signs			4	$ 350.00	$ 1,400.00	
TOTAL					**$ 47,872.00**	
				Rounded Total	**$ 47,900.00**	

Location 14
Lexington Boulevard at Austin Parkway

Item	Number	Ft. Each	Total	$ Each	$ Total
New Curb Ramp (count)			8	$1,600.00	$ 12,800.00
TOTAL					**$ 12,800.00**
				Rounded Total	**$ 12,800.00**

**24" striping, 6' wide = $6.20 * 6 = $37.20/stripe*
24" stripe followed by a 24" space means each 24" stripe serves 4' of crossing distance.
For 1' of linear crossing distance, divide the stripe price by 4. $37.20 / 4 = $9.30/ft
$9.30/ft for the "ladder rungs."
The "ladder sides" are standard 12" stripes at $3.75/ft, so $7.50/ft for both sides.
$9.30 (rungs) + $7.50 (sides) = $16.80/linear ft

Bicycle Racks (Improvement #15)

U-Type Racks
Also referred to as "hoops" or "arches."

www.dero.com Nick Mason 888-337-6729
25% off 100 or more
Shipping costs $1,200 per lot of 100
(calculated Minneapolis to zip 77479)

	U-type
standard galvanized	$ 95.00
black rubber-coated	$ 135.00

For 100 Racks:	Racks:	$ 9,500.00
	Shipping	$ 1,200.00
	TOTAL	$ 10,700.00
For 200 Racks:		**$ 21,400.00**
For 300 Racks:		$ 32,100.00
For 400 Racks:		$ 42,800.00
For 500 Racks:		$ 53,500.00

Other Bicycle Improvements -- 2007 $

New signage, crossings, trails

Location 16
Overall Trail Additions

Item	Number	Ft. Each	Total	$ Each	$ Total	
New Bicycle Trails						*
North side of US 59			5000	$ 88.89	$ 444,450.00	
East of First Colony Mall			2100	$ 88.89	$ 186,669.00	
Canal to Lexington (near FBISD stadium)			1150	$ 88.89	$ 102,223.50	
US 59/Sweetwater to Ditch "H"			800	$ 88.89	$ 71,112.00	
New Crosswalks across street	1	100	100	$ 16.80	$ 1,680.00	**
Stop Signs			1	$ 350.00	$ 350.00	
TOTAL					**$ 806,484.50**	
				Rounded Total	**$ 806,500.00**	

Location 17
Bicycle Signal on Lexington

Item	Number	Ft. Each	Total	$ Each	$ Total	
New Traffic Signal			1		$ 60,700.00	
New Stop Bars	2	25	50	$ 6.20	$ 310.00	
New Crosswalks across street	2	100	200	$ 16.80	$ 3,360.00	**
TOTAL					**$ 64,060.00**	
				Rounded Total	**$ 64,100.00**	

**Bike trail assumed similar to concrete sidewalk, 8' wide rather than 5'.*
*$55.56 / LF (5' wide) / 5 * 8 = $88.89 / LF (8' wide)*

***24" striping, 6' wide = $6.20 * 6 = $37.20/stripe*
24" stripe followed by a 24" space means each 24" stripe serves 4' of crossing distance.
For 1' of linear crossing distance, divide the stripe price by 4. $37.20 / 4 = $9.30/ft
$9.30/ft for the "ladder rungs."
The "ladder sides" are standard 12" stripes at $3.75/ft, so $7.50/ft for both sides.
$9.30 (rungs) + $7.50 (sides) = $16.80/linear ft

Potential Improvement #17 considers the installation of the traffic signal as a lump-sum pay item.

Signalized Pedestrian Crossing (used in Improvement #17) -- 2007 $

Item #	Series	Description		Total	Unit Cost	Total
416	2004	DRILL SHAFT (36 IN)	LF	30	$ 175.00	$ 5,250.00
618	2019	CONDT (PVC) (SCHD 40) (2") (BORE)	LF	150	$ 11.00	$ 1,650.00
620	2009	ELEC CONDR (NO. 6) BARE	LF	150	$ 1.00	$ 150.00
620	2010	ELEC CONDR (NO. 6) INSULATED	LF	50	$ 1.20	$ 60.00
624	2002	GROUND BOX TY 1 (122422) W/APRON	EA	3	$ 1,000.00	$ 3,000.00
625	2001	ZINC-COAT STL WIRE STRAND (5/16 IN)	LF	480	$ 2.10	$ 1,008.00
625	2002	ZINC-COAT STL WIRE STRAND (3/16 IN)	LF	200	$ 1.70	$ 340.00
628	2125	ELC SRV TY D 120/240 100 (NS)SS(N)SP(O)	EA	1	$ 2,700.00	$ 2,700.00
636	2001	ALUMINUM SIGNS (TY A)	SF	90	$ 26.00	$ 2,340.00
666	2048	REFL PAV MRK TY I (W) 24"(SLD)(100MIL)	LF	300	$ 3.40	$ 1,020.00
666	2157	REFL PAV MRK TY II (W) 24"(SLD)(100MIL)	LF	300	$ 0.90	$ 270.00
680	2002	INSTALL HWY TRF SIG (ISOLATED)	EA	1	$ 7,200.00	$ 7,200.00
682	2001	BACK PLATE (12 IN) (3 SEC)	EA	4	$ 72.00	$ 288.00
682	2014	PED SIG SEC (12 IN) LED (2 INDICATIONS	EA	2	$ 400.00	$ 800.00
682	2023	VEH SIG SEC (12 IN) LED (GRN)	EA	4	$ 230.00	$ 920.00
682	2025	VEH SIG SEC (12 IN) LED (YEL)	EA	4	$ 200.00	$ 800.00
682	2027	VEH SIG SEC (12 IN) LED (RED)	EA	4	$ 200.00	$ 800.00
684	2009	TRF SIG CBL (TY A) (12 AWG) (4 CONDR)	LF	300	$ 1.40	$ 420.00
684	2012	TRF SIG CBL (TY A) (12 AWG) (7 CONDR)	LF	400	$ 1.80	$ 720.00
685	2003	INSTL RDSD FLSH BEACON ASSM(SOLAR PWRD)	EA	2	$ 5,800.00	$ 11,600.00
686	2015	INS TRF SIG PL AM(S) STR (TY C)(36')	EA	2	$ 4,500.00	$ 9,000.00
688	2001	PED DETECT (2 INCH PUSH BTN)	EA	2	$ 120.00	$ 240.00
Sub-Total						**$ 50,576.00**
Contingency (20%)						$ 10,115.20
TOTAL						**$ 60,691.20**
					Rounded Total	**$ 60,700.00**

The development of a transit system in the study area was not priced. This improvement, for which there are many variables, is considered long-term and deserving of additional study before design concepts are developed.

Pedestrian overpasses, while also having many variables in terms of design, can be estimated to cost upwards of $5-6 million each. The following table illustrates construction costs for five representative bridges throughout the country. The most similar bridges would be the final two, in Columbia and Austin. With US 59 requiring a bridge somewhere in between those two in length, the price could be estimated at $5,600,000 in 2002 dollars, approximately $6,300,000 with five years of inflation.

Survey of Pedestrian Overpasses

Year	Location	What it Crosses	Cost	Reference
1992	Phoenix, AZ	Greenway Parkway (7 lanes)	$ 985,000	http://www.walkinginfo.org/pedsafe
1994	San Diego, CA	Washington St. (4 lanes in canyon)	$ 1,200,000	http://www.walkinginfo.org/pedsafe
1998	Maitland, FL	US 17-92 (5 lanes) and CSX Railroad	$ 2,132,805	http://www.dot.state.fl.us/
2001	Austin, TX	Colorado River (700 feet)	$ 7,000,000	http://www.walkinginfo.org/pedsafe
2003	Columbia, SC	SH 277 freeway (6 lanes)	$ 4,200,000	http://www.thestate.com/

Cost Estimate Summary

The total, shown below, is for all priced projects. By the terms of the federal grant by which H-GAC funds the Pedestrian and Bicycle Districts improvements, the sponsoring agency (in this case the City of Sugar Land) must pay for 20% of the cost of improvements. In-kind services are not countable towards this total; it must be actual dollars spent.

Sugar Land Pedestrian/Bicyclist Plan
Overall Cost Estimates -- 2007 $

Code #	Description		Estimate
1	SH 6 at US 59 Crossing Improvements	$	220,000.00
2	SH 6 Crossing Improvements: North of US 59	$	77,000.00
3	SH 6 Crossing Improvements: South of US 59	$	31,000.00
4	Pedestrian Improvements - Town Center Boulevard North	$	24,000.00
5	Pedestrian Improvements - Sugar Land Town Square	$	7,000.00
6	Pedestrian/Bicyclist Improvements near Fluor Daniel offices	$	125,000.00
7	Pedestrian Improvements - Meadow Lake Park area	$	9,000.00
8	Pedestrian Improvements - Southeast Quadrant of SH 6 and US 59	$	114,000.00
9	Pedestrian Improvements - Williams Trace Boulevard area	$	116,000.00
10	Pedestrian/Bicyclist Improvements - First Colony Boulevard area	$	56,000.00
11	Pedestrian Improvements - North Side of Mall	$	14,000.00
12	Pedestrian Improvements - Theatre and South Side of Mall	$	85,000.00
13	Pedestrian Improvements - Sweetwater Boulevard and Methodist Hospital	$	48,000.00
14	Pedestrian Improvements - Lexington and Austin	$	13,000.00
15	Bike Racks at Businesses/Destinations	$	21,000.00
16	Bicycle Improvements - Overall Study Area	$	807,000.00
17	Bicycle Signal on Lexington	$	64,000.00
SUB-TOTAL		**$**	**1,831,000.00**
20% Contingency		$	366,000.00
GRAND TOTAL		**$**	**2,198,000.00**
FEDERAL SHARE (80%)		$	1,758,000.00
LOCAL MATCH (20%)		**$**	**440,000.00**

Pedestrian bridges are considered separately (see text on previous page).
Estimated cost for each pedestrian bridge is $6,000,000 +
Cost estimates were not generated for Improvement # 19, Transit Service, due to the number of variables involved for a long-term programmatic improvement.

The Sugar Land City Council, at this time of this report writing, was scheduled to meet after the conclusion of the study, to consider the funding of the potential improvements identified in this report. Further information on the disposition of the funding is available from the City of Sugar Land.

Policy and Planning Recommendations—Pedestrians

Following are general suggestions to improve the pedestrian experience:

The Americans with Disability Act requires sidewalks to be at least five feet wide to allow two people in wheelchairs to pass each other. This also allows two people pushing strollers to walk together.

Construct sidewalks straight (not curved) to facilitate efficient travel. Curved / serpentine sidewalk alignments assume that everyone afoot is on a recreational stroll. If people are expected to use the study area as a park-once district, they will desire the most efficient route possible.

Make sidewalks continuous across driveways; the driveway should ramp up. Cross slope of the sidewalk is limited to 2% (1:50).

Do not block continuous paths of travel with hedges, fences or other obstacles which block walkways. Formal links should be created where people already walk.

Install crosswalks on all legs of all intersections; they must be straight (no bends at medians) and aligned with the sidewalk. Sidewalks should not bend to meet the crosswalks or pedestrian ramp.

All medians should extend through crosswalks to protect waiting pedestrians. Narrow medians should be cut at the crosswalk. Some examples in the study area are shown on the following page.

Where significant sustained pedestrian flows exist, the city should consider having signal timing plans include a pedestrian phase each cycle. Priority then could be given to pedestrians via leading pedestrian intervals.

Provide crossings for pedestrians according to their desire lines, not the vehicle network. Mid-block crossings should be provided if necessary to facilitate pedestrian travel. The design of the crossing (marked crosswalk, signal, refuge island) is dependent on vehicle speed and volume and roadway width.

This is a good example of a connection through a hedge break to the corner of a parking area.

This sidewalk takes an indirect route to its destination and thus adds travel time.

This sidewalk provides a useful connection from the driveway in the foreground to the parking area behind the buildings.

The curve in this sidewalk may lead blind or visually- impaired pedestrians into the intersection at the wrong angle.

If traffic or signal timing requires pedestrians to cross the roadway one side at a time, median refuges provide a sense of safety. Cut-throughs can be at grade, or have a ramp at either end.

Policy and Planning Recommendations—Parking

Park-Once District

Sugar Land is typical of area cities in that people will often stop and park at one business, then drive a short distances to park at a second or third stop, even if they are within comfortable walking distance. This trip chaining pattern of many short trips and frequent turns into and out of parking lots can substantially worsen congestion in the area, as well as contribute to greater air pollution. The resulting congestion is a direct effect of large-lot, single-use parcels with individual curb cuts and no interconnectivity between adjacent lots. A Park Once district, in contrast, uses shared parking facilities to allow visitors to park once, and walk or take a shuttle between different destinations.

Shared Parking

The Urban Land Institute's publication *Shared Parking* states that a mixed-use area is more economically viable because it efficiently uses the same parking for multiple land uses at differing peak demand times, therefore reducing the total parking needed in an area. Shared parking is a necessary prerequisite for creating a park-once environment, which additionally needs supportive transit, non-motorized transportation alternatives, and compact development to make destinations seem closer. The fact that people at the community meetings asked for a park-once district puts Sugar Land ahead of the game because it means they are willing to walk and take transit.

There are many examples of parking reserved for customers only, such as at TGI Friday's restaurant. In contrast, the study area already has a precedent of a shared-parking arrangement. Since 2000, the AMC movie theater has allowed the Trek Express commuter bus to use a small portion of its parking lot as a park-and-ride location. Trek has set up two tents in the AMC parking lot to shade commuters' cars during the day and AMC is indemnified in the insurance policy. New management at AMC has since taken over and wants to charge Trek for the space, but is allowing Trek to stay until its new location at the University of Houston at Sugar Land, is complete.

To facilitate shared parking, adjacent surface lots should be connected to create internal street networks. Several communities have successfully interconnected parking and access across adjacent parcels through their access management plans. For instance, the Genesee/Finger Lakes Regional Council in New York has developed a guidebook[1] for enhancing access management for several high-volume commercial corridors in the region. Their plan promotes safety of pedestrians and efficiency of travel.

By working with developers to coordinated a public parking system, the City would be taking the critical step towards circulating people rather than vehicles in the study area, and allow planners to make better-informed district-wide assessments for where to allow parking and how much is really necessary.

Signage (above) and shelters (below) at the TrekExpress pick-up point.

Parking Management and Pricing

City Walk is one of the few locations in the study area that has a form of parking management—meters. Most other parking is free and open to the public. The Sugar Land Town Square Parking Association (through the Sugar Land Town Square Management Company) sets the rates, collects the revenue, and enforces the parking restrictions for the meters along City Walk, Lone Star Drive, Texas Drive, and Town Square Place. Planned Community Development installed the meters, which were activated and enforced beginning in May 2006. Annual gross revenue is about $300 per day for 5 days a week, or about $78,000 per year. All revenue beyond what is required for maintenance and enforcement—about $12,000 per year—is donated to the Plaza Account, which brings in event and marketing activities to generate business for the retailers.

According to the Sugar Land Town Square Management Company, which administers the parking association, the meters are in place with two-hour time limits to prevent office tenants from parking in front of the stores during daytime business hours. The company does not view the meters as a revenue source, but as a parking management tool. It is encouraging that one of Sugar Land's most popular areas is thriving and also has meters. This precedent is also important because experience shows that it is easier to go from 10 cents an hour to $1 an hour than it is to go from free to $1. Even if parking is free, it is strategic to get people used to the idea of parking management, such as taking tickets in a garage. This kind of management is a training process.

On the evening of the field visit to City Walk, most of the metered spaces were occupied at 50 cents per hour, even though there was free parking available in several nearby garages. This shows that some areas are more desirable to park in than others and they can be priced accordingly. In the case of commuter parking, for every 100 percent increase in price, demand falls by 30 percent, according to Donald Shoup's book, "The High Cost of Free Parking." Therefore, increasing prices at meters and off-street parking facilities would encourage turnover and relieve some of the demand pressure on the most popular spaces. Likewise, the decreasing the cost of parking at less popular locations would encourage more people to park there. Parking meter pay stations have become quite sophisticated, and can provide flexible payment options and variable fees as demand rises or falls. See www.parkeon.com for an example.

1 www.gflrpc.org/Publications/AccessManagement/GuidebookNarrative.pdf

Parking Benefit District

In Parking Benefit Districts, all or a portion of revenue raised by local parking fees is reinvested in the district. The City of Pasadena, California, has one of the longest-established parking benefit districts in the United States: it raises $3 million annually for improvements in the local business district, including new parking construction, daily steam cleaning of sidewalks, landscaping, lighting, and advertising. The potential to charge for parking in more desirable areas might allow Sugar Land to establish "Parking Benefit Districts" in the future, particularly in dense mixed-use areas.

The City of Austin, Texas, has applied similar principles to its residential parking program. Austin allows neighborhoods in the program to sell a limited number of daytime parking permits to commuters, with the net revenue supporting neighborhood improvements such as traffic calming, placing utilities underground and street trees.

Sugar Land should work with major landowners in the study area to establish both types of programs toward a goal of supporting walking, bicycling, and riding transit between destinations in the study area.

On-Street vs. Off-Street Parking

People prefer to park as close to their destination as possible. On-street parking has other benefits. It protects pedestrians on sidewalks from speeding cars and if zoning allows, it can satisfy some off-street parking requirements. By its nature, it is shared parking. But the only commercial on-street parking in the study area is located in City Walk—again, a desirable shopping area in Sugar Land.

Zoning for Parking

How much is the right amount of parking to build? This basic question drives zoning requirements for new development, and it is difficult to accurately estimate. Too little parking frustrates customers, but requiring too much parking might prevent developers from building more income-generating uses on the site. The following table lists Sugar Land's parking requirements.

Off-Street Parking Schedule—City of Sugar Land Development Code, Section 2-215

(Ord. No. 1421, § 3, 12-2-03)

LAND USE CLASSIFICATION	REQUIRED SPACES	UNIT OF MEASUREMENT
Single and Two Family Dwellings	2	Dwelling Unit
Multi-Family Dwellings and Townhouses: 1 bedroom 2 or more bedrooms	1:5 plus 1.5:1 2:1	 Dwelling Unit Dwelling Unit
Commercial Uses not listed below	1:200 (minimum 5)	Square Feet
Eating and drinking establishments	1:100 plus 1:2	Square Feet Employees
Banks, Clinics, and Other Personal Services	1:200	Square Feet
Retail Sales - Furniture/Carpet or other showrooms	1:300	Square Feet
Shopping Centers Less than 400,000 Square Feet 400,001 to 600,000 Square Feet Greater than 600,001 Square Feet	 1:200 1:250 1:300	 Square Feet Square Feet Square Feet

LAND USE CLASSIFICATION	REQUIRED SPACES	UNIT OF MEASUREMENT
Equipment Sales and Service or Wholesale Sales	1:300	Square Feet
Office Buildings	1:250	Square Feet
Industrial Buildings (manufacturing, research or testing) - Less than 25,000 Square Feet - Greater than 25,001 Square Feet Warehouses - less than 25,000 Square Feet Warehouses - greater than 25,000 Square Feet	1:500 1:500 plus 1:1000 1:4000 + 1:1 employee 1:2000	Square Feet Square Feet (Office) Square Feet (Warehouse) Square Feet (Warehouse) Square Feet
Clubs or Lodges	1:200	Square Feet
Churches, Theaters, Auditoriums, Stadiums, Gymnasiums, and Other Assembly Halls	1:4 (With Seats) 1:100 (Without Seats)	Seats Square Feet
Mortuaries or Funeral Homes	1:4 plus 1:2	Seats Employees
Elementary and Middle Schools	1:20	Students
High Schools	1:4	Students
College or University	1:2	Students
Trade or Vocational School	1:1 plus 1:1	Students Employee
Country Club or Golf Course	1:4 plus 1:2	Members Employees
Hospitals	1:2 plus 1:1	Beds Employee
Convalescent Homes	1:4 plus 1:1	Beds Employee
Hotels and Motels	1:1 plus 1:2	Guest Room Employees
Community Center, Library, Museum, Gallery	1:200 (10 Minimum)	Square Feet
Car Wash - Full Service Car Wash - Self Service	1:200 (5 Minimum) 1:1 (5 Minimum)	Square Feet Bays
Retirement Housing	0.8	Dwelling Unit
Day Care Facilities	1:1 employee plus 1:8 students	

(b)Eating and drinking establishments in Town Square that also provide a place on private property for outdoor on-premises service adjacent to the establishment must provide additional off-street parking under the schedule applicable to eating and drinking establishments only for that portion of the outdoor service area that exceeds by more than 25 percent the square feet of the indoor dining area to which the off-street parking requirements apply.

The requirements are suburban in nature—shopping center developers must build 5 parking spaces per 1,000 square feet for the first 400,000 square feet of a project. For City Walk, Steve Ewbank of Planned Community Developers applied the Urban Land Institute study on shared parking to the City of Sugar Land parking ratios. The model produces an hour-by-hour and day-by-day analysis of how busy the parking will be given the uses.

"Shared parking makes a lot of sense," Ewbank said. "You don't need to build twice as much parking as you need. It's a waste of space and a waste of cost. Nobody likes an empty parking."

Even with shared parking, Ewbank said the City Walk garage has "a lot of extra parking spaces." He says the office community demands that developers build 3.8 spaces per 1,000 square feet despite only using about 2.68 per 1,000. Most companies need 2.7 spaces per 1,000 square feet, but a higher demand for more parking is thought to be a backlash against a period when buildings were developed with 2.5 spaces per 1,000 square feet, then occupied by call centers that filled all the parking. The brokerage community began assuring non-call-center tenants that they would demand plenty of parking from developers.

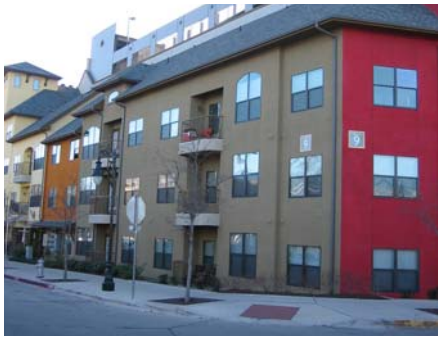
Kensington Town Center is another example of overbuilt parking. When Planned Community Developers owned offices at Kensington, Ewbank did a utilization count when the building was 100% occupied. The project was built with 4 spaces per 1,000 but tenants only occupied 2.6 spaces per 1,000 at peak. Ewbank said that people perceived a parking shortage because all the parking was located on one side of the building since it backed up to the water on the other side. "There were more than 100 empty spaces and people were still complaining because they had to walk farther."

Overbuilt parking has left Sugar Land with unutilized spaces, which should be converted to shared parking before building new parking. The City should aim to ensure that 85 percent of all spaces are being used during peak demand. For curb parking, that translates to roughly one space per block. The 85-percent goal ensures that parking is used efficiently but guards against creating a perceived shortage. Because the cost of constructing new parking supply can be prohibitively expensive, it makes financial sense to optimize the use of existing parking facilities before building new spaces.

To encourage communities to build shared parking, Sugar Land should structure its requirements to include:

- A minimum of shared parking
- A maximum of reserved parking
- No requirements for small sites
- A restriction on any limits of shared parking in non-residential development—at least 12 hours of public parking must be allowed in a 24-hour period
- The option to pay fees in lieu of meeting minimum requirements
- The option to meet all requirements off-site

Parking garage in Harvard Square, Cambridge with ground-floor retail. Notice the top level is stepped back to reduce the perception of the building's bulk.



Villas on Guadalupe parking garage wrapped in mixed-use, privately developed student housing at UT Austin

Parking Lot Design

Sugar Land has several surface parking lots and garages can negatively impact the walking environment. Open lots can be windy and hot, as well as being uninteresting to walk through. Garages, if not carefully designed, may create conflict points between vehicle and pedestrian circulation. The following design features can mitigate some of those issues and elevate the position of pedestrians in an automobile-oriented place.

Edges

Parking garages should not present blank walls to the street. The best solution is to wrap the garage with commercial or residential uses. An alternative is to locate retail on the ground floor of the garage.

Driveways

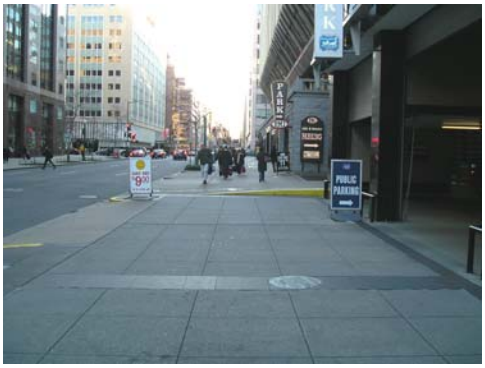
Sidewalks should take priority over driveways as drivers are legally required to yield to pedestrians on sidewalks. The driveway should ramp up to sidewalk level at the curb; the sidewalk should not ramp down to meet the driveway.

The design of the garage should not interfere with pedestrian-driver visibility and blind spots should be minimized. Signs that warn either driver or pedestrian of the presence of the other are usually indications of poor design. The two modes should intuit the other's presence because of effective design.

Research has shown that drivers turn into driveways at about the same speed, regardless of driveway configuration.[2] Driveways should be as small as possible and never wider than the entrance.

These two sidewalks share the same problem. The sidewalk visually breaks for the driveway and there is nothing to indicate to drivers they are crossing a pedestrian route. (Charleston WV at left; Kansas City MO at right)

2 Committee on Access Management (2003). Access Management Manual. Washington, DC: Transportation Research Board, 2003, p. 169.



Two driveways to parking garages, Washington DC. Note the yellow curb across the sidewalk – a trip hazard.

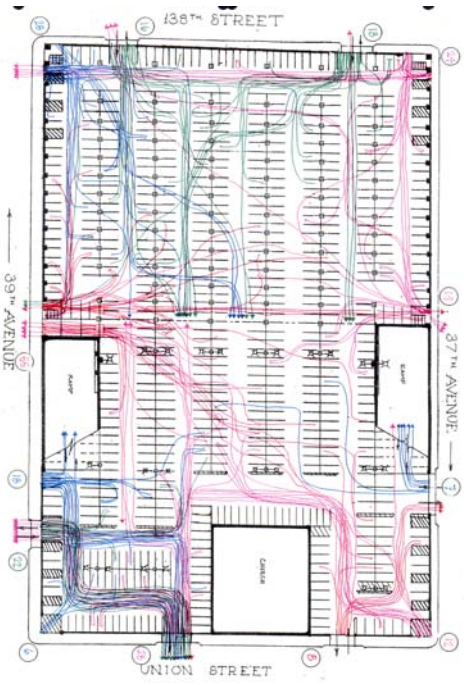
BAD

Driveway to parking garage, Manhattan NY. Note the people walk in the street while the driver waits for a gap in traffic.

Curb extension with driveway, Colorado Springs CO. The design provides a place for drivers to wait for a gap in traffic without blocking the sidewalk.

GOOD

Driveway from parking garage, Arlington VA. Note the double stop signs, one at the sidewalk and one at the street.



Tracking survey in a parking lot, Queens NY. This shows the usage of the lot by pedestrians – walking to cars, cutting the corner and just passing through.

Through-passage

Parking garages and lots should not block through-passage for pedestrians. Garages and parking lots can enhance pedestrian mobility by providing mid-block access and allow people to shorten their journey. The routes can be enhanced by trees, retail, arcades and other features. Marked crosswalks, if provided, should follow pedestrian desire lines. Traffic calming features (speed humps, refuge islands, raised crosswalks) can be included to improve pedestrian safety.

Bicycle parking facilities inside a parking garage, Arlington VA. Note the additional security offered by the lockable chain link fence, located near the attendant's booth.

Bicycle parking

Parking for cyclists should be included in all garages and lots. This is an inexpensive way to increase use, as one can fit about 10 bikes in the space normally used by one car. It also protects bicycles from rain, an important consideration for a vehicle one rides on, not in. Bike parking should be located near the entrance in a visible location. Cyclists would ride through the vehicle entrance and then walk out as pedestrians, similar to other garage users.

Wayfinding

After parking, people need direction to destinations. Wayfinding for those on foot includes a variety of information options: directional signage, maps and kiosks. It is recommended that signs give not only distance information, but also travel time.

Wayfinding sign for pedestrians with number of blocks to destination, Alexandria, VA

Wayfinding sign for pedestrians with time to destination, Trenton, NJ (Studio L'Image)

General Parking Recommendations

- Change the development code that requires a continuous green hedge around parking lots to also require pedestrian passageways through hedges.
- Address perceived parking shortage by managing supply in a way that keeps the most sought-after spaces at 85% occupancy.
- Manage parking demand by removing time limit on City Walk meters and use variable fees to (i.e. price increases for longer stays).
- Expand valet parking service at the Cheesecake Factory to allow people to leave their cars there longer while they go to other places.
- Improve parking information and access by instituting a universal parking logo and rate structure for all short-term public parking; this can be accomplished through the City's signage code. A key factor in the success of cities that operate coordinated public parking systems is the use of signage that is recognizable and consistent in presentation (whether public or private). These principles include:
    - Install rate boards visible from the approaching lane of traffic at all approaches to the garage entry.
    - Prominently display the rate for the first hour of parking, as well as the evening rate and daily maximum. This assures that customers know costs up front
    - Display the address and/or name of the garage on the sign. This will help in the future with coordinating wayfinding and guidance systems.
    - Make signs out of high-quality reflective material to assure visibility after dark.

- Encourage people to park once and move between destinations without a private car. Launch a public education campaign that would inform people that it is permissible, for example, to go to Target if they are already parked at the Madras Pavilion restaurant.
- Maintain a relationship with First Colony Management Company, as this will be necessary to achieve many of the recommendations since they own much of the land in the study area.
- Install bicycle racks at all major destinations in the study area, such as the AMC movie theater and City Hall Plaza.

Interconnections, like this one from a parking lot to an adjacent street, allow shorter walking distances.

Appendix A
Background Statistics and Demographics

Demographics and Employment

The selected study area consists of the central retail core of the City of Sugar Land, divided into quadrants by SH 6 and US 59. It is predominately commercial, with single family residential of varying densities surrounding it on all sides. Some institutional uses are present, most significantly City Hall and Methodist Hospital. There are approximately 500 townhomes at the eastern edge and approximately 200 condominiums in Town Square (see Land Use below). As the residential population is quite low, a statistical sample is not useful. Instead, the demographics are compiled for the City of Sugar Land as a whole. Table 1 on the following page shows comparisons between the City of Sugar Land, H-GAC's eight-county planning region, and the state of Texas as a whole, for various 2000 Census statistics.

The 8-county region consists of the following counties:

Harris	Fort Bend	Liberty
Galveston	Waller	Chambers
Brazoria	Montgomery	

Many of the City of Sugar Land's characteristics are what may be expected in a high-income, suburban city with much recent development. Sugar Land's median household income is by a large margin higher than that of Fort Bend County as a whole, and roughly double that of the region and the state. The unemployment rate is half that in the larger areas, and the poverty rate is lower. Fewer than one of twenty Sugar Land residents have incomes below the poverty level.

The vast majority of housing units in Sugar Land and Fort Bend County are single-family homes. Nearly 90% of Sugar Land units are single-family detached, compared to roughly 60% in the region and 64% in the whole state. Apartments and condominiums of all size complexes are correspondingly less common, making up only about 10% of the total, while regionally apartments and condominiums are nearly one-third of all housing units. Housing ownership rates in the City and County are higher than in the region and state, and vacancy rates are lower.

The City of Sugar Land is majority non-Hispanic White, with a significant minority of non-Hispanic Asians (about one-fourth the City).Compared to the larger geographies, the City has, fewer non-Hispanic Blacks, and fewer Hispanics. These groups are represented at rates less than half the regional or state average.

The age breakdown of Sugar Land is roughly equivalent to Fort Bend County as a whole, and both reflect a recently-developed area with a predominance of new families. Children, teenagers, and middle-age (35-64) adults are more common than in the region or state, and there are fewer senior citizens, and fewer young adult (18-34).

Educational attainment in the City is higher than in the County as a whole, which in turn is higher than the region or state. In particular, 70% of Sugar Land adults have a Bachelor's degree or higher, the corresponding percentage for the State is less than 30%. Only one of 16 Sugar Land adults had not finished high school in 2000; in the region and state as a whole, nearly one out of four have not.

Finally, and most significant for this study, residents of Sugar Land were much less likely to use alternative transportation on their journey to work. Walking, bicycling, and transit usage all occurred at levels lower than the region and state. Interestingly, the proportion of workers working at home or using other means of travel was higher than the other geographies.

Table 1: City of Sugar Land vs. Other Areas
Comparative Demographics - 2000 Census

STATISTIC	City of Sugar Land	Fort Bend County	H-GAC	Texas
Population	63,328	354,452	4,669,571	20,851,820
Households	20,515	110,915	1,639,401	7,393,354
Persons per Household	3.06	3.20	2.85	2.82
Income-Related				
Median Household Income	$ 81,767	$ 63,831	$ 44,788	$ 39,927
Unemployment	3%	3%	6%	7%
Below Poverty Level	4%	7%	14%	15%
Housing Units by Occupancy				
Owner-Occupied	84.1%	80.8%	60.9%	63.8%
Renter-Occupied	15.9%	19.2%	39.1%	36.2%
Housing Vacancy Rate	2.7%	4.4%	7.8%	9.4%
Housing Units by Type				
Single-Family Detached	88.2%	83.2%	59.9%	63.4%
Single-Family Attached	2.4%	2.2%	3.5%	3.1%
Apartments/Condos 2-9 units	3.1%	2.8%	8.7%	9.8%
Apartments/Condos 10+ units	5.8%	6.5%	21.5%	14.4%
Other	0.5%	5.3%	6.4%	9.4%
Race/Ethnicity				
Non-Hispanic White	60.8%	46.2%	47.9%	52.4%
Non-Hispanic Black	5.2%	19.8%	16.6%	11.3%
Non-Hispanic Asian/Other*	26.0%	12.9%	6.6%	4.3%
Hispanics of any race	8.0%	21.1%	28.9%	32.0%
Age				
Children/Adolescents (0-17)	31.2%	32.0%	28.8%	28.2%
Young Adults (18-34)	15.2%	20.6%	25.6%	25.5%
Adults (35-64)	46.9%	41.7%	37.8%	36.4%
Seniors (65+)	6.7%	5.7%	7.8%	9.9%
Education				
No High School	6.6%	15.7%	23.8%	24.3%
High School Only	33.3%	41.2%	45.1%	47.2%
Finished College	40.8%	31.4%	22.5%	20.8%
Graduate Degree	19.3%	11.8%	8.6%	7.6%
Journey to Work				
Private Vehicle	93.6%	94.2%	91.3%	92.2%
Transit	1.4%	1.7%	3.2%	1.9%
Bicycle	0.1%	0.1%	0.3%	0.2%
Walked	0.2%	0.5%	1.6%	1.9%
Other/Work at Home	4.7%	3.4%	3.5%	3.8%

Source: U.S. Census Bureau, Census 2000

*includes "some other race" and "two or more races"

Land Use / Zoning

The predominant land use in the study area is commercial, with some institutional uses, mostly medical. The surrounding areas are residential, mostly single-family with limited amounts of multi-family. The center of the study area is Sugar Land Town Square, and other major commercial areas include First Colony Mall and the Marketplace at Town Center. Sugar Land is a zoned city, and the zoning was in place before the study area was developed, thus the land use conforms to the zoning categories. The map on the following page illustrates the zoning districts in and around the study area. Pink represents commercial zones, turquoise is planned-unit developments (mixed-use), and residential is depicted with varying shades of yellow and gold.

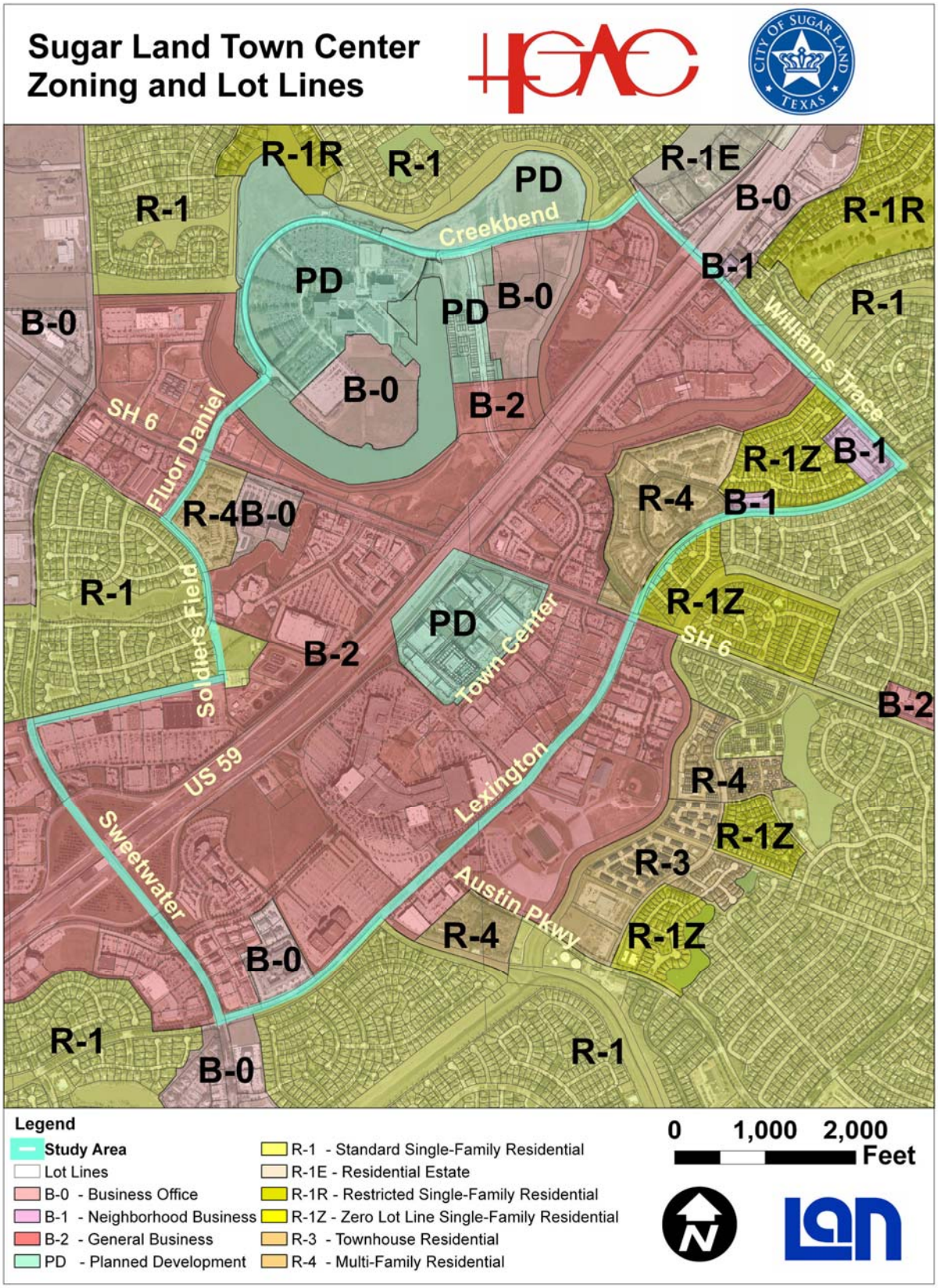
Transit

Sugar Land does not participate in METRO, the regional transit authority, and thus there is no local bus service in the study area. Currently, a service called TrekExpress operates commuter services to Greenway Plaza and downtown Houston. TrekExpress currently has a pick-up point within the project study area, with two tent shelters near the AMC Theaters adjacent to First Colony Mall. A permanent location for the shuttle is under construction at the University of Houston—Sugar Land campus.

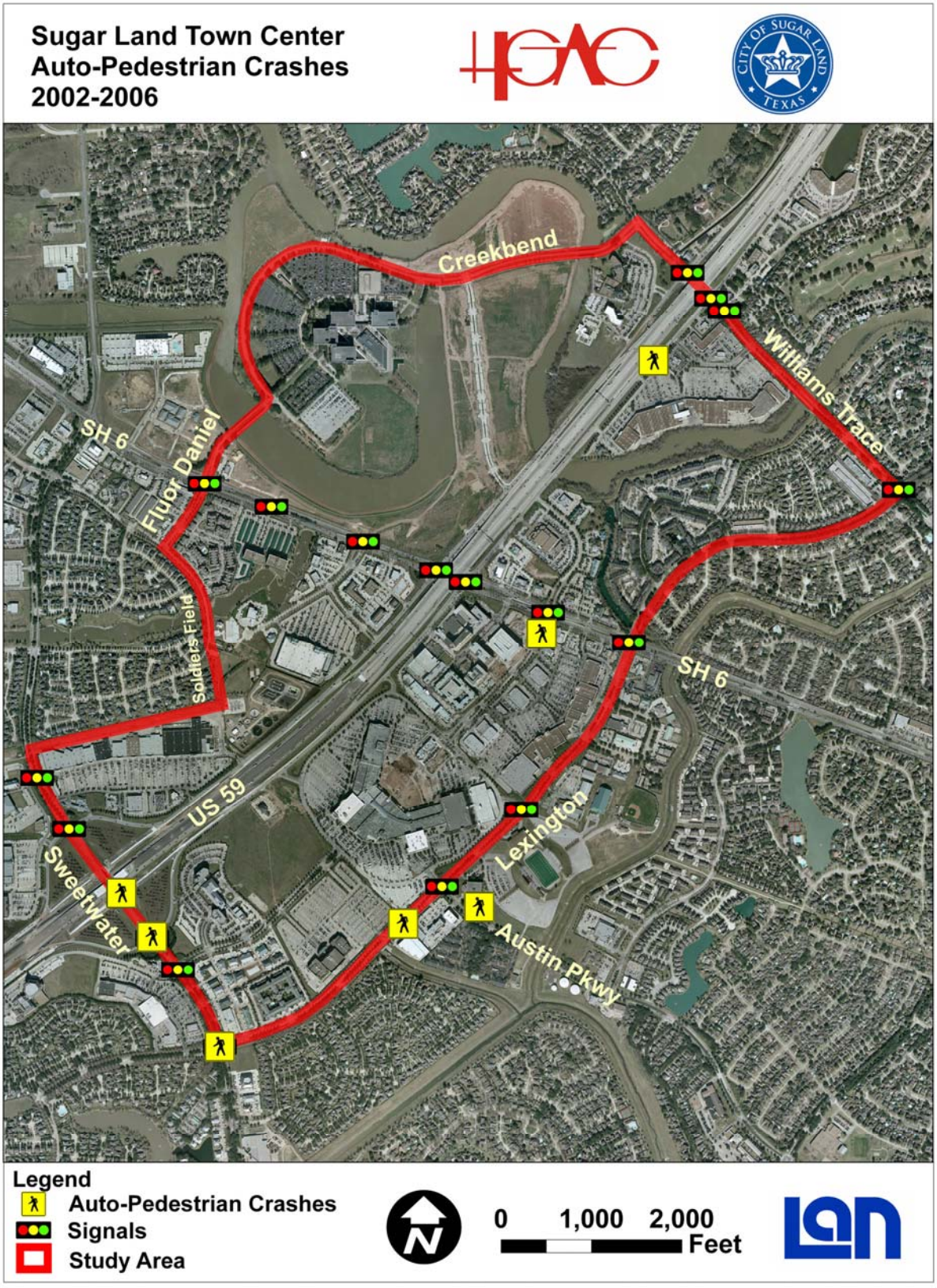
Traffic Signals

The City of Sugar Land, having a population of over 50,000, operates all traffic signals within its city limits, including those on state-maintained roadways. In the study area, this includes State Highway 6 and the frontage roads of US 59. The map following the zoning districts maps illustrates the location of traffic signals in the study area.

Land Use / Zoning Map



Traffic Signal Map



Appendix B
Introductory Public Meetings—April 2007

In 2004, H-GAC conducted a study to identify districts where there were high levels of existing or potential pedestrian and bicyclist activity, and where there were significant opportunities to replace vehicle trips with pedestrian or bicycle trips and improve pedestrian and bicyclist safety. Fifteen districts were identified throughout the region, including one in the Sugar Land Town Center area.

H-GAC selected consultant Lockwood, Andrews & Newnam, Inc. (LAN), in association with sub-consultants Nelson\Nygaard Consulting Associates and The Clifford Group, to develop a conceptual master plan for comprehensive pedestrian and bicyclist improvements in the commercial core of Sugar Land. The consultant team is working closely with the community to define the best possible overall plan that fits the needs of the community's residents, businesses, and visitors.

Purpose and Location

To kick off the project, the consultant team conducted two public workshops to provide information about the study and obtain one-on-one input from citizens and community leaders. The workshops were held at the following location:

- April 25, 2006, from 3:00 – 5:00 p.m. at Sugar Land City Hall
- April 25, 2006, from 6:00 – 8:30 p.m., also at Sugar Land City Hall

Invitees to the 3:00 – 5:00 p.m. meeting included city and county officials, FBISD administration, Texas Department of Transportation, Planned Community Developers (owners of many commercial properties in the study area), institutional representatives, and social service organization representatives.

For the 6:00 – 8:00 p.m. meeting, the team combined forces with Department of Parks and Recreation, whose Hike & Bike System study had started some months earlier, and was presenting first drafts of their potential improvements to the public. This meeting welcomed the general public as well as neighborhood and community association representatives, bike and disabled persons advocates, media, and other organizations.

Notifications

Meeting notice postcards and e-mail reminders were sent to area businesses, schools, churches, social service organizations, neighborhood and community associations, bicycle and disabled persons advocacy groups, and government and agency representatives. As the Parks & Recreation Department had already compiled lists of these persons and organizations, the project team began with their database, and also mailed approximately 4,000 postcards to residents and businesses within 1 mile of the study area.

Additionally, workshop notices were posted on Island Transit buses and trolleys, GISD's TV channel, and the city Web site. Information about the meeting was publicized in The Houston Chronicle, and several community publications and Web sites.

Attendance

A total of 80 people attended the first public meetings, including representative of the City of Sugar Land, First Colony Community Association, and Sugar Cycles, a local bicycle shop.

Meeting Format

For the afternoon meeting, Dan Raine, AICP, Pedestrian-Bicycle Coordinator with H-GAC welcomed attendees and explained the purpose of the plan and why input from citizens is crucial to developing a successful plan that addresses the community's pedestrian and bicyclist needs. LAN team members David Manuel, EIT, AICP and Michael Feeney, PE joined Mr. Raine in facilitating the group's ideas and suggestions. Maps of the area were used to record comments

regarding specific areas of concern. General comments concerning safety, parking, suggested routes, and goals were recorded on a flipchart.

At the end of the meeting, Mr. Raine thanked everyone for attending, encouraged them to direct others to www.sugarlandtowncenterpedbike.org to give their suggestions and comments for the area, and informed them that the anticipated dates of the next round of workshops are in June.

The evening meeting was conducted as an open house, with the Parks & Recreation Department having maps illustrating potential improvements for various sections of the City, along with representatives to answer questions and receive comments. The LAN project team provided additional presentation boards describing the difference between the two studies, how the Town Center study focused in more detail on the commercial core area, and also provided representatives to answer questions and receive comments. Maps were provided so attendees could illustrate concerns, and team members at flip charts recorded text comments.

A slide presentation was conducted, primarily focusing on the Hike & Bike Trail project, but with elements explaining, as discussed above, the additional work to be done in the Town Center Pedestrian/Bicyclist Study.

Comment Summary

The following is a summary of the ideas and suggestions received from meeting attendees:

- I'd like to see easier pedestrian access from town center areas between Town Square, Town Center, and the mall. Maybe pedestrian bridges across Town Center Drive.
- I'd like to see bike paths (lanes) on the streets to allow easier access to ride bike to the mall, town center, churches, etc for recreation/fitness.
- A way to get across Hwy 59 on 6 and Sweetwater/First Colony Boulevard on bike or walking.
- Please consider bike lanes along road-ways that have room for growth. And, please consider bike lanes infrastructure road proposals. Four to five feet of pavement could save someone's life while increasing everyone's way of life. Also, I love the proposed "nature trail" along the Brazos River.
- Find balance between pedestrian friendly or pedestrian-only areas and open areas i.e., Riverwalk in San Antonio is great for visitors + convention guests but residents rarely come in.
- Use walkways + trolleys to move people around. Find parking areas rarely used as designated parking + trolley pick-ups- keep trolleys moving every 8-10 min. Trolleys need right-of-way + priority on roads to keep them moving on schedule
- I have wished to be able to bicycle to the mall/movies/Town Square area for some time. There is currently no "practical" way to get to this area from New Territory.
- I find it very difficult to walk (or bike) out of the individual areas. Why can't I go to the mall and Town Square w/o moving my car? The Lake Pointe Super Target, Town Square Mall & Lupe Tortilla/Corner might as well be completely separate destinations. Even Wolfgang Puck's express' recent closure seems related to its isolation from either the mall or the Town Square.
- Think about Marriott guests. They can't really walk to the mall or movies safely.
- All seems well thought out and well planned
- Need to get to retail, get to work, and exercise
- Barriers exist between trails and retail- no connecting path, high traffic trails and sidewalks are disjoint, can't get to work w/o traveling on road bike lanes on roadways are frequently cluttered + ignored by drivers.

- Sidewalks in Meadow Lakes are inaccurate.
- Need bike parking at destinations such as around Town Center. Could there be a trail along FM2759 (south side of Greatwood)?
- How are route priorities determined?
- We need trails or sidewalks along SW Frwy (59) from Williams Trace Boulevard to HY 6, on the east side of (59) preferably.
- Need safe way to cross SW Frway (59) at HWY 6 for bikes + pedestrians. This needs to be a major crossway.
- Stripe Bike Lanes {Sugar Lakes + Commonwealth thru Commonwealth + Avalon)
- SH 6 & US 59- ped and bike crossings away from signal?
- Increased bike rakes at locations such as Target and Wal-Mart- many bikers travel in the afternoon
- Designate often-unused parking for "park once" areas. Could coordinate with property trolley
- Shared parking at area entrances
- Ped malls at busy times-Sat/Sun/Holidays
- Access issue to Target from east- gated recreational area
- Sidewalks/crosswalks end @ US 59 and SH 6- needs extending
- Ensure that actuated signals recognize bikes
- Hike/Bike trails to accommodate rollerbladers (additional width for additional modes)
- External crossing to trails: across Lexington from south of T.C.
- Don't forget about recumbent and road bikes. They cannot hop curbs or take advantage of mountain bike trails.
- Please finish building sidewalks. We cannot now walk from our house to Town Square without walking on busy streets or muddy unpaved areas-Designated bike lanes would be great next to sidewalks.
- Research the Netherlands hike/bike access with lanes and stop lights, stop signs, etc. Make the boulevards not so wide....i.e. less trees and narrower medians=bike lanes. Build it and bikers will come!
- Connecting several of the small lakes with bike trails would give people a series of destinations and rest stops and enhance the biking experience.
- Provide areas for locking bikes (at Town Center) to enter stores or restaurants
- Signal at Williams Trace and County Tax office is dangerous for bicyclists/pedestrians. Need exit from Sugar Creek that is safe.
- Build more timed crosswalks signals
- City Hall access to adjacent mall
- Target/SW connectivity into study area
- Largely recreational bicyclist trips(except elementary school)

- Low bicyclist activity within Town Center
- Highway 6 is a dangerous barrier to bicyclists
- Wide sidewalks can be used by bicyclists
- Possible rail along 90 A
- Trek express bus service for commuters
- City maintains sidewalks. Require 4′ now and 5′ soon. New standard for both side of street
- Add rebar to sidewalks for strength/durability
- Community opposition to retrofit sidewalks—NIMFY- preserve "rural" feel
- Pedestrian key mode for study area
- Tree cover/shade will promote sidewalk use
- Connectivity will be essential for success
- Review parking lots to develop 'pedestrian corridors' to improve safety
- US 59 is very difficult to walk beneath

Photographs






Appendix C
Initial Public Survey—Document and Results

Survey Mailer (front)

Do you walk or bicycle around the Town Center? Do you want to? You can help us make it easier and safer. The City of Sugar Land and the Houston-Galveston Area Council are sponsoring a study to identify policies and physical projects that will improve conditions for pedestrians and bicyclists. (See study area map on other side.)

Please share your thoughts and concerns, and join us for our next public meeting in August. Watch the website (www.sugarlandtowncenterpedbike.org) for time and date.
If mailing the survey, please do so by July 9, 2007.

Where do you live?

_____Sugar Land--south of US 59
_____Sugar Land--north of US 59
_____Elsewhere in Fort Bend County
_____Houston/Harris County
_____Other_____

Where do you work?

_____Within the Study Area
_____Another part of Sugar Land
_____Elsewhere in Fort Bend County
_____Houston/Harris County
_____Other_____

How many times a week do you walk or bike to the following places?

Place	*Walk*	*Bike*
To the Park	____	____
For Exercise	____	____
To Work/School	____	____
Go Shopping	____	____
Attend an Event	____	____
Other	____	____

_____

How many people and vehicles are in your household? Adults _____ Cars _____
Children_____ Bikes _____

Are there areas you specifically avoid when walking or bicycling? Where are they and why do you avoid them?

_____
_____
_____

What improvements would make you walk or bike more often?

_____
_____
_____
_____
_____
_____

Please provide your address and/or e-mail if you'd like to be added to the mailing list.

_____
_____

Survey Mailer (back)

SUGAR LAND TOWN CENTER PEDESTRIAN & BICYCLIST STUDY

Please fold and tape this mailer with the address below showing.
You may also e-mail us by visiting the project website at:
www.sugarlandtowncenterpedbike.org

Dan Raine, AICP
Pedestrian/Bicyclist Coordinator

832-681-2525
dan.raine@h-gac.com

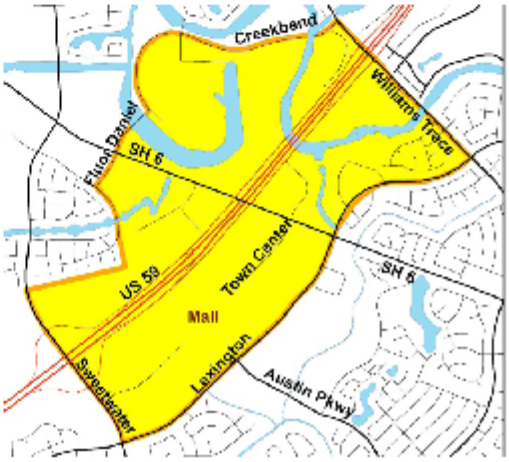
From: _____
_____
_____

PLACE STAMP HERE

David Manuel, AICP, Planning Manager
Lockwood, Andrews, & Newnam, Inc.
2925 Briarpark Drive, 4th floor
Houston, Texas 77042

The Study Area covers the central urban core of Sugar Land, the Town Center. See the shaded area at right.

The study will look at improving pedestrian and bicyclist safety, access for persons with disabili-ties, bicycle routes, and striping, signage, and signal treatments for pedestrians and bicyclists. The focus is on non-recreational trips (such as to work or school)



Survey Results compiled August 22, 2007

Where do you Live?	Number	Percent
Sugar Land -- south of US 59	8	53%
Sugar Land -- north of US 59	5	33%
Elsewhere in Fort Bend County	2	13%
Houston/Harris County	-	0%
Other	-	0%
TOTAL	**15**	**100%**

Where do you Work?	Number	Percent
Within the study Area	3	20%
Another Part of Sugar Land	2	13%
Elsewhere in Fort Bend County	2	13%
Houston/Harris County	4	27%
None listed	1	7%
Other	3	20%
TOTAL	**15**	**100%**

Average Number of Trips per Week	
Walk to the Park	1.0
Walk for Exercise	1.8
Walk to Work/School	0.3
Walk to Shopping	0.6
Walk to attend an Event	0.3
Bike to the Park	0.1
Bike for Exercise	1.3
Bike to Work/School	0.3
Bike to Shopping	-
Bike to attend an Event	-
TOTAL Walk/Bike Trips	**5.7**

Are there areas you specifically avoid when walking or bicycling?	Number	Percent
Yes	5	33%
No/Blank	10	67%
TOTAL	**15**	**100%**

What areas do you avoid?		
Busy intersections	1	8%
Williams Trace	2	15%
US 90	2	15%
US 59	3	23%
Highway 6	3	23%
Sweetwater Blvd	2	15%
TOTAL	**13**	**100%**

Average Number of Persons per Household	
Adults	2.0
Children	0.6
TOTAL Persons per HH	**2.6**

Average Number of Vehicles per Household	
Cars	1.9
Bikes	2.8
TOTAL Vehicles per HH	**4.7**

Appendix D
Public Input Workshop—June 2007

Purpose and Location

H-GAC and the consultant team conducted an initial round of meetings in April 2007 to provide information about the study and obtain one-on-one input from citizens and community leaders. A second round of workshops was held to update the public on the project's status and to solicit input on specific needs and improvements that should be addressed by the new plan. The workshops were held at the following locations:

June 13, 2007, from 3-5 p.m. at Sugar Land City Hall

June 13, 2007, from 6-8 p.m., also at Sugar Land City Hall

Invitees to the 3:00 – 5:00 p.m. meeting included city and county officials, FBISD administration, Texas Department of Transportation, Planned Community Developers (owners of many commercial properties in the study area), institutional representatives, and social service organization representatives.

For the 6:00 – 8:00 p.m. meeting, the team welcomed the general public as well as neighborhood and community association representatives, bike and disabled persons advocates, media, and other organizations.

Notifications

Meeting notice postcards and e-mail reminders were sent to area businesses, schools, churches, social service organizations, neighborhood and community associations, bicycle and disabled persons advocacy groups, and government and agency representatives. All residents who left an e-mail or physical address were contacted, and postcards were mailed to approximately 300 businesses within the study area

Attendance

A total of 26 people attended the second round of public workshops.

June 13, 2007, from 3-5 p.m. — 7 people, including representatives from the City and County, TxDOT, and HGAC.

June 13, 2007, from 6-8 p.m. — 19 people, including 14 who had attended the April meeting.

Meeting Format

The workshops were conducted in an identical format. Dan Raine, AICP, Pedestrian-Bicycle Coordinator with H-GAC welcomed attendees and explained the purpose of the plan and why input from citizens is crucial to developing a successful plan that addresses the community's pedestrian and bicyclist needs. LAN team members David Manuel, EIT, AICP and Michael Feeney, PE continued the presentation with a recap of input collected at the first round of public meetings in April 2007 and by explaining some of the data the team has collected thus far in the project. The team asked attendees to use the maps and supplies provided at each table to identify problem issues, point out locations/facilities that currently worked well for pedestrians and bicyclists and that would a good example to emulate, and make suggestions for improvements throughout the project area.

After attendees recorded their comments, each group was asked to present their suggestions. Following the group presentations, Mr. Raine explained the input given at this round of meetings will be used to prepare a list of proposed improvements. He closed the meetings by thanking everyone for attending, and encouraging them to direct others to the website at www.sugarlandtowncenterpedbike.org to give their suggestions and comments for the area. He also informed participants that there will be one more meeting in August to allow attendees to vote

on their favorite proposed improvements. A summary of the potential improvements will be presented to City Council in an information session planned for September 2007.

Comment Summary

Following is a summary of the ideas and suggestions received from meeting attendees:

Crosswalks

- What crosswalk treatments are best-may be @ unsignalized locations
- More pedestrian walkways to provide connectivity
- Crosswalks at uncontrolled locations—make very simple for pedestrians
- Ped crossing across SH 6—particularly at Citywalk, Town Center…what improvements are best? Citywalk area is tricky, and seems unsafe for crossing, but how do we prevent folks from running across to BJ's? How do we encourage using Town Center
- Enhance crosswalks—side light flashing when pedestrians crossing to notify drivers
- Illuminate/better demarcation of crosswalks

Sidewalks

- Sidewalk needed along SH 6.
- Sidewalks along US 59 that would connect First Colony Mall to trail area near Austin Parkway making a sidewalk loop
- Sidewalks along US 59—our design standards have not required sidewalks along 59, but that could change, and I would recommend that this change in the future. As part of this study, are there gaps in the study that should be filled?
- Sidewalks are grown over—make it difficult for pedestrians to cross
- Wider bridges in parks so that hikers & bikers can pass

Connectivity

- Safe crossing between shopping centers & across major streets
- No easy way to cross safely across US 59
- Resident feel about connections into their subdivisions?
- Ped bridge over SH 6/US 59. (elevator crosswalk transitioning to SH 6)
- Future Trail for mixed use—Lake Pointe Area- work with private dev. To coordinate access from trail to businesses
- Make 59 crossings more accessible
- Proposed ped bridge in Town Center Lake Pointe
- Connectivity to mall(bike lanes, wide sidewalks)
- Connectivity in Quad #3 trail all along neighborhood
- Quad #2 making it accessible to mall—sidewalks on US 59
- Tunnel under US 59--- US 59 IS loud, dirty, traffic, no separation of ped/traffic, no obvious way

- Ped bridge(private funds) in Lake Pointe
- US 59 @ SH 6, ped connectivity at the quadrants—how do we connect the ramps at the corners to the development, particularly the 'north"(Lake Pointe) and "west" corners. On the west corner, we've discussed with PCD to wrap a sidewalk around the big landscape easement and First Colony blade signs
- Coordination with Leech's wayfinding/signage study and recent activities
- Crosswalks across Town Center Boulevard—look at both sides of mall; look at Town Square ultimate buildout, understand major ped generators; need specific recommendations on crosswalk locations and crosswalk treatments; use latest studies on ped crossings at unsignalized intsx (NCHRP Report 562
- Get bikers to center of town via bayou—limestone all bayous
- Bridge over freeway
- Oyster Creek—go under freeway
- Pedestrian flyover
- Look at existing bridges for underpasses as in Terry Hershey
- Connection for Lake Pointe to Town Center and across SH 6 to BJ's
- Connect bayous which have banks to new trails
- Connection missing @ Fluor Daniel from S/W— a bridge with road access
- No S/W connection @ Becks Prime
- Ped-bridge @ US 59/SH 6 with ramp
- "Imperial Crossing" pedestrian/bicycle flyover bridge
- Need access from mall to movies
- Need access from mall to town hall
- Path around final portion of lake
- Connections from neighborhood to Ditch H—hike/bike trail planned

Parking Lot Safety

- Ped plan for large parking lot
- Parking design for parking lots to make safer
- Improvements within private parking lots, such as market at Town Center. Can anything be done that is worthwhile?

Bike Racks

- More Bike Racks in places other than Town Square- such as Mall, Movie Theatre, etc.
- Increase bike racks

Transit

- Trolley or other transit—park once

- Pedestrian mass transit plan in & between developments
- Trolley system
- Shuttle system—best suited to cross US 59
- DSW—place for shuttle
- Covered shuttle stops

Policy

- Need a plan for shoppers/walkers/bikers to get from First Colony Mall to SLTC or the market
- Review development code which requires a legislative hedge across parking lots(limits connections)
- Hedge height requirements a hindrance?
- Neg.- Development Code require solid planting; screen deters easy ped access
- Existing openings in hedges on side of town center
- Bikers disrespect laws—do not stop @ stop signs—Enforcement issue
- Dog trouble
- Oblivious bikers(earphones)
- City needs to be more proactive in state construction projects towards H Drivers turning right on red disrupts biking
- Drivers stopping on crosswalks(increase signs @ intersections, biker education hike/bike issues
- Fast cyclists and unlashed dogs in Oyster Creek Park. Walkers not being warned of approaching cyclists
- Designated bike lanes & signals
- Lighting and Safety
- Security Cameras, lighting, pavers
- US 59/6 need lighting, raised sidewalk, decorative pavers will increase number of bikers
- Increase police visibility @ shuttle pick ups
- Safer corner at First Colony Mall

General

- Add maps that zoom in on problematic areas; work on separately
- Ultimate town square development-Ped destinations
- Simplify pedestrian decision making
- Busy pedestrian area near Austin Parkway
- Midblocks Town Center Boulevard crossing
- Town Center Boulevard N- heavy pedestrian-proposed movie theatre/hotel in Town Sq./8 story office building

- Methodist Hospital is expanding development to S.
- Restrooms needed along trails—signage for water, etc
- Implementation—what to do now

Loaner bikes

- Actively consider & coordinate in planning road expansion/redevelopment for hiking & biking. i.e. Highway 90 expansion and revision to multilane. North of 90 will need to get across without danger
- Bicycle & pedestrian "locals"
- Allow electric low powered bikes on sidewalks

Photographs






Appendix E
Public Presentation of Draft Plan

In 2004, H-GAC conducted a study to identify districts where there were high levels of existing or potential pedestrian and bicyclist activity, and where there were significant opportunities to replace vehicle trips with pedestrian or bicycle trips and improve pedestrian and bicyclist safety. Fifteen districts were identified throughout the region, including one in the Sugar Land Town Center area.

H-GAC selected consultant Lockwood, Andrews & Newnam, Inc. (LAN), in association with sub-consultants Nelson\Nygaard Consulting Associates and The Clifford Group, to develop a conceptual master plan for comprehensive pedestrian and bicyclist improvements in the commercial core of Sugar Land. The consultant team is working closely with the community to define the best possible overall plan that fits the needs of the community's residents, businesses, and visitors.

Purpose and Location

Using input gathered from two rounds of public workshops held in April and June 2007, the project team, along with the City of Sugar Land and H-GAC, developed a list of potential projects to improve and enhance pedestrian and bicyclist safety and mobility. Ideas and issues on the maps drawn by the public were concretized into a physical description. For example, "difficult access to Meadow Lake Park" became "install raised crosswalk at park entrance, construct sidewalk to end of Colony Lakes Drive, and construct bike trail connecting park to citywide system" A public workshop was held on **August 22, 2007** at the **Sugar Land City Hall** to present the proposed projects for discussion and comment.

At this workshop and via the project web site, www.sugarlandtowncenterpedbike.org, the public was given an opportunity to submit comments and vote for the five (5) projects they feel would be the most beneficial to the area. Voting began on the web site August 23 and ended September 9, 2007.

Notifications

Meeting notice postcards and e-mail reminders were sent to area businesses, schools, churches, social service organizations, neighborhood and community associations, bicycle and disabled persons advocacy groups, and government and agency representatives.

Attendance

A total of 18 people attended the public presentation of the plan. Eight of these people submitted paper voting ballots.

Meeting Format

Dan Raine, AICP, Pedestrian-Bicycle Coordinator with H-GAC welcomed attendees and explained the purpose of the plan and why input from citizens is crucial to developing a successful plan that addresses the community's pedestrian and bicyclist needs. Mr. Raine explained that the team used public input from workshops held in May and June to produce a list of seventeen (17) proposed projects that would benefit the area.

Mr. Raine along with LAN team members David Manuel, EIT, AICP and Michael Feeney, PE went through each project, pointing out their location and explaining details and their benefit. The projects are:

1. SH 6 at US 59 Crossing Improvements
2. SH 6 Crossing Improvements: North of US 59
3. SH 6 Crossing Improvements: South of US 59
4. Pedestrian Improvements - Town Center Boulevard North

5. Pedestrian Improvements - Sugar Land Town Square
6. Pedestrian/Bicyclist Improvements near Fluor Daniel offices
7. Pedestrian Improvements - Meadow Lake Park area
8. Pedestrian Improvements - Southeast Quadrant of SH 6 and US 59
9. Pedestrian Improvements - Williams Trace Boulevard area
10. Pedestrian/Bicyclist Improvements - First Colony Boulevard area
11. Pedestrian Improvements - North Side of Mall
12. Pedestrian Improvements - Theatre and South Side of Mall
13. Pedestrian Improvements - Sweetwater Boulevard and Methodist Hospital
14. Pedestrian Improvements - Lexington and Austin
15. Bike Racks at Businesses/Destinations
16. Bicycle Improvements - Overall Study Area
17. Bicycle Signal on Lexington
18. Pedestrian Overpasses
19. Transit/Trolley Service

Other policy improvements were also presented that were not to be voted upon, as they were not subject to the ranking for cost-effectiveness and other factors. Following the presentation of the projects, Mr. Raine explained the voting process. Attendees were given a handout explaining the potential improvements, which contained one ballot each to cast their vote, choosing the five (5) projects they feel would most benefit Sugar Land. Mr. Raine then opened up the floor for questions regarding the projects. Some of the topics discussed/comments included:

- Enforce drivers to stop when pedestrians are approaching. An example can be found in La Jolla, California
- Implement a push-button light to stop traffic to enable pedestrians to cross when needed therefore traffic wouldn't stop when there are no pedestrians waiting
- Stop signs on Town Center Boulevard will reduce pass through traffic making it safer for pedestrians to use
- Rumbling pavement effect can replace speed humps in places
- In reference to improvement #11- removing light…interactive crossing. Not sure if stop sign will be useful
- Transit system will be good for adolescents who cannot drive yet but who don't walk but frequent the town center
- Trolleys and other transit vehicles should accommodate bike racks
- Signal Timing, for example at Fluor Daniel Drive, is too short. There is not ample time for pedestrians to cross safely before light is green again
- Suggest having a signal that will allow pedestrians to cross almost immediately after hitting it. Then, if there are no pedestrians, cars will not be stopped unnecessarily. Stopping cars when there is no need "only transfers mobility issues."
- There are many "Stop" signs in the city that are dangerous, due to there lack of a stop bar. "Why doesn't someone just buy a $2 bottle of spray paint and fix the problem?"

- "Why aren't there more speed humps or those strips of pavement that are raised to slow drivers"
- Transit system will allow more mobility to teens who don't yet drive
- Visitors at the future Convention Center will also benefit from transit
- More "active" groups (such as gyms and running clubs) need to know about the study

Teri Kaplan, Bicycle Coordinator for TxDOT's Houston District, offered the following:

- Great ideas being suggested but the city needs to remember that there are other agencies and groups that will have a say in this process, such as Federal Highway Administration
- Many do not realize that pedestrian bridges and overpasses actually need to be stronger and more structurally sound than bridges for vehicles

Before adjourning for voting, Mr. Raine thanked everyone for attending and encouraged them to direct others to vote for their favorite projects at www.sugarlandtowncenterpedbike.org. He explained that voting would be available until September 9.

Project Voting

A total of 8 ballots were received at the public workshop. Following the close of web site voting on September 9, results will be tabulated and a preferred list of projects developed.

Photographs






Appendix F
Public Preference Survey

Project Development

Using input gathered from two rounds of public workshops held in April and June 2007, the project team, along with the City of Sugar Land and H-GAC, developed a list of potential projects to improve and enhance pedestrian and bicyclist safety and mobility. Ideas and issues on the maps drawn by the public were concretized into a physical description. For example, "difficult access to Meadow Lake Park" became "install raised crosswalk at park entrance, construct sidewalk to end of Colony Lakes Drive, and construct bike trail connecting park to citywide system" A public workshop was held on **August 22, 2007** at the **Sugar Land City Hall** to present the proposed projects for discussion and comment.

At this workshop and via the project web site, www.sugarlandtowncenterpedbiken.org, the public was given an opportunity to submit comments and vote for the five (5) projects they feel would be the most beneficial to the area. Voting began August 23 and ended September 9, 2007.

All persons that had left contact information either through website visits, previous meetings, or personal e-mails and phone calls, were notified of the survey and asked to select their top five projects.

27 responses were received through the website, in addition to 8 paper ballots at the August public meeting, for a total of 35. Although the vote total is lower than the previous special district studies in Montrose and Galveston, it should be noted that the Sugar Land study area, at 1.5 square miles, is less than half the size of the other two districts, and its land use profile is unique, consisting almost exclusively of commercial retail uses, with fewer than 2,000 residents actually within the study area boundaries, compared to approximately 40,000 for each of the previous studies.

The results tallied as shown in the listing below.

Voting Results

35 possible votes per item—Projects (Numbered in Order Presented) Sorted by Number of Votes

Number	Potential Improvement	Vote Count
1	SH 6 at US 59 Crossing Improvements	20
2	SH 6 Crossing Improvements: North of US 59	9
3	SH 6 Crossing Improvements: South of US 59	11
4	Pedestrian Improvements - Town Center Boulevard North	10
5	Pedestrian Improvements - Sugar Land Town Square	7
6	Pedestrian/Bicyclist Improvements near Fluor Daniel offices	5
7	Pedestrian Improvements - Meadow Lake Park area	1
8	Pedestrian Improvements - Southeast Quadrant of SH 6 and US 59	5
9	Pedestrian Improvements - Williams Trace Boulevard area	11
10	Pedestrian/Bicyclist Improvements - First Colony Boulevard area	6
11	Pedestrian Improvements - North Side of Mall	3
12	Pedestrian Improvements - Theatre and South Side of Mall	6
13	Pedestrian Improvements - Sweetwater Boulevard and Methodist Hospital	3
14	Pedestrian Improvements - Lexington and Austin	2
15	Bike Racks at Businesses/Destinations	14
16	Bicycle Improvements - Overall Study Area	21
17	Bicycle Signal on Lexington	9
18	Pedestrian Overpasses	11
19	Transit/Trolley Service	18

Final Scored Ranking of Potential Improvements

The scoring mechanism used to rank the potential improvements used a score created by multiplying the number of votes by a weighting factor, called the "composite rating." This rating was the sum of four qualitative factors measuring relative feasibility, relative cost, safety benefit and relative demand. These four factors received rankings of 1 to 3, where 3 was considered "best." These are explained below the table.

Final Rankings of Potential Improvements

Code Number	POTENTIAL IMPROVEMENT	Relative Feasibility A	Relative Cost B	Safety Benefit C	Relative Demand D	Composite Rating E=A+B+C+D	Vote Count V	Overall Score E * V	Ranking
1	SH 6 at US 59 Crossing Improvements	2	1	2	2	7	20	140	1
15	Bike Racks at Businesses/Destinations	3	3	1	2	9	14	126	2
16	Bicycle Improvements - Overall Study Area	2	1	1	2	6	21	126	3
3	SH 6 Crossing Improvements: South of US 59	2	3	2	3	10	11	110	4
19	Transit/Trolley Service	2	1	1	2	6	18	108	5
4	Pedestrian Improvements - Town Center Boulevard North	2	3	2	3	10	10	100	6
9	Pedestrian Improvements - Williams Trace Boulevard area	3	2	1	2	8	11	88	7
17	Bicycle Signal on Lexington	2	2	2	3	9	9	81	8
5	Pedestrian Improvements - Sugar Land Town Square	3	3	2	3	11	7	77	9
2	SH 6 Crossing Improvements: North of US 59	2	2	2	2	8	9	72	10
18	Pedestrian Overpasses	1	1	1	2	5	11	55	11
12	Pedestrian Improvements - Theatre and South Side of Mall	2	2	2	2	8	6	48	12
10	Pedestrian/Bicyclist Improvements - First Colony Boulevard area	3	2	1	1	7	6	42	13
6	Pedestrian/Bicyclist Improvements near Fluor Daniel offices	3	2	1	2	8	5	40	14
8	Pedestrian Improvements - Southeast Quadrant of SH 6 and US 59	2	2	1	1	6	5	30	15
13	Pedestrian Improvements - Sweetwater Boulevard and Methodist Hospital	3	3	2	2	10	3	30	16
11	Pedestrian Improvements - North Side of Mall	2	3	2	2	9	3	27	17
14	Pedestrian Improvements - Lexington and Austin	3	3	1	3	10	2	20	18
7	Pedestrian Improvements - Meadow Lake Park area	3	3	1	1	8	1	8	19

A: Relative Feasibility: 3=Easy, 2=Average, 1=Difficult
B: Relative Cost: 3=Inexpensive (under $50,000), 2=Average ($50,000-130,000),
1=Expensive (over $130,000)
C: Safety Benefit: 2=High Benefit, 1=Low Benefit
D: Relative Demand: 3=Higher, 2=Average, 1=Lower (see full analysis in Appendix I)
E: Composite Rating: A+B+C+D
V: Vote Count (as detailed in previous section)
Overall Score: E multiplied by V

Feasibility is an assessment of the complexity of project approval and administration, as well as design and construction time. Bike racks received the highest rating of 3, indicating little more than a simple procurement process. Most pedestrian improvements involved crosswalk striping and

sidewalk and curb ramp construction, and received a score of 2. Finally, improvements along state highways, although similar in specifications to other pedestrian improvements, will require coordination between the City of Sugar Land, TxDOT, and the Texas Department of Licensing and Review (for ADA compliance). This additional coordination implies a longer time frame, and thus such projects receive the lowest score of 1.

Cost scores were based on the estimated expense of each improvement. Striping and signage are typically low-cost. Pedestrian improvements can be moderately expensive, because of the linear distance of missing sidewalks and number of missing or substandard curb ramps. Improvements that are more limited in geographic area, as well as bike rack improvements that involve simple purchasing agreements, are rated low-cost.

Safety benefit is defined as the potential improvement to pedestrian and bicyclist safety. For example, SH 6, Williams Trace, and other major arterials have heavy traffic volumes moving at relatively high speeds, and improvements there will benefit pedestrians by increasing their safety. Other safety-impact improvements include speed-reduction measures in areas of heavy pedestrian activity. These in general are rated higher than improvements that affect convenience or accessibility.

Finally, relative demand measures the number of persons likely to use or benefit from each improvement. The Federal Highway Administration (FHWA) prescribes methodologies that are based on population density, location of destinations such as schools, offices, and transit stops, improvement over existing conditions, and travel demand modeling. The full detail of the FHWA methodology used is located in Appendix I. Note that bicyclist-related improvements were not analyzed in the same manner as pedestrian improvements. The three bicyclist improvements were assigned a relative demand based on subjective judgment.

These four criteria are summed, and the resulting number multiplied by the number of votes each improvement received from the public.

Appendix G
Additional Public Comments

Listed below are additional public comments that were submitted through the website.

It is obvious that there needs to be some walkable connections between the main retail areas of Sugar Land. I love the areas that have been developed, Town Square, the outdoor plaza at First Colony Mall, and soon Lake Pointe Town Center. What I don't like is having to car hop from area to area to visit multiple places in one day. I think making Hwy 6 or 59 crossable by pedestrians in a way that would be inviting will be very difficult especially in the summer or after dark.

Although expensive, I think some type of shuttle bus loop or even a subway loop would be great. If the major retail areas were connected by a subway loop, one could park at one location and ride the subway to other stores without have to drive and park several times. Plus the stations could be situated in a way that the neighborhood residents on the fringe of the retail developments could access them by walking a short distance. As time progressed other subway lines could be connected that went out to other parts of Sugar Land so more residents could get "downtown" without have to drive at all. This could become a sort of wheel of subways with the outer lines being the spokes and the original loop being the central hub. Of course this is very expensive, a logistical nightmare, and I suppose subways are a safety concern. To start, it could be a shuttle bus loop to gauge ridership to see if a subway would be viable. However, to take Sugar Land forward through the next 30 years I think this should be strongly considered. I don't think pedestrian friendly sidewalks and bike lanes will do it alone. Look at Houston; they are trying to play catch up with their light rail system that should have been built 30 years ago. I hope Sugar Land won't end up doing the same things.

"The SL Loop" - First Colony Mall, Methodist Hospital, Lowe's/Target, Lake Pointe Town Center, First Colony Commons

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My husband and I have lived in Sugar Lakes since 1989 and have been avid cyclists since the early 1990s. We ride almost every Sunday and most Saturdays. In order to make cycling safe through out the city, education and enforcement campaigns are needed for both motorists and cyclists. I can't count the number of times I've almost been sideswiped, honked at, yelled at and/or cussed at for taking up either part of or a whole a lane to ride around Sugar Land. At this point, I feel like I'm taking my life in my hands when I head out on my bike. For example, we're looking forward to being able to ride to Whole Foods, but have serious concerns about getting hit making the trip which will be about two miles from our house.

As I stated earlier, I believe there needs to be both education and enforcement for both motorists and cyclists. Motorists need to know the rights of bicycles on the road – that a cyclist does have the right to be on the road and not on the sidewalk – and enforcement through ticketing when a motorist violates a cyclist's rights. Cyclists have responsibilities which come with the rights to be able to use the road including stopping at stop signs, not taking up more than 1 lane of traffic, not impeding traffic, etc. Cyclists also need education on these facts as well as enforcement through ticketing if necessary.

Additionally, to make Sugar Land walker-friendly, some of the same education/enforcement needs to happen for motorists. It can often be frightening to try and cross the streets in Sugar Land Town Square. Motorists don't often don't stop for pedestrians. Hopefully, many of the proposed items will help with this problem.

I enjoy living in Sugar Land and understand that many of these challenges are faced by cities everywhere. I'm excited the city is taking on these challenges and working to make Sugar Land a better place to live and be active.

Our interest is mostly access from the Old Sugar Mill area to a network of hike and bike trails. One of the destinations would be the Town Center, but in actuality, the congestion/traffic is so intense, I am not sure it will be of much use to most bikers. Biking trails (similar to Terry-Hershey Park in Houston) that connect to the new Brazos River Park, Oyster Creek Park and Cullinan Park to major subdivision areas of Sugar Mill, Telfair, First Colony are much preferred, especially if dedicated highway crossings are built under existing bridges that bypass the major intersections and allow non-stop riding (again similar to T-H Park).

I have attached a proposed routing of such a hike and bike trail (routing marked in bold red line)

Thanks for all your efforts to improve our great City.

It was difficult to choose just 5 - several connect to each other.

I have attended 3 meetings about the study. I have the following comments on specific improvements:

No. 4 - I do not want to see stop signs on Town Center Boulevard Crosswalks for pedestrians at various points will be good but signals should be used only when pedestrians cross and left green for traffic. The pedestrian option should respond almost immediately to encourage pedestrians to use these crossovers but we don't want to exchange pedestrian traffic issues with more vehicle issues.

No. 5 - instead of a speed HUMP, why not use strips like on Country Club Boulevard's quiet zones? Also, try not to take from the anesthetic look of City Walk with bright yellow stripes. Use white bricks to delineate crosswalks.

No. 11 - do not remove the new signal. We had such difficulty crossing the Mall Ring Road before the light was installed. We do need to work on helping pedestrians navigate this intersection.

No. 19 - this is my favorite option for mobility in the area and my group submitted this at the workshop meeting. I have several notes to make about the presentation board as it does not reflect some of our thoughts.

A. In order for trolleys to be utilized, they must run on time about 10-12 minutes apart and there should be enough trolleys to handle demand. I do not think including the shopping center at Williams Trace is feasible for any such system as it is too far from the main Town Center area. It should be dropped.

B. Some trolleys can be designed to handle bikes and wheelchairs to move these pedestrians around the study area.

C. Trolleys can run on different time schedules - summer/holiday/week-end, Friday and Saturday late nights, week-day light use.

D. Students might ride free to encourage use over vehicles and to allow younger teens safe mobility.

E. Have about 6 main "stations" on the perimeter of the area for cars to park. Then schedule stops between these 6 main stations for quick pick-up and drop off. Increase security at the stations at high risk times.

F. Suggested stations because of unused parking: DSW parking lot, Whole Foods (not sure of parking here but somewhere inside Lake Pointe), Target parking corner near Hwy 59, Lowe's parking, AMC parking near Lexington, Mall parking near Lexington outside Food Court entrance. Build well-lit, covered waiting areas at these stations. Have smaller collection points where trolleys stop.

Appendix H
Air Quality Benefits

Premise of Benefits

The objective of the overall Pedestrian/Bicyclist Special Districts Program is to fund strategic investments in walk/bike facilities to improve safety and mobility. Several of the project recommendations are to provide attractive and functional sidewalks in the areas in which they are most needed, namely where sidewalks do not exist, or where existing sidewalks have deteriorated and are in poor condition. These improvements in the pedestrian environment will make this travel mode more attractive. It will also increase the attractiveness of transit as a travel mode, if in the future the study area is served by a transit system. Additionally, the recognition of bicycle travel through the network of trails, together with bicycle rack installation at visible locations near destinations, will make this travel mode more visible and more attractive. The net result anticipated is a modest decrease in automobile trips, vehicle miles traveled, and associated vehicle emissions.

Statement of Benefit

Key Data and Assumptions

- 272,373 person-trips in Traffic Analysis Zones (see right)
- 2.58 average vehicle occupancy

(person trips per vehicle trip)

- 0.9% reduction in vehicle trips due to projects
- 12.0 miles per vehicle trip
- local intrazonal vehicle type mix

Table 1. TAZs included in or adjacent to Sugar Land study area

2175	2180	2192
2176	2187	2193
2177	2188	2197
2179	2189	

Results

- VOC reduced: 5.701 kg/day
- NOx reduced: 11.744 kg/day

Calculations

There are very few studies on the effect of microscale pedestrian improvements on travel patterns. The "Making the Land Use, Transportation, Air Quality Connection" (LUTRAQ) demonstration project is one such study (1000 Friends of Oregon (1993). Making the Land Use Transportation Air Quality Connection -- The Pedestrian Environment -- Volume 4A. Available at: http://ntl.bts.gov/DOCS/tped.html) Special attention was given to the quality of the pedestrian environment as gauged by the Pedestrian Environment Factor (PEF), a composite measure of "pedestrian friendliness". The four variables included in the PEF are: ease of street crossings, sidewalk continuity, local street characteristics (grid vs. cul-de-sac) and topography. Each of these is given a score of 1-3, resulting in a maximum PEF score of 12. Most significant to this project was the finding that a higher PEF score for a zone was accompanied by a lower automobile mode share for that zone. A one-point increase in PEF was accompanied by a decrease in automobile mode share of 1.8 percent.

The sidewalk improvements proposed here will increase sidewalk continuity along approximately 9,000 linear feet of neighborhood streets in the study area. Although PEF was not field-verified, this improvement is expected to increase the PEF score by 1 based on sidewalk continuity benefits. While the Portland study would suggest a 1.8 percent decrease in automobile mode share, H-GAC estimates a more conservative 0.9 percent decrease.

The number of automobile trips generated by these zones is estimated at 105,571 per day based on 272,373 person trips/day divided by the Sugar Land average vehicle occupancy of 2.58. The

average vehicle trip distance of 12.0 miles is calculated using 2005 regional trip characteristics by trip type (e.g. home-based work), weighted by the distribution of work, non work and non-home trips modeled for the TAZs in the study area (See Tables 2 and 3 below). According to the 2005 American Community Survey, work trip travel times for the region averaged 28.0 minutes, while in the City of Sugar Land the average was only 26.6 minutes, or 95.0% of the regional average. In order to calculate an average trip distance for Sugar Land, the regional trip distances were pro-rated by that same 95.0% figure, which assumes similar travel speeds. For example, the regional average trip distance for home-based work trips was 20.3 miles. Multiplying this figure by 95.0% yields 19.3 miles, shown below in Table 2.

Table 2. Data for Estimate to Average Trip Distance

Trip Purpose	2005 Sugar Land Avg Distance (mi)	Number of Trips in TAZs
Home-Based Work	19.3	41,170
Home-Based School	8.9	63,485
Home-Based Shopping	9.6	53,011
Home-Based Other	11.8	34,588
Non-Home-Based	12.4	68,994
Truck/Taxi Trips	12.4	11,125
Weighted average	**12.0**	**272,373**

Table 3. Data for Estimate to Vehicle Occupancy

Trip Purpose	2005 Sugar Land Avg Occupancy	Number of Trips in TAZs
Home-Based Work	1.77	41,170
Home-Based School	4.67	63,485
Home-Based Shopping	2.02	53,011
Home-Based Other	1.94	34,588
Non-Home-Based	1.90	68,994
Truck/Taxi Trips	-	11,125
Weighted average	**2.58**	**272,373**

Sources: 2005 American Community Survey, U.S. Census Bureau; Technical Memo RE: Houston-Galveston 1995 Household Travel Survey from David Pearson, Texas Transportation Institute to Jerry Bobo, H-GAC, December 20, 1996; and 2009 Person Trip Tables provided by H-GAC August 2007. Home-based non work trips are assumed to be evenly distributed between school, shopping and other.

VMT reduced are calculated to be 8,266 per day based on multiplication of the average trip distance (12.0), number of vehicle trips in the zone (105,571) and the percentage of trips reduced by the project (0.9%).

12.0 x 105,571 = 1,266,852

1,266,852 * 0.009 = 11,402 mi/day

Vehicle emissions are calculated by multiplying VMT by the weighted average emission rates by vehicle type (average emission rates by vehicle type multiplied by the fraction of such vehicles measured regionally on the Local (intrazonal) road type as shown in Table 4 below).

Table 4. Vehicle Mix and Average Emission Rates by EPA Vehicle Type

	LDGV	LDGT1	LDGT2	HDGV	LDDV	LDDT	HDDV	MC	All Vehicles
Vehicle Type									
Local Roads	59.0%	24.2%	7.2%	3.2%	0.2%	0.3%	5.9%	0.1%	**100.0%**
Emissions									
VOC (g/mile)	0.40	0.47	0.45	1.36	0.06	0.10	1.12	4.65	**0.50**
NOx (g/mile)	0.62	0.66	0.77	3.87	0.50	0.54	5.58	0.97	**1.03**

VOC = 11,402 mi/day * 0.5 g/mi = 5,701 g/day = 5.701 kg/day

NOx = 11,402 mi/day * 1.03 g/mi = 11,744 g/day = 11.744 kg/day

Appendix I
Pedestrian/Bicyclist Demand Analysis

Introduction

Pedestrian facility demand was projected through use of the Pedestrian Potential Index and the Pedestrian Deficiency Index, a concept that was originally developed for the Portland, Oregon region. Ultimately, this analysis resulted in a "Demand" ranking of 1 to 3, with 1 being lowest and 3 being highest. This corresponds to the rankings given in Chapter 3 for feasibility, cost, and safety impact.

A ranking was generated through this process for Potential Improvements 1 through 14, plus 17 and 18. Improvements 15 and 16 were focused on bicyclists, and 19 was transit, a programmatic improvement rather than physical. These three improvements were not scored in the same manner as the others, but assigned a relative demand figure of 2 (the middle ranking), for use in the overall project ranking (see Chapter 3).

The demand analysis included the following independent variables: the number of activity centers within 1/4 mile of project sites; average parcel size within 1/4 mile of project sites; percent zero-vehicle households and walk-to-work commute share circa the US Census 2000 for census block groups directly adjacent to project sites; traffic speeds and volumes for project street sections and intersections; right-of-way widths for project street sections; and number and proximity of pedestrian crash locations. Scores were subjectively assigned from one to five based on values of the independent variables, with 1 being least conducive to pedestrians and 5 being most conducive to pedestrians. "High-Volume" pedestrian areas were coded 1, with "standard" volumes being zero. Tables 1 and 2 below summarize the scores for the pedestrian projects.

Table 1. Pedestrian Potential -- Straight Score

Project Number	% Walk to Work	% Zero Vehicle Housing Units	Average Parcel Size	Activity Centers	Heavy Pedestrian Area	Subtotal
1	1	3.25	4	4	1	13.25
2	1	1	2	1		5
3	2	5	4	4		15
4	2	5	4	4	1	16
5	2	5	4	4	1	16
6	1	5	2	1		9
7	1	1	4	3		9
8	1	2	1	1		5
9	1	2.33	5	1		9.33
10	1	1	3	1		6
11	2	5	3	5		15
12	2	5	1	3		11
13	1	1	1	3		6
14	2	5	1	3		11
17	2	5	3	3		13
18	1.67	3	3	3		10.67

Higher scores indicate higher potential pedestrian demand

Table 2. Pedestrian Deficiency -- Straight Score				
Project Number	Traffic Speed	Traffic Volume	Pedestrian Collisions	Subtotal
1	3	3	4	10
2	3	2	4	9
3	3	1	2	6
4	4	2	4	10
5	4	1	4	9
6	4	2	5	11
7	4	4	5	13
8	3	1	5	9
9	3	2	5	10
10	3	5	5	13
11	4	4	3	11
12	4	4	3	11
13	3	4	2.5	9.5
14	3	3	1	7
17	3	3	2.5	8.5
18	2	1	4.67	7.67

Higher scores indicate higher pedestrian deficiency

Pedestrian facility improvements in high-volume pedestrian areas were weighted by applying a multiplier of 5 to the initial total score. Other factors were weighted according to the figures shown at the top of Tables 3 and 4 below. The remaining rows are the scores from Tables 1 and 2, multiplied by those weighting factors.

Table 3. Pedestrian Potential -- Weighted Score						
Project Number	% Walk to Work	% Zero Vehicle Housing Units	Average Parcel Size	Activity Centers	Heavy Pedestrian Area	TOTAL SCORE
WEIGHT	**3**	**2**	**1**	**1**	**5**	**-**
1	3	6.5	4	4	5	22.5
2	3	2	2	1		8
3	6	10	4	4		24
4	6	10	4	4	5	29
5	6	10	4	4	5	29
6	3	10	2	1		16
7	3	2	4	3		12
8	3	4	1	1		9
9	3	4.66	5	1		13.66
10	3	2	3	1		9
11	6	10	3	5		24
12	6	10	1	3		20
13	3	2	1	3		9
14	6	10	1	3		20
17	6	10	3	3		22
18	5	6	3	3		17

Higher scores indicate higher potential pedestrian demand

Table 4. Pedestrian Deficiency -- Weighted Score				
Project Number	Traffic Speed	Traffic Volume	Pedestrian Collisions	TOTAL SCORE
WEIGHT	3	1	3	-
1	9	3	12	24
2	9	2	12	23
3	9	1	6	16
4	12	2	12	26
5	12	1	12	25
6	12	2	15	29
7	12	4	15	31
8	9	1	15	25
9	9	2	15	26
10	9	5	15	29
11	12	4	9	25
12	12	4	9	25
13	9	4	7.5	20.5
14	9	3	3	15
17	9	3	7.5	19.5
18	6	1	14	21

Higher scores indicate higher pedestrian deficiency

The scoring consists of points according to street segment and factor. These are combined into two separate groups to comprise the Pedestrian Potential Index and the Deficiency Index. Priority projects for future funding would be projects that rank high in the Pedestrian Potential Index (lots of potential users) and low in the Deficiency Index (obstacles to their usage). This score, Potential minus Deficiency, was converted into a ranking group of 1 to 3, with 1 being the lowest, and 3 the highest. These rankings are collected in Table 5.

Table 5. Final Weighted Scores				
Project Number	Pedestrian Potential Score	Pedestrian Deficiency Score	Potential minus Deficiency	Ranking Group
1	22.5	24	**-1.5**	2
2	8	23	**-15**	2
3	24	16	**8**	3
4	29	26	**3**	3
5	29	25	**4**	3
6	16	29	**-13**	2
7	12	31	**-19**	1
8	9	25	**-16**	1
9	13.66	26	**-12.34**	2
10	9	29	**-20**	1
11	24	25	**-1**	2
12	20	25	**-5**	2
13	9	20.5	**-11.5**	2
14	20	15	**5**	3
15				2
16				2
17	22	19.5	**2.5**	3
18	17	21	**-4**	2
19				2

Ranking Group 1 = less than -15
Ranking Group 2 = between -15 and 0
Ranking Group 3 = greater than 0

Improvements 15, 16, and 19 not evaluated with numerical method.

Glossary

Acronyms

ADA	Americans with Disabilities Act
CMAQ	Congestion Mitigation and Air Quality
COSL	City of Sugar Land
FBISD	Fort Bend Independent School District
FCCA	First Colony Community Association (Civic organization in study area)
H-GAC	Houston-Galveston Area Council
LID	Levee Improvement District
METRO	Metropolitan Transit Authority of Harris County, Texas (transit agency providing service throughout the Houston metro area, including portions of Fort Bend County, but not the City of Sugar Land)
PCD	Planned Community Developers (major commercial property owner in study area)
TAS	Texas Accessibility Standards (local interpretation of ADA)
TDLR	Texas Department of Licensing and Regulation (administers ADA/TAS in Texas)
TxDOT	Texas Department of Transportation (owns and maintains all numbered state highways, including US 59 and SH 6)
USDOJ	United States Department of Justice (administers ADA nationwide)
WCID	Water Control Improvement District

Terms/Names

Allee	Walkway or pathway between two rows of trees
Median	A landscaped area between two sets of travel lanes on a roadway
Creekside	A retail development south of US 59 and east of SH 6; includes Chuck E. Cheese.
Fluor Daniel	A street which crosses SH 6 north of US 59; also the office complex it leads to (Fluor Daniel the company is now part of Schlumberger). Fluor Daniel originally owned much of the land which is now Lake Pointe.
Kensington	A retail development north of US 59 and west of SH 6; includes Target
Lake Pointe	A mixed-use development north of US 59 and east of SH 6; mostly east of Fluor Daniel offices as well, includes a Whole Foods Market, for-sale townhomes, and various medical office buildings
Ped	Abbreviation for pedestrian
Ped Button	A push button on a pole or other surface near a traffic signal; pushing it indicates to the traffic signal the presence of pedestrians desiring to cross the roadway.
Speed Bump	A device affixed to or part of the roadway; generally 3-4 inches in height and width; intended to slow traffic almost to a halt
Speed Hump	A larger and more gentle version of a speed bump, a hump is typically 4-5 feet or more in width and less abrupt than a bump; intended to slow but not stop traffic
Stop Bar	A wide stripe across the travel lanes of a roadway to indicate where traffic should stop while the traffic signal is red. It is placed behind any crosswalks.
Town Center	This report's study area—the commercial core of Sugar Land at the four corners of US 59 and SH 6
Town Square	A development south of US 59 and west of SH 6; includes Marriott Hotel, retailers along City Walk, Sugar Land City Hall, the City Plaza Condominiums

Credits

Houston-Galveston Area Council
Dan Raine, AICP

City of Sugar Land
Keisha Seals, PE
Michael Leech
Kimberley Terrell, ASLA

Lockwood, Andrews, & Newnam, Inc.
David Manuel, AICP
Michael Feeney, PE
Christina Berry
Marshall Cheek
Charles Taylor, PE
Thomas Duncan, PE
Dorinda Meeks

Nelson\Nygaard Consulting Associates
Stephanie Groll
Michael King
David Waugh

The Clifford Group, Inc.
Margaret Menger
Ellen Feely
Tiffany Estes