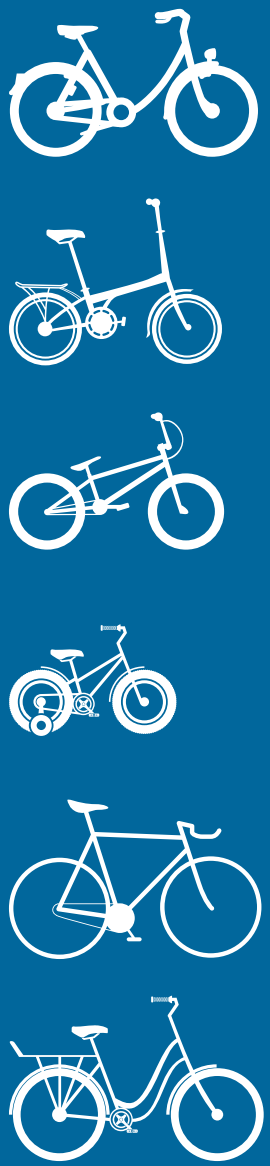
HOUSTON BIKEPLAN





City of Houston
February 2017

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Houston Bike Plan

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Acknowledgments

City of Houston

Sylvester Turner, Mayor

Annise D. Parker, Former Mayor

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The Houston Bike Plan was adopted by City Council and Mayor Sylvester Turner on March 22, 2017 by motion 2017-0161.

Project Funding Partners

City of Houston
BikeHouston
Houston Parks Board
Houston Galveston Area Council
Federal Transit Administration (FTA)
Federal Highway Administration (FHWA)
Texas Department of Transportation (TxDOT)

City of Houston Staff

Planning & Development

Patrick Walsh, Director
Amar Mohite
Cathy Halka
Matthew Seubert
Monique Johnson

Public Works & Engineering

Dale Rudick, Director
Jeff Weatherford
Ian Hlavacek
Anita Hollmann

Parks & Recreation

Joe Turner, Director
Rachael Die

Bicycle Advisory Committee

AARP	Isabel Longoria	Houston – Galveston Area Council	Chelsea St. Louis Jesse Thornsen Andrew Pompei
Alief Independent School District	Sue Page	Houston Independent School District	Leo Bobadilla
BikeHouston	Michael Payne Mary Blitzer	Houston Parks Board	Chip Place Roksan Okan-Vick
Bike Barn	Neil Bremner	Management District Energy Corridor	Clark Martinson
City of Houston – Health Department	Stephen Williams Carra Moroni	Management District Houston Downtown	Lonnie Hoogeboom
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Critical Mass	Fab Ordonez	Neighborhood Centers	Matt Starr
Greater Houston Partnership	Joey Sanchez	Super Neighborhood Alliance	Steve Parker
Houston B-cycle	Will Rub	TxDOT – Houston District	Ana Ramirez Huerta
Houston Coalition for Complete Streets	Jay Blazek Crossley	Urban Land Institute (ULI)	Ann Taylor

Study Team

Traffic Engineers, Inc.

Geoff Carleton
Brad Eaves
Shaida Libhart
James Llamas
Alex Weinheimer

Morris Architects

Christof Spieler
Armandina Chapa
Amy Westermeyer
Mel Fuentes

Asakura Robinson Company

Zakcq Lockrem
Tara Mather

HOUSTON BIKE PLAN

EXECUTIVE SUMMARY



EXECUTIVE SUMMARY



INTRODUCTION

Houston is a thriving, diverse, and vibrant city. New residents and businesses continue to move to Houston. New projects continue to be developed, from master-planned communities to higher-density, mixed-use neighborhoods. Much of this growth is driven by the affordable, attractive quality of life that is available in the city. With this growth, more people are moving about the city, and an increasing number are doing so by bicycle.

People bicycling in Houston match the diversity of the city and the types of bicycle trips people take are just as varied. The city and region have made great strides to support people bicycling. The Bayou Greenways Initiative is expanding rapidly to provide attractive, comfortable paths for people of all ages by transforming major bayou corridors in the City and beyond. The bike share system, Houston B-cycle, is in the process of a major expansion to connect more neighborhoods with more destinations. Bike connections on METRO's transit system continue to grow and more people of all backgrounds are riding in events like Tour de Houston and Critical Mass. The city has installed its first separated on-street bikeway on Lamar Street in Downtown and has adopted new context-sensitive infrastructure design approaches to integrate safe, comfortable bikeways into more streets in the City of Houston. PlanHouston, the City's first general plan, was adopted in 2015 and identifies a goal of Connecting People and Places, including the development and maintenance of a citywide bicycle plan.

THE HOUSTON BIKE PLAN

The City and region have made great strides in supporting the growing number of people bicycling, but without some organization and a coordinating framework the efforts risk being disconnected or missing opportunities to complement each other in ways that maximize the return on the investments. 1993 was the last time the City adopted a Comprehensive Bicycle Plan and the City and region have changed significantly in the twenty-three years since.

The 2017 Houston Bike Plan is a multi-year planning effort developed with the Houston community and many partners. The Bike Plan is a master plan similar to other City master plans that outline the City's long range vision, goals and recommendation for policies, programs and projects. It is a component plan required by the City's Complete Streets Executive Order.

The Bike Plan sets out a clear Vision to be a Gold-level Bicycle Friendly City by 2027. This is supported by goals that identify the transformative opportunity the plan represents for the City of Houston and establishes a framework for how to achieve that vision by building on the many successful efforts underway.

A Bicycle Toolbox has been developed detailing bikeway project elements, potential policy changes, and programmatic approaches to help make Houston a more bicycle-friendly city. The plan includes Implementation Strategies to move from plan to action and a Bikeway Network Map (Figure ES.1) has been developed with opportunities for short-term improvements and to achieve the ultimate vision.

The bikeways shown in the Bike Plan are recommendations for future facilities, representing corridors along which bicycle facilities should be considered along the corridor. Having a recommended facility in the Plan on a street does not mean the facility must be built on that street; nor does the Plan prohibit a facility from being built if the facility is not shown on a map in the Plan. The Plan provides a framework for agencies who are improving streets to consider as they develop designs for improvement along a particular corridor. Final decisions on the design and location of bicycle facilities on City streets will only happen after additional analysis and public engagement.

The City of Houston Planning & Development Department, in coordination with the Public Works & Engineering Department and the Parks & Recreation Department, lead the Plan update. The City has greatly benefited from the support of the project funding partners:

- BikeHouston;
- The Houston Parks Board;
- Houston-Galveston Area Council (H-GAC) with the Federal Transit Administration (FTA); Federal Highway Administration (FHWA); and Texas Department of Transportation (TxDOT)

THE OPPORTUNITY

The Houston Bike Plan presents a transformative opportunity for the City and implementation has the potential to create great improvements in mobility and access, health and safety, equity and access to opportunity, and economic development. While many positive elements are working together to make Houston more bicycle-friendly, there are still significant challenges to achieving that outcome across Houston's 640 square miles.

The plan sets out an approach to address the following challenges. These are detailed in **Chapter 2: Existing Conditions & Opportunities** of the Houston Bike Plan.

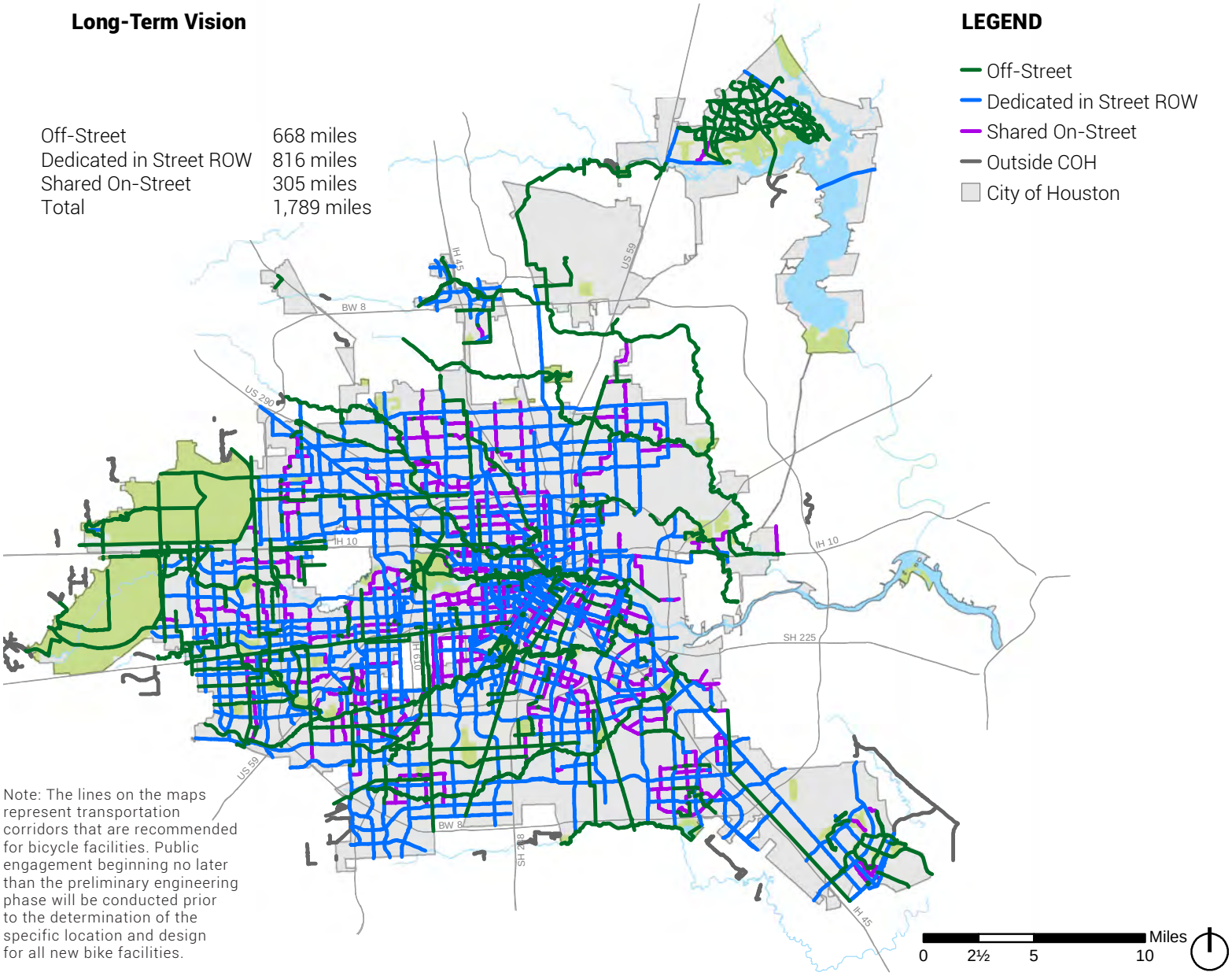
1. **Provide a safer, more comfortable environment for the growing number of people riding bicycles in Houston.**
   - More people are bicycling across Houston. Census data and counts, check outs of bike share bikes, participation in organized rides, and bike boardings on buses all show positive trends in ridership.
   - Over one third of trips by all modes in Houston are under three miles, ideal to be made on a bicycle in under 15 minutes. Even with recent growth, bicycle ridership remains small. Commute mode share is at approximately 0.5%, leading to more vehicles on the road and people getting less exercise. In some section of the City bicycle mode share approaches 4%.
   - The Existing Bikeway Network (Figure ES.2) has nearly 500 miles of designated bikeways, but most are below standard and only half provide a comfort level that is likely to attract anyone besides the most confident riders.
   - There have been 25 bicycle fatalities and over 1,500 reported bicycle crashes over the past 5 years.
2. **Provide affordable access to opportunities.**
   - Bicycles provide a cost-effective mobility alternative for families that cannot afford the annual cost of car ownership (estimated by AAA at over $8,600) or choose not to own a car for every person. This is particularly true when integrated with the region's transit options.
   - The Existing Bikeway Network (Figure ES.2) provides a bikeway within one half mile of 61% of Houston residents and 71% of jobs but many of these are narrow bike lanes or signed routes on arterials with significant traffic volumes and higher speeds. Many neighborhoods do not have existing bikeways.
   - Only 38% of people and 41% of jobs are within one half mile of a higher-comfort bikeway, such as those attractive to a broad range of cyclists.
   - This rate drops to 32-33% when population of color or those that are living in poverty are analyzed.
   - Bikeways connect near many activity

centers like Downtown, the Texas Medical Center, and Uptown, but last mile connections that would connect people to more jobs and key destinations are often missing.

3. **Improve community health and wellness.**
   - Bicycles provide an opportunity to exercise, improving health outcomes and reducing vehicle emissions that contribute to poor air quality.
   - Only 51.1% of the adult population in Houston gets the recommended amount of weekly aerobic physical activity.
   - Low activity levels contribute to an adult population in which 28.7% are obese, 8.5% are diabetic, and 29.8% have high blood pressure.
   - 32% of children in Houston are obese, a leading indicator of future health issues, and about 50% do not live within one half-mile of a park space.
4. **Compete with peer cities**
   - Quality of life indicators such as access to safe, comfortable opportunities to bicycle are strong factors when people and businesses are making decisions about where to locate.
   - A citywide bikeway network creates opportunities in more neighborhoods creating more choices for where to locate and benefits for more people.
   - Peer city average mode share for bicycling commutes is 1.8%; Houston is at 0.5%. Meeting the average mode share would represent over a 300% increase in bike commuting in Houston.
   - Peer cities have increased mode share for biking by employing a wide variety of strategies including improved bikeway improvements supported by policies and programs to serve a range of residents of various skill levels.
   - Cities with dedicated funds and spending targets for bicycle infrastructure have made significant strides in improving their bikeway networks.
5. **Benefit everyone, not just people who bike.**
   - Studies have shown that bicycle infrastructure investments can reduce commercial vacancy rates and increase retail sale volumes. For retail, people biking spend more overall because, while they spend less in a typical trip, they tend to visit stores more often.
   - Every person biking reduces the number of potential cars on the road. In travel lanes and parking areas, bicycles are more space efficient.
   - Dedicated bikeway facilities on thoroughfares reduce conflicts between people biking and driving.
   - Safe, abundant bicycle access to the bayou and utility corridor trails and transit lines maximizes the return on these significant community investments and allow more people to enjoy them.

Long-Term Vision

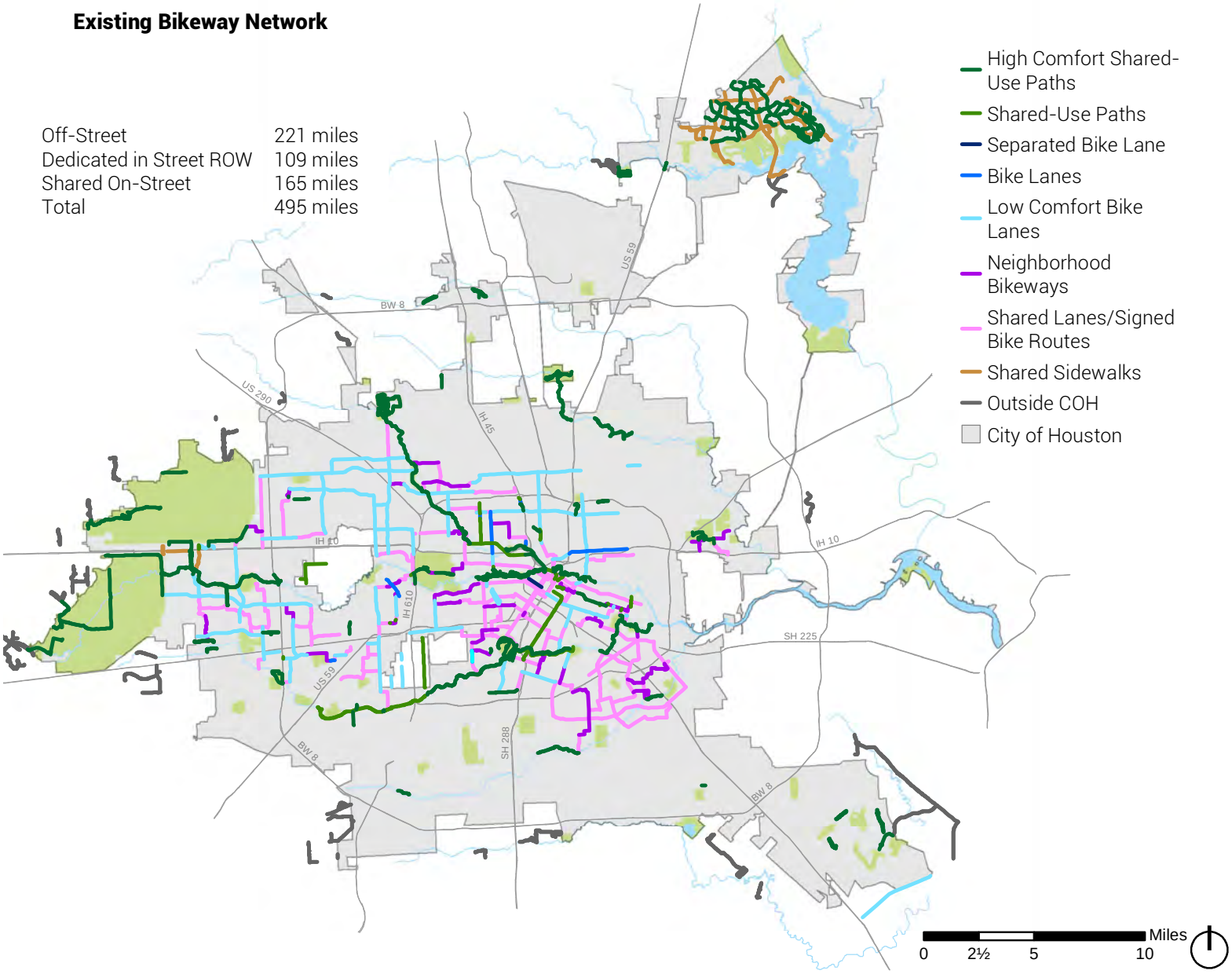
Off-Street	668 miles
Dedicated in Street ROW	816 miles
Shared On-Street	305 miles
Total	1,789 miles



Note: The lines on the maps represent transportation corridors that are recommended for bicycle facilities. Public engagement beginning no later than the preliminary engineering phase will be conducted prior to the determination of the specific location and design for all new bike facilities.

Source: City of Houston; Team Analysis & Site Visits

Figure ES.1: City of Houston Long-Range Bikeway Network Map
(detailed maps available at www.houstonbikeways.org)



Source: City of Houston; Team Analysis & Site Visits

Figure ES.2: Existing City of Houston Bikeways - As of June 2016

The Vision

The development of a vision and goals for the Houston Bike Plan (Figure ES.3) required a set of community conversations to reflect the broad values and expectations of a well-connected, citywide bike plan and the supporting policies and programs that go with it. The Bicycle Advisory Committee for the Houston Bike Plan, made up of a diverse set of community leaders, served as a sounding board and helped guide the direction of the plan. Community meetings, online forums and public surveys provided several thousand comments on both the broad goals for the plan and specific locations in the city where bikeway improvements are desired. There was also significant feedback on the draft of the Houston Bike Plan which was incorporated to develop the final Plan.

As discussed in **Chapter 3: Vision & Goals,** the Houston Bike Plan Vision sets an aspirational outcome for Houston to become a ***Gold Level Bike-Friendly City by 2027***, ten years from the development of this plan. Bike Friendly Communities is a rating system developed by the League of American Bicyclists to assess a community's efforts to encourage and support bicycling. The City of Houston is currently a Bronze-level Bicycle Friendly Community, largely based on the work the City and BikeHouston have done on education and the regional effort to improve the bayou trails. Achieving Gold level would be a significant step forward for the City.

To reach a Gold rating, significant progress will need to be made on a broad range of goals. These have been summarized into the four Houston Bike Plan goals outlined in Figure ES.3. These are focused on ***Increasing Safety, Increasing Access, Growing Ridership, and Developing and Maintaining Facilities***.

To achieve these goals, the Plan sets out a comprehensive plan to improve the environment for biking in Houston, and to make it inclusive to people of all ages, abilities, and backgrounds. It also sets out a set of ***performance metrics*** to assess how the City is performing against its goals (Figure ES.4).

To grow ridership, the plan focuses on improving opportunities for both people currently riding and also the 50-60% of the population that is "Interested but Concerned" about bicycling. This involves getting the right ***policies and programs*** in place to support access to bicycles, education of how to ride safely, end of trip facilities, and enforcement of regulations. The expansion of the ***high comfort bikeway network*** is critical to reach many more people and jobs across the city.

By 2027 Houston will be a Safer, More Accessible, Gold Level Bike-Friendly City

Goals

Improve Safety



To provide a safer bicycle network for people of all ages and abilities through improved facilities, education, and enforcement

Increase Access



To create a highly accessible, citywide network of comfortable bike facilities that connects neighborhoods to transit, jobs, and activity centers, including schools, universities, parks, and libraries

Grow Ridership



To exceed average ridership levels in peer cities by implementing policies and programs that enable more people to ride bicycles and encourage healthy, active transportation choice

Develop & Maintain Facilities



To develop and sustain a high-quality bicycle network, including both bikeways and end-of-trip facilities

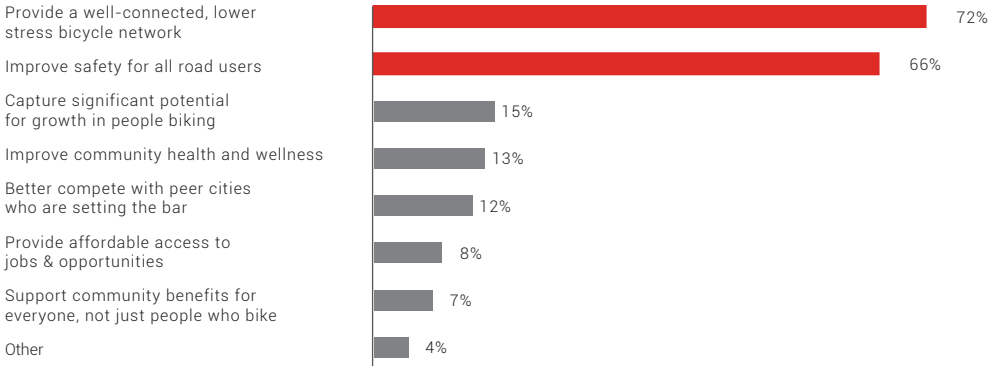
Figure ES.3 Houston Bike Plan Vision

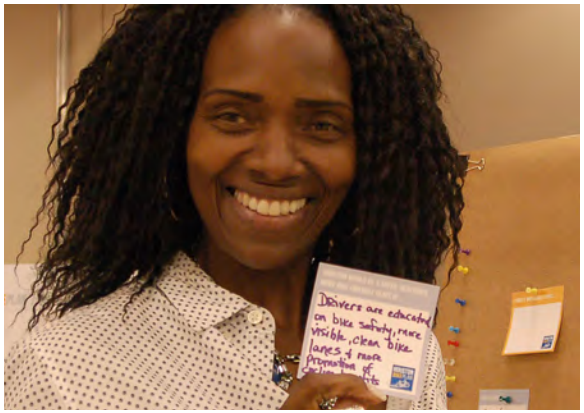
Vision: By 2027 Houston will be a Safer, More Accessible, Gold Level Bike-Friendly City

Goal Area	*BFA Rating Areas*						*Performance Metrics*	*Current Performance*	*Performance Trend (+ - or neutral)*	*Data Source*
	Enforcement	Education	Engineering	Evaluation	Encouragement	Key Outcomes				
Improve Safety 						✓	# of bicycle related crashes reported	361	-	H-GAC
						✓	# of bicycle fatalities per 10,000 commuters	7.4	+	H-GAC, US Census
				✓			Disparity in bicycle mode share versus fatalities	3.80	+	H-GAC, US Census
		✓					# of people who complete an approved bicycle education program	TBD	N/A	TBD
					✓		# of "Bicycle Friendly Businesses"	4	Neutral	League of American Bicyclists
Increase Access 			✓				% jobs within 1/o mile of a high-comfort bike facility	46%	+	US Census
			✓				% population within 1/o mile of a high-comfort bike facility			
							• Overall population	38%	+	US Census
							• Minority population	32%	+	US Census
							• Low income population	32%	+	US Census
			✓				% of facilities within ¼ mile of a high-comfort bike facility:			
							• Transit nodes (transit centers, Park & Rides, and light rail stations)	37%	+	METRO/City of Houston
							• Schools and libraries	23%	+	City of Houston
							• Community and multi-service centers	33%	+	City of Houston
			✓		✓		% population with comfortable access to greenways system (bayous and other trails)	21%	+	US Census
Increase Ridership 						✓	Commute mode share	0.5%	-	US Census
				✓			# of permanent count stations	2	Neutral	H-GAC
				✓		✓	% growth in bicyclists observed through permanent count stations	TBD	N/A	H-GAC
				✓			# of bike boardings on Metro per year	258,094	+	METRO
				✓			# of bike share checkouts per year	98,449	+	Houston Bike Share
					✓		Annual City events that support increased ridership (e.g., Sunday Streets, Tour de Houston, Bicycle Advisory Committee meetings)	11	Neutral	City of Houston
Develop and Maintain Facilities 			✓				Miles of high comfort bikeways per capita (per 10,000 people)	1.17	+	City of Houston/Census
			✓				% of bikeways in good or better condition	TBD	N/A	City of Houston
					✓		Population within ¼ mile of a bike share station	27,900	+	Houston Bike Share
					✓		Jobs within ¼ mile of a bike share station	155,600	+	Houston Bike Share
			✓				% of major transit nodes[1] with secured bike parking	4%	Neutral	METRO
				✓			Dedicated city staff (FTE) for bikeway program	1	Neutral	City of Houston

Figure ES.4: Performance Metrics for the Houston Bike Plan Goals

Figure ES.5 Priority Goals For Online Survey Responses







Participants at public meeting providing Goal and Map Feedback





A High-Comfort Bikeway Network

One of the key elements to improve bicycling in Houston is the expansion of safe, connected bikeways that minimize people's interaction with high volume, high speed traffic. This is one of the key barriers that keeps more people from riding. Cities that have made investments in expanding their network of comfortable bikeways have seen increases in overall ridership.

The City of Houston has approximately 500 miles of designated bikeways including off-street trails, dedicated bike lanes, and shared on-street bike routes. The study team assessed the existing bikeway network against the framework in Figure ES.6 to determine which of the existing facilities meet the standard of a high-comfort facility. The criteria include factors such as roadway width, travel lanes, travel speed, and traffic volumes. High-comfort facilities were those that rated a 1 or 2 on the scale and are the desirable outcome for bikeways in the proposed bikeway network. Level of comfort 3 and 4 bikeways are discouraged.

Figure ES.6 Bicycle Facility Level of Comfort Assessment

		MORE COMFORTABLE			LESS COMFORTABLE
		1	2	3	4
SHARED ON-STREET	SPEED LIMIT residential	25 MPH or less	30 MPH	30 MPH	35+ MPH
	SPEED LIMIT non-residential		25 MPH or less	30 MPH	35+ MPH
	NUMBER OF LANES	2 LANES	2-3 LANES	2-3 LANES	4+ LANES
	INTERSECTING STREETS	NARROW, CALM	CALM	BUSY	WIDE, BUSY
		1	2	3	4
DEDICATED BIKE LANES	SPEED LIMIT	30 MPH or less	30 MPH	35 MPH	40+ MPH
	LANES EACH DIRECTION without median	1 LANE	1 LANE	2+ LANES	2+ LANES
	LANES EACH DIRECTION with median	1-2 LANES	2 LANES	3+ LANES	3+ LANES
	BIKE LANE WIDTH	6 FEET	5-6 FEET	5 FEET	<5 FEET
	INTERSECTION TREATMENTS	CONTINUOUS	SHARED	SHARED	NONCONTINUOUS
	SEPARATION	SEPARATION MOVES A FACILITY ONE COMFORT LEVEL TO THE LEFT			
		1	2	3	4
OFF-STREET	CROSSING FREQUENCY	RARE	INFREQUENT	MODERATE	FREQUENT
	TYPE OF CROSSINGS	CALM & NARROW OR CONTROLLED	UNCONTROLLED BUT NARROW	UNCONTROLLED WIDE OR FAST	UNCONTROLLED WIDE & FAST

Level of Comfort Criteria based on the Mineta Transportation Institute report "Low-Stress Bicycling and Network Connectivity" published in 2015

Bikeways were classified into three color-coded categories:

- **On-Street Shared:** Locations where bicyclists share the travel way with vehicles. Most appropriate for low-volume, low-speed streets.
- **Dedicated in Street Right-of-Way**: Represent dedicated bicycle facilities within the public street right-of-way. A sidepath within the right-of-way could be implemented where appropriate, based on context, design considerations, and community input.
- **Off-Street Bikeway:** Dedicated path or trail, often shared with people walking or jogging, that is completely separated form parallel traffic.

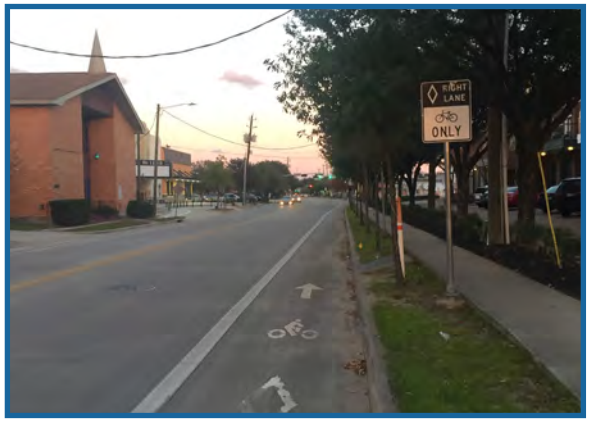
Based on this assessment, of the 500 miles in the existing bikeway network, only about 270 miles (50%) are high-comfort bikeways. The map of these facilities is shown in Figure ES.9. It shows that while there are some comfortable, long segments, they are discontinuous and do not form a connected network. As a result, for most longer trips a person bicycling is likely to experience at least one segment of low-comfort riding. This can often be enough to keep people from riding.

The existing high-comfort network forms the baseline that the recommendations of the Plan build upon. Future recommended bikeways were developed through a collaborative approach with the study team, key City of Houston staff, and community



On-Street Shared

Bike Route in Southgate Neighborhood (Dryden Street)



Dedicated in Street Right-of-Way

Standard Bike Lane in Fifth Ward Neighborhood (Lyons Avenue)



Off-Street Trail or Walk/Bike Path

Buffalo Bayou Trails in Houston's East End (Tony Marron Park)

Figure ES.7 Bikeway Types

stakeholders. This process is detailed in **Chapter 5: Network Plan & Maps.** The recommended bikeways reflect public feedback collected throughout the plan and have been categorized based on the following potential implementation phases.

- **Programmed Projects** are those in the pipeline with dedicated funding that will expand the bikeway network. These include Bayou Greenways, City CIP and TxDOT projects, and partner projects such as those being completed by management districts and TIRZs.
- **Potential Short-Term Opportunities** are relatively low-cost implementation opportunities that appear feasible within the existing street pavement. This includes painted lanes, low capital cost projects and shared routes, and may require reallocation of travel lanes or parking. These have the highest potential to significantly expand the high-comfort bikeway network in near term.
- **Key Connections** are potential capital projects that would link neighborhood areas into a network that crosses the city. These are recommended as higher priorities among longer-term projects.
- **Long-Term Houston Bikeway Vision** includes all other bikeways in the plan, including new off-street segments and new dedicated bike lanes. Many of these projects are likely to be capital-intensive or require street reconstruction to implement. Resource requirements and the need to reconstruct streets will likely make these longer-term projects.

Full build-out of the proposed bikeway network includes over 1,780 miles of bikeways, more than triple the existing mileage and six times the existing high-comfort mileage.

Figures ES.9-ES.23 show how these networks build upon one another. The maps on each page show the potential bike network assuming completion of the projects in the category and all prior categories. These maps reflect recommendations as of June 2016.

The graphs show how the recommendations change outcomes related to the Houston Bike Plan goal of increasing access to the bikeway network. They show the percent of the City's population and jobs that would be served within one-half mile by the bikeway network. These access metrics all start in the 30-40% range for the existing high-comfort network and steadily grow to over 70% access with programmed, short-term potential opportunities, and key connections. Full completion of the bikeway network will put comfortable bikeways within reach of over 95% of people and jobs in the city.

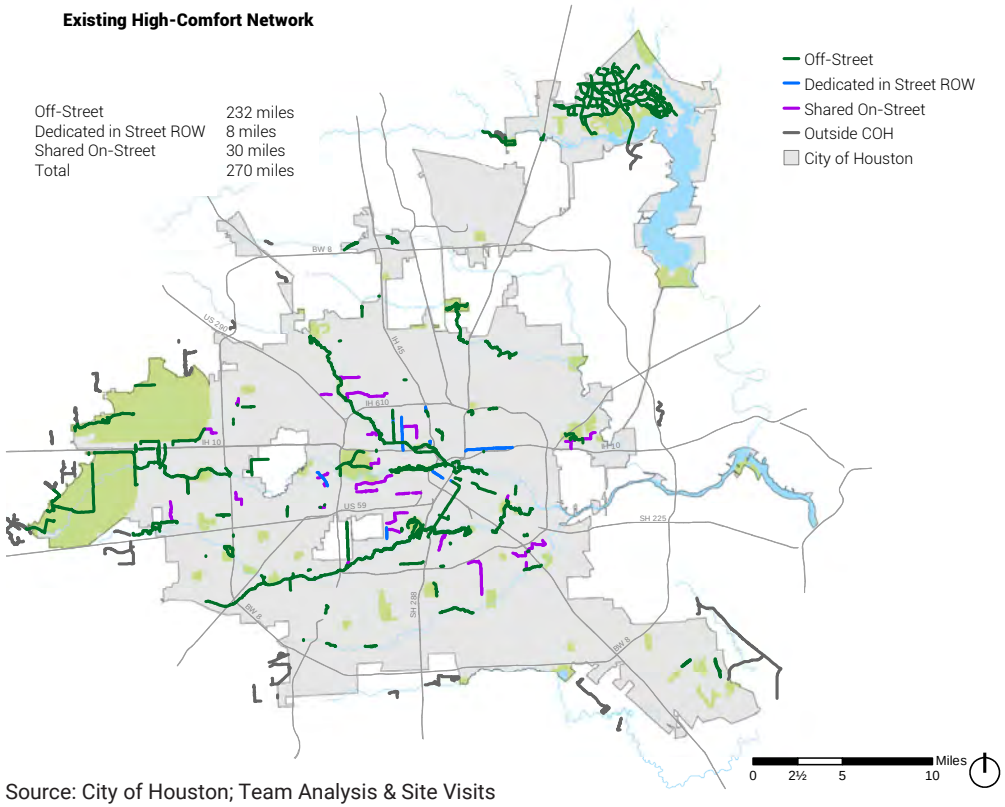
The graphs also show quarter-mile access to key civic institutions like schools, libraries, and community centers. These key destinations across the city would experience similar improvements in access as the network grows.

EXISTING HIGH-COMFORT BIKEWAYS

While the existing Houston Bikeway Program map includes approximately 500 miles of bikeway facilities, only about half of those provide adequate separation from traffic to feel comfortable for most adults who are interested in bicycling. These are shown on Figure ES.8.

The vast majority of existing high-comfort bikeways are bayou and rail-trails. Some existing bikeways on neighborhood streets meet the definition of high comfort, but relatively existing few bike lanes meet this standard.

For more details on Level of Comfort, see **Chapter 2: Existing Conditions & Opportunities.**



Source: City of Houston; Team Analysis & Site Visits

Figure ES.8: Existing City of Houston Bikeways - As of June 2016

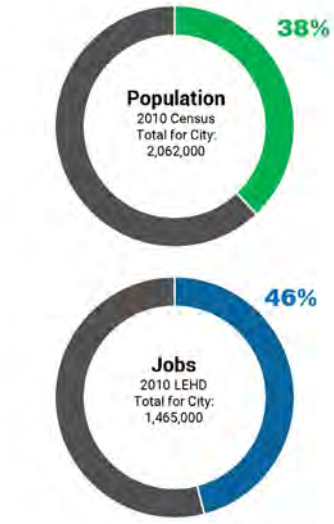


Figure ES.9: Half-Mile Access for People & Jobs

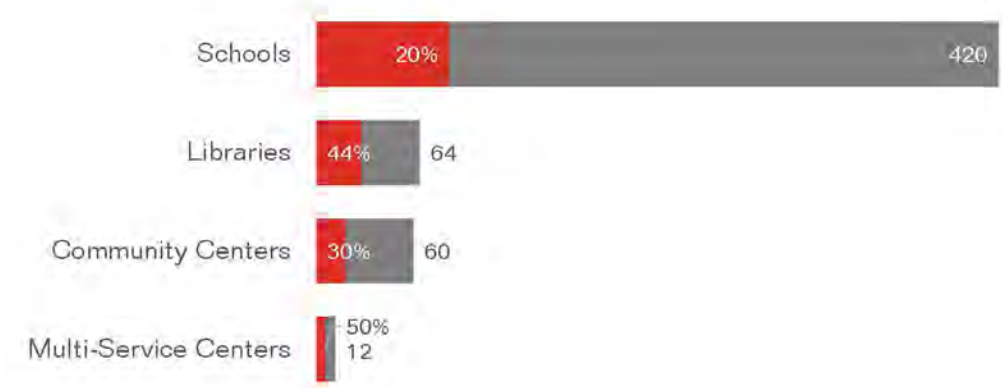
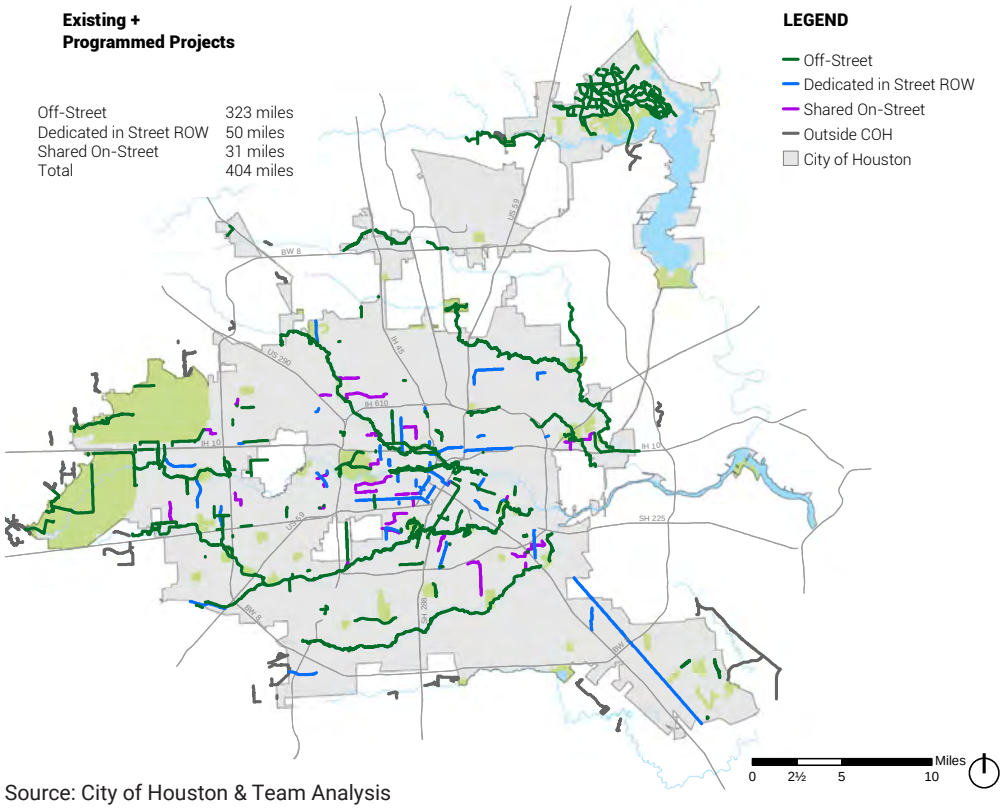


Figure ES.10: Quarter-Mile Access to Civic Destinations



Source: City of Houston & Team Analysis

Figure ES.11: Existing High-Comfort Bikeways and Programmed Projects

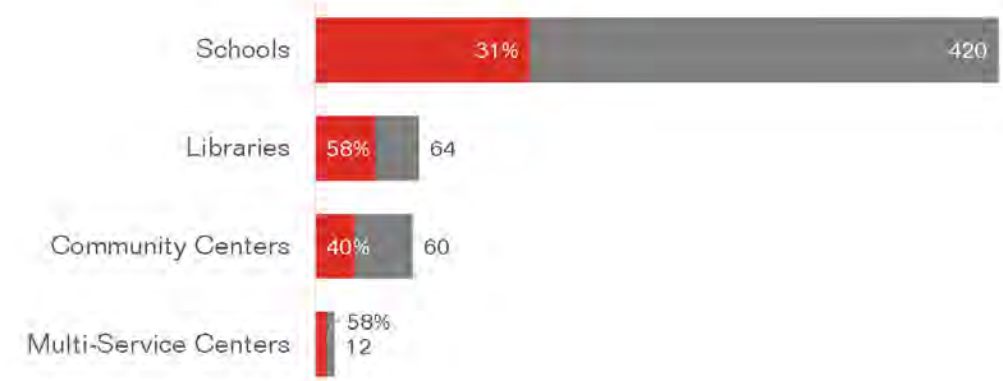


Figure ES.12: Quarter-Mile Access to Civic Destinations

PROGRAMMED PROJECTS

Projects that will create additional high-comfort bikeways are already in development by the City of Houston, TxDOT, Houston Parks Board, management districts, and others.

These projects will largely complete the major bayou corridors and add certain on-street connections.

This map shows funded projects that include high-comfort bikeways and are expected to be completed in the next five years, by 2021.

Programmed New Bikeway Mileage:

Off-Street:	91 mi.
Dedicated in Street ROW:	42 mi.
On-Street Shared:	1 mi.

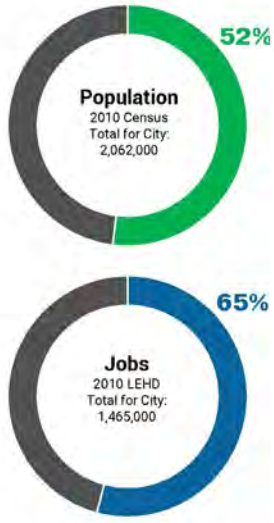


Figure ES.13: Half-Mile Access for People & Jobs

POTENTIAL SHORT-TERM OPPORTUNITIES

In some cases, high-comfort bikeways can be created with relatively modest investments in signs and striping. This can involve reallocating pavement space on streets with excessively wide lanes or excess capacity, or by designating shared routes on low-speed, low-volume streets.

This map shows bikeways that appear to be feasible to implement using these retrofit strategies. Further study and design may be required to confirm.

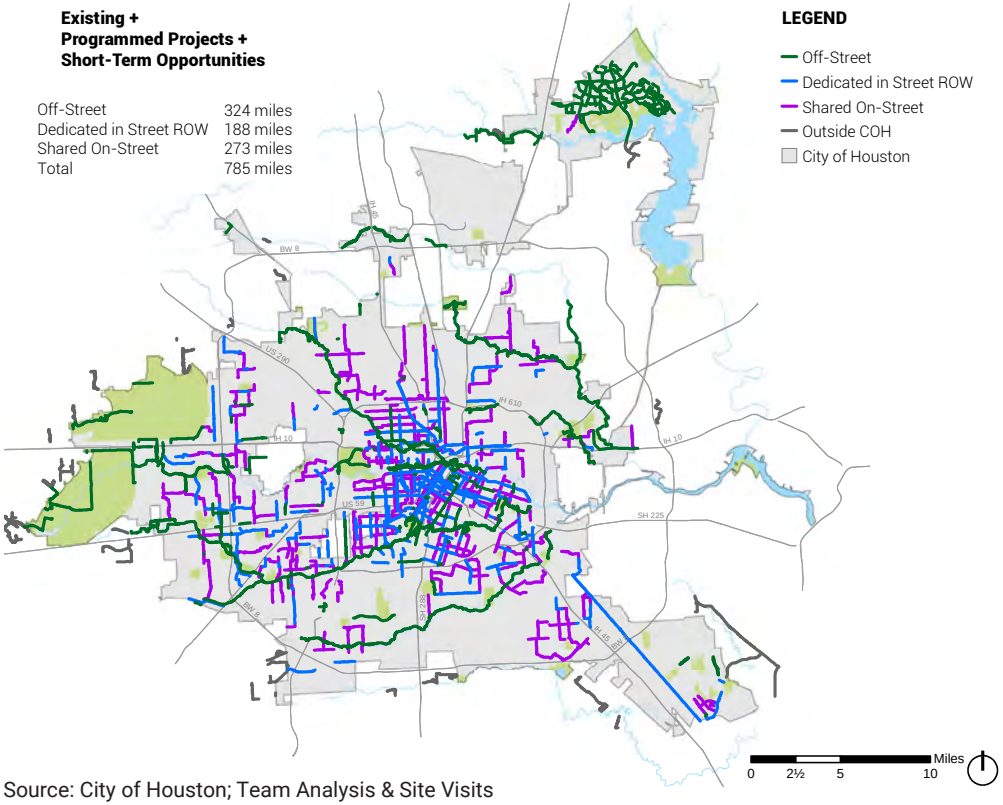
Potential Retrofit Opportunity Mileage:

Dedicated in Street ROW: 138 mi.

On-Street Shared: 242 mi.

Estimated Cost to Complete:

$27 - $51 million



Source: City of Houston; Team Analysis & Site Visits

Figure ES.14: Existing High-Comfort Bikeways, Programmed Projects, and Short-Term Implementation Opportunities

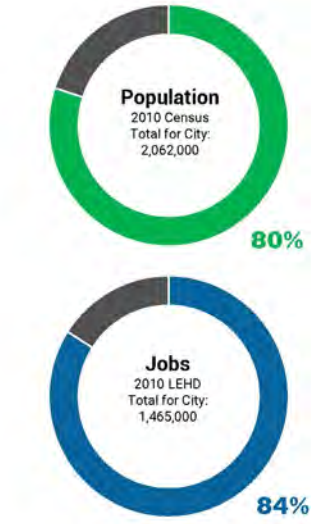


Figure ES.15: Half-Mile Access for People & Jobs

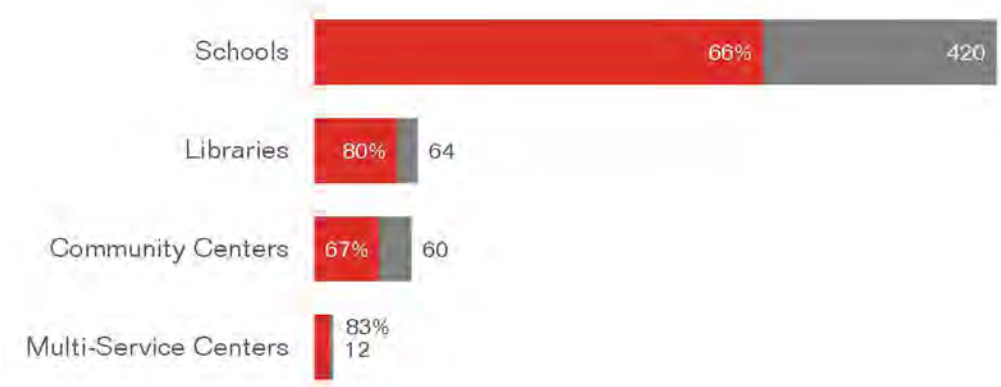
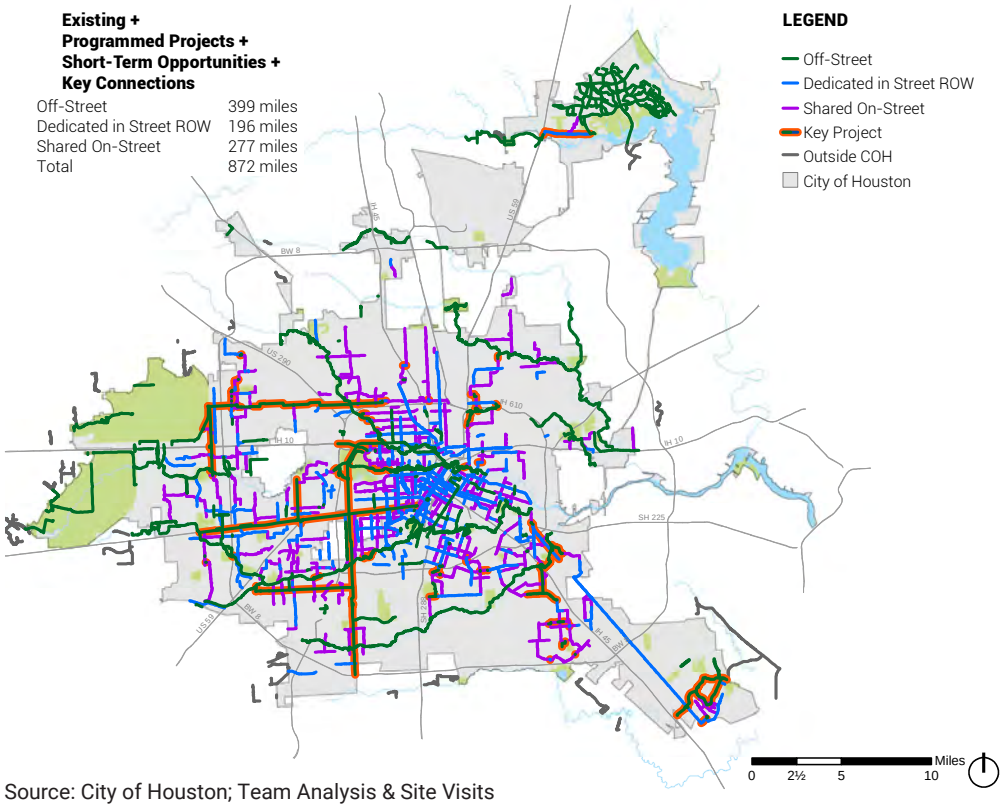


Figure ES.16: Quarter-Mile Access to Civic Destinations



Source: City of Houston; Team Analysis & Site Visits

Figure ES.17: Existing High-Comfort Bikeways, Programmed Projects, Potential Short-Term Projects, and Key Connections

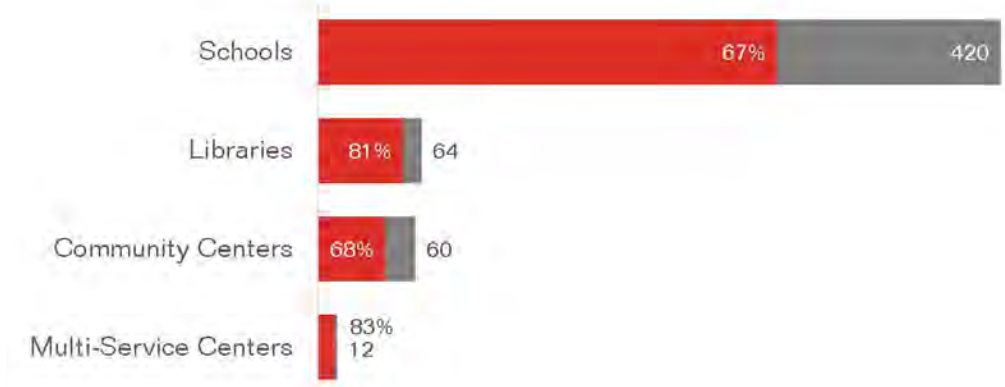


Figure ES.18: Quarter-Mile Access to Civic Destinations

KEY CONNECTIONS

The short-term retrofit opportunities can create high-comfort bikeway networks in individual areas of the city, but connecting neighborhoods into a true citywide network will require investing in certain higher-cost connections. More detail on these Key Connection Projects is available in **Chapter 6: Implementation Strategies.**

Key Connections Mileage:

Off-Street:	76 mi.
Dedicated in Street ROW:	8 mi.
On-Street Shared:	4 mi.

Estimated Cost to Complete:

$73 - $119 million

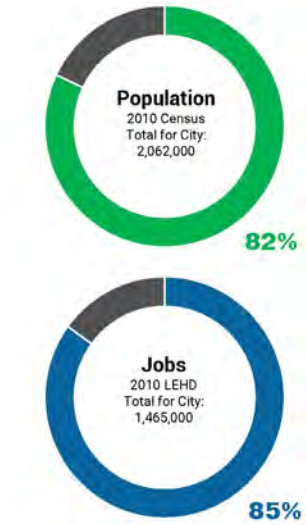


Figure ES.19: Half-Mile Access for People & Jobs

LONG-TERM VISION

This map shows the long-term vision for the Houston Bikeway Network. In many cases, installing high-comfort bikeway facilities on major streets will require reconstruction of the street. Systematically implementing these bikeways as streets come up for reconstruction will eventually create a comprehensive network that serves nearly all Houstonians and connects them to many destinations.

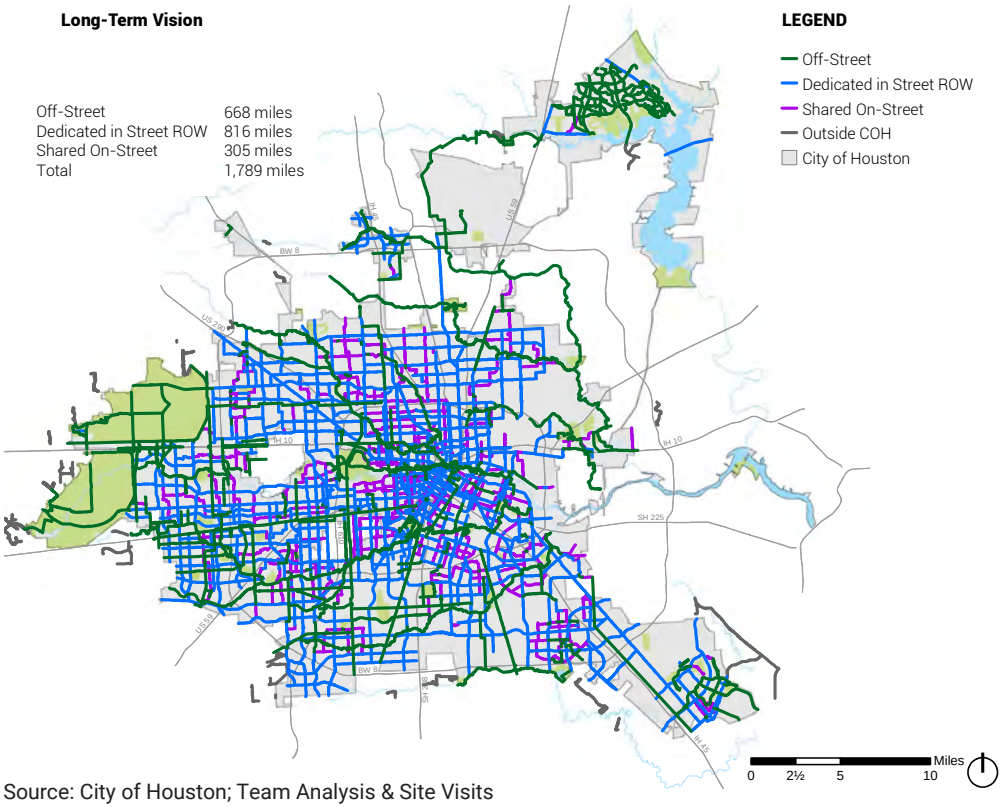
Additional Future Bikeway Mileage:

Off-Street:	269 mi.
Dedicated in Street ROW:	620 mi.
On-Street Shared:	28 mi.

Estimated Cost to Complete:

$235 - $382 million*

*Cost does not include 620 miles of on-street bikeways that would likely be incorporated during future street reconstruction



Source: City of Houston; Team Analysis & Site Visits

Figure ES.20: Long-Term Vision of the Bicycle Master Plan

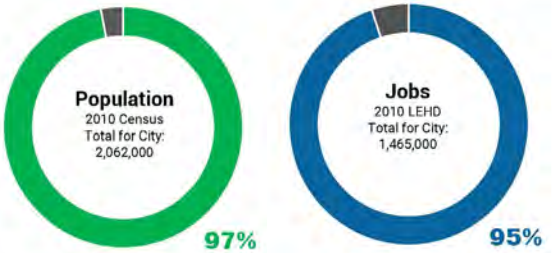


Figure ES.21: Half-Mile Access for People & Jobs

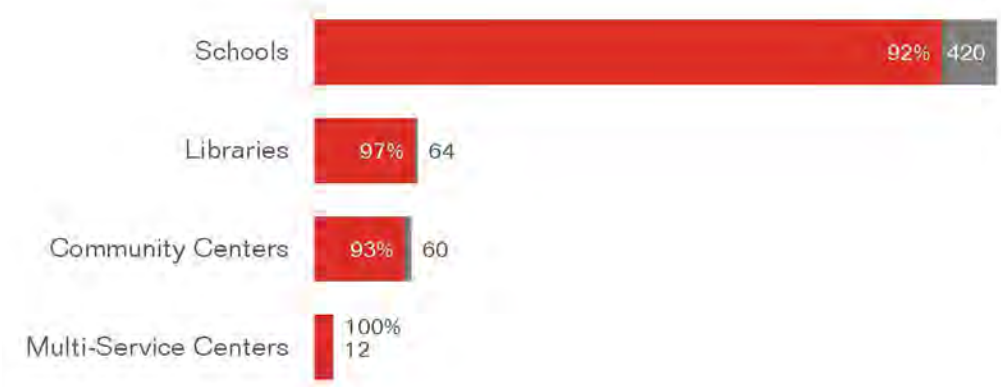


Figure ES.22: Quarter-Mile Access to Civic Destinations

For each of the project categories, planning-level cost estimates were developed. These were based on past project costs and the 2014 H-GAC Regional Pedestrian and Bicycle Plan. The estimated miles of bikeway by type, (shared, dedicated, or off-street) are shown in Figure ES.23. These were developed to size the relative funding needs required to implement the recommendations of the plan.

These estimated costs will need more detailed refinement based on specific corridor selection, bikeway types, and engineering of specific bikeways. Longer-term recommendations of the plan tend to be more capital-intensive and therefore higher cost. Short-term opportunities focus on utilization of existing streets by reallocation of space to striped dedicated bike lanes, low capital cost projects, or by signing and striping improvements that designate a shared bike route.

Based on the relative challenge of implementation, potential short-term opportunities have been identified to add 380 miles with an estimated cost of $27 - $51 million. This would nearly double the existing and programmed bikeway network and connect many more neighborhoods and destinations. Some of these projects may also be implementable through regular maintenance and street striping programs, mitigating the costs.

Key connections, which are typically more challenging capital projects, would add 86 miles of comfortable bikeways to the network. But because they tend to require trail construction or, in several locations, bridges, they are estimated to cost $73 - $119 million to complete.

Strategies for funding and project implementation are detailed in **Chapter 6: Implementation Strategies.**

Implementation Category	Miles of Bikeway			Average Cost per Mile* Low-High Range ($Thousands)			Planning Level Cost Range ($Millions)
	Dedicated in Street ROW	On-Street Shared	Off-Street	Dedicated in Street ROW	On-Street Shared	Off-Street	
Existing High-Comfort Bikeway Network	8	30	232	-			-
Programmed Projects	42	1	91	-			-
Short Term Potential	138	242	-	$90-210	$10-140	n/a	$27 - $51
Key Connections	8	4	75	$90-210	$10-140	$600-1,700	$73 - $119
Full Bikeway Network	620	28	269	n/a**	$10-140	$600-1,700	$235 - $382
Total Network	816	305	668				$335 - $552

Figure ES.23 Planning Level Cost Summary for Bikeway Network Implementation

* Cost per mile estimates are based on data from the 2014 H-GAC Regional Bikeway Plan, general planning estimates from comparable projects. Total cost estimates assume a 75%-25% and 25%-75% mix of low and high cost projects to develop range. Cost per miles estimates also include 20% to 40% for contingency, survey, engineering, and project management.

** On street bikeways will clearly have a cost as part of the full network build out but these would be included in the cost of street reconstruction and therefore are not included here.

Bicycle Toolbox

While the bikeway network map defines the corridors to be prioritized for expansion of the bikeway network, final project design will be critical to developing quality bikeways that serve the broad range of people riding in the City of Houston. Bikeway projects alone are not enough to build and sustain a bicycle-friendly city. Doing so requires a complementary set of infrastructure projects, a bicycle-supportive policy framework, and a foundation of programs to help educate and encourage more people to ride.

To support this, **Chapter 4: Bicycle Toolbox** outlines a set of recommendations for the city to move forward across these three categories.

Projects: detailed design elements to help inform the design of higher comfort bikeway projects. This includes bikeway corridor alternatives, intersection treatments, and connections that form the basis for a large part of the experience of riding a bicycle safely and comfortably in Houston. It also includes wayfinding and end-of-ride amenities that are critical to consider for the entirety of a person's trip. Examples of project design elements are shown in Figure ES.24 and ES.25.

Policies: recommendations for the regulatory, enforcement, and evaluation approaches to bicycling in Houston. Policies are complementary to Projects and Programs in that they can formalize the approach to

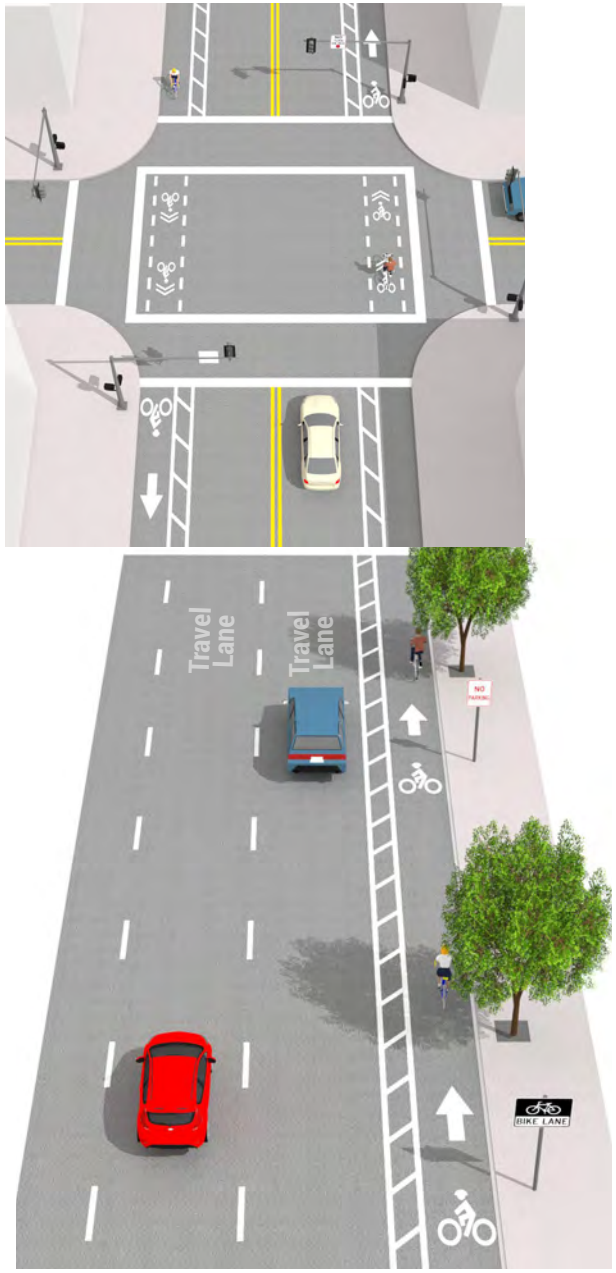


Figure ES.24: Toolbox Examples: Intersection Treatment and Buffered Bike Lane

Bicycle Advisory Committee (BAC):

The BAC will be critical to the ongoing implementation of the Bike Plan. The role of the BAC is recommended to include but not be limited to: working with the City in achieving the ten-year vision and any interim goals and targets; development of an annual report; and working with the City to develop recommendations to address the issue of long-term maintenance of bikeways, both off and on street.

consistent project development and set a framework for programs to successfully support a bicycle friendly culture. Policies can also define incentives that would improve safety, access, and amenities for people biking. Figure ES.26 shows how the lack of a standard policy for prohibiting parking in a bike lane unless "No Parking" signage exists can create challenging situations for people cycling. A new policy supported by ordinance would eliminate the need to install signs everywhere and create a consistent expectation for people cycling as well as parking. The development of a Bicycle Advisory Committee (BAC) to help support the implementation of the Plan is also recommended as an important Policy as part of a broader agency and stakeholder coordination strategy.

Programs: recommendations for programs that improve education and encouragement to support more people of all ages, abilities, and backgrounds to bicycle in Houston and help meet the Bike Plan's goal of Increased Ridership. Best practices are identified that can be employed by the public, non-profit, and private sectors to encourage more bicycling within the community. This section also identifies approaches for better data and information gathering to support decision-making related to Projects and Policies. Sunday Streets, Houston's Open Street program, (Figure ES.27) is a great example of encouraging more people to be get out and be active on Houston streets.



Figure ES.25: End of Trip Facilities
Bike Station



Figure ES.26: Policies
No Parking in Bike Lanes Ordinance



Figure ES.27: Programs
Sunday Streets/Open Streets Programs

Implementation Strategies

Success in achieving the Vision for the Houston Bike Plan will only be realized through effective implementation. An effective approach builds on the recommendations of the plan to identify strategies that capture the identified opportunities, supports ongoing execution, manages progress against plan goals, and allocates resources where they can have the greatest impact. **Chapter 6: Implementation Strategies** outlines eight key implementation strategies and supporting recommendations to help the City of Houston to move the Houston Bike Plan forward and improve opportunities for people bicycling in Houston.

Various departments within the City will need to lead many of the initiatives to move them forward and key partnerships have been identified within each strategy, where appropriate, to help leverage the resources available to the City.

The Houston region has made meaningful strides in implementing projects and adopting policies to become more bike-friendly. Even with the positive momentum, the implementation environment will be challenging for the City of Houston over the next several years.

Challenges

While a significant number of projects, such as Roadway CIP and Bayou Greenways, have dedicated funding identified for implementation over the next five years, there will be challenges in identifying additional resources, either in personnel, capital, or operations and maintenance, to advance many additional components of the plan forward in the near term.

The City's significant infrastructure needs create strong competition for resources for new projects meaning capturing opportunities to integrate improved bikeways into all projects will be critical. Many of the Plan's recommendations, particularly those related to policy and programmatic changes, may require changes to the current regulatory environment. Successfully implementing any of these will require political support to enact and will likely take time to advance.

From Plan to Action

The nine implementation strategies for the Houston Bike Plan are shown in Figure ES.28 on the following page. They outline steps that the City and other partners can take to implement key components of the Bike Plan. These strategies include strategies to move programs and policies forward, prioritization and funding strategies to implement projects to expand the bikeway network, and a performance management approach to measure progress. The Plan also identifies several strategies to create positive change and show examples of what is possible to build momentum for implementing the plan. These include conceptual pilot projects showing key components of the Bicycle Toolbox as well as an approach to communicate plan at the neighborhood level.

Figure ES.28 Implementation Strategies and Key Recommendations for the Houston Bike Plan:

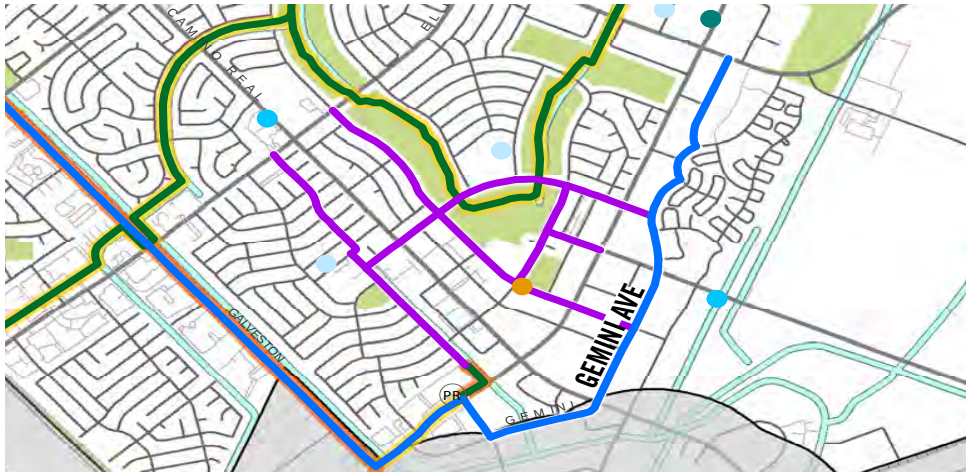
1. **Manage Performance Against Goals**
   - 1.1 Develop and present an annual Houston Bikeways Program Strategic Report.
   - 1.2 Develop approach to capture data to assess performance on a regular basis and develop performance targets.
2. **Prioritize and Collaborate on Policies and Programs**
   - 2.1 Develop agreed-upon roles with city departments including Houston Bikeways Program staff and partners for implementation of policies and programs identified in the Bike Plan.
   - 2.2 Develop prioritization approach for tackling policies and programs considering resources, staffing levels, and partnership opportunities.
3. **Project Development and Implementation**
   - 3.1 Develop packages of short-term bikeway projects that can be implemented within existing street rights-of-way and seek funding to implement.
   - 3.2 Prepare key connection recommendations as a package of projects detailing benefits and costs. This package should be utilized to recruit funding partners and apply for grants as opportunities become available.
4. **Develop Resource and Staffing Needs**
   - 4.1 Increase Houston Bikeways Program staff in appropriate departments in the City.
   - 4.2 Establish the Bicycle Advisory Committee as a regular standing committee that works with City staff to implement the Bike Plan.
5. **Leverage Funding Opportunities**
   - 5.1 Create a spending target with dedicated funds from the City's budget for bikeway projects and programs.
   - 5.2 Identify and pursue funding partnerships and support from other local agencies, City departments, and private entities to leverage funds.
   - 5.3 Pursue funding for short-term and key connection projects.
   - 5.4 Develop bicycle facility maintenance prioritization criteria and incorporate bicycle facility maintenance as part of roadway maintenance activity as possible.
6. **Build Momentum Through Pilot Projects**
   - 6.1 Create conceptual plans for specific bikeway treatments across the city.
   - 6.2 Implement and celebrate bikeway projects to build momentum to implement the Plan.
7. **Connect to Major Bicycle Thoroughfares (e.g., Bayous and other Greenway Trails)**
   - 7.1 Develop specific plans and policies for access to major greenway corridors to ensure safe access to these "bicycle highways" from neighborhoods and activity centers.
   - 7.2 Coordinate with adjacent jurisdictions to provide a connected network across city lines.
8. **Engage Neighborhoods to Translate Plan to a Local Level**
   - 8.1 Incorporate and refine the provided approach and tools for neighborhood level planning to connect to citywide bikeway network, in future planning projects.
   - 8.2 Identify opportunities to apply specific policies or programs at the neighborhood level to support the growth of safe, healthy opportunities to bicycle.
   - 8.3 Continue proactive outreach to neighborhoods and other civic groups on the Bike Plan.
9. **Continue to Engage the Public in the Development of Bicycle Facilities.**
   - 9.1 Incorporate public engagement on bikeway projects beginning no later than preliminary engineering i.e. the design phase of the project.

Pilot Projects

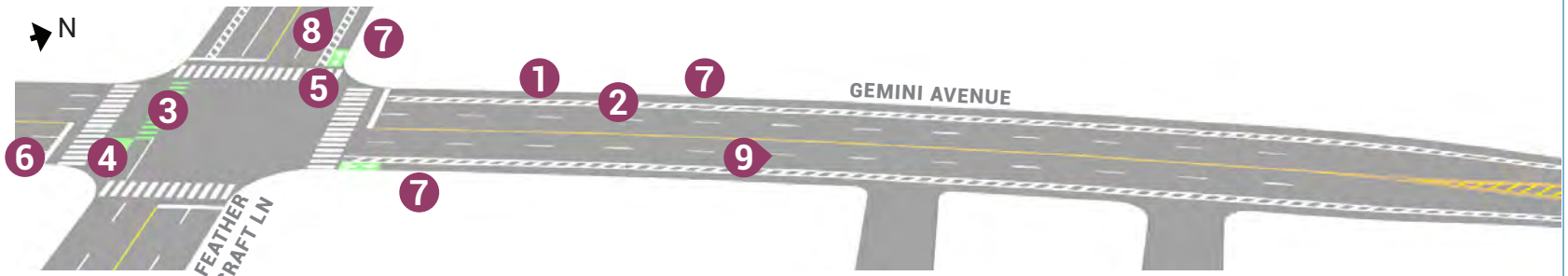
Pilot projects not only build momentum for implementation, but can also provide opportunities to showcase best practices and build partnerships. The pilot projects showcased in **Chapter 6: Implementation Strategies** include a variety of project types that will provide the City with additional, key near-term improvement opportunities. These include:

1. Intersection Improvements – Polk Street at Scott Street
2. ROW Reallocation – Kelley Street Hirsch to LBJ Hospital
3. ROW Reallocation – Gemini Avenue– Bay Area Park & Ride to Saturn Lane
4. Neighborhood Bikeways – Gulfton-Sharpstown neighborhood plan area.
5. Bike Station – Downtown Houston

The pilot project for Gemini Avenue in Clear Lake connection the Bay Area Park & Ride to the Johnson Space Center (NASA) is shown here and on the following page.



1. Existing travel lane conversion to 7' Bike Lane
2. 3' Buffer from travel lane
3. Pavement treatment to increase driver awareness of bicycle presence
4. Bike box to accommodate common turning movement from Feather Craft to Gemini
5. Pavement treatments to guide bicyclists as bike route turns
6. Right turn only lane allows bike lane to begin
7. Bike Lane and No Parking Signage
8. Access to Bay Area Park & Ride
9. Access to jobs, housing, and NASA



Proposed Pilot Project- Gemini Avenue



CHAPTER 1
INTRODUCTION

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01

INTRODUCTION



Castillo Community Center

THE 2017 HOUSTON BIKE PLAN

The 2017 City of Houston Bike Plan (Bike Plan) is a year-long planning effort to update the City's Comprehensive Bikeway Plan, originally adopted in 1993. The Plan comes at a critical time. Plan Houston, the City of Houston's first general plan adopted in 2015, calls for the development of a "citywide plan for bicycling." The City and the Houston region have made great strides in improving people's ability to bike to more destinations, even earning a Bronze-level Bicycle Friendly Community award from the League of American Bicyclists in 2013. New trails are being built along our bayous, a new protected bikeway has been installed, and more people are riding all over the City. The Bike Plan builds on these efforts to develop a deeper understanding of the opportunities and challenges for bicycling in Houston.

The Bike Plan seeks to make Houston a safer, healthier, more accessible, bicycle-friendly city. The plan provides a framework for the development of a shared vision and goals for biking in Houston, and identifies future projects to create a citywide bicycle network. The future citywide network will serve a broader spectrum of people who bike at all skill levels. It will provide more transportation choices with both on-street and off-street facilities connecting key origins and destinations such as employment centers, parks, and schools.

The plan identifies key supporting policies and programs that help build a more bicycle-friendly culture covering issues like bicycle safety, expansion of bike parking, bike share options, and increased integration with transit. The plan also looks at best practices in bicyclist and driver education, enforcement, and facility maintenance to help all users of the City's transportation system integrate well together on high quality facilities. The Plan builds on current efforts, such as the Bayou Greenways Initiative, to create an inter-connected bicycle network. By providing better access through the construction of key connections, there is great potential to increase ridership and maximize the investment in this major trails expansion project.

Public input plays a critical role throughout the planning process. A Bicycle Advisory Committee, made up of representatives from Houston's bicycling community, implementing authorities, community leaders, and other representatives, will guide the development of the Bike Plan. Citizens will be able to participate at public meetings and through online activities and feedback tools.

The City of Houston Planning & Development Department, in coordination with the Public Works and Engineering Department and the Houston Parks and Recreation Department, is leading the Bike Plan update.

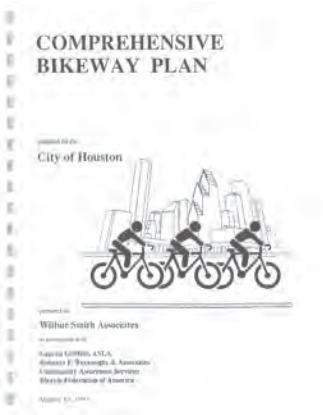
The City has greatly benefited from the support of the project funding partners:

- BikeHouston;
- Houston Parks Board;
- Houston-Galveston Area Council (H-GAC);
- Federal Transit Administration (FTA);
- Federal Highway Administration (FHWA); and
- Texas Department of Transportation (TxDOT).

THE HOUSTON BIKEWAYS PROGRAM (WWW.HOUSTONBIKEWAYS.ORG)

The Houston Bikeways Program has served as a clearinghouse for the efforts to improve the ability of people to safely bike in the City of Houston. The Program includes oversight of major Rails-to-Trails projects in the City, such as the MKT Trail through the First Ward and Heights, and the Columbia Tap Trail connecting Brays Bayou to downtown through the Third Ward. The Program supports bicycle facility planning such as the new separated bike lane on Lamar Street in downtown Houston, which was designed and implemented by the City's Public Works and Engineering Department.

The Program leads events such as Bike to Work Day and has also been a leader in developing and rolling out online bicycle education programs (www.bikeed.org) in partnership with the League of American Bicyclists.



1993 City of Houston Comprehensive Bikeway Plan

HISTORY OF BICYCLE PLANNING IN HOUSTON

In 1993, to address growing roadway congestion, air quality issues, and federal mandates, the City of Houston undertook the development of a Comprehensive Bicycle Plan. The Plan sought to create an extensive system of bikeways that would support increased ridership. The Plan was particularly focused on promoting opportunities to increase home to work trips during peak hour when congestion is highest.

The Plan was developed with significant community input and established a recommended network and implementation approach that led to a significant amount of the bicycle facilities that exist in Houston today. Building on previous work by the Citizen's Environmental Coalition, trails were proposed along many of the bayous which served as a precursor to the development of the Bayou Greenway Initiative. Many of the City's existing bike lanes were also developed through the Plan.

The Comprehensive Bikeway Plan was the last time the City of Houston took a holistic assessment of its bikeway system, but in the interim, many additional policies, planning efforts, and programs were implemented to help improve the conditions and comfort levels for bicycling in the City.

Figure 1.1 shows the existing Houston Bikeway Network with a classification of bikeway types for facilities that are in use today. This map is based on existing bikeway maps developed by the City of Houston and others, and further refined based on aerial maps and site assessments from riding through the City.

BICYCLE LEVEL OF COMFORT

Facility types are not the only factor that impact people's ability to bike, and many Houstonians would recognize that in the wide variety of conditions experienced on designated bike lanes around the city. Separation from traffic, intersection crossings, speed of traffic and width of the bicycle facility play an important role in the bike rider's experience.

A key element the map in Figure 1.1 shows is a classification of various comfort levels for a typical bicycle rider. In general, bicycle

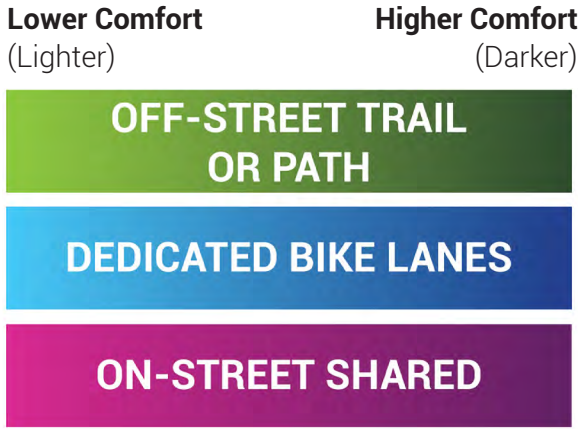
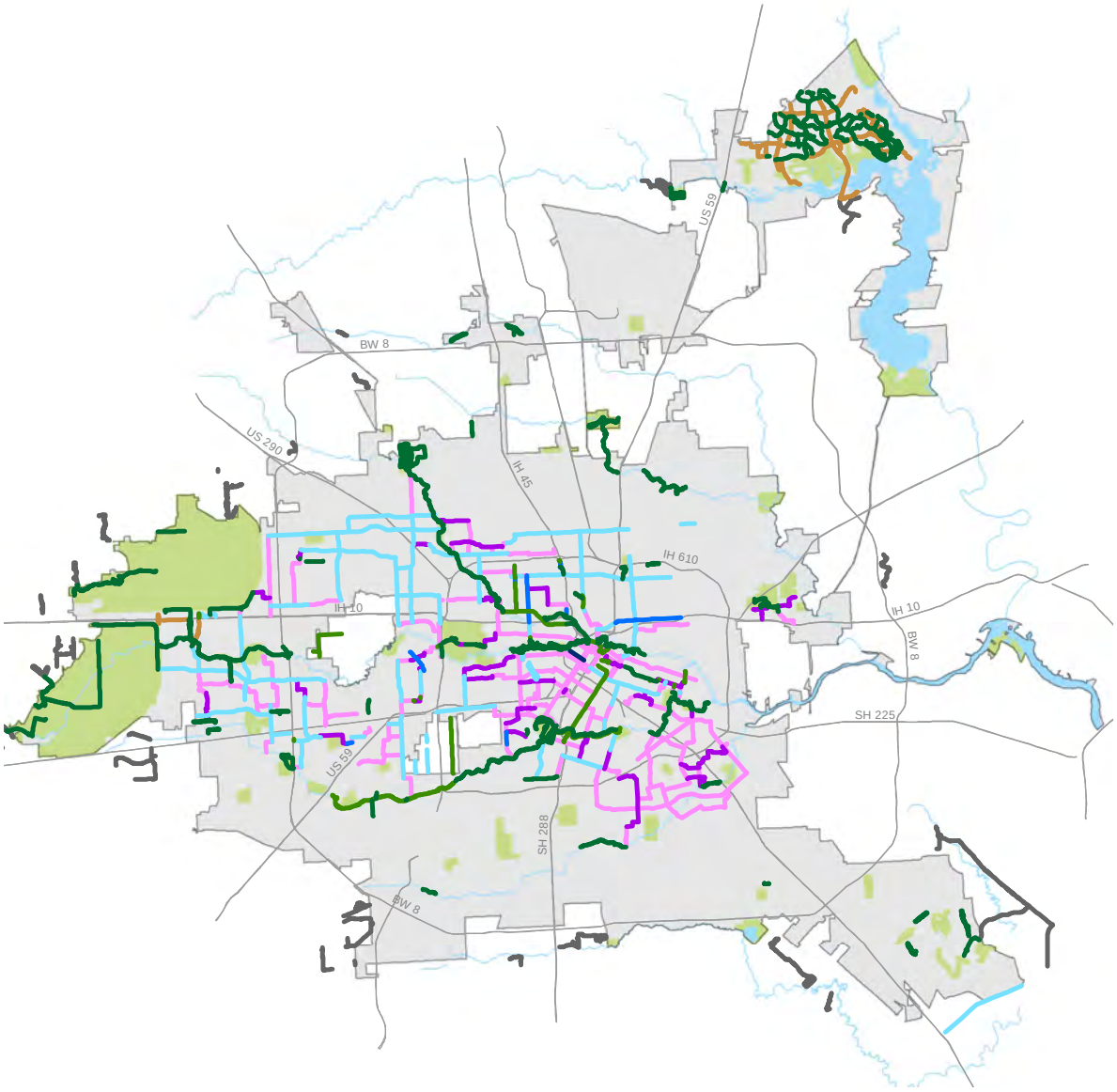


Figure 1.2 Level of Comfort: General Map Colors

Figure 1.1: Existing City of Houston Bikeways



LEGEND

Off-Street Facilities
- High-Comfort Walk/-Bike Path
- Walk/Bike Path
- Shared Sidewalk

Dedicated Bike Lanes
- Separated Bike Lane
- Bike Lane
- Low-Comfort Bike Lane

Shared On-Street Facilites
- Neighborhood Bikeway
- Shared Lane/Bike Route

- Facility outside of City of Houston
- Parks



Map Locater

0 2.25 4.5 9 Miles

Source: City of Houston; Team Analysis & Site Visits

facilities that are shown on the maps in this report will be darker if they are assessed to be a higher comfort level and lighter if they are lower comfort levels. Higher comfort bicycle facilities have been shown to correlate with increased bicycle ridership where they form a network connecting key destinations. Many of the existing segments of the Houston bikeway network are lower comfort. There is a clear opportunity to increase ridership through the expansion of high comfort facilities in the bicycle network. Level of Comfort is a concept that is discussed in greater detail in **Chapter 2: Existing Conditions and Opportunities**.

EXISTING PLANS, PROGRAMS AND POLICIES

The following sections outline many of the policy and planning efforts that have led to the current state of bicycling in Houston. They have set a strong foundation to support the development of a new comprehensive Houston Bike Plan.

Planning

Many existing plans were either entirely or partially focused on improving bicycling in Houston. The plans and studies reviewed and considered for incorporation into the Bike Plan are listed in Figure 1.3.

Figure 1.3 Existing Plans in the City of Houston

- 1993 COH Comprehensive Bicycle Plan
- 2010 Ensemble HCC Livable Center
- 2010 Fourth Ward Livable Center
- 2010 Northside Livable Center
- 2010 Upper Kirby Livable Center
- 2011 Clear Lake Bike Ped Study
- 2011 Fifth Ward Bike Ped Study
- 2011 Downtown/EaDo Livable Center
- 2011 Energy Corridor Livable Center
- 2011 West Houston Trails Master Plan
- 2012 Airline Livable Center (Harris County)
- 2012 East End Mobility Study
- 2012 Independence Heights Northline Livable Center
- 2012 Washington Avenue Livable Center
- 2013 Inner West Loop Mobility Study
- 2013 Urban Houston Framework
- 2014 METRO Bike & Ride Access and Implementation Plan
- 2014 TMC Mobility Study
- 2015 Heights-Northside Mobility Study
- 2015 Northwest Mobility Study
- 2015 West Houston Mobility Study
- 2015 Energy Corridor Master Plan
- 2015 Strollin' & Rollin' Southeast Houston
- 2015 Houston Park Master Plan
- Health/Built Environment Plans: CTI & Healthy Living Matters
- Other Management District and Neighborhood Plans

Houston was founded and has grown up around its bayous. The **Bayou Greenways Initiative** (BGI) is a transformative effort that is adding and maintaining many miles of voter approved trails, shared-use paths, and linear park space along the major bayous in the City. Trail development along the city's bayous is a great foundation from which to build a citywide bicycle network.

The Bayou Greenways Initiative provides great east-to-west connectivity for the network. To provide north-south connectivity as well as other off-street links around the city, a 2014 agreement between the City and Centerpoint Energy will allow hike and bike trails to be built along **Utility Corridors**. This will greatly expand the opportunity to build out the off-road trail network and connect to many more activity centers, neighborhoods and other destinations.



Utility Corridor Trail
Spring Branch District

Policies

The **Executive Order for the Houston Complete Streets and Transportation Plan** (EO 1-15) outlines the steps necessary to develop a multimodal transportation network for the City of Houston of which the Houston Bike Plan is a critical component. The order calls for the development of a multimodal transportation network to allow Houstonians to travel safely between their desired destinations, regardless of their mode of transportation, age, physical ability, or financial resources. The Order envisions achieving this network as part of a long-term plan that will be accomplished through both new and redeveloped transportation projects, and the development and enforcement of supporting plans and policies.

A **Safe Passing Ordinance** was adopted by City Council to protect more vulnerable road users by mandating that motorists passing bicyclists maintain a three-foot passing distance.

Programs

Goal Zero is a joint safety program between the City and Bike Houston to support safety improvements across Houston's transportation system with a goal of zero fatalities. The program includes improved education, enforcement of regulations like the Safe Passing Ordinance, and the development of this updated Bike Plan.

Houston received a bronze-level designation of the **Bike Friendly Communities Award** from the League of American Bicyclists. This points to the progress made, particularly in bicyclist education, but also the opportunity to continue to become more bike-friendly.

Multiple Bike to Work Days across the city in locations like Downtown, the Texas Medical Center and the **Energy Corridor** as well as the **Tour de Houston** are other City supported events that contribute to a bike-friendly culture. These events get more people to experience what bicycling is like in Houston.

Sunday Streets are seasonal, monthly events where sections of streets are closed to motor vehicles. Thousands of people have used these streets to be active by walking, biking, and playing while discovering new parts of the city, shops, and other businesses.

Over 10,000 people ride from Houston to Austin every year as part of the **MS 150** and thousands of others participate in other rides like **Critical Mass** or the **First Sunday Bayou Rides**.

Houston B-Cycle is a growing network of bike share stations that let people rent bikes for short periods of time to travel between stations. Currently people use these for a mix of recreation, entertainment, and as part of their daily commute. In addition, not everyone is traveling between stations. For example, in Third Ward, the bike share station at Project Row Houses is used most by residents that need to access a destination through a short trip within their neighborhood. They return the bike to that station.



Houston B-Cycle
Market Square



Bike to Work Day Ride
White Oak Bayou Bridge Downtown

Existing programs in the City of Houston that support growing Bicycle

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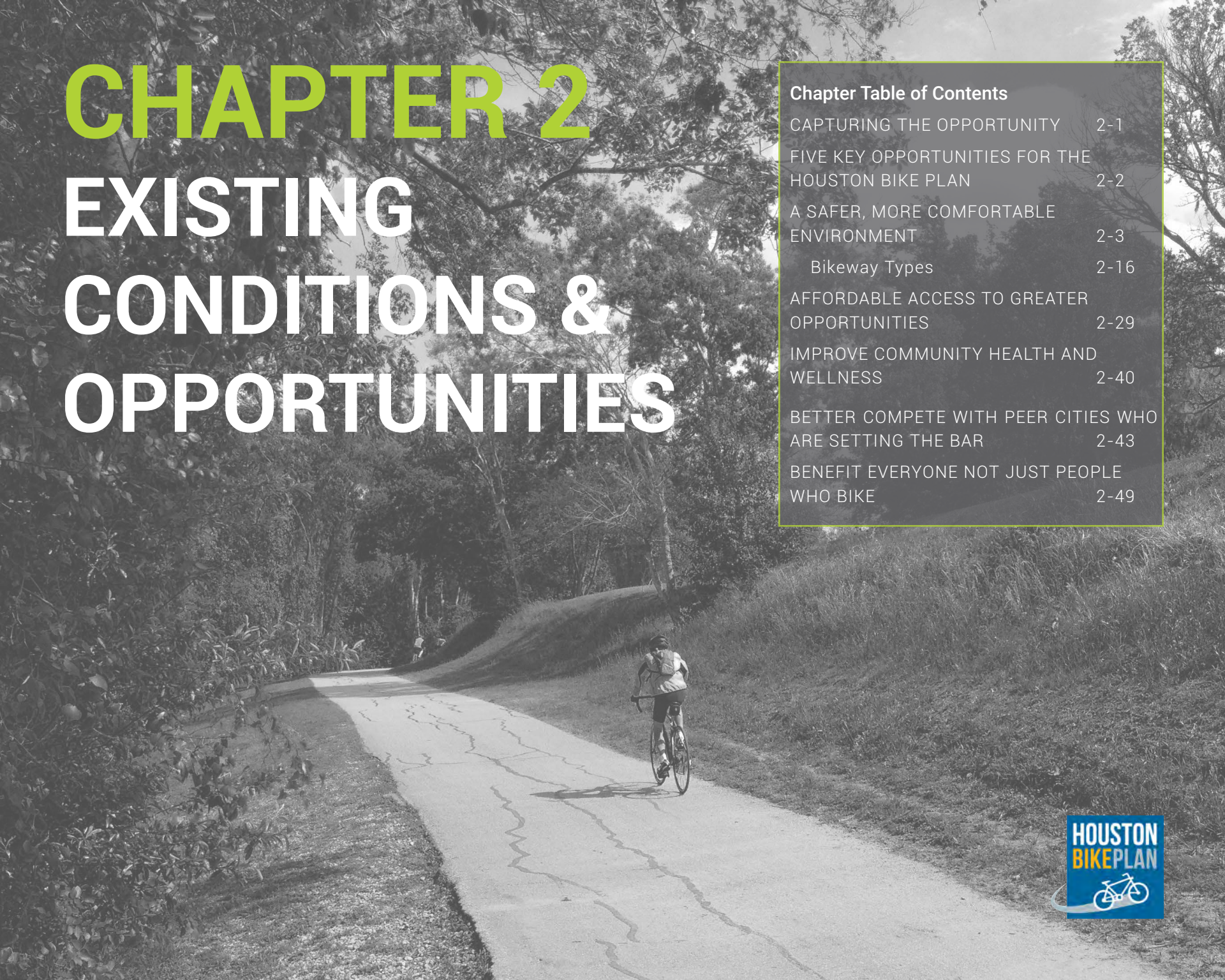
CHAPTER 2
EXISTING CONDITIONS & OPPORTUNITIES



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HOUSTON BIKEPLAN

02

EXISTING CONDITIONS & OPPORTUNITIES



CAPTURING THE OPPORTUNITY

The Houston Bike Plan comes at a critical time for bicycling in Houston. People bicycling are helping revitalize and transform cities worldwide, and many of the trends that support those transformations are also impacting Houston. Houston is becoming increasingly diverse, with people moving to Houston from all over the world. Demographic groups like Millennials, Baby Boomers, immigrant populations, and lower income and/or zero-car household populations are making decisions on where to live and work that influences the real estate and job markets and a company's ability to attract and maintain a talented workforce. Houston continues to work to help people live healthier lives and have access to more job and educational opportunities. At the same time, the roadways of the region continue to see significant levels of congestion. The plans, policies, and programs described in **Chapter 1** are making Houston into a place where more people want to ride a bicycle more often.

The Bike Plan represents an opportunity to create a framework and an action plan to address and capitalize on all of these trends. The development of Bayou Greenways and Complete Streets signals a change toward multimodal planning where people can have many transportation choices when they make their decision about where to live, where to work, and how to get around the city. This section details the current state of bicycling in Houston and the potential opportunities created by having a safe, accessible citywide bicycle network that is more comfortable for users of all abilities.

Why Develop the Houston Bike Plan?

Cities across the world have seen the benefits that come from improved bicycle infrastructure supported by complementary policies and programming. The Bike Plan represents a key step for the City of Houston in capturing these benefits. At the same time, many citizens of Houston are asking for more transportation options. The 2012 city bond election to support the build-out of Bayou Greenways on nine major bayous in the City of Houston passed with 68% of the votes. Two-thirds of respondents to the online 2014 Houston Parks and Recreation survey identified connecting their neighborhood to trails and revitalizing existing parks as their highest budgetary priority. In 2011, METRO surveyed over 1,000 people who bike about the biggest barrier to more bicycle use; 60% indicated it was a lack of better bicycle facilities.

Summarizing the many benefits and recognizing the opportunity that could come from addressing key challenges, the Bike Plan identifies key factors that support the case for action for the development of the Plan and how it is a transformative opportunity for Houston. These factors have been developed as a result of an in-depth assessment of existing bicycle conditions, feedback from the community, and the potential for increased ridership based on current trip patterns, demographic trends, and peer city performance.

FIVE KEY OPPORTUNITIES FOR THE HOUSTON BIKE PLAN

The Houston Bike Plan is a **transformative opportunity** to...

1. **Provide a safer, more comfortable environment for the growing number of people riding bicycles in Houston;**
2. **Provide affordable access to opportunities;**
3. **Improve community health and wellness;**
4. **Compete with peer cities who are setting the bar; and**
5. **Benefit everyone, not just people who bike.**

The following sections outline these factors in more detail and discusses the current conditions for biking in Houston as a foundation for the Bike Plan to build upon.



Bayou Greenway Trail
Brays Bayou

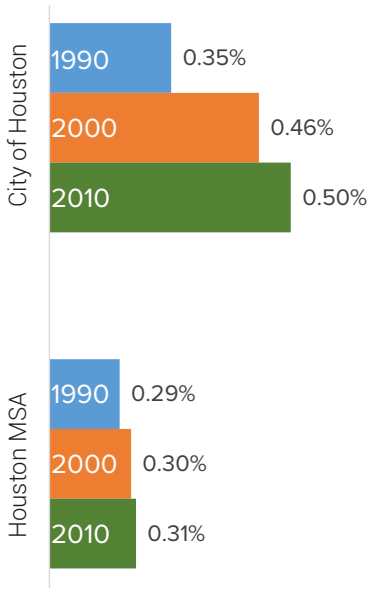
AN OPPORTUNITY TO...

PROVIDE A SAFER, MORE COMFORTABLE ENVIRONMENT FOR THE GROWING NUMBER OF PEOPLE RIDING BICYCLES IN HOUSTON

With the expanding amount of bicycle infrastructure in Houston, particularly trails along the city's bayous, the growth of the bike share network, the many programs offered, and the informal and organized rides that occur, it is difficult to travel through Houston without seeing people biking. Annual events such as the BP MS 150 attract over 13,000 people to ride from Houston to Austin every year as part of the nation's largest charitable ride of its kind. Participating in organized rides is often times a first step to riding more often for recreation and transportation.

While observations support the idea that many people are biking in Houston, the key challenge to assess the prevalence of bicycling in Houston is the limited data available, especially relating to trends over time. While significant data is collected annually on traffic volumes, limited data has been collected on people who bike. Where reliable data has been collected, however, it shows significant growth.

Figure 2.1: Work Commute Bike Mode Share



Existing Data

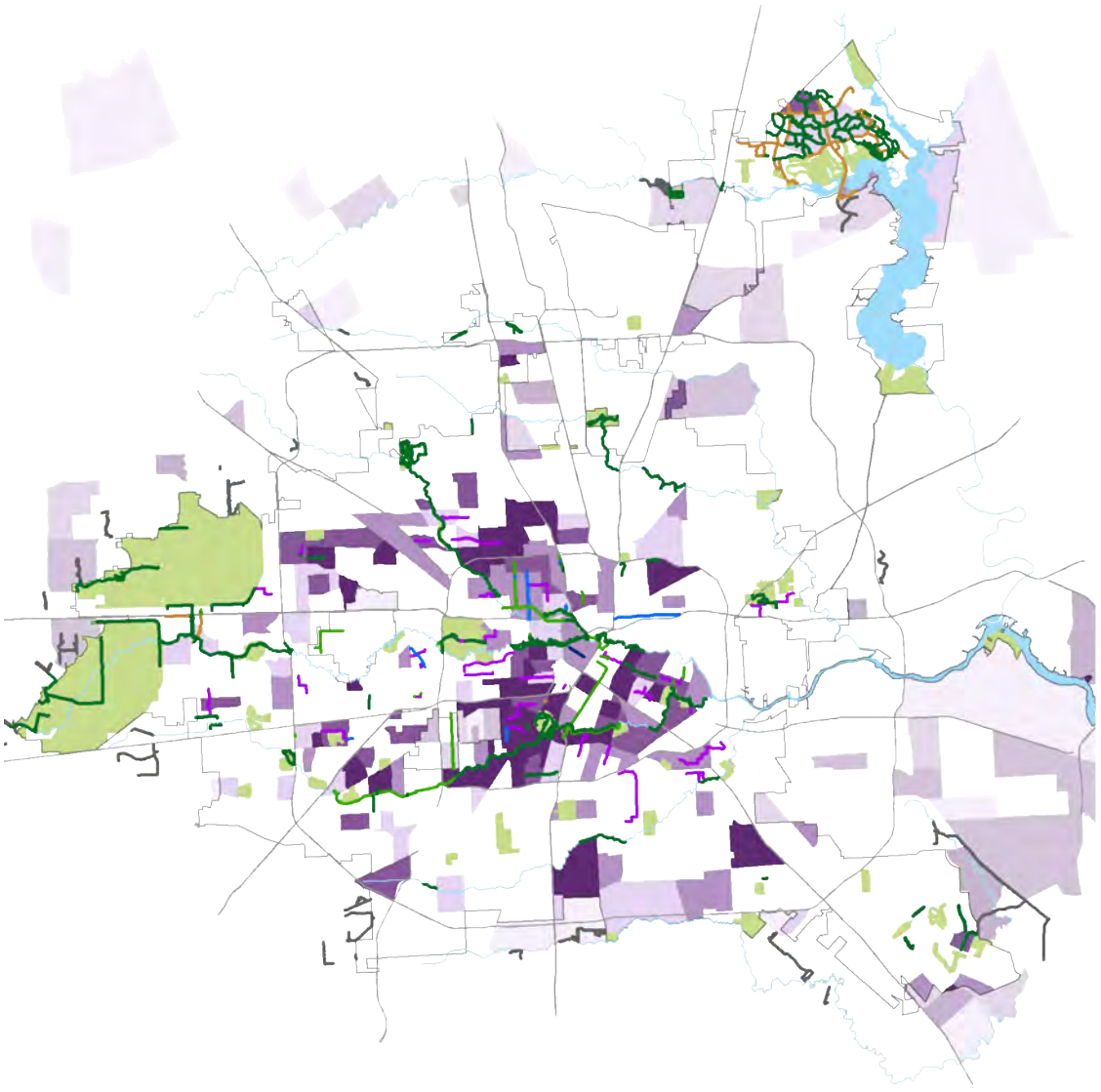
One fairly limited measure of people biking at a regional level is bicycle commute mode share utilizing Census data. As work commute trips make up less than 1 in 7 trips in the region, a large segment of the total number of people who bike is missed. This also only captures people who bike for the longest part of their commute on most days. This misses people who bike to work occasionally or chain trips between biking and transit. Even given those challenges, the Census data (Figure 2.1) shows that bicycle commute mode share has been growing in the Houston region, particularly in the City of Houston.

This data shows that during a twenty year period, while the number of commuters in the City of Houston grew 29%, the number of bicycle commuters grew 84%.

Figure 2.2 shows those places where there is an above average share of people commuting to work by bicycle, in many cases over 2%. These areas tend to be employment centers like Downtown or the Texas Medical Center where bicycles can be time competitive with driving and transit, or close to bike facilities like the Brays and White Oak Bayou Trails.

While no systematic bicycle count program currently exists for the City of Houston, two permanent counters have been installed on the MKT trail in the Heights and the White Oak Bayou trail near 34th Street. The counters have only been in place since 2013, too short a time period for conclusions about trends to be drawn, so they have experienced periods of unreliable data collection. Recently, three temporary pedestrian/bicycle counters have also been installed. Recent data from April 2015 is shown in Figure 2.3.

Figure 2.2: Work Commute Bike Mode Share



LEGEND

- City of Houston City Limit
- Parks

Bicycle Commute Mode Share

- 0.02% - 0.5%
- 0.51% - 1%
- 1.01% - 2%
- 2.01% +

Existing Bicycle Network

High Comfort Facilities

- High Comfort Walk/Bike Path
- Walk/Bike Path
- Separated Bike Lane
- Bike Lane
- Neighborhood Bikeway
- Shared Sidewalk
- Bike Facility Outside COH



Map Locater

0 2.25 4.5 9 Miles

Source: US Census Data (2013)

While it is just a snapshot of overall trail use and includes some pedestrian activity, the data does show the level of use along the trails is significant, even though many of the count locations are at the end of existing trails. This data will serve as a useful baseline as the bayou greenways system is expanded.

One place the growth in bicycling is well documented is in the number of people boarding METRO buses with their bicycles. In 2010, METRO completed the installation of fold-down bike racks on the front of its low-floor local bus fleet and the designation of bicycle compartments in the under-bus storage on its commuter fleet. Through the on-board data system, bus drivers record each time a passenger loads a bike onto the bus. (Note, data is not collected on the light rail system.)

The monthly boarding totals are shown in Figure 2.4. In the 12 months ending with March 2015, over 260,000 riders brought bikes on board METRO buses. This is more than twice the total in 2011, the first full year of the program. The data covers the broad spectrum of people traveling in the region including those that do not have ready access to a car and rely on transit and bicycles as their primary means of transport. This population is often difficult to reach through

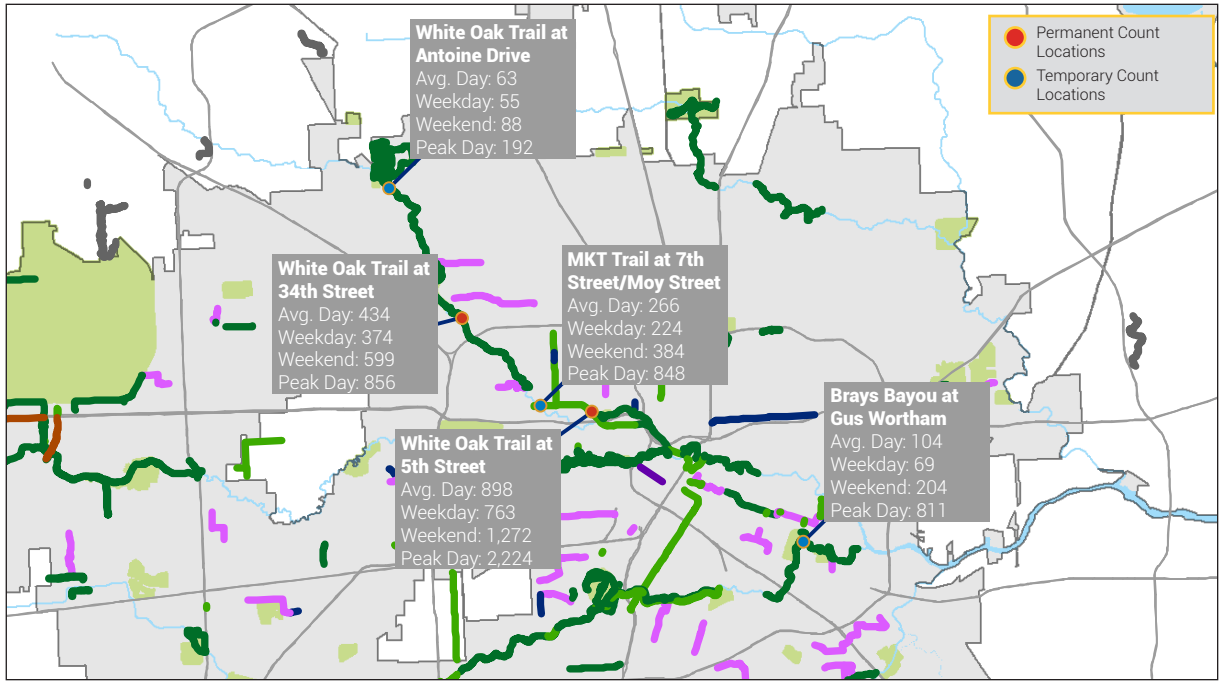


Figure 2.3: Trail Counter Data (April 2015)

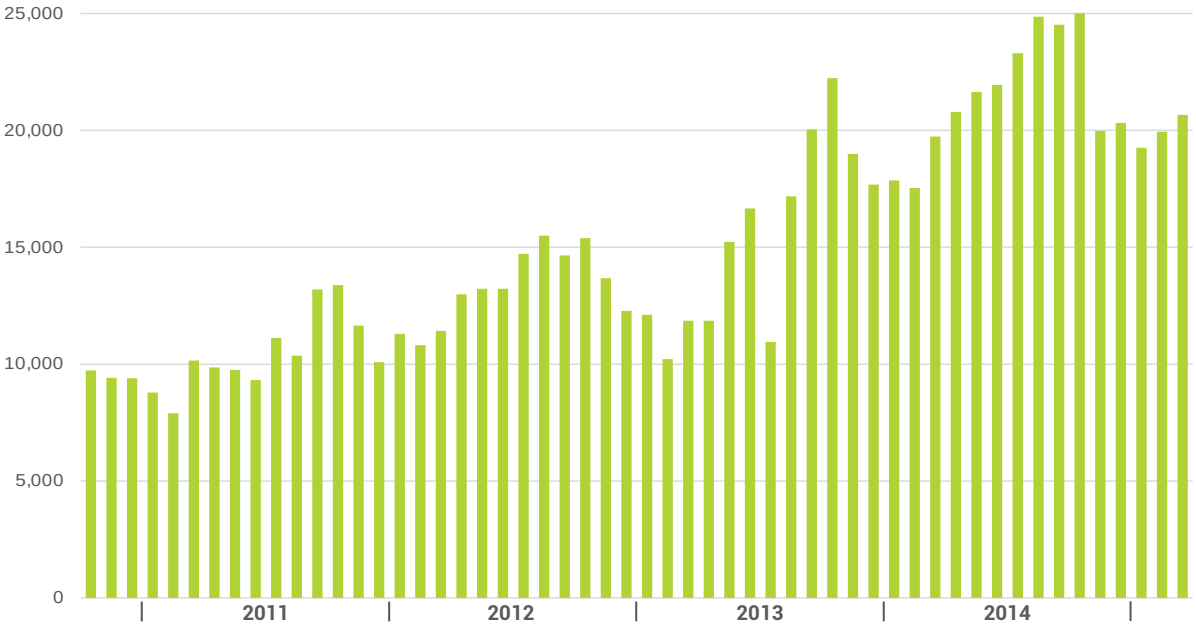


Figure 2.4: Bicycle Boardings on METRO Buses



Bike Boardings on METRO buses have more than doubled since 2011, the first full year of the

traditional planning outreach methods, but can especially benefit from an improved and safer network of bicycle facilities and programs. Over the same time period, METRO local bus ridership was stagnant overall, making the increase in bike boardings even more remarkable.

Another program showing continual growth in people biking is Houston's Bike Share, described in more detail on the following pages. In the first four months of 2015 over 28,000 trips were taken on the system, a 23% increase over the same period in 2014 despite no additions of stations or bikes. Usage continues to grow and the system regularly exceeds 2,000 checkouts per week. An all-time record of 3,250 trips was set during the last week of March 2015.

Participating in organized rides is often times a first step to riding more often for recreation and transportation. For those who do not own a bike, the bike share program allows them to participate in organized rides and other activities.



Sunday Streets

Source:
Go Healthy Houston
Office of Mayor Parker
Houston Bikeway Program

Existing Bike Programs & Events

Another way to assess the amount of people biking in Houston is to look at the existing involvement in bicycle programs and events. The City of Houston has been influential in promoting bicycling as a form of recreation, transportation, and a component of community health through various initiatives, programs, and events such as Sunday Streets and Bike to Work Day. Go Healthy Houston is an initiative that was launched by Mayor Annise Parker in 2012 to raise awareness of the health risks of obesity. In 2014, Go Healthy Houston. a task force of City departments and community leaders launched Sunday Streets, a pilot program that received corporate sponsorship by Cigna in 2015. During Cigna Sunday Streets, a segment of a major street in a neighborhood is closed off to automobile traffic for a four-hour period to create a family-friendly environment for people to walk, bike, play, and socialize. It has been an incredibly successful program with over 26,000 attendees estimated at some events. These events allow participants to enjoy the streets in a unique way, and diminish common safety concerns that are present with automobile traffic. According to Go Healthy Houston's website, this program has the potential to influence people's behavior as roughly half of participants say they are more likely to walk or bike to neighborhood destinations after attending.

National Bike to Work Day has a much different target audience than Sunday Streets, but a crucial one that encourages more people to commute by bike. 2015 marks the 15th year that the City of Houston has hosted a Bike to Work Day event, which traditionally begins with a celebratory bike ride near Downtown Houston, followed by festivities outside City Hall.

Management districts, bike shops, and community organizations have been influential in helping to coordinate these efforts, and their partnerships are essential

in reaching the general population in such an expansive city. For example, the Energy Corridor District hosts its own Bike to Work event, where designated "Bike Champions" lead groups on bike routes. The District has bike jerseys for purchase, receives sponsorships, and hosts Lunch & Learn events for area employers on bicycle instruction and safety. On a smaller scale, bike shops serve as meeting points for group rides in the City's celebratory Bike to Work Day ride, and can be a vital location for information dissemination for outreach and education.

Houston's bike share program, known as Houston B-cycle, improves bicycle access to the public by offering bike rentals at 29 locations throughout central Houston. B-cycle offers daily, weekly, and annual rates that allow for 60-minute trips between stations. The program launched in May 2012 with the introduction of three bike stations in Downtown Houston. Within three years, the program has increased to 29 stations and 200 bikes, and has a goal to expand to 1,000 bikes and 100 stations by the end of 2017. Each new station increases the program's usefulness while providing more connections and opportunities for more people and more destinations. Neighborhoods that now have access include Downtown, Midtown, Montrose, Third Ward, East End, and Memorial Heights.

The dynamic population of Houston riders is also influenced by the numerous organized, community, and social bike rides with



Figure 2.5: Houston B-cycle Station Map

differing purpose, culture, size, and location. These rides include BP MS 150, Critical Mass, Kidical Mass, Bayou Bikers, Karbach Brews Cruise, Crucial Matter, among many others. While some are highly organized rides, such as Tour de Houston and BP MS 150, community-based bike shops and social media have made it easy for communities to form social rides that are tailored to their needs, level of ability, and interests.



Houston Critical Mass

Sources:
Chip Gates
UWire, 7/29/2013

The Tour de Houston highlights a new route each year to showcase Houston neighborhoods. The 20, 40, and 60-mile ride is a BP MS 150 approved recommended ride. The ride has grown to more than 6,000 riders from the city and region.

The BP MS 150 is an example of a major organized ride as it is the largest charity ride in the U.S. This 160-180 mile, two-day bike ride (organized by the National MS Society South Central Region) starts in Houston and ends in Austin. An estimated 13,000 cyclists participated in the 2015 event, which was the 31st annual ride since it began in 1985. The annual event has been impactful by increasing bike ownership in Houston, creating a culture of cycling for sport, and raising awareness of bike safety and maintenance.

Critical Mass is a monthly cycling event that originated in San Francisco in 1992 to build support and awareness for people who bike, and has since spread to cities worldwide. The culture of these monthly bike rides varies across cities, and the Houston Critical Mass is typically a "casual, fun" event. There is no formal organization or membership, but it is estimated to attract 1,000 to 3,000 participants, who congregate in downtown Houston at Market Square on the last Friday of each month.

Due to the large number of participants, the ride may be slow paced and inclusive for a wide range of experience and comfort levels. Since 2014, Critical Mass leaders have been coordinating with the Houston Police Department to improve safety conditions of the ride. This social ride remains a symbol of the growing interest in streets where people on bikes are welcome.

Significant Potential For Growth

At the same time that cycling has grown significantly over the past decade, it remains a relatively small share of the mobility picture in Houston. There are many reasons to

believe that there is significant potential for growth. The Bike Plan is an opportunity to set a path to capture the latent demand among the large segment of the community who are interested in bicycling for more of their trips but currently do not.

National trends for bicycling in cities across the US and the world show rates increasing, with the ACS data for the 70 largest US cities seeing bicycle mode share increase an average of 85% from 2000 to 2012. The average mode share in these large cities is 1.1%, more than double the current mode share in Houston, which is 0.5% (See Fig 2.1).

As discussed earlier, home-to-work commuting is less than 15% of all trips made in Houston and the mode share calculations likely undercount the rate of people biking in Houston. Overall, a much larger percentage of people report biking for some of their trips, with 13% of people biking for one or more trips per week in the most recent 2009 National Household Travel Survey. Providing more people with safe, comfortable options to bike has the potential to significantly increase the level of usage in the City.

Houston is a rapidly growing and evolving city. Figure 2.7 on the following page shows how the population density in Houston has changed from 1990, approximately when the last Comprehensive Bikeway Plan was developed, to 2013. Over 430,000 people have moved to Houston over that time, a growth rate of 6% per year.

Density is simply a way of showing the amount of something (e.g., population, jobs) that exists in a defined area. By providing more things closer together, denser neighborhoods allow for shorter trip distances and support a broader range transportation options. Many of the current higher density areas did not have the same level of activity the last time the Bikeway Plan was updated.

The preference for higher density neighborhoods is partly driven by the high percentage of residents between the ages of 18 to 34 moving to urban areas. The percentage of residents in Houston within this age bracket, often called the Millennials, is 29%, which is higher than the national average of 23%. Millennials are the largest age cohort within the City. (Figure 2.6)

Baby Boomers, people ages 50-69, also represent a large cohort (19% of the population). They have shown some preference for the amenities available in more urban settings, particularly among people looking to downsize their homes as children have grown and moved away. A recent survey by the Urban Land Institute showed approximately half of these cohorts support more bicycle lanes in their communities (AMERICA IN 2015: A ULI Survey of Views on Housing, Transportation, and Community; Pg 17).



Bicycle maintenance and repair classes encourage safe riding

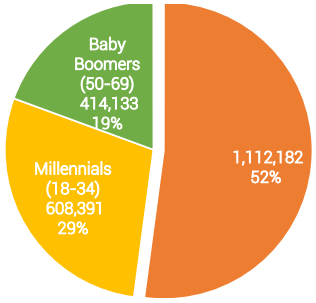
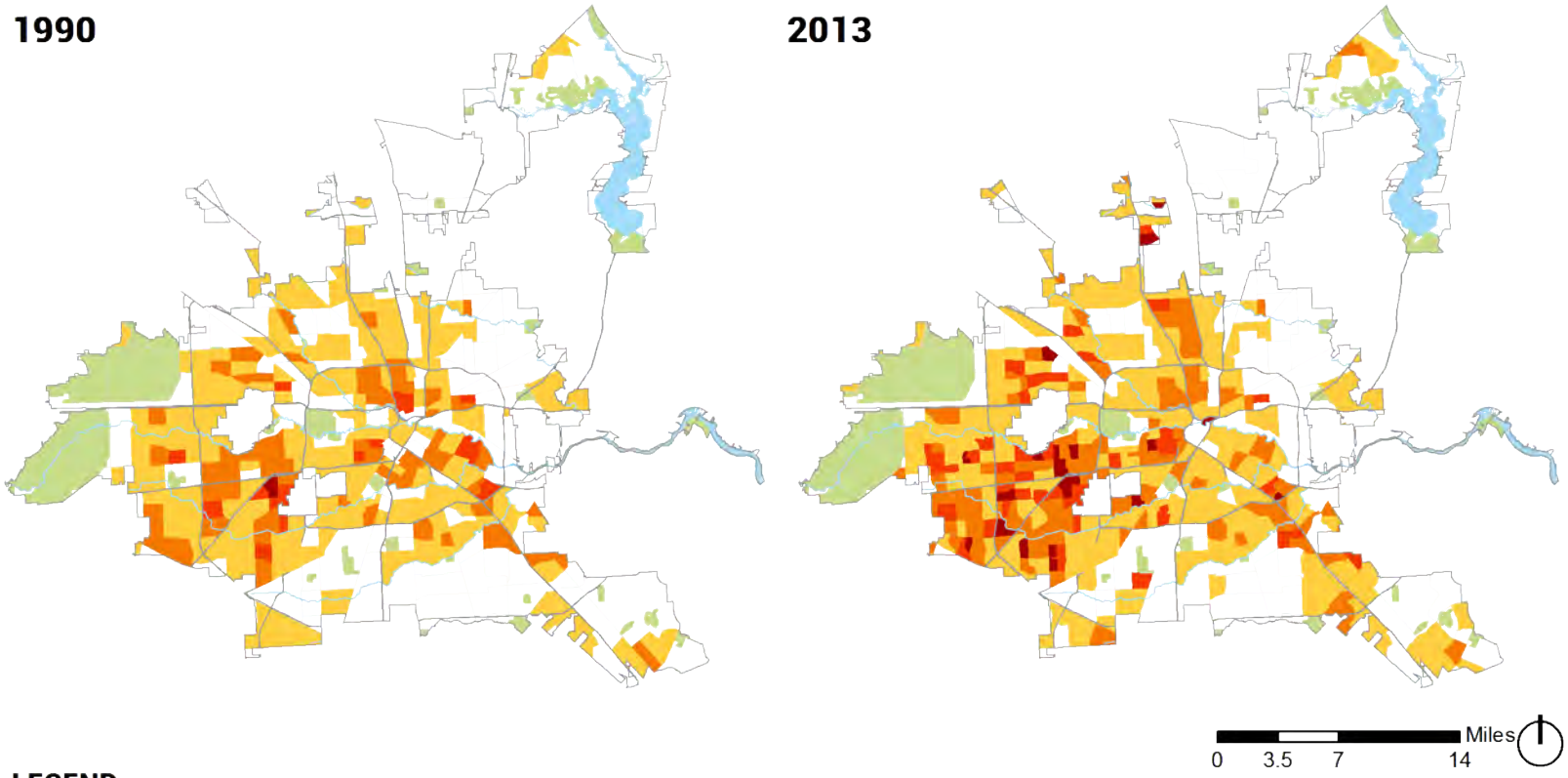


Figure 2.6 Houston's Largest Age Cohorts: Baby Boomers and Millennials

Figure 2.7: City of Houston Population Density: 1990 and 2013



Source: US Census Data, ACS (2013), US Census Data (2010)



Map Locater

Who Bikes in Houston?

To get an understanding of the potential to increase bicycle usage in Houston, it is important to understand demographic trends as well as the various types of people who may be looking to ride. In 2012, Portland State University and the Portland Bureau of Transportation developed a breakdown of people into "Four Types of Bicyclists". This was used to better understand the potential for bike usage in the city and has since been repeated in other cities like Austin, Texas.

These studies, including the data from Portland and Austin shown in Figure 2.8, have found that two to four percent of the population is made up of "**Strong & Fearless**" riders who will ride regardless of the extent and quality of existing bicycle facilities. 9%-16% percent of people are "**Enthused & Confident**" riders who will ride with basic bicycle facilities, such as bicycle lanes, but prefer to avoid sharing the road with traffic if possible.

Another 31%-44% percent of people, in the "**No Way, No How**" category, will not or cannot consider riding a bicycle under any circumstance. The fourth category represents the largest potential for growth of people bicycling. Between 39%-56% percent were classified as "**Interested but Concerned**" meaning that they would be willing to ride a bicycle, or ride more often, if conditions were improved and they felt more comfortable.

It is likely that people in the Strong & Fearless and Enthused & Confident categories make up the majority of frequent riders in Houston today, particularly people riding on city streets. People bicycling who are in the Interested but Concerned category are increasingly drawn to attractive trails segments along the bayous and other corridors. The lack of a well-connected network, as described in the next section of this report, limits the level of biking in Houston or leads people to load their bikes on their car to ride in comfortable locations.

It is worth noting that people who bike because other transportation options are limited might fall into any one or several of these categories. For instance, some riders might appear 'Strong & Fearless' and bicycle on streets with heavy vehicular traffic out of necessity, but they may also be 'concerned' about their safety and have limited transportation choices.

By defining a broader network that connects many of these comfortable bikeways with neighborhoods, activity centers, and each other, the Bike Plan can lay the groundwork for continued growth of bicycling in Houston and provide more transportation options for the broad and diverse set of people who are concerned about riding in Houston today.

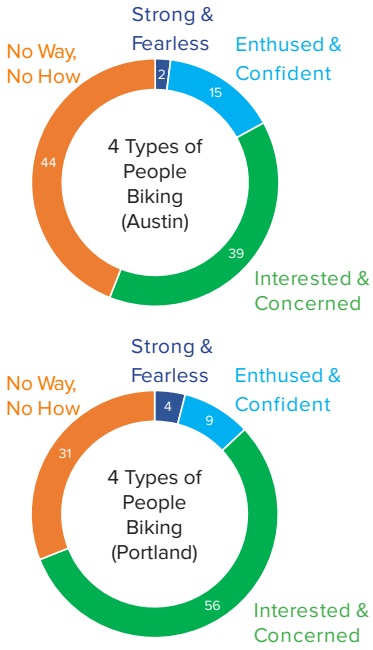


Figure 2.8: Population Breakdown of the Four Types of Bicyclist for Austin and Portland; Percent (%)

Women's Group Ride







Bike Routes on South Boulevard (top) and Griggs

The Existing Bikeway Network

This growth in people biking is happening on existing streets and bicycle facilities. As of Spring 2015, the existing Houston bikeway network is comprised of 498 miles of designated bicycle facilities and routes. This figure and the subsequent analyses include all designated facilities and routes within the City of Houston limits as well as any that pass outside the city but provide a link between Houston bikeways. An additional 50 miles of facilities located proximate to but outside the city limits are shown on the maps but are not included in the analysis.

The Houston Bikeway Program currently classifies facilities into one of six categories: shared-use trail, bike lane, signed bike route, signed shared roadway, cycle track, or other trail.

In the case of on-street facilities, the distinctions between these categories are drawn based upon the technical features of the facility type. Signed bike routes are designated by "bike route" signs only, while signed shared roadways also feature "sharrow" pavement markings. Bike lanes are separated from vehicle traffic by a white stripe while cycle tracks have a buffer and some physical feature to provide separation.

Rather than physical features, the difference between shared-use trails and other trails has to do with jurisdiction; other trails are maintained by entities other than the City of Houston.

While these categories provide a general idea of the type of provisions a person on a bike can expect along city roadways and bikeways, they have some limitations. Variation in condition and comfort within a category can result in vastly different experiences. For example, South Boulevard and Griggs Road, pictured at left, are both classified as bike routes. South Boulevard is a quiet, neighborhood street with low traffic volumes and speeds. Most bicyclists, including children, are likely to find this a comfortable and pleasant environment to ride. Griggs Road, meanwhile, is a four-lane, 40 mph thoroughfare. Only cyclists confident enough to ride in the vehicle lane alongside high-speed traffic will consider this a usable facility.

A person's decision of whether or not to bicycle on one of those streets wouldn't depend on the type of signage and markings provided, but rather the level of safety and comfort they felt using it. Concern about traffic is the most frequently cited factor that prevents people from bicycling, so it is important to understand which facilities provide a level of comfort that makes them appealing to most people who bike or are interested in biking.

Systems have been developed to objectively categorize facilities by level of traffic stress, or the inverse Level of Comfort (LoC). Some approaches utilize vast quantities of data to make these assessments. The

Figure 2.9: General Guideline for Level of Comfort Assessment of the Existing Bikeway Network



Minetta Transportation Institute developed the report "***Low-Stress Bicycling and Network Connectivity***" in 2015 utilizing a more balanced quantitative and qualitative approach that leveraged existing roadway data and information on the existing bicycle facilities to develop a rating from 1 (high LoC) to 4 (lower LoC) for each roadway or bicycle facility. This approach has been refined and utilized by the Houston Bike Plan study team to assess Houston's existing bikeway network. The general characteristics for bikeways for each LoC classification are shown in Figure 2.9. Quantitative site visits, safety data, and an assessment of surrounding land use context were used to classify existing bikeways. The 4 categories of Level of Comfort are described below:

LoC 1 facilities present very little stress and provide a relaxed riding experience. They are suitable for all people who bicycle including children who have been taught to cross intersections safely.

LoC 2 facilities require occasional interaction with calm, low-speed traffic and more attention than might be expected of children, but are still comfortable for nearly all adults who bike.

LoC 3 facilities involve more interaction with cars but still provide an exclusive riding zone when alongside multilane and/or moderate-speed traffic. These are still welcoming to many people who currently bicycle in the city.

LoC 4 facilities are all those beyond LoC 3. They require interacting with multilane and moderate to high-speed traffic and are unlikely to appeal to anyone but the strongest and most fearless cyclists or those that do not have alternatives to riding on these corridors. This can include people that do not have access to a personal vehicle and use their bicycle as their primary transportation mode, or out of necessity. This is an important consideration in developing a bikeway network that supports a diversity of transportation needs and choices.

Bikeway Types

In order to better associate bicycle facility types and map symbols with the type of bicycling experience they represent, the existing bikeway network was mapped by defining bikeways that incorporate both the facility type and the Level of Comfort. This analysis helps communicate to people interested in biking where they are most likely to find routes that are tailored to their desired riding experience. It also can show gaps in the existing network where people transition between bikeway segments of different comfort levels while traveling along a route.

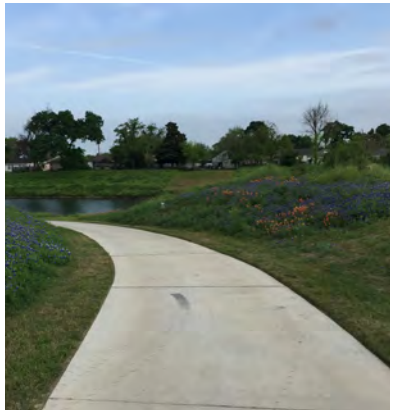
Figure 2.10 maps the existing bikeway network according to these bikeway categories. Consistent colors have been used for the three main categories of bikeways with darker shades aligned to higher levels of comfort. This allows simpler trip planning for people biking as they can select the routes that are most appropriate for their skills and experience. The bikeways are designated as shown in the following pages. There are also many local streets with low traffic volumes and speeds that have not been designated on the citywide bikeway network that are also comfortable places to bike. Some of these that serve as key connections in the citywide plan will be identified as part of the HPB. Neighborhood level planning should identify additional connections in the future. Bikeway types are discussed in more detail on the following pages and in **Chapter 4: Bicycle Toolbox**.

Bikeway Types

Off-Street

High Comfort Walk/Bike Path

Off-street facility shared by people biking and walking. Street crossings are few, and those that exist are safe and easy to cross.



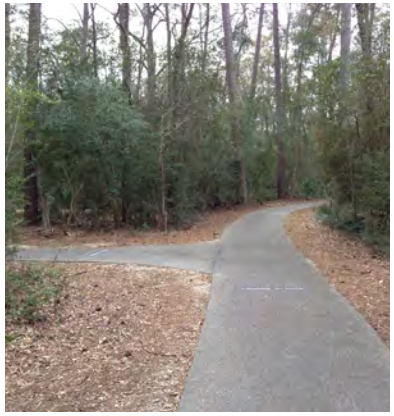
Shared-Use Walk/Bike Path

Off-street facility shared by people on bike and on foot. May include frequent driveway crossings and/or unprotected crossings of wide streets.



Shared Sidewalk

Sidewalk designated for bicycle use as well as foot traffic but too narrow to be considered a shared-use path (less than 8 feet wide).



On-Street Designated

Separated Bike Lane

Dedicated on-street space for bikes separated from traffic with a buffer and other physical delineation.



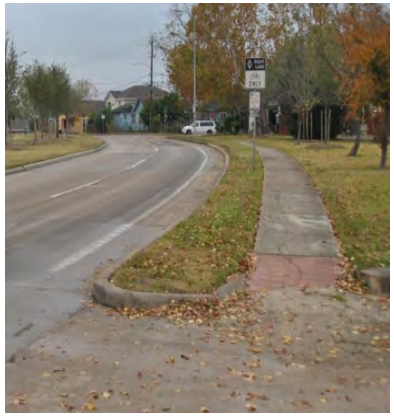
Bike Lane

Dedicated on-street space for bikes separated from traffic with painted markings.



Low-Comfort Bike Lane

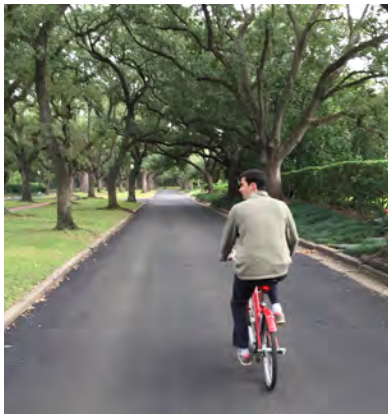
Dedicated on-street space for bikes separated with a white stripe. May be extremely narrow and/or located on a high speed, high volume street.



On-Street Shared Roadway

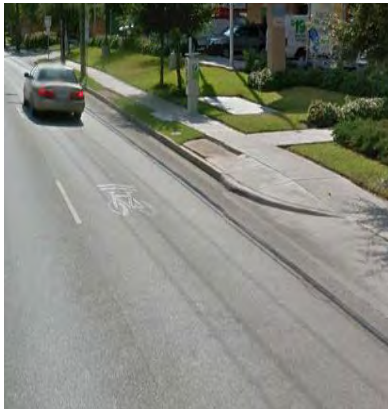
Neighborhood Bikeway

Low speed, low volume residential street shared by motor vehicles and bikes. Marked with "bike route" signs. These are a subset of Signed Bike Routes on the existing City map.



Shared Lane

Lane shared by motor vehicles and bikes. Marked with "share the road" signs and "sharrow" pavement markings.



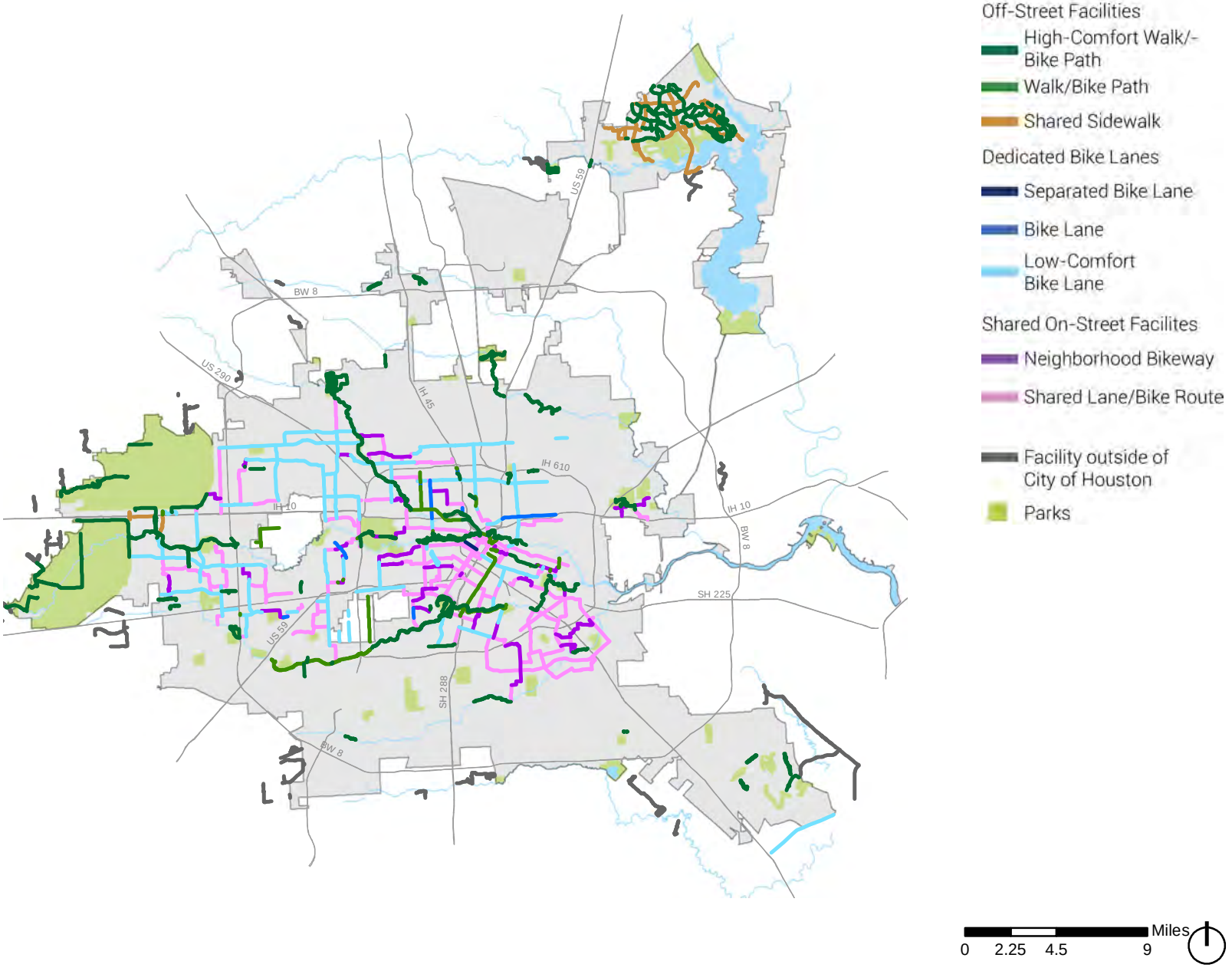
Signed Bike Route

Street shared by motor vehicles and bikes. Marked with "bike route" signs.



Shared lanes and signed bike routes are symbolized in the same color as the qualitative differences are not significant.

Figure 2.10: Existing Houston Bikeway Network



Source: Houston GIMS; Team Analysis & Site Visits

About 45% of the existing network is off-street and 33% is in lanes shared with cars.

Less than half of the existing network provides a level of comfort that would appeal to an average adult who bikes.

Figure 2.11 breaks down the total mileage of facilities in the network. Length is measured by centerline miles, i.e., a two-way street that is one mile long with a bike lane in each direction counts as one mile of bike lane.

Of the roughly 500 miles of total network, 45% consists of off-street bikeways, 22% is dedicated bike lanes, and the remaining 33% is shared roadways with motor vehicles in the form of bike routes and shared lanes. This data also shows that many of the existing bikeways are not higher comfort facilities, including the majority of existing bike lanes and signed bike routes. This limits the range of people who ride in the city. While the scope of the Bike Plan is focused on a citywide bikeway network, there are very comfortable facilities in each of these bikeway typologies which can serve as key neighborhood connections, in particular low volume neighborhood streets that link to regional bikeway corridors like the bayou trails.

Figure 2.12 shows the existing Houston bikeway network with the LoC 4 facilities removed. This represents the network that most "Enthused and Confident" cyclists but few "Interested but Concerned" cyclists would likely be most comfortable using.

Without the low-comfort facilities, most of the existing bike lanes and shared lanes disappear, as well as bike routes on multilane streets. The remaining network is fragmented and discontinuous, limiting people's ability to make many trips and likely the overall usage of the bikeway network. Continuity is particularly impacted in the outlying areas of the city where existing routes rely on narrow (less than four feet) bike lanes on fast, multi-lane streets. Even closer in, bikeways near the Uptown area become isolated and access to Downtown from the south is lost. Greenway Plaza is not connected at all.

Figure 2.11: Network Mileage and Level of Comfort

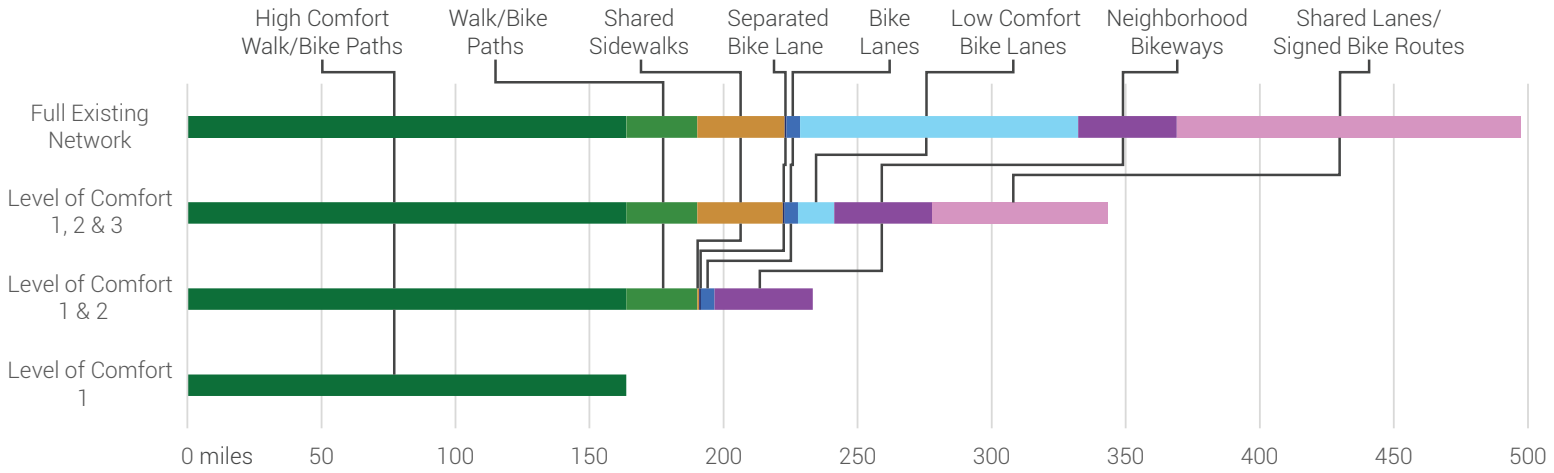
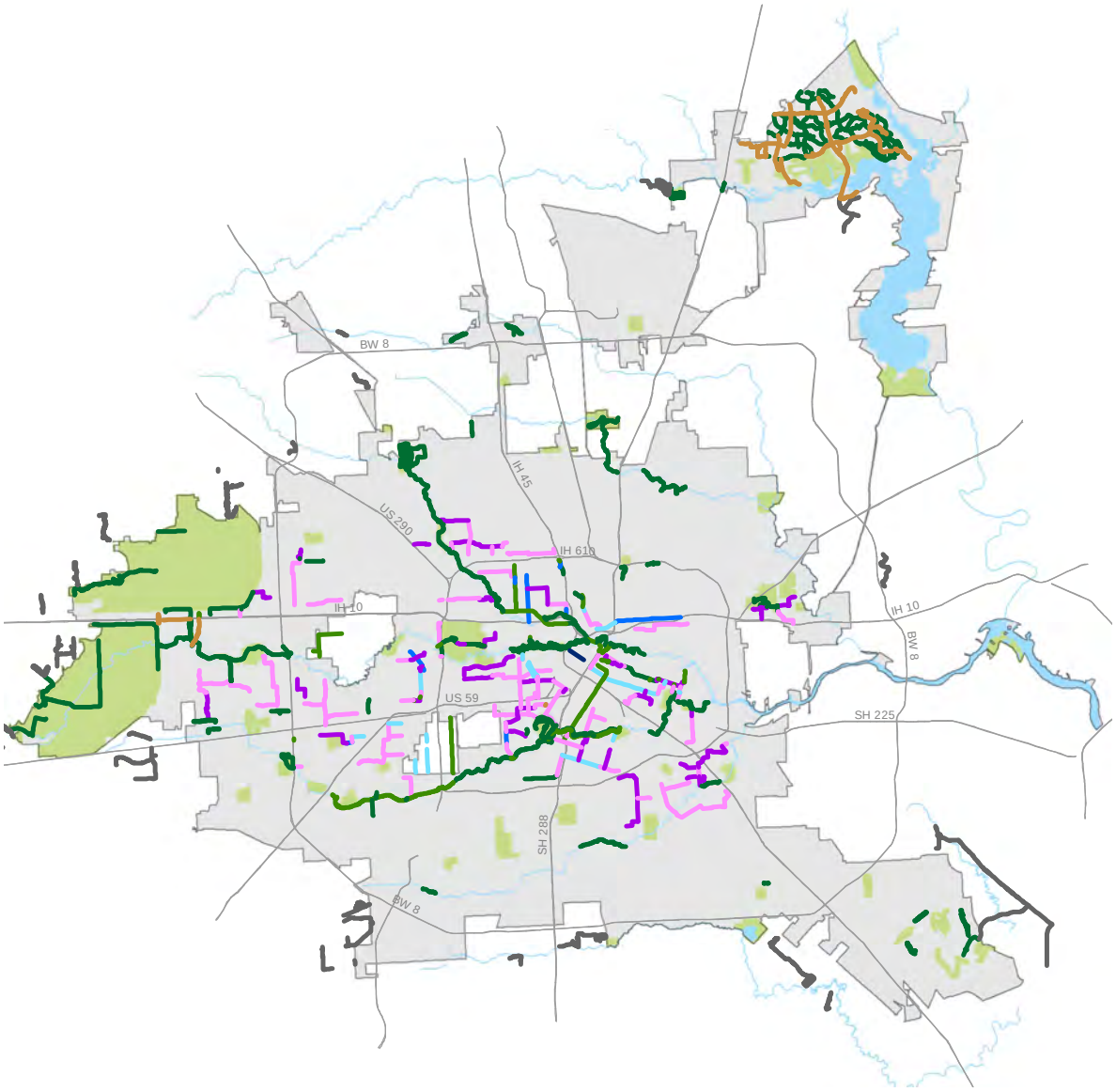


Figure 2.12: Existing Moderate to High Comfort Facilities (Level of Comfort 1, 2, 3)



LEGEND

Off-Street Facilities
- High-Comfort Walk/-Bike Path
- Walk/Bike Path
- Shared Sidewalk

Dedicated Bike Lanes
- Separated Bike Lane
- Bike Lane
- Low-Comfort Bike Lane

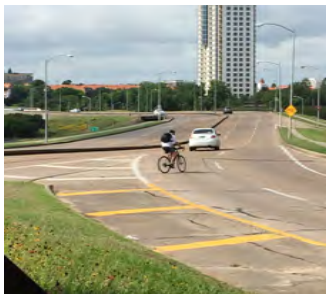
Shared On-Street Facilites
- Neighborhood Bikeway
- Shared Lane/Bike Route

- Facility outside of City of Houston
- Parks

0 2.25 4.5 9 Miles

Source: Houston GIMS; Team Analysis & Site Visits





Top: Buffalo Bayou near Tony Marron Park
Bottom: Waugh Street Overpass at Memorial Drive

Figure 2.13: Network Mileage and Dedicated Facilities

The middle bar of Figure 2.13 shows the two-thirds of the network not shared with cars. Among these dedicated bicycle (and bike/ped) facilities, many were not designed to current guidelines set by the National Association of City Transportation Officials (NACTO) and the City of Houston's current Infrastructure Design Manual (IDM). The NACTO Urban Bikeways Design Guide and IDM specify that bike lanes should be at least five feet wide and that shared-use paths should be a minimum of ten feet wide though wider is typically desirable.

Figure 2.13 shows the extent of facilities that meet these guidelines for width, less than half of the total dedicated facility mileage. A large share of bike lanes in Houston were retrofitted on boulevard thoroughfares with a 24-foot pavement width. Narrowing the vehicle lanes from 12 to 10 feet allowed the striping of a 4-foot bike lane, below current standards. The shared-use paths and shared sidewalks that don't meet AASHTO or NACTO standards are primarily located in Kingwood, a planned community that integrated trails into its design. These trails were largely designed to the standard for walking but have been designated as bicycle facilities on the City Bikeway maps.

Figure 2.14 shows the network with LoC 3 and LoC 4 facilities removed. This excludes all signed bike routes that aren't on quiet residential streets. What remains are the routes that would appeal to most people who bike. The expansion of these facilites to form more of a network is most likely to attract new people to ride.

The high-comfort bikeways currently do not function as a network since very few connect beyond a particular bayou corridor or neighborhood. For the majority of people who bicycle, or are interested in bicycling, opportunities to make useful trips are limited since most daily activities and destinations are not located directly on bayous. Some high-comfort facilities connect to the edge of activity centers like Downtown, Uptown, and the Texas Medical Center, but few actually serve the hearts of these areas.

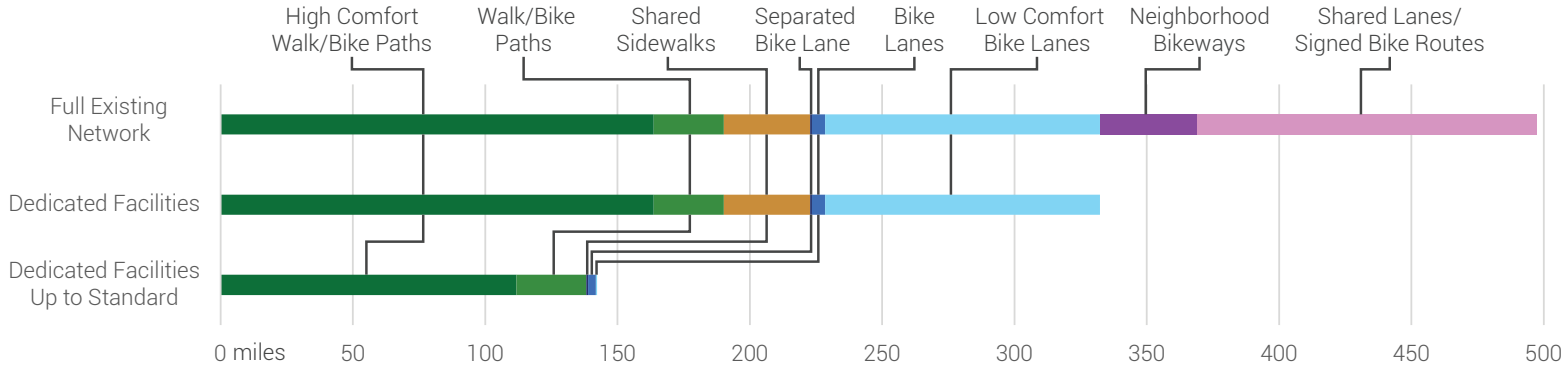
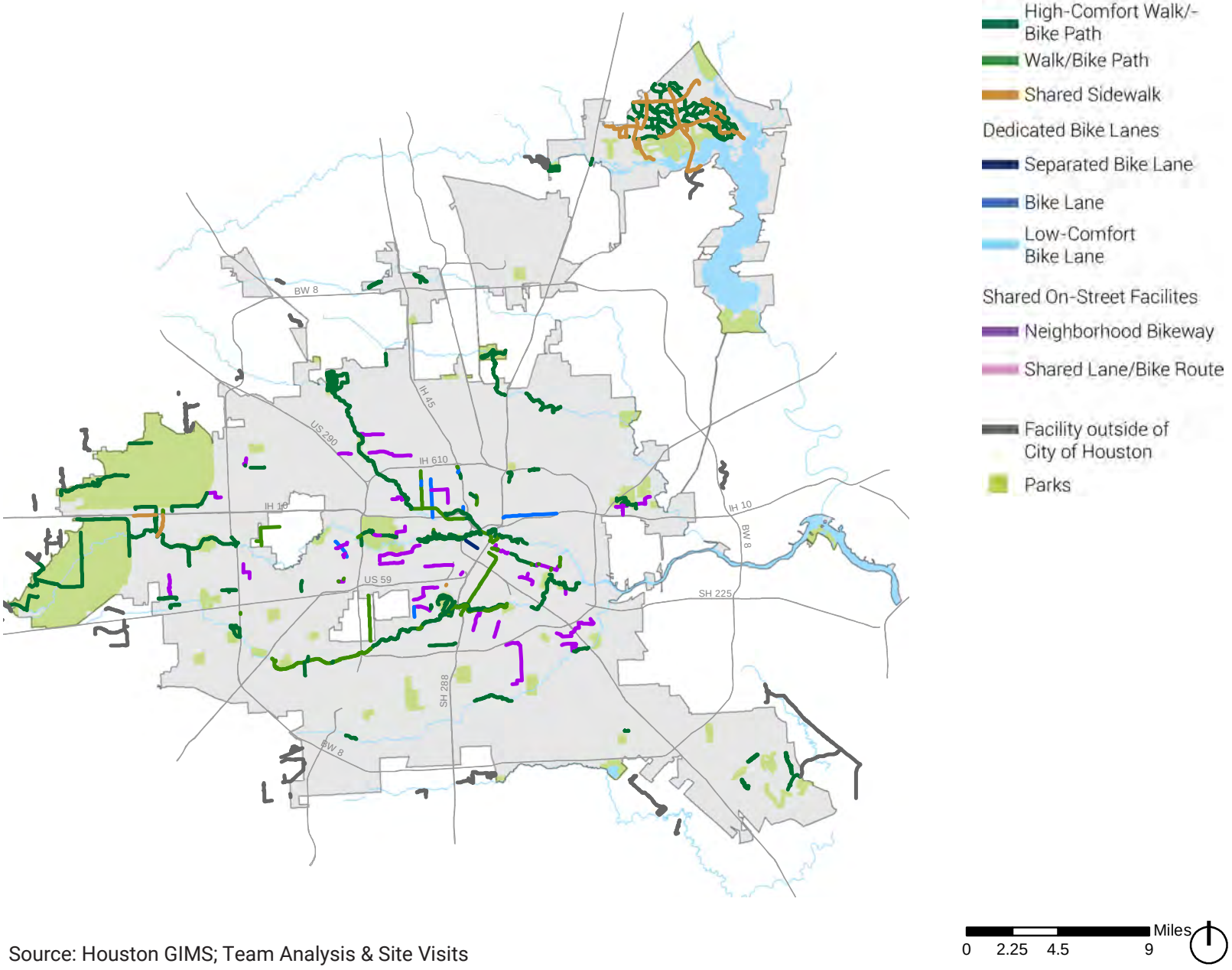


Figure 2.14: Existing High Comfort Facilities (Level of Comfort 1, 2)



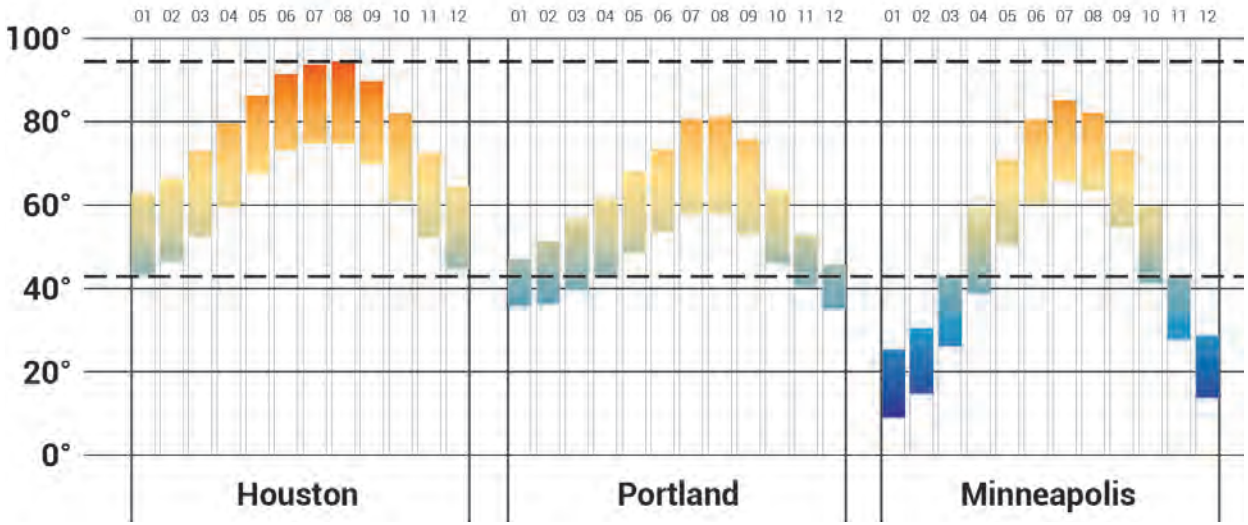
Source: Houston GIMS; Team Analysis & Site Visits

Climate and Geography

Houston benefits from a climate that makes bicycling possible throughout most of the year. Outside of the summer, approximately three months out of the year, Houston offers nine months of comfortable bicycling weather. Houston is ranked number 52 of U.S. cities with the highest percentage of bicycle commuting. Of the top five, Houston's climate is most comparable to Washington D.C. (ranked third), with temperatures that reach into the 90s (degrees Fahrenheit) in the summer (see graph below). But unlike Washington D.C., Houston's temperature rarely drops below 40 degrees in the winter. The lack of snow makes Houston winters very manageable for bike commuters. However, thermal comfort level may not be a primary deciding factor for people. Minneapolis, the U.S. city with the second highest percentage of bike commuters, maintains high ridership during extreme winter conditions with average temperatures below 20 degrees.

Regardless, Houston is well positioned to support bicycling based on its natural geography. In addition to Houston's bicycle friendly climate, the City's flat terrain makes most bicycling trips relatively easy. Looking again at a comparison between the top five bicycle commuting cities, Houston's elevation has the shortest range, from sea level to 83 feet. Portland and San Francisco's elevation ranges are close to 1,000 feet. Steep hills can present challenging conditions for bicyclists, and may discourage those who are less experienced. This is rarely a concern in Houston neighborhoods.

Monthly Climate Normal Temperatures (1981-2010): Houston and the Top Five U.S. Cities by Percentage of Bike Commuters



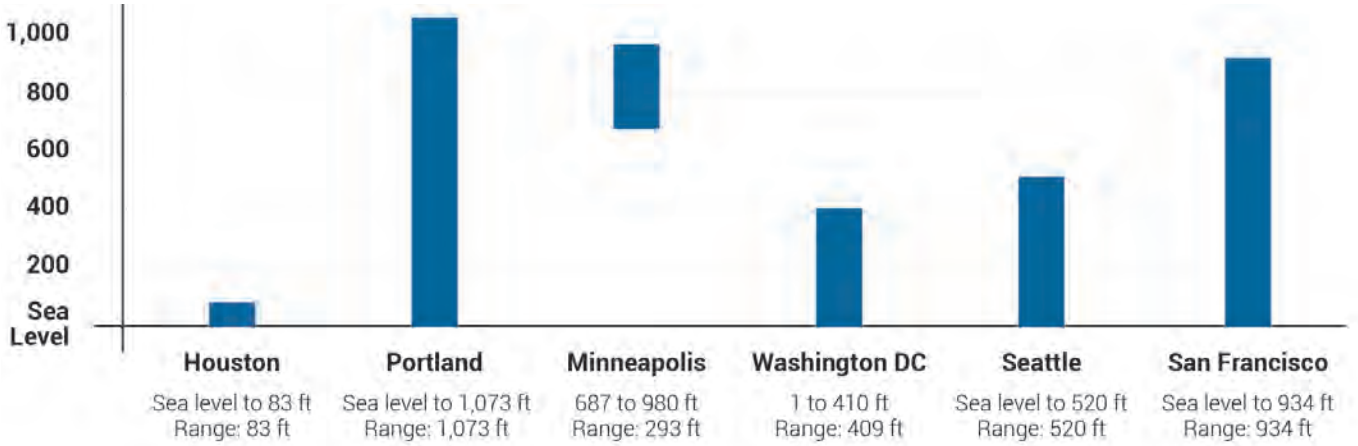
Sources:

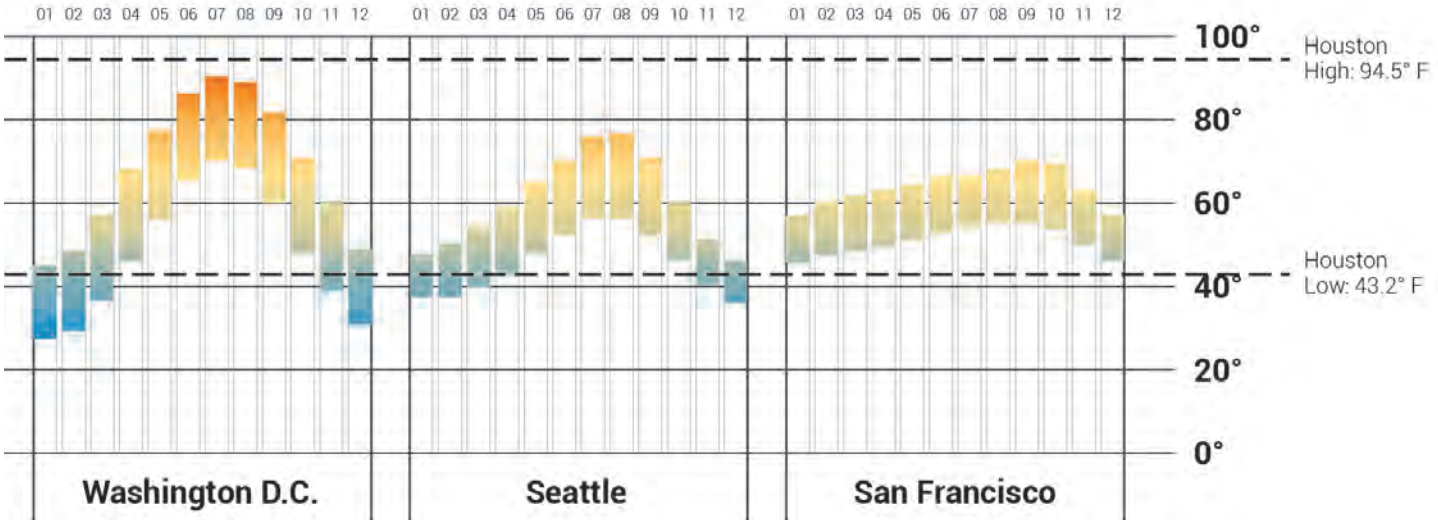
National Oceanic and Atmospheric Association, National Climatic Data Center / The 1981-2010 Climate Normals are NCDC's latest three-decade averages of climatological variables, including temperature and precipitation.

League of American Bicyclists, 2013 American Community Survey Data Report

U.S. Geological Survey

Elevation Range: Houston and the Top Five U.S. Cities by Percentage of Bike Commuters





In the 2014 Houston METRO Bike & Ride Study for over 1,100 people surveyed, the lack of safe bicycle facility and general safety were the top two barriers to people increasing their bicycle use.

Safety for All Road Users

Safety, or a perceived lack of safety, is typically cited as a top impediment to more people biking. The development of a safer citywide bicycle network is a critical outcome of the Bike Plan.

Data from the League of American Bicyclists gathered as part of Houston's designation as a Bronze-level Bike Friendly City indicates that Houston's bicyclist safety rate is below many national peers. This is measured by the number of fatalities over a three year period per 10,000 bicyclist commuters.

To assess more closely where bicycle related crashes have occurred in Houston, historical data was obtained for all recorded crashes within the City from 2010 through 2014, although there were likely more crashes that were never reported. Over that period, there were 1,509 documented crashes in the City of Houston, 0.6% of all documented crashes over that time. This rate is slightly higher than the bicycle commuter 0.5% mode share in the City. 67% of all crashes occurred at intersections where conflicts with vehicles are likely to be highest.

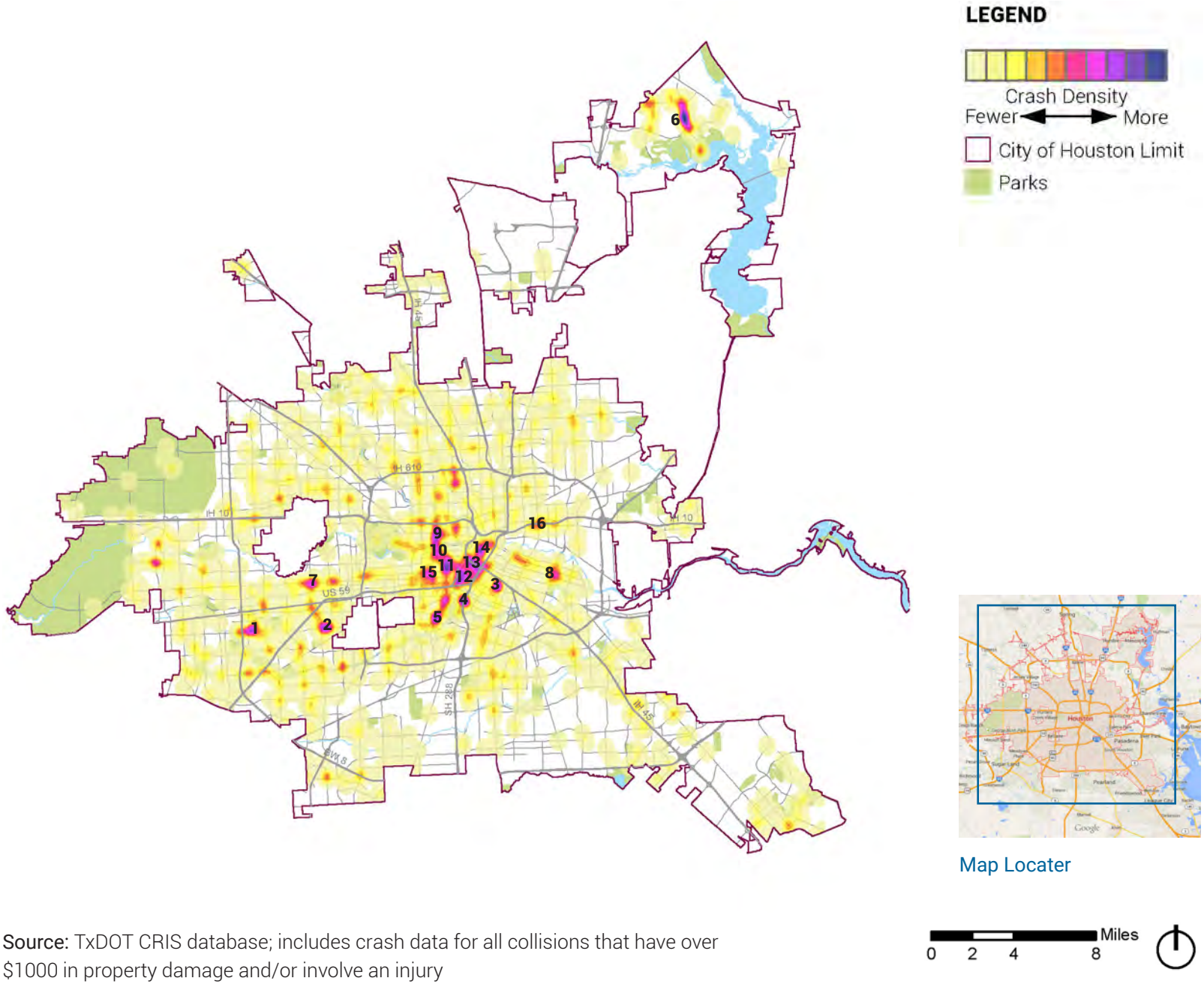
All bicycle crashes were mapped to identify clusters of crashes. Figure 2.15 includes the crash density of all crashes involving a bicycle within the city. Given the lack of systemic bicycle count data, the crash density does not normalize the number of crashes to the actual rate of bicycling at a local level. What the map can be used for is to assist with identifying the areas with a higher concentration of crashes that should be closely assessed as part of the development of the Bike Plan.

Sixteen higher crash regions were identified in the city. Each of the high crash regions included over 10 crashes within a ½ mile diameter area. These regions are depicted by the darker purple colors on the map which are primarily clustered in the areas near and west of downtown and other dense locations like Gulfton and Alief.

Areas with 10+ Crashes (2010-1014)

1. Bellaire and Corporate - Chinatown
2. Bellaire and Renwick – Gulfton/Sharpstown
3. Scott Street between 45 and Elgin
4. 3rd Ward – Riverside Terrace
5. Med Center
6. Kingwood – Kings Crossing – Along Lake Houston Parkway
7. Westheimer and Voss/Hillcroft
8. Wayside and Canal – Magnolia Park
9. Waugh – North of Buffalo Bayou
10. Waugh – South of Buffalo Bayou
11. East Montrose
12. Midtown
13. Downtown – Pierce Elevated
14. Downtown
15. Woodhead/Dunlavy – Lanier Middle School
16. Lockwood and IH10 – Denver Harbor/Port Houston

Figure 2.15: Bicyclist Crash Density Map (2010-2014)



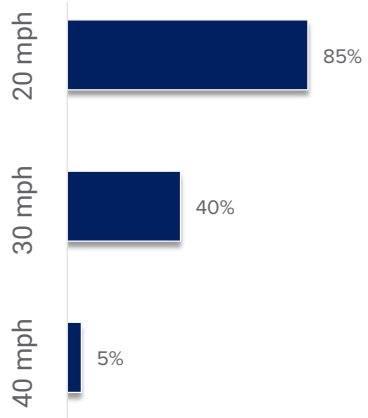
Source: TxDOT CRIS database; includes crash data for all collisions that have over $1000 in property damage and/or involve an injury

There have been a total of 25 bicycle fatalities in the 5 year analysis period. The location of these are shown in Figure 2.16. As shown in the map they are widely distributed across the city. While there is a range of specific causes for the crashes, all fatality crashes occurred when the speed of the vehicle was reported as 30 mph or over, and 84% of the fatalities resulted from a crash with a reported speed of 35 mph or over. Speed differential is one of the main factors in the severity of crashes.

In response to the terrible impact of these incidents, the City of Houston and BikeHouston partnered to launch the Goal Zero Campaign. The campaign works to educate both people who drive and those who bike about how to be safer when using and sharing the road. One of the key focal points of the Goal Zero campaign is the development of the Bike Plan to identify strategies and improve bicycle infrastructure to increase safety and eliminate bicycling fatalities. In addition, the Houston Police Department produced a Public Safety Announcement on Bicycle Safety, increased training levels, and conducted crime prevention operations.

The Bike Plan can develop plans, policies, and programs that build on the work of BikeHouston and the City to make traveling around the City safer for all users.

% Chance a Person Would Survive if Hit by a Car Traveling...



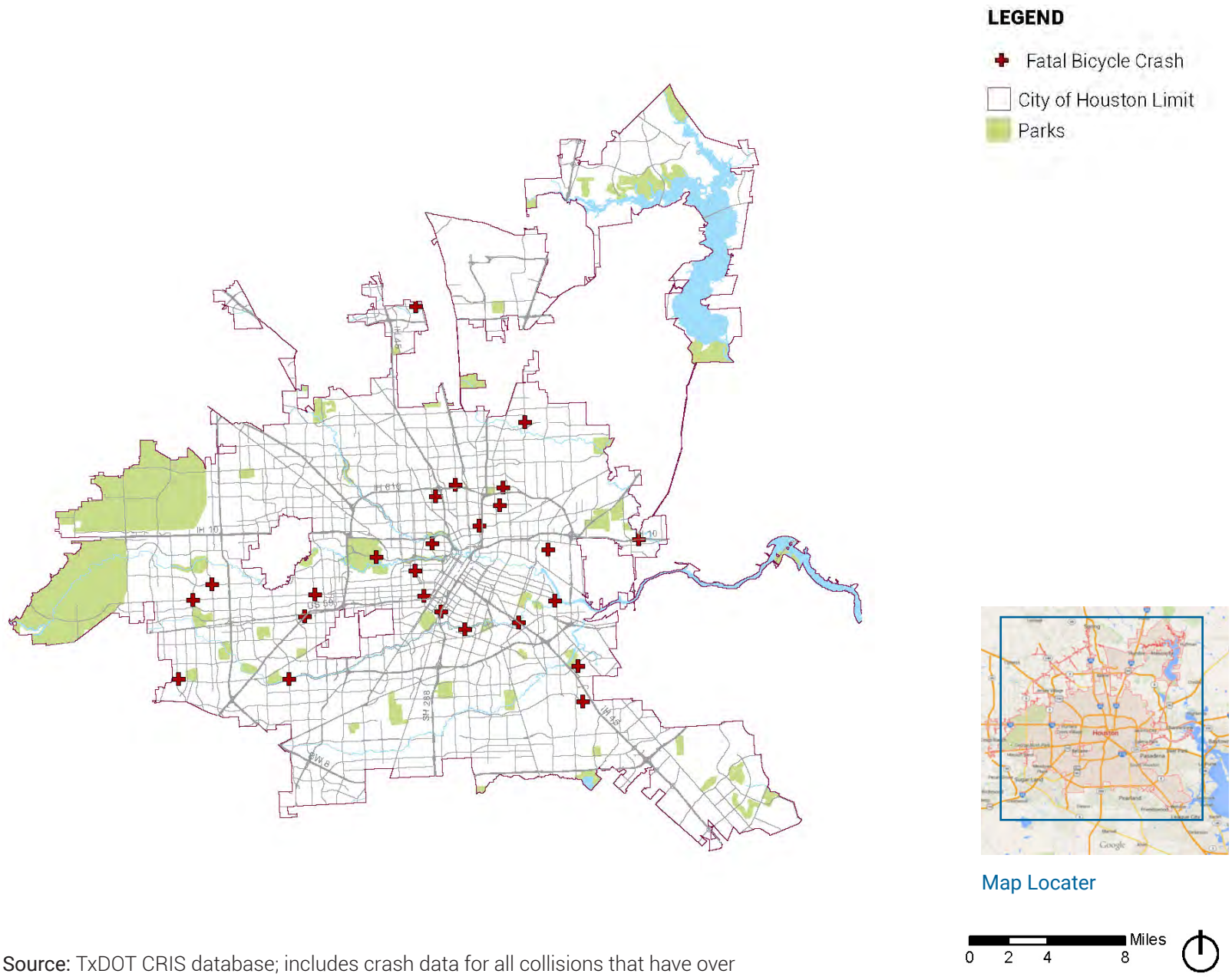
Goal Zero Lifesavers for drivers:

1. Follow the law. Speeding and driving under the influence puts lives at risk.
2. Motor on, cell phone off. No texting while driving. It can wait, Houston!
3. Give cyclists enough room. Houston law requires 3 feet or more.
4. Intersections require special attention. Always scan carefully before proceeding.
5. Never open a car door without looking for passing traffic.

Goal Zero Lifesavers for cyclists:

1. Follow the law. Cyclists have the same rights and duties as drivers. Always ride with traffic, in the right lane closest to the curb, unless needed to use the left lane for a left turn. Stop when required.
2. Be predictable. Make intentions clear to everyone on the road. Ride in a straight line and don't swerve between cars. Signal and check before changing lanes.
3. Be extremely visible. Use bright white lights on the front of the bicycle and bright red lights on the back, and reflectors. Bright, reflective clothing should be worn.
4. Think ahead. Plan your route carefully to avoid dangerous streets. Narrow, busy streets with fast speed limits are particularly dangerous. Watch for car doors being opened, road hazards, and drivers' next moves.
5. Be ready. Check that tires are properly inflated, brakes are working, the chain is running smoothly, and quick release levers are closed. Leave the earplugs and mobile phone off while cycling. Fewer distractions and the ability to listen will reduce risk substantially. Always wear a helmet.

Figure 2.16: Location of Bicycle Related Fatalities (2010-2014)



Source: TxDOT CRIS database; includes crash data for all collisions that have over $1000 in property damage and/or involve an injury

AN OPPORTUNITY TO...

PROVIDE AFFORDABLE ACCESS TO GREATER OPPORTUNITIES

A well-developed bicycle network can be liberating to people by providing a low-cost transportation choice to access key destinations that may be outside of an easy walking distance. Over 40% of all trips across all modes made in Houston are under three miles, the distance that most people on bicycles can comfortably cover in 15 minutes (12 miles per hour). Many of these short trips are home-to-work trips, but an even larger amount are to locations like schools, parks, libraries, shopping centers, transit, and other frequent destinations.

As shown in the previous section, the existing bikeway network has many gaps that make these connections difficult. Implementation of the Bike Plan can significantly increase the benefit for people biking, and increase the overall number of bicycle trips by developing an improved bicycle network that better serves more of these destinations.

Bicycling as a Low Cost Travel Option

Even with recent reductions in the cost of gasoline, operating a car for one year can be expensive for many people. In its annual assessment, motorist advocacy organization AAA estimates the cost to own and operate a typical sedan at $8,698 per year. This represents 19% of the City of Houston Median Household Income of $45,010.

The annual cost to own and operate a sedan represents 19% of the median household income in the City of Houston.

The ability to save money through the use of other modes such as walking, bicycling, or transit provides meaningful benefits to many households. This does not necessarily mean a household must go car free to capture the benefit, but improved transportation choices means they can reduce the number of cars they own.

Annual ownership and operation of a bicycle is estimated at approximately $310. An annual membership to Houston Bike Share is $60 (Figure 2.17). Cycling represent a significant savings versus car ownership and allows the members of a household to use these

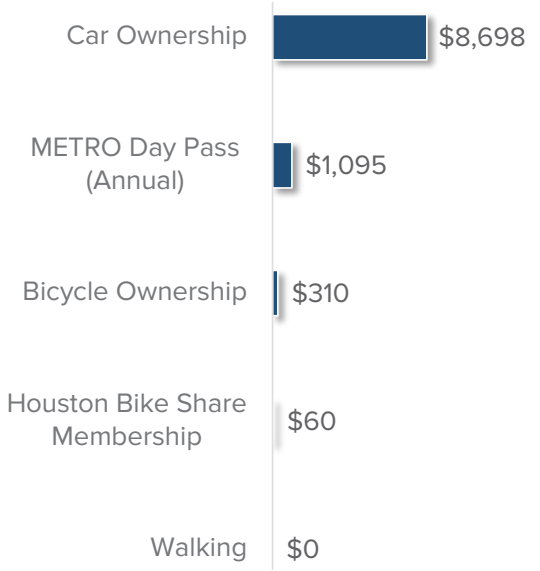


Figure 2.17. Annual Cost of Operations by Mode
Source: AAA; Litman 2012' Houston B-Cycle; METRO

resources on other items. These travel options combined with other lower cost travel options like walking and transit can save thousands of dollars that can be used for food, rent, a nicer house, a better vacation, more savings and investments, or other opportunities.

Connections to People and Jobs

The relationship between the existing bikeway network and the places people live and work is charted in Figure 2.18. The most recent aggregate population and job data from the Census are shown. Figures 2.19 and 2.20 show the high comfort bicycle network over population and job density, respectively. One half mile buffers were measured in direct line, or "as the crow flies," to asses general access in a consistent fashion across all design scenarios.

Out of the roughly two million residents in the City of Houston, 61% live within a half-mile of an existing bikeway. Only 38% of the population however, lives within a half-mile of a high-comfort facility that people who bike would be most likely to use.

Rates of bike facility access are slightly lower for populations of color and people living below the poverty line. Low-income individuals in particular can benefit from the low-cost access to jobs and services that a bicycle and safe bicycle facilities can provide.

Information regarding households without a vehicle is not available on as detailed a geographic level. However, the data does show slightly higher rates with 65% of households located within a half-mile of any facility and 40% within a half-mile of a high-comfort facility.



Tour de Hood bike ride

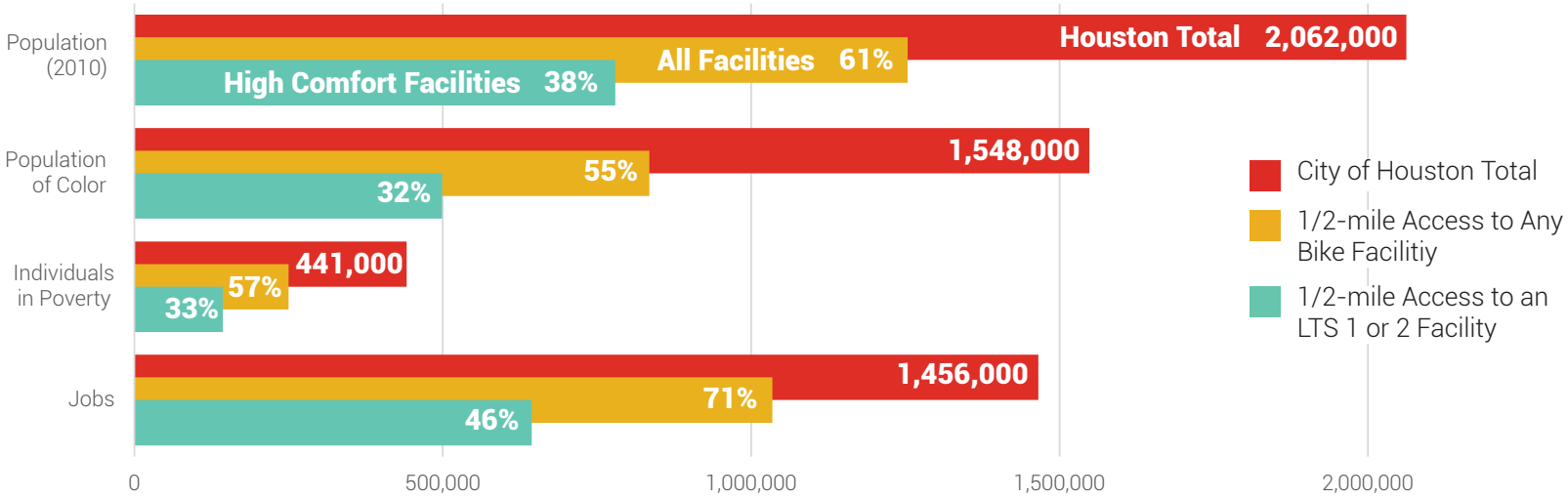
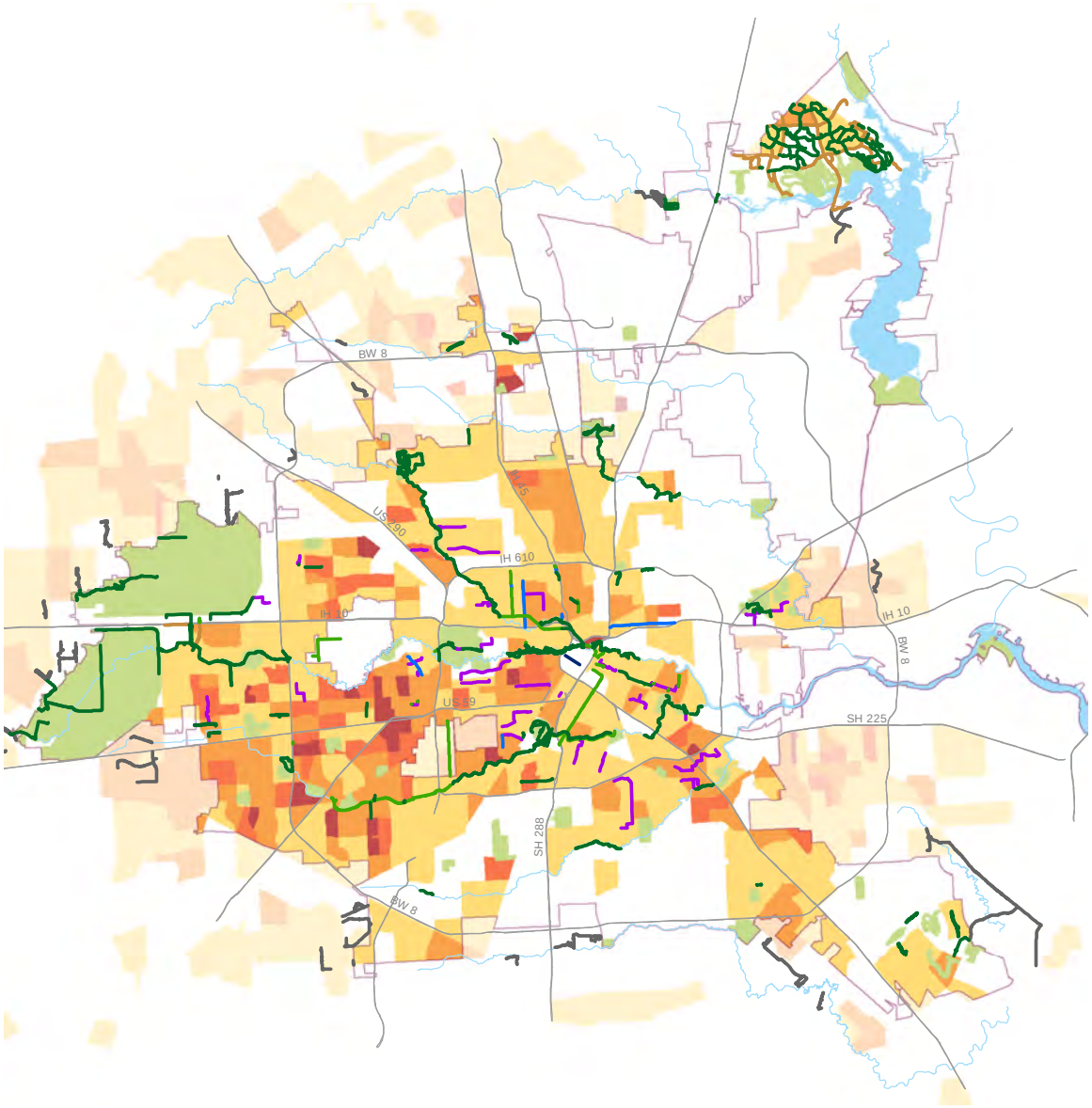


Figure 2.18: Half-Mile Access to Existing Bike Facilities
Source: US Census; American Community Survey; Team Analysis

Figure 2.19: Population Density and the High-Comfort Bicycle Network



LEGEND

Population Density
(Persons per square mile)
- 0 - 3,000
- 3,001 - 6,000
- 6,001 - 9,000
- 9,001 - 12,000
- 12,001 - 67,718

Existing Bicycle Network
High Comfort Facilities
- High Comfort Walk/Bike Path
- Walk/Bike Path
- Separated Bike Lane
- Bike Lane
- Neighborhood Bikeway
- Shared Sidewalk
- Bike Facility Outside COH
- City of Houston City Limit
- Parks

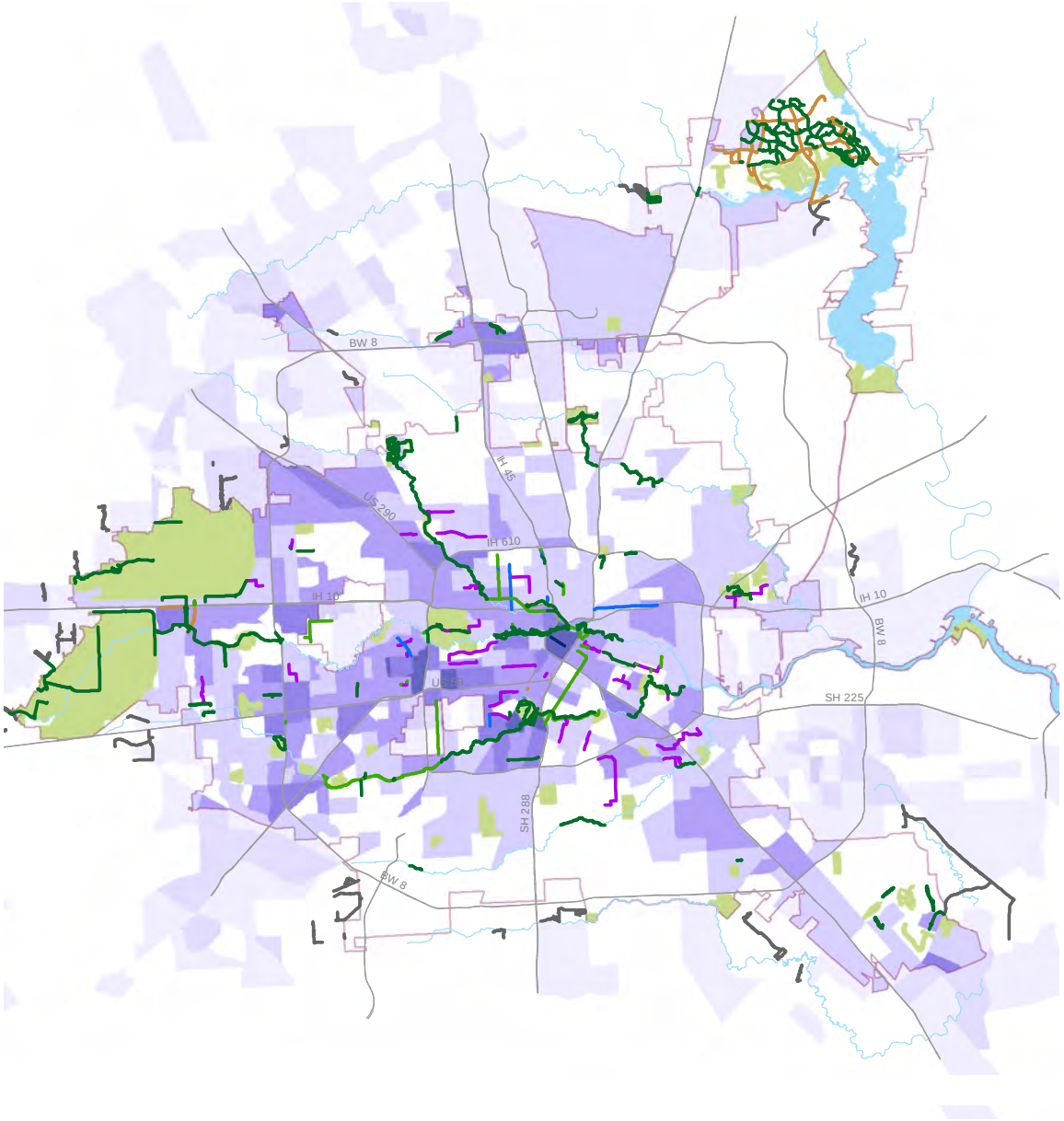


Map Locater

0 2.25 4.5 9 Miles

Source: US Census ACS (2013)

Figure 2.20: Employment Density and the High-Comfort Bicycle Network



LEGEND

Employment Density
(Persons per square mile)
- 0 - 500
- 501 - 2,000
- 2,001 - 8,000
- 8,001 - 40,000
- 40,001 - 97,309

Existing Bicycle Network
High Comfort Facilities
- High Comfort Walk/Bike Path
- Walk/Bike Path
- Separated Bike Lane
- Bike Lane
- Neighborhood Bikeway
- Shared Sidewalk
- Bike Facility Outside COH
- City of Houston City Limit
- Parks



Map Locater

0 2.25 4.5 9 Miles

Source: LEHD (2011)

Right page: The Texas Medical Center illustrates the "last mile" problem with employment centers: while bike networks connect in all directions, they all stop at the edge of the area of highest employment density.

Below left: The buildings of the TMC are tantalizingly close to the Braes Bayou trail system.

Below right: The Energy Corridor Management District has focused on building paths to connect regional bikeways to employment.

Job and Activity Center Access

Increased access to jobs means more access to job opportunities. Jobs in the region tend to be more concentrated in major employment centers so a higher share, about 71%, of the city's 1.5 million jobs are proximate to existing bikeways. As previously noted however, it's hard to comfortably get into Houston's major activity centers on a bicycle. Currently, bayou trails and existing bicycle infrastructure effectively penetrate only a relatively small share of major job centers and other key destinations. Increasing this access opens up new opportunities for people to find a better job, take classes to improve their skills, or connect to transit that further increases their access. The lack of these connections is in part responsible for Houston's 0.5% bicycle commute mode share.

Activity centers -- concentrations of employment, education, retail, culture, and entertainment -- are major destinations for all modes of transportation. These centers include a significant share of regional jobs: Downtown has 200,000 jobs, Uptown has 130,000, the Texas Medical Center has 127,000, and Greenway Plaza has 104,000. Together, these four centers account for 20% of the non-farm jobs in the Houston metropolitan region. The regional bikeway system provides useful routes to some of these centers. For example, Downtown is located near the Buffalo Bayou and White Oak Bayou greenway systems and several Rails to Trails, setting up connections to surrounding neighborhoods including Neartown, the Washington Avenue corridor, the Heights, the Near North Side, Fifth Ward, the East End, and the Third Ward. The Texas Medical Center is on the Braes Bayou trail, with connections to Braeswood and the Third Ward. Uptown is close to the Buffalo Bayou trails system.





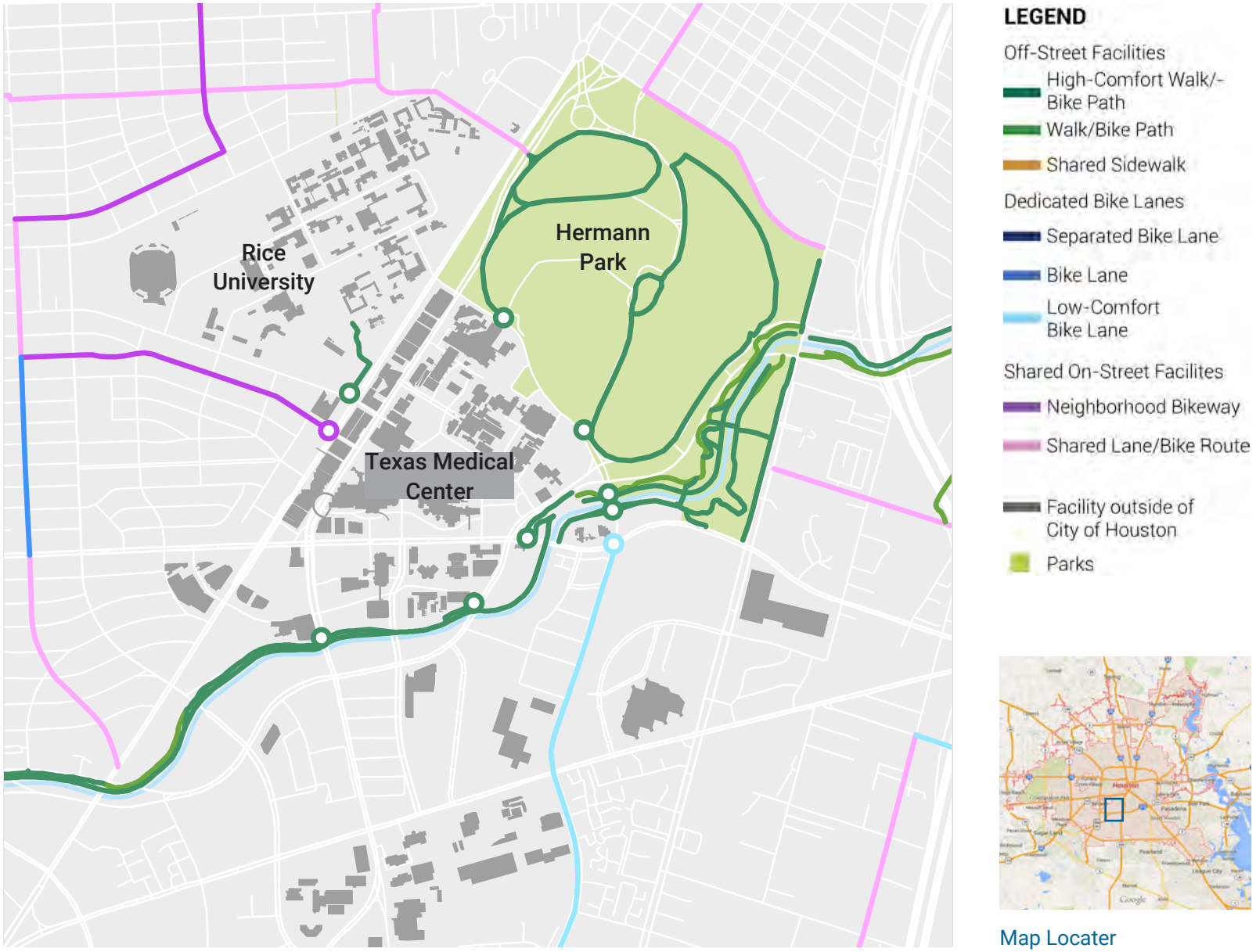


Figure 2.21: Texas Medical Center Bicycle Network

Right page: Rice Village, a bustling commercial area with dozens of businesses, has only a handful of bike racks. Generally, racks have been provided at new developments and for large buildings, but smaller and older buildings have none.

Below: Businesses that do provide places to store bicycles find that bike racks bring customers.

None of these centers, however, have good connections from the regional bikeway systems into the activity center itself. Trail systems end at the edge of the centers, requiring bicyclists to use congested, often dangerous streets to reach their place of work. Figure 2.21 highlights this challenge for the Texas Medical Center.

There have been some projects to improve bicycle connectivity. The Energy Corridor in particular has linked office buildings and corporate campuses to regional off-street trails. The new separated bike lane on Lamar Street in Downtown, once connected to trails at both ends, will extend the Bayou Greenway and Rail-to-Trail system into the heart of Downtown. Any strategy for increasing biking to work must focus on activity centers and, in particular, closing the "last mile" gap to link bike networks right to major destinations.

Bikeways are useless for transportation unless there is a place to securely park a bike at a destination, an area for which there is little current data.

Houstonians have come to expect convenient car parking; ironically, despite the fact that bike parking takes up a fraction of the space that car parking does, most Houston businesses have more car parking than bike parking. In Rice Village (Figure 2.22), for example, a busy retail area surrounded by bikable neighborhoods within an easy ride of the Rice University campus, the majority of businesses are more than 100 feet from the nearest bike rack. Thus, a bike ride can mean a long walk.

The uncertainty of finding bike parking is a further deterrent. In Houston, there's no assurance that there's a place to park your bike when your arrive, and that makes biking a much less appealing option.







Map Locater

400 ft

Figure 2.22: Map of Rice Village Bike Parking Coverage
Source: COH Bike Plan Team Site Visit August 2015

Other Major Destinations

Figure 2.24 shows the existing bicycle network compared to major destinations within the City. These include schools, multi-service and community centers, and libraries. These are representative of the types of locations that people travel to that are outside of a typical home-to-work trip and make up a significant portion of the total trips people make in the City of Houston

While some of these destinations are readily accessible by bicycle for certain locations, many are not. As shown in Figure 2.23, sixty percent of schools in the City of Houston are more than 1/4 mile away from an existing bikeway. The numbers for other destinations are comparable. For access from higher -comfort bikeways the connectivity is even lower. The lack of a well-connected network also limits the ability of people across the city from accessing those locations by bike.

Capturing More Short Trips

One of every three trips made by any travel mode in the City of Houston is estimated to be less than 3 miles, the distance most bicyclists can cover in less than 15 minutes. In many parts of Houston over half of all trips are under 3 miles. These short trips are typically those that can most readily be transitioned from driving to bicycles by providing bikeway infrastructure that is attractive to a broad range of people.

Figure 2.25 shows the share of trips that are less than 3 miles, based on the Houston Galveston Area Council's estimates from the regional travel demand model, compared with the locations that have high comfort bikeway facilities. The lack of bikeways in these areas shows the missed opportunities in the current bikeway network and suggests a significant potential to attract more people biking with a stronger bike network.

Figure 2.23: Access Statistics for Major City Destinations

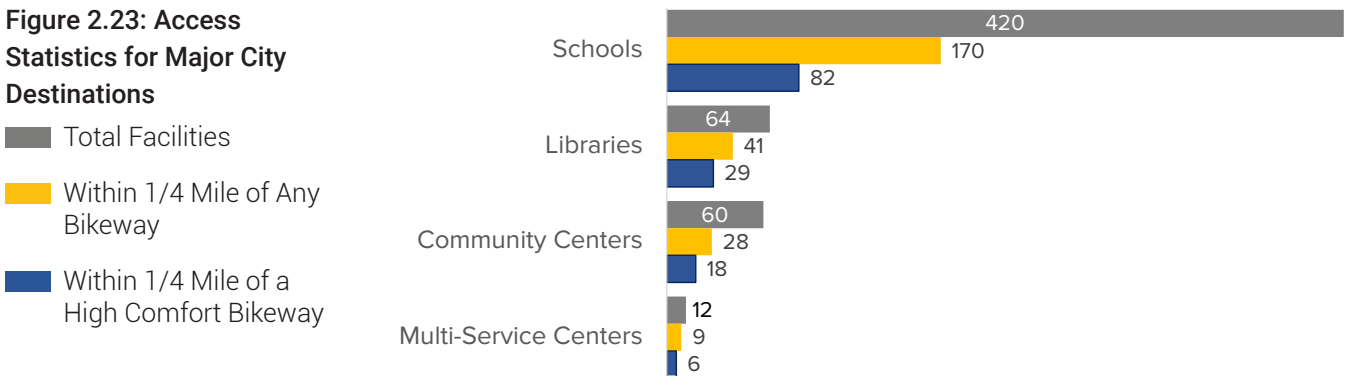
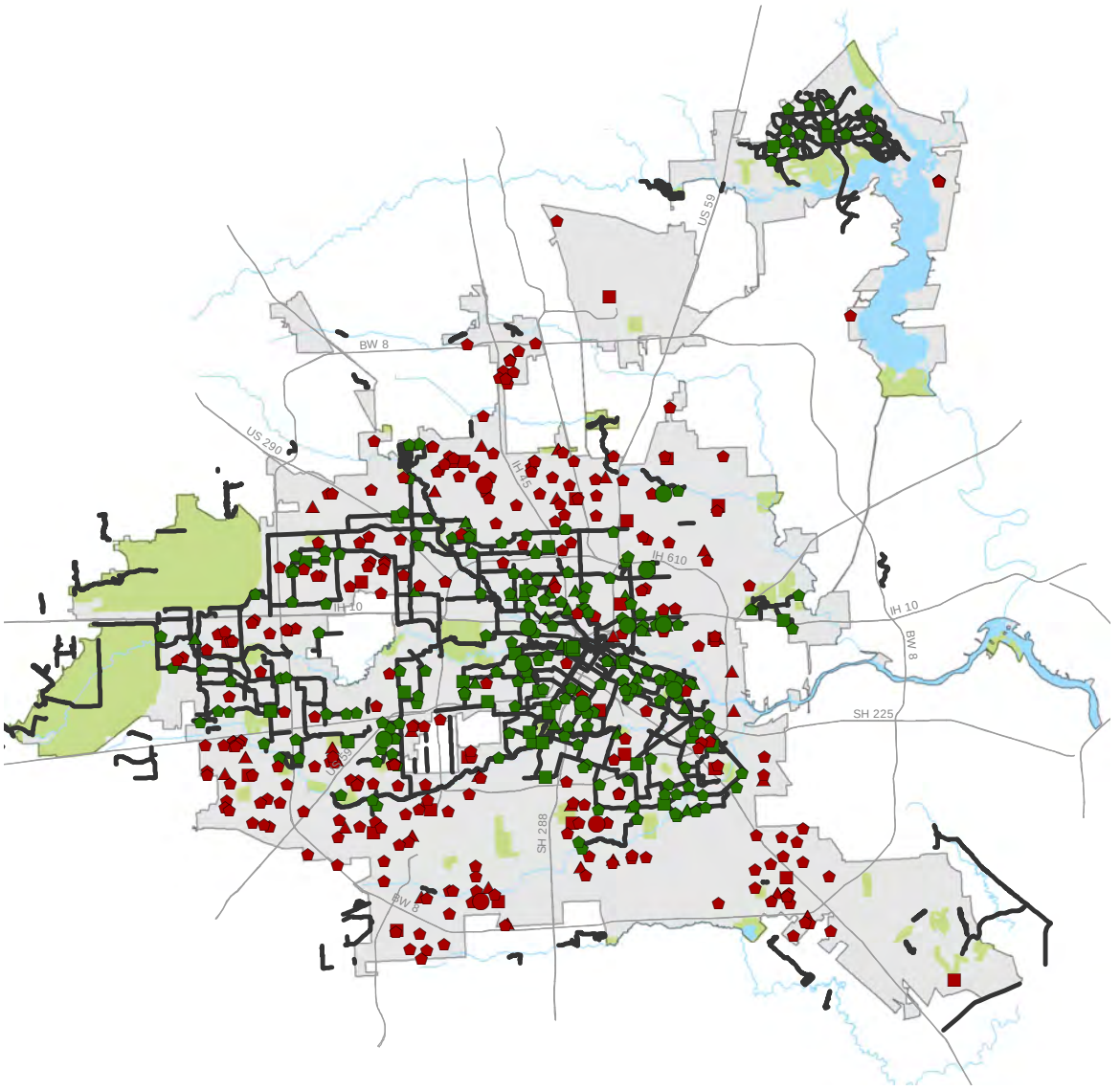


Figure 2.24: Existing Bikeways and Major Destination Access



Existing Bikeways

Community Destinations Within 1/4 mile of a Bike Facility
- Multi-Service Centers
- Schools
- Community Centers
- Libraries

Community Destinations Outside 1/4 mile of a Bike Facility
- Multi-Service Centers
- Schools
- Community Centers
- Libraries

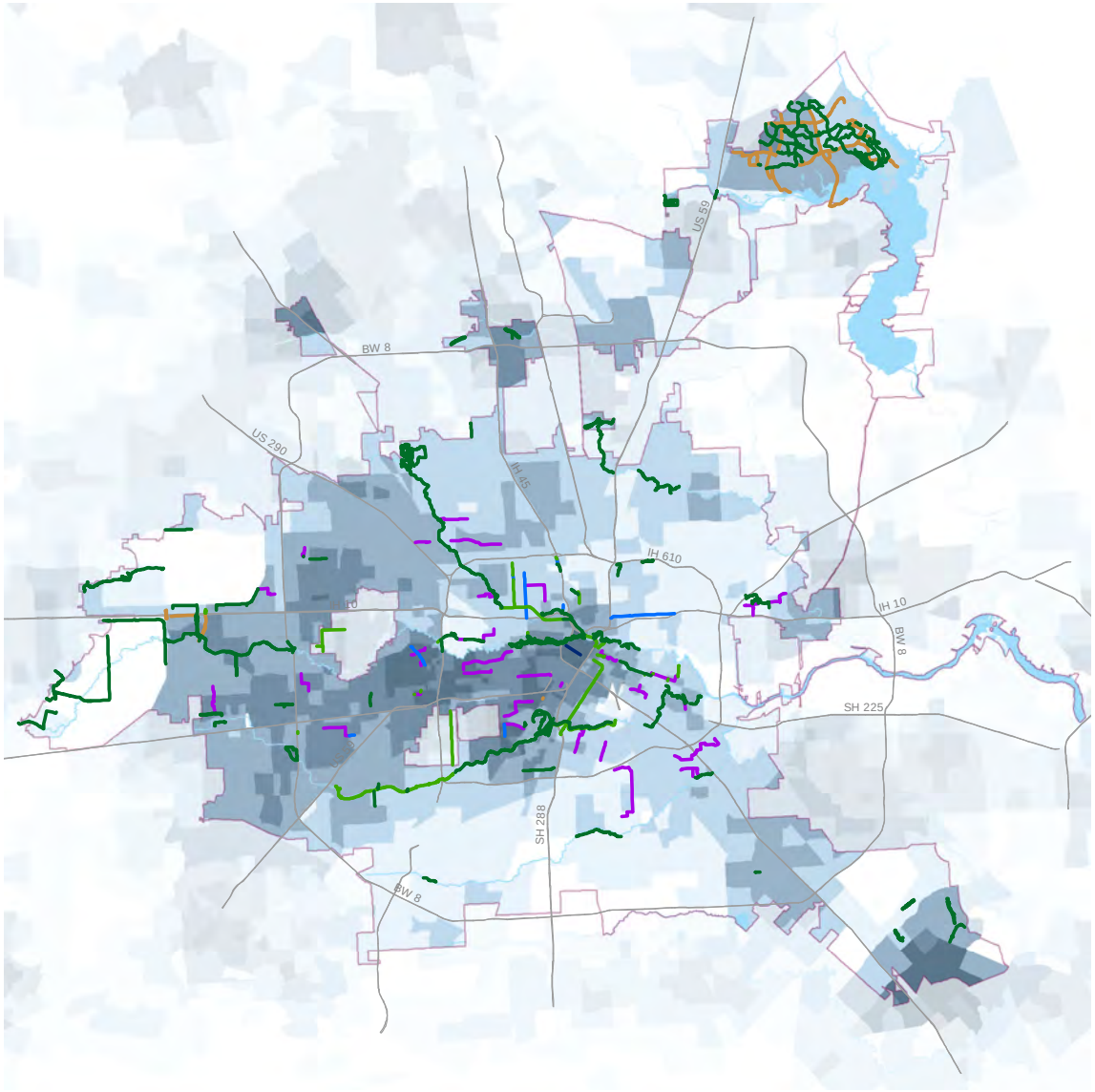


Map Locater

0 2 4 8 Miles

Source: City of Houston GIMS Data & Team Analysis

Figure 2.25: Existing High-Comfort Bikeways and Share of All Trips by All Modes that are Less Than 3 Miles



LEGEND

All Trips

Percentage of Trips 3 Miles or Less

- 1.1% - 10%
- 10.1% - 20%
- 20.1% - 30%
- 30.1% - 40%
- 40.1% - 50%
- 50.1% - 65%

Existing Bicycle Network

High Comfort Facilities

- High Comfort Walk/Bike Path
- Walk/Bike Path
- Separated Bike Lane
- Bike Lane
- Neighborhood Bikeway
- Shared Sidewalk
- City of Houston Limit



Map Locater

0 2.25 4.5 9 Miles

Source: City of Houston GIMS Data, H-GAC Travel Demand Model

AN OPPORTUNITY TO...

IMPROVE COMMUNITY HEALTH AND WELLNESS

Health is not merely the absence of illness or occurrence of doctor visits. It is determined by how we live, work, learn, play, and eat. A healthy community is one where the built environment allows making healthy choices easier for individuals. In many places in Houston, incorporating physical activity into a person's daily routine is very difficult. Our transportation system is a major part of the built environment, and in many ways it poses barriers to better health outcomes. By providing a plan for safe, accessible bicycle infrastructure, the Bike Plan can support more physical activity in people's daily life.

The medical profession is recognizing this challenge. According to the American Heart Association (AHA), increasing one's level of physical activity reduces the risk and impact of cardiovascular disease, diabetes, and some cancers, as well as helps to control weight and improve mood. The AHA advocates changes to the built environment, street level design, and community development that promotes opportunities for physical activity. Specific strategies recommended include complete streets, smart growth design, and implementing Transportation Alternatives as identified under MAP-21. Studies have also found that building bike/pedestrian trails reduces health care costs associated with physical inactivity. For every $1 invested in these facilities, nearly $3 in medical cost savings can be achieved.

The Centers for Disease Control and Prevention (CDC) states that the nation is in the midst of an obesity epidemic with more than one-third of American adults identified as obese. Additionally, obesity related conditions, including high blood pressure and diabetes, are occurring in 32% and 9% of the national population respectively. These health indicators are closely related to the level of regular aerobic activity. According to the Alliance for Walking and Biking's 2014 Benchmarking Report, there is a strong inverse correlation between bicycling and walking commuter rates and levels of obesity, high blood pressure, and diabetes. Public health officials recommend a minimum of 150 minutes of physical activity a week. In Houston, only 51.1% of the adult population gets the recommended amount of weekly aerobic physical activity. Low activity levels contribute to an adult population that is 28.7% obese, 8.5 % diabetic, and 29.8% having high blood pressure.

At 32%, the prevalence of obesity and other health complications in children in Houston is also higher than the national average. Obesity in children not only causes risks for other health complications such as metabolic syndrome, joint problems, and sleep apnea, but it increases the likelihood of chronic health problems as an adult and a higher risk of obesity throughout life. Childhood obesity also increases the financial burden on families and individuals, as children who are obese spend more time at doctor's offices

and in hospitals. In 2005, a study concluded that a 1% drop in obesity among 12-year-olds would lead to over $260 million in medical cost avoidance nationally over their lifetimes.

Physical Activity

One of the reasons cited for the obesity epidemic is an increasingly sedentary lifestyle and changes in modes of transportation. Children living in densely-populated urban areas often lack access to safe, open spaces and parks in which to play. It is estimated that 56% of children in Houston do not live within half a mile of public green space.

Figure 2.26 shows the existing park system in Houston, including SPARK parks which are school sites with park and playgrounds areas open to the public. The figure shows limited access to high comfort bikeways in areas with higher obesity levels. Access to park space for children is also limited by few connections to comfortable, safe bikeways suitable for children. The Bayou Greenways Initiative addresses some of these proximate access challenges. Connecting households to these corridors and connecting major bikeways to parks can expand rates of physical activity.

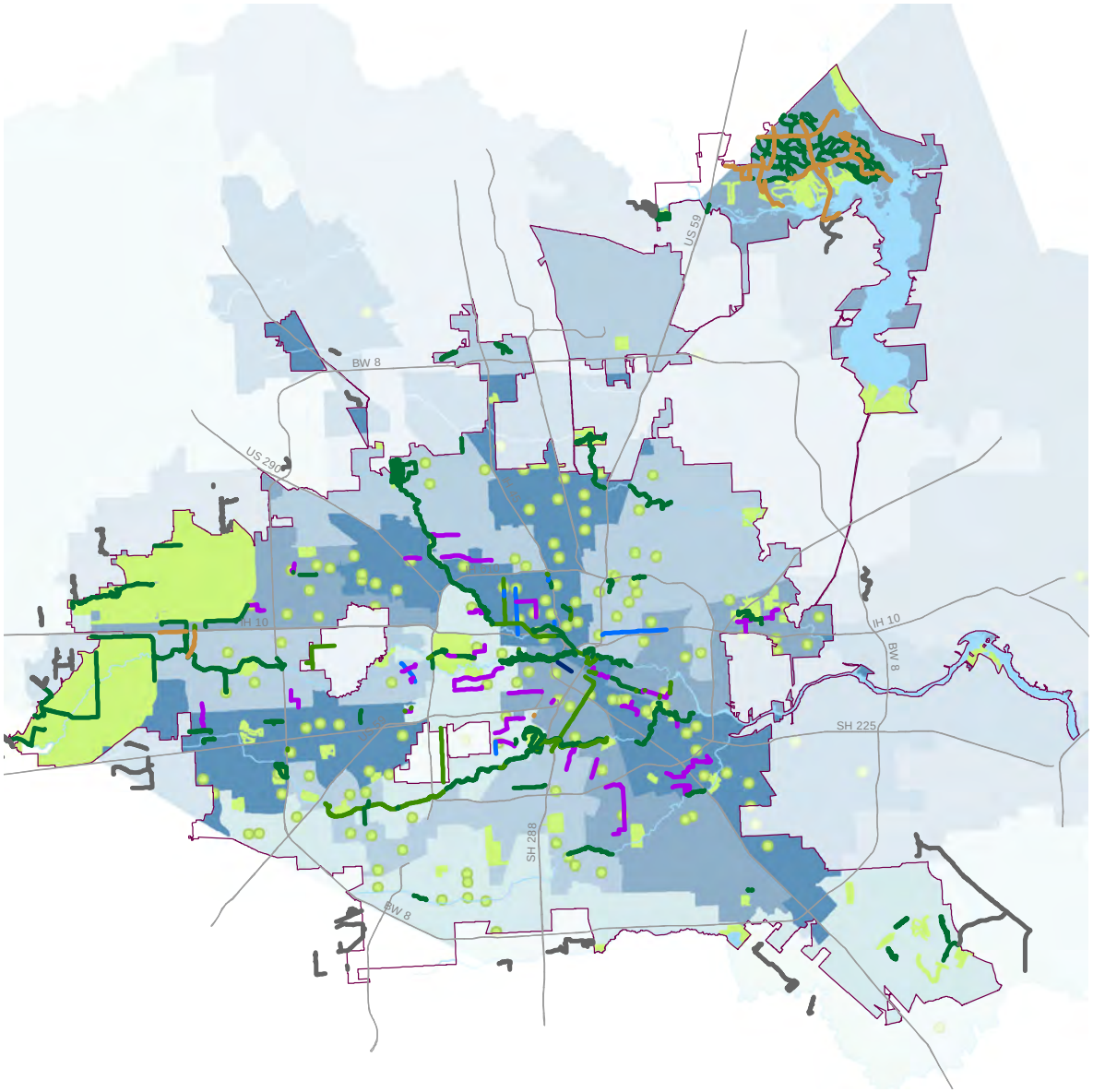
The lack of access keeps children indoors and prompts them to pursue less active activities. Providing access to safe bicycle facilities that connect parks and open spaces, schools, and community facilities to neighborhoods could have a significant impact on reducing obesity in Houston, especially among the younger population.

Air Quality

Public health impacts of the transportation system extend beyond physical inactivity and chronic disease. Walking and bicycling, even for short trips, reduces automobile emissions and improves air quality. Cleaner air improves conditions for those suffering from asthma and other chronic respiratory conditions. Health professionals and advocates have become new partners in promoting and planning for active transportation. After carefully considering the best science and converging evidence, public health authorities, including the Centers for Disease Control and Prevention and the American Medical Association, have recommended road improvements, connectivity, land use policies, active transportation to schools, and programs to advance walking and bicycling.

According to the US Department of Transportation, at a national level, nearly half of all trips in metropolitan areas are three miles or less and 28 percent are one mile or less – distances easily covered by foot or bicycle. Yet 60 percent of trips under one mile are made by automobile, in large part because incomplete streets make it dangerous or unpleasant to walk, bicycle, or take public transportation. This data identifies a great opportunity for increasing bicycle mode share and trips. With safe facilities and connections to locations of interest, the City of Houston could see a significant improvement in the community's use of bicycling as an option for short trips, which could have a positive impact on community health.

Figure 2.26: Existing High-Comfort Bikeways and Childhood Obesity Rates



LEGEND

Percentage of Obese Children

- *17%*
- *27%*
- *37%*
- Park
- FreewayTollway
- SPARK Park
- High Comfort Shared-Use Path
- Shared-Use Path
- Protected Bike Lane
- Bike Lane
- Neighborhood Bikeway
- Shared Sidewalk
- Outside COH
- City of Houston



Map Locater

0 2.25 4.5 9 Miles

Source: 2010 Health of Houston Survey and City of Houston Health Department data

AN OPPORTUNITY TO...

BETTER COMPETE WITH PEER CITIES WHO ARE SETTING THE BAR

While Houston has made significant strides in improving its bikeway network, to truly understand the context of Houston's existing conditions, comparisons identifying similarities and differences between peer cities is important. Peer cities are competing with Houston for talented workers that can choose to live many places. Investment from employers that have choices about where they locate their business is increasingly competitive. A peer cities review provides valuable insights for what can be achieved through a focused effort of bikeway programs, policies, and projects, and helps identify realistic but aspirational targets for Houston as it works to be a more bicycle-friendly city.

As biking has gained significant momentum and validity nationally as a transportation option in the last several years, there are many cities that provide valuable data and insight for Houston. Fifteen peer cities have been chosen for this report based on several factors, which range from their similarity to Houston in environment (demographic, geographic, and political), such as Dallas and Atlanta, to their successes in increasing mode share, safety, and health outcomes such as Minneapolis or Denver. Many have used creative approaches to develop multiple infrastructure and implementation strategies. The peer city data and analysis is largely based on the Alliance for Biking & Walking's 2014 Benchmarking Report for Bicycling and Walking in the United States (http://www.bikewalkalliance.org/). The 2014 Benchmarking Report utilizes the most up-to-date data from various sources including self reported data from the individual cities in order to develop a comprehensive look at the state of walking and bicycling.

City Size and Density

Compared to the selected peer group the City of Houston is characterized by a larger population spread out over a larger city footprint area. Utilizing 2010 census data, the City of Houston had about twice the population of the peer cities average (2.11 million versus 1.03 million), and is about 2.5 times as large in area. As density measures the proximity of people to one another it can impact the level of biking.

Higher density means that more destinations are likely to be within a comfortable biking distance. Given its larger footprint, Houston's population density is lower than the average peer city (3,522.7 persons/sq. mi. versus 6,192.2 persons/sq. mi.), though using average density obscures the fact that there are many higher density places in Houston with many people, jobs, and other destinations in close proximity to one another that facilitate higher bicycling usage.

Bicycle Commuting Mode Share

The mode share for bicyclists represents the percentage of people who use their bike for commuting purposes. While it is the

Figure 2.27: Peer City Analysis on Key Bike-Friendly Performance Factors

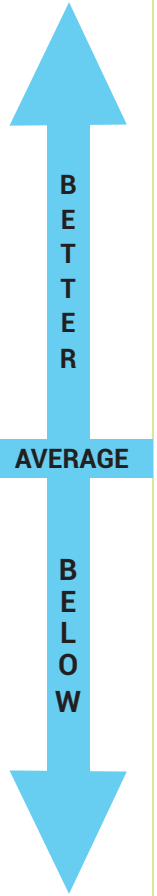
% of Bicycle Commuter Mode Share	
6.1	Portland, OR
3.6	Minneapolis, MN
3.4	Seattle, WA
3.3	San Francisco, CA
2.9	Washington, D.C.
2.2	Denver, CO
1.8	Average
1.3	Austin, TX
1.3	Chicago, IL
1.1	Atlanta, GA
1.0	Los Angeles, CA
0.7	Miami, FL
0.7	Phoenix, AZ
0.5	Houston, TX
0.2	Dallas, TX
0.2	San Antonio, TX
0.1	Fort Worth, TX

Total Existing Miles of Bicycle Facilities / Sq Mile	
7.8	San Francisco, CA
4.6	Austin, TX
3.9	Seattle, WA
3.9	Minneapolis, MN
3.8	Washington, D.C.
3.1	Denver, CO
3.0	Portland, OR
2.7	Average
2.6	Chicago, IL
2.5	Dallas, TX
1.5	Phoenix, AZ
1.3	Los Angeles, CA
1.3	Miami, FL
1.1	Houston, TX
1.1	San Antonio, TX
0.7	Atlanta, GA
0.5	Fort Worth, TX

Miles of Planned Bicycle Facilities	
1741	San Antonio, TX
1680	Los Angeles, CA
1296	Dallas, TX
1100	Austin, TX
1000	Fort Worth, TX
962	Portland, OR
640	Chicago, IL
632	Average
523	Seattle, WA
311	Denver, CO
277	Miami, FL
275	Minneapolis, MN
125	Washington, D.C.
98	Houston, TX
60	Atlanta, GA
19	San Francisco, CA
5	Phoenix, AZ

% Adults Meeting Recommended Minimum Weekly Aerobic Physical Activity*	
62.4	San Francisco, CA
61.5	Denver, CO
60.6	Miami, FL
60.3	Portland, OR
56.0	Los Angeles, CA
55.9	Austin, TX
55.5	Minneapolis, MN
55.3	Average
54.9	Washington, D.C.
54.5	Seattle, WA
52.9	Phoenix, AZ
52.3	Chicago, IL
52.1	Atlanta, GA
51.1	Houston, TX
50.3	San Antonio, TX
48.8	Dallas, TX

Bicyclist Fatalities per 10k Bicycling Commuters	
0.9	San Francisco, CA
1.1	Portland, OR
1.1	Washington, D.C.
1.5	Denver, CO
1.6	Atlanta, GA
1.7	Seattle, WA
2.3	Minneapolis, MN
2.4	Austin, TX
3.9	Chicago, IL
4.3	Los Angeles, CA
5.4	San Antonio, TX
7.8	Average
7.9	Miami, FL
11.2	Houston, TX
17.6	Dallas, TX
19.3	Phoenix, AZ
41.9	Fort Worth, TX



*Data was unavailable for Fort Worth, TX

Source: Alliance for Biking & Walking's 2014 Benchmarking Report for Bicycling and Walking in the United States



Washington DC Bike Repair Station

most reliable data that is regularly available for estimating bike use at a city-wide level, commuting mode share represents less than one in seven trips made in the Houston region. The peer city average for bicycle mode share is 1.8%, with Houston's bicycle mode share at 0.5%. The range fluctuates from 6.1% in Portland to 0.1% in Fort Worth. Mode share in cities like Atlanta (1.1%) and Los Angeles (1.0%) supports the potential that Houston can at least double commuting mode share.

Existing & Planned Bicycle Facilities

The existing miles of bicycle facilities per square mile of a city indicates how dense or accessible the bike network is. The average miles of bicycle facilities per square mile for a city is 2.7. San Francisco has the highest with 7.8 miles of bicycle facilities per square mile with Austin in second at 4.6 miles per square mile. Houston is near the lower end of the spectrum with 1.1 miles per square mile and Fort Worth has the lowest at 0.5. This is not surprising based on a review of Houston's existing Bikeways Map, as significant focus has not been placed on large sections of the City leaving areas without bikeways.

The number of miles of planned bicycle facilities among the peer cities varies greatly. Looking forward, San Antonio is the highest with 1,741 miles of bicycle facilities planned and Phoenix is the lowest with only 5 miles planned. The peer average is 632 miles. Houston was near the bottom with a reported 98 miles of bike facilities planned. The development of the Bike Plan should go a long way toward addressing this though the critical aspect will be how to move from planned bikeways to implementations.

Safety (Fatalities)

In order to understand safety, the data must be looked at in context with the level of bicycling in a city to determine the risk. For this measure, annual bicycle fatalities (an average over 3 years) were divided by the number of bicycling commuters over that same three year period for each peer city. Across the peer cities, there were 7.8 bicyclists killed per year per 10,000 bicycle commuters with Houston observing 11.2 bicyclist fatalities per year per 10,000 bicycle commuters. San Francisco had the best peer rating with 0.9 fatalities and Fort Worth had the worst at 41.9 fatalities per year per 10,000 bicycle commuters.

Active Community

Community health measures typically encompass the percentage of adults with obesity, high blood pressure, and diabetes. There is a link to those factors with the amount of regular exercise. The peer cities average of 55.3% of adults meeting the recommended minimum weekly aerobic physical activity level is higher than in Houston with 51.1%. Peer cities range from a high of 62.4% in San Francisco to a low of 48.8% in Dallas.

Use of Infrastructure Strategies

Not all infrastructure types and treatments will be appropriate in all situations. Peer cities that utilize a wide variety of strategies to encourage bicycling in various contexts have achieved greater mode share. This is particularly true in areas where infrastructure has been developed to serve cyclists of all age ranges and abilities as this opens up bicycling to the broadest possible set of people. These strategies range from the use of bike share and bicycle corrals, to the implementation of bicycle boulevards, bicycle signals, separated bike lanes, bike boxes, and other items that are addressed as part of the Bicycle Toolbox.

Transit Connectivity

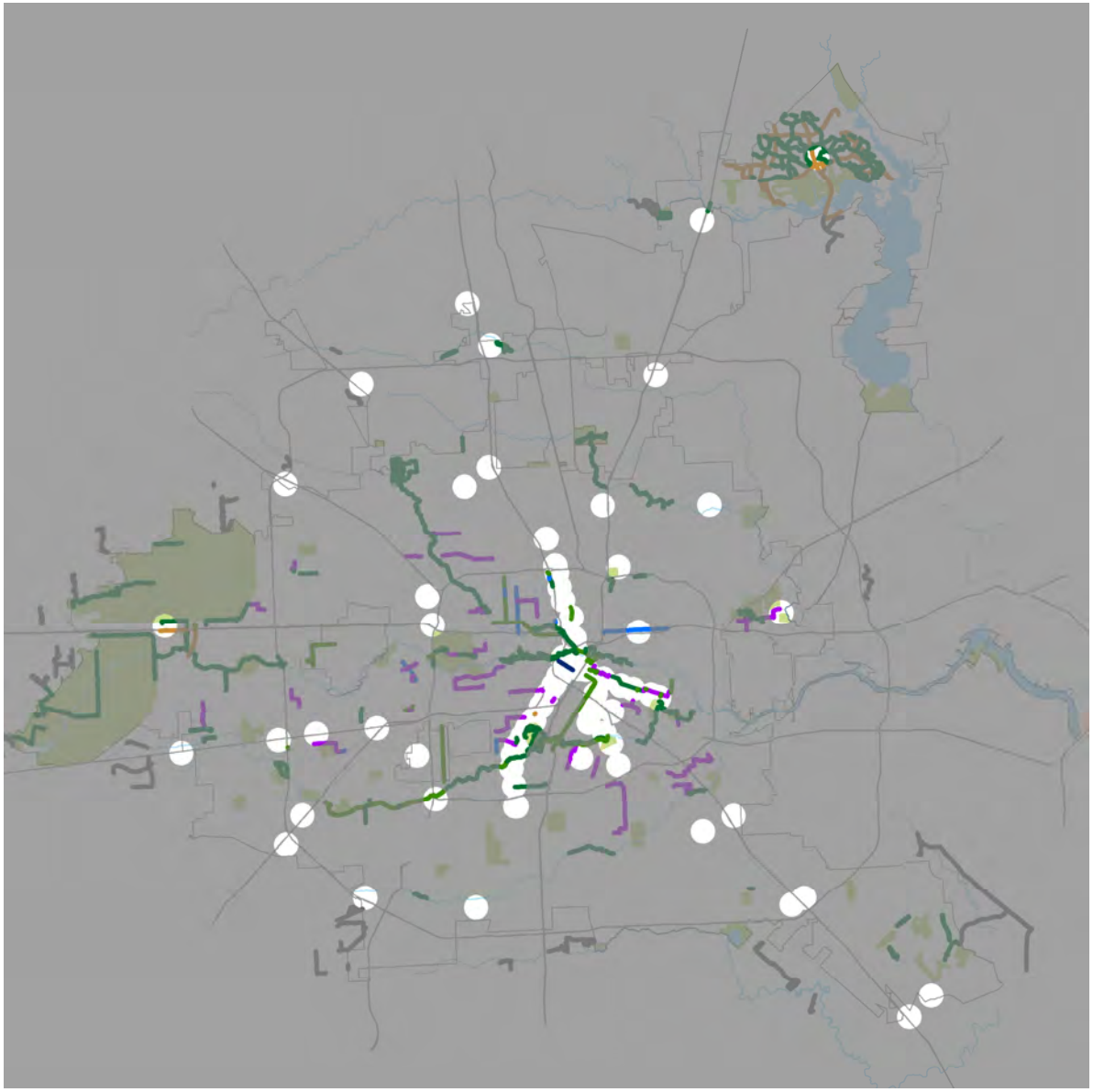
Combining bicycling with transit improves mobility options and expands the catchment area for transit. Bicycles can be a key factor in helping transit users complete the first/last mile gap between their origin/destination and transit stop. Improving and increasing bicycle connections to transit facilities and high frequency routes can have a positive impact on mode share both for bicycling and transit. Thinking through the challenges of where to provide bike parking and integrate bike share can make these networks work together more seamlessly. Peer regions that have high quantity and quality transit connections for bicyclists tend to achieve higher mode share. Figure 2.23 shows the catchment areas around transit stations and other nodes, such as transit centers, compared to the existing high comfort bikeways.

Funding and Maintenance of Facilities

Funding for new bicycle facilities and maintenance of existing facilities is essential to consider in the evaluation and development of bike systems. Funding for bicycling and walking facilities is inconsistent among peer cities with some having dedicated city funding, annual spending targets, and utilized federal funds to increase the amounts obligated per capita beyond "normal" levels.

Cities that have dedicated city budget funds and an annual spending target for bicycling and walking are making greater strides for improving bicycling and walking opportunities. Austin has an identified funding amount of $8 million of the city's budget for bicycling and walking facilities. Austin also has a dedicated city budget of $19 million and was able to obligate 4.8% of federal funds to bicycling and walking. Minneapolis, without an annual spending target, does have a dedicated city budget of over $15 million and has prioritized using federal funding with 24.4% of those funds for bicycle and walking facilities.

Houston does not have an annual spending target and obligated only 3.3% of federal funds to bicycle and pedestrian facilities. However, in 2012, Houston did top the peer cities with a dedicated city budget of over $46 million largely through new Bayou trail projects. Utilizing multiple funding mechanisms to leverage federal funds and setting local annual targets will be key for Houston to expand and maintain its system.



Areas in White Represent 1/2 Mile Distance from Existing METRO Transit Nodes

LEGEND

Off-Street Facilities
- High-Comfort Walk/-Bike Path
- Walk/Bike Path
- Shared Sidewalk

Dedicated Bike Lanes
- Separated Bike Lane
- Bike Lane
- Low-Comfort Bike Lane

Shared On-Street Facilites
- Neighborhood Bikeway
- Shared Lane/Bike Route



Map Locater

0 2 4 8 Miles

Figure 2.23:Transit Nodes (Transit Centers, Park & Rides, and Rail Stations) Miles and High-Comfort Bikeways

Bicycle Friendly Designation

The League of American Bicyclists has identified five broad areas of bicycling activities that comprise the core of what is "bicycle friendly." This is commonly referred to as the 5 E's: Engineering, Education, Encouragement, Enforcement, and Evaluation. By evaluating factors that fall into each of the 5E's, the "bicycle friendly" level of a community, business, or university can be identified and if so, to what level (Bronze, Silver, Gold, Platinum and Diamond). Houston was awarded designation as a Bronze-level bicycle friendly community in 2013. While the designation is an accomplishment to be proud of, much work needs to be done in order to move up to Gold or higher levels.

As shown in Figure 2.28, cities with higher mode share and Bike Friendly designations tend to do well on at least four of these comparison areas. Many of these cities started in a very similar place to Houston in terms of existing infrastructure and mode share and have been able to steadily improve.

Since 2013, Houston has made additional improvements, such as the Sunday Streets initiative and completion of the first Separated Bike Lane in Downtown Houston. The Bayou Greenway Initiative and more trails on utility easements offer immense opportunities to further improve Houston's level.

Just meeting the average mode share across this 15 city peer group would represent over a 300% increase in biking in Houston.

Figure 2.28 Peer Region Best Practice Areas

Peer Region Factors	Atlanta, GA	Austin, TX	Chicago, IL	Dallas, TX	Denver, CO	Fort Worth, TX	Los Angeles, CA	Miami, FL	Minneapolis, MN	Phoenix, AZ	Portland, OR	San Antonio, TX	San Francisco, CA	Seattle, WA	Washington, D.C.
Mode Share					●				●		●		●	●	●
Existing Infrastructure Levels		●			●				●		●		●	●	
Planned Facilities		●		●		●	●				●	●			
Safety Levels	●				●						●		●	●	●
Healthy Communities					●			●			●		●		
Infrastructure Strategies		●	●						●		●		●	●	●
Funding Levels		●						●	●	●	●				●
Transit Connectivity			●		●						●			●	
Bike Friendly Designation		S	S		S		B	B	G	B	P	B	G	G	S

B=Bronze
S=Silver
G=Gold
P=Platinum

AN OPPORTUNITY TO...

BENEFIT EVERYONE NOT JUST PEOPLE WHO BIKE

The Bike Plan has the potential to provide significant benefits to people who bike through development of a well-connected bikeway network that serves a broader range of people all over the city. Importantly, development and implementation of the plan also has significant benefits including health outcomes, mobility, and overall quality of life for all of Houston, including those who don't bike.

Fewer Cars on the Road

Every person biking reduces the number of potential cars on the road. Growth in Houston has put stresses on the City's transportation networks and efficient utilization of space is critical. In both travel lanes and parking areas, bicycles are much more space efficient than cars so the same number of trips take up less space. This means more can be allocated to other travel modes, better sidewalks and pedestrian realms, more green space or more development opportunities.

By providing the projects, policies, and programs that increase the rate of people biking, the City can remove the marginal drivers who compound congestion levels, particularly at peak travel times.

Less Conflicts with People Biking

Heavily traveled shared routes and narrow bike lanes frustrate both people biking, people driving, and transit vehicles. Bicycles in mixed traffic on arterials present a conflict for motorists who are traveling at a faster speed and must find a safe opportunity to pass. Buses stopping on shared routes or in bike lanes create conflicts with passing bicyclists. This adds stress to the cyclist who is vulnerable on the street and to the car and bus drivers who are navigating the corridor. A recent University of California-Berkley study found that over 80% of motorists feel comfortable driving next to a person cycling in a separated bike lane. That number drops to roughly half for motorists who feel comfortable driving in a shared lane with cyclists. Some level of discomfort is good for both people on bikes and people in cars because it increases their level of awareness and caution. Too much frustration can be a detriment to bicycling levels and lead to frustration between drivers and cyclists that underscores many debates about the growth of bicycling in urban areas.

Right:

Cyclehoop Bike Parking:
1 car - 10 bikes
www.cyclehoop.com



The design gaps in the current bikeway network lead to many situations where bicyclist go from a comfortable separated facility to one where cars, buses, pedestrians, and people biking are all mixing. New York City has studied the impact of the installation of separated bike lanes and found that they have improved safety for all users of the corridor, not just people biking. This often includes a reduction in the rate of speeding which is a key factor in the severity of crashes when they do occur. Making multimodal conflict points more predictable, easier to navigate, and where possible less frequent, is a benefit to all roadway users.

Economic Development and Quality of Life

Many recent studies support the implementation of bicycle facilities as economic development tools. For retail, people biking have been shown to spend more overall than other customers because, while they spend less in a typical trip, they frequent stores more often. New York has seen lower commercial vacancy rates, and higher retail sales in corridors where they have made investments in improved bicycle infrastructure.

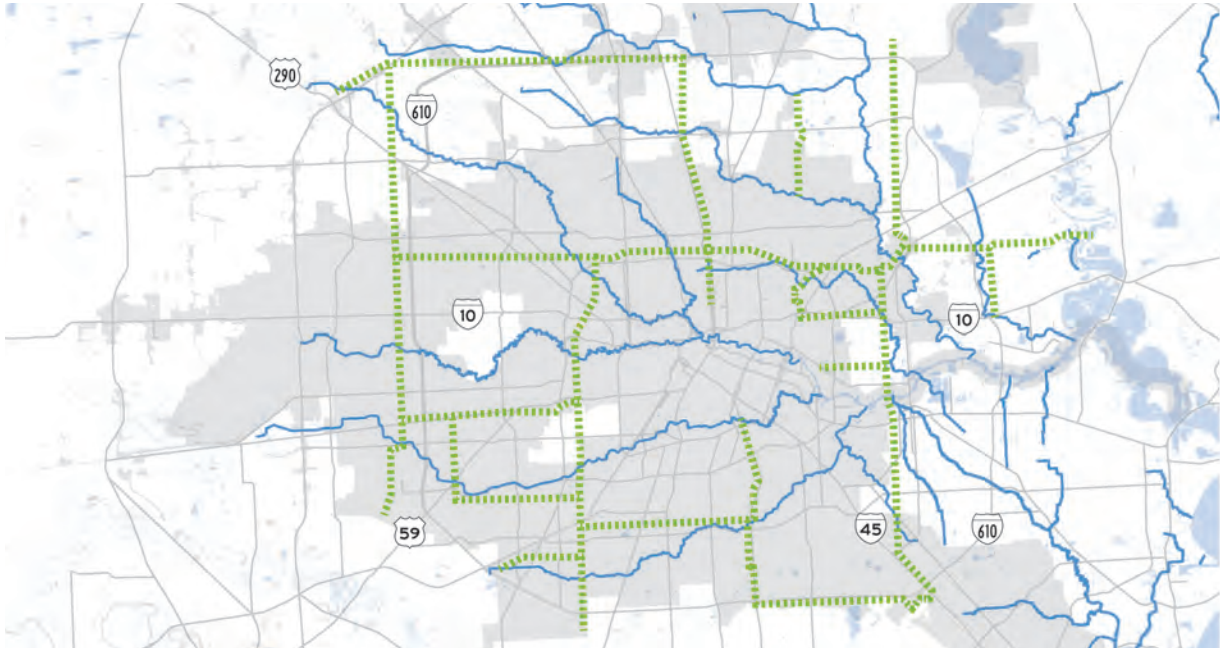
New York is not alone in these findings, other studies around the US and the world have found similar outcomes. Many cities are including the improvement of bicycle networks and related programs and policies as key pillars in their value proposition to attract major employers and corporate investments. Employers see the benefit of locating in bike accessible places to attract young professionals who have shown a stronger preference for more transportation choices than previous generations. The economic and quality of life benefits have been realized by the philanthropic community in Houston leading to recent major investment in bayou trails and green space from leading foundations such as the Kinder Foundation, the Hildebrand Foundation, and the Houston Endowment.

Environment and Health

People biking can provide benefits to their own personal health, but the benefits also translate to regional benefits as well. More people biking reduces the impacts from green house gas (GHG) and other emissions from automobile trips, particularly as it occurs during congested peak hours. It increases community resilience by providing more transportation options and a redundancy the City's transportations networks.

More people biking also improves the overall health of a community which can lead to meaningful reduction in health care costs. This indirect benefit can translate to lower insurance rates and taxes that support treatment of the large number of chronic diseases related to obesity, heart disease, and other outcomes from low levels of physical activity.

Figure 2.29: Major Bayou and Utility Corridors



Maximizing Investments

Successful implementation of the Bike Plan can enhance the investments being made in new trails and transit connections by making them more accessible and useful to more potential users.

Bayous and Utility Corridors: In 2012, Houston voters overwhelmingly approved a city bond program to support the construction of new shared-use trails and parkland along nine major bayou corridors in the City of Houston. These corridors would be developed in partnership with local philanthropic donors to provide over $200 million in new park and bicycle infrastructure known as the Bayou Greenway Initiative

In 2013, the Texas Legislature also passed regulation that would support the development of new shared use trails along major utility corridors in the Houston region, including the many utilized by Centerpoint for electric power distribution. Figure 2.29 shows a high level view of the bayou and utility corridors that have the potential to be the backbone of a well connected bicycle network in Houston. Many of these corridors have existing high quality trails and many more will in the next 7-10 years.

Developing better bicycle access from neighborhood and activity centers to these major corridor investments will allow more people to use them more often. In discussions with many people in the community, they love

riding on these trails and can't wait to see more of them constructed. They feel the biggest challenge is accessing these corridors from where they live or work, leading many people to feel the need to drive to the bayous to then ride their bikes.

Instead of having to devote parkland to expanded parking lots, by creating opportunities for more people to access the bayous by bicycle, these resources can go toward the improvement and maintenance of these amazing linear parks, and improve their ability to be major bicycle arterials across the city. Safer, more abundant access to the major investment in these corridors that are being supported regionally will maximize the return on the significant community investment in many ways.

Transit Connections

Bicycle access greatly increases the catchment area that is readily served by transit. While walksheds, the area easily walked to around a transit stops, are typically assumed to be 0.25 to 0.5 miles, bikesheds for transit can be one to three miles. As shown in Figure 2.30, the Houston region is investing in new transit service in the form of three new light rail corridors, which have opened in the past 18 months, bringing the total miles of active light rail to 22. In August 2015, METRO implemented its New Bus Network that redesigned how the local bus network can better serve the Houston region. Importantly for people biking, a growing segment of METRO's ridership, the New Bus Network provides a significant increase in the places reached by frequent transit, meaning transit coming every 15 minutes for most of the day (Figure 2.30). The frequency of transit service is a critical element for all users but is particularly important to people biking. When a person with a bike waits for transit, the alternative distance they could travel on their bike during that wait time is significant.

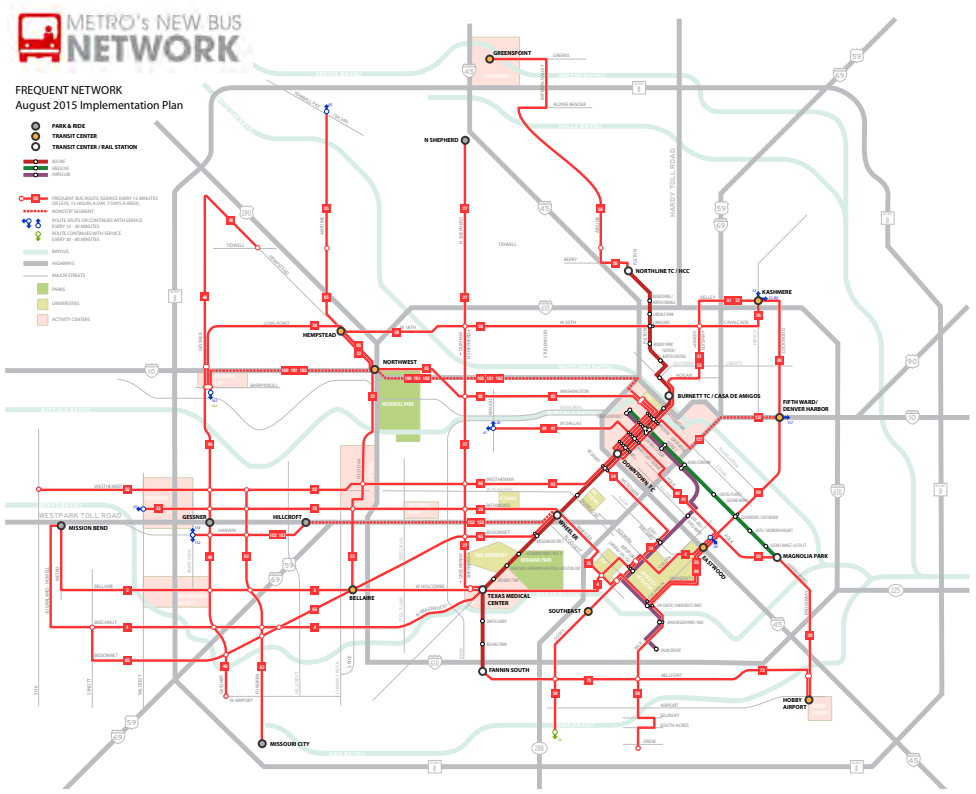


Figure 2.30: Houston METRO High Frequency All-Day Transit Service (August 2015)

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CHAPTER 3
VISION & GOALS

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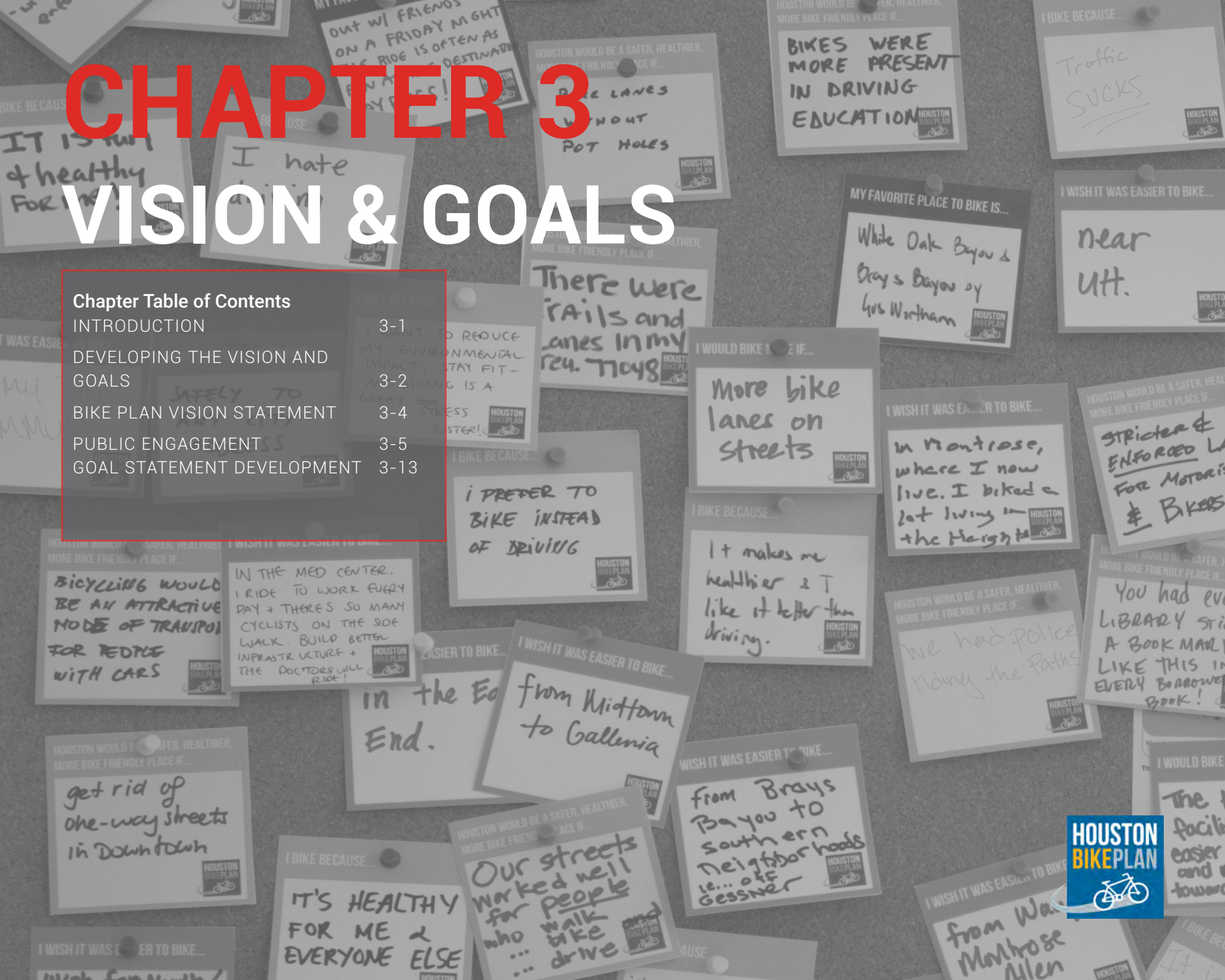


03

VISIONS & GOALS



Bike Plan Community Meeting

Houston has a passionate bicycling community of all ages, abilities, and backgrounds. To develop the overall vision and goals for the Bike Plan, Houstonians throughout the city were engaged in a variety of ways to take advantage of the community's knowledge of the city's streets and infrastructure, and opportunities to make bicycling better. A robust public outreach process was conducted to understand overall goals for improving bicycling in Houston. Participants provided broad feedback on themes of safety, bike facilities, and access to better opportunities for people to bike. More specific feedback included what streets people thought were appropriate for new or improved bike facilities, barriers to riding, opportunities to get more people riding bikes, and policies and programs to support increasing bicycling.

Each area of the city has its own unique opportunities and challenges. Bicycling in Midtown or Sharpstown is different from bicycling in Montrose or Acres Homes, and bicycling on Washington Avenue or Lamar Street in Downtown is different from bicycling on the Columbia Tap Trail, or Brays Bayou Trail. In order to develop a citywide plan with effective and achievable goals that is appropriate for all neighborhoods in Houston, close collaboration was necessary with local residents and leaders. This included public meetings led by the City of Houston, outreach at community events and smaller neighborhood meetings, as well as multiple online tools to reach as many people as possible.

DEVELOPING THE VISION AND GOALS

The development of a vision and goals for the Bike Plan required conversations with a diverse set of participants to reflect the broad values and expectations of a well-connected, citywide bike plan. These conversations were two-way, both to listen to the community's questions, concerns, and objectives but also to educate and inform the community of the findings from existing conditions and opportunities for the Plan and outline the path forward. Information about existing conditions and opportunities was provided to stakeholders, City staff, and the community to think about how better bicycling conditions can serve the City's population and how they envision the Plan to influence larger goals, e.g., mobility, health, safety, innovation, and economic development.

Building a broad consensus with cyclists and non-cyclists ensures that the Bike Plan reflects regional ambitions, as implementation has the potential to affect not only the mobility of residents, but also their quality of life. The results of this phase established a framework around stated values from the community, stakeholders, and City staff as the goals that will frame the development of recommendations.

A variety of approaches were used to collect feedback. These tools were utilized in public meetings, online through the project website, stakeholder meetings, and outreach at community events and meetings. In all, over 3,000 people provided feedback on the plan and many more signed up for updates about the plan progress.

A Bicycle Advisory Committee (BAC) was developed that consisted of representatives from various stakeholder groups in order to help provide feedback throughout the Bike Plan development, including development of goals and performance metrics, and assistance with public outreach methods and materials. BAC members represented schools, bicycle advocacy organizations



Participants gathered to discuss bike-friendly design on the Project Kickoff Ride at the May 30th Bike Ride & Open House

Figure 3.1 Houston Bike Plan Vision & Goals Relationship



and businesses, various City of Houston departments, the business community, neighborhood associations, management districts, transit interests, and other organizations that provide advocacy and representation for bicycle issues in Houston. This group was instrumental in refining the goals and metrics to represent public and stakeholder input.

The results of this process and community input provided support for the development of a Vision and Goals for the Bike Plan. As described in Figure 3.1, the Vision and Goals provide a clear direction for the development of the plan. Additionally, performance metrics will track the plan's performance against the goals. These metrics should be readily measurable and support activity that advances the goals of the plan. The Goals will be supported by strategies which include recommendations related to projects, policies, and programs that will help move Houston towards the stated goals. Specific strategies are detailed in **Chapter 5 Network Plan & Map**.

The Goals for the Bike Plan address categories of improving safety, increasing access, increasing ridership, and developing and maintaining facilities. The input from communities and stakeholders directly informed these goal statements through public meeting activities and online activities, such as surveys and discussion forums. The Vision and Goals for the Bike Plan are shown in Figure 3.2.

Figure 3.2 Houston Bike Plan Vision & Goals

VISION

By 2027, the City of Houston will be a Safer, More Accessible, Gold Level Bike-Friendly City

GOALS



Improve Safety

To provide a safer bicycle network for people of all ages and abilities through improved facilities, education, and enforcement



Increase Access

To create a highly accessible, citywide network of comfortable bike facilities that connects neighborhoods to transit, jobs, and activity centers, including schools, universities, parks, and libraries



Increase Ridership

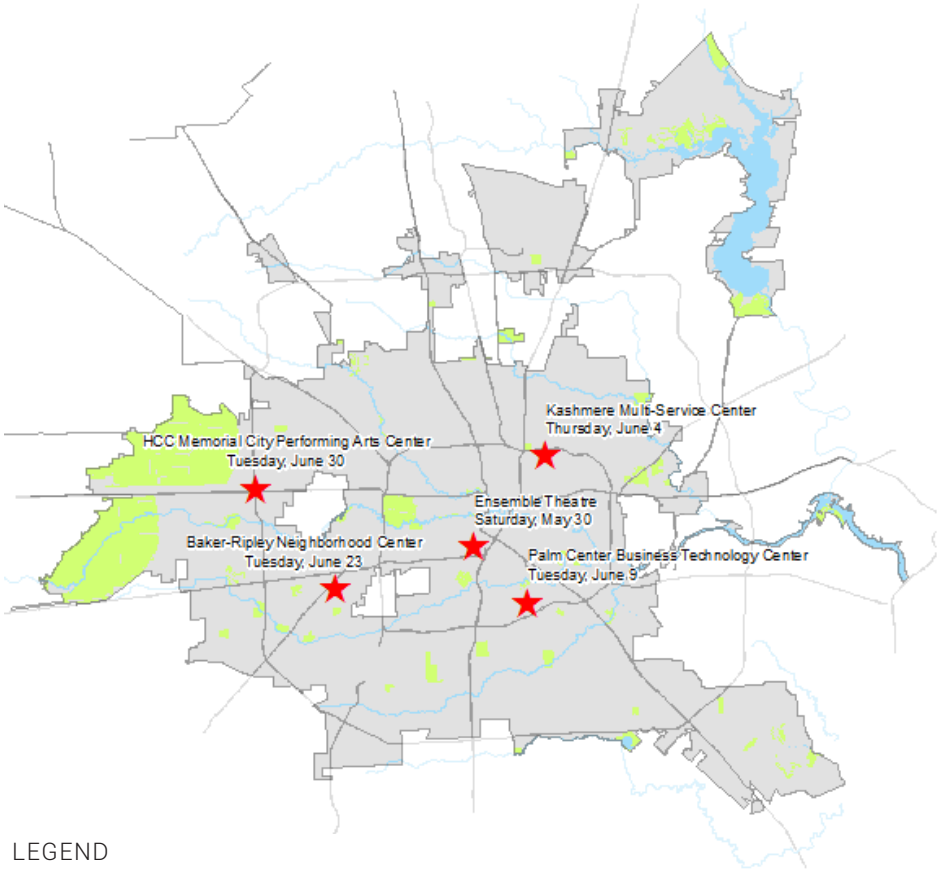
To exceed average ridership levels in peer cities by implementing policies and programs that enable more people to ride bicycles and encourage healthy, active transportation choices



Develop and Maintain Facilities

To develop and sustain a high-quality bicycle network, including both bikeways and end-of-trip facilities

Figure 3.3 Houston Bike Plan Public Meeting Locations



PUBLIC ENGAGEMENT

Five public meetings were held throughout the City to discuss current bicycling conditions and goals for the Houston Bike Plan. The outreach process kicked off on May 30, 2015 with an open house meeting and educational bike ride at the Ensemble Theater in Midtown. Four more open house meetings were held throughout the city between June 4th and June 30th. See Figure 3.3 for meeting locations.

All open house meetings included a presentation from the City of Houston staff and the study team that introduced the need for a new bicycle master plan, the Bike Plan project scope and timeline, initial findings from the analysis of existing conditions, and opportunities that exist in Houston today that can be leveraged or improved upon by recommendations in the plan.

Participants were encouraged to provide ideas and comments by drawing on maps to identify challenges and barriers with the existing bikeways, and desired locations of future facilities and connections. The community was also asked to create and identify goals for the Houston Bike Plan by completing the following statements:

- I wish it was easier to bike...
- My favorite place to bike is...
- I bike because...
- I would bike more if...
- Houston would be a safer, healthier, more bike-friendly place if...

A total of 237 people attended the public meetings and completed 258 goals cards, 455 map ideas and comments, and 35 general comments. Analysis of the public input received was encouraging and highly consistent across the City. Major themes that resonated across communities are shown in Figure 3.4, which includes public meeting and online comments.

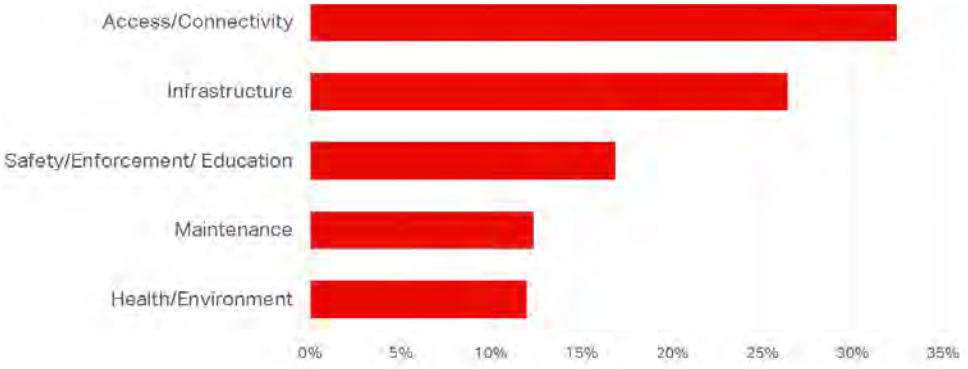
- Safety/Enforcement/Education
- Infrastructure
- Access/Connectivity
- Maintenance
- Health/Environment

In addition to the five public meetings, the City provided opportunities to comment on the plan at 25 community events and meetings throughout Houston between March and July. Events included Sunday Streets, Art Car Parade, Tour de Houston, METRO Rail opening, Critical Mass, and others. This effort was done to increase the availability of opportunities to participate and increase awareness of the Bike Plan to the public. Overall, an additional 830 comments on the plan were received through these efforts and over 3,800 people signed up to receive email updates about the plan.

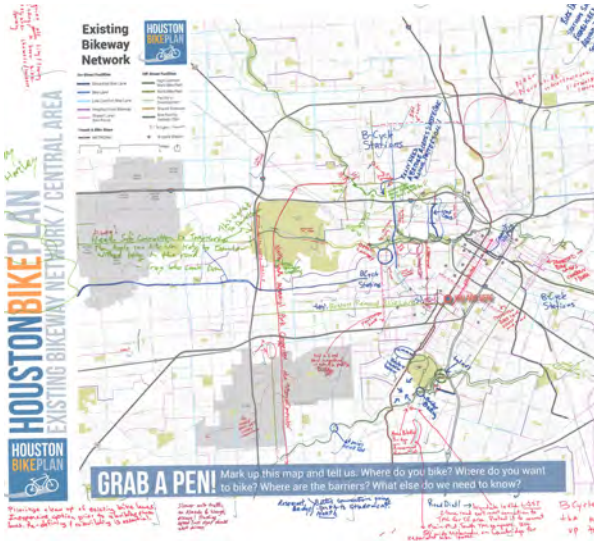


Goal statements from the May 30th Bike Ride & Open House

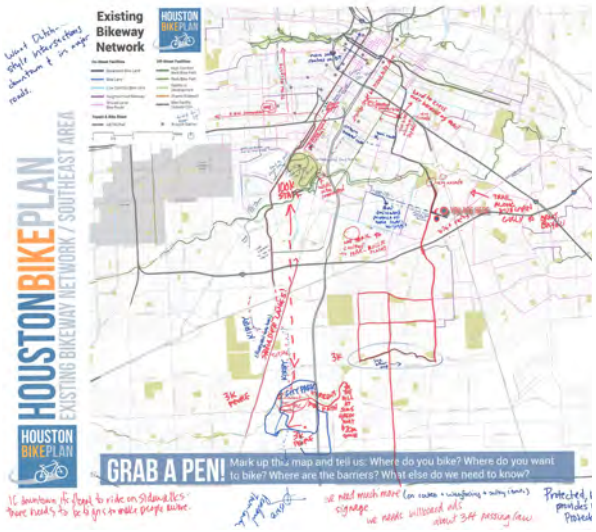
Figure 3.4 Goal Comment Themes & Percent Distribution



Maps with comments from participants at the public meetings



Ensemble Theater
May 30



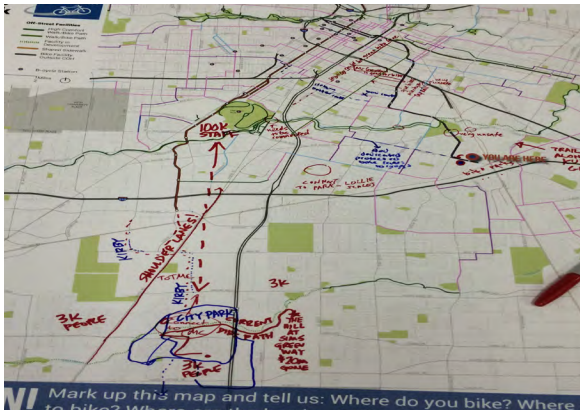
Palm Center
June 9



Baker Ripley Neighborhood Center
June 23



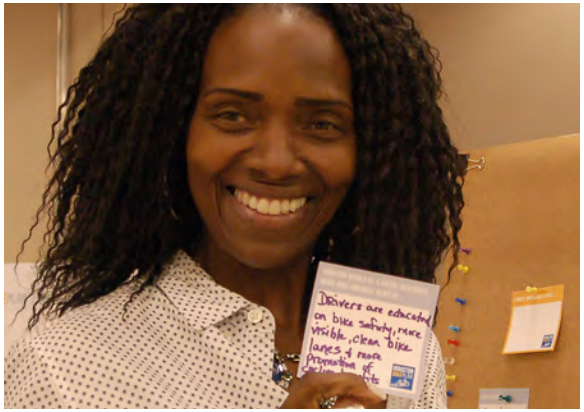
HCC Memorial City
June 30





Participant at May 30th public meeting (right)

Map ideas from June 9th public meeting (left)





Participants drawing map ideas at June 23rd public meeting (right)

Participant at June 4th public meeting (left)





Participant at June 30th public meeting (right)

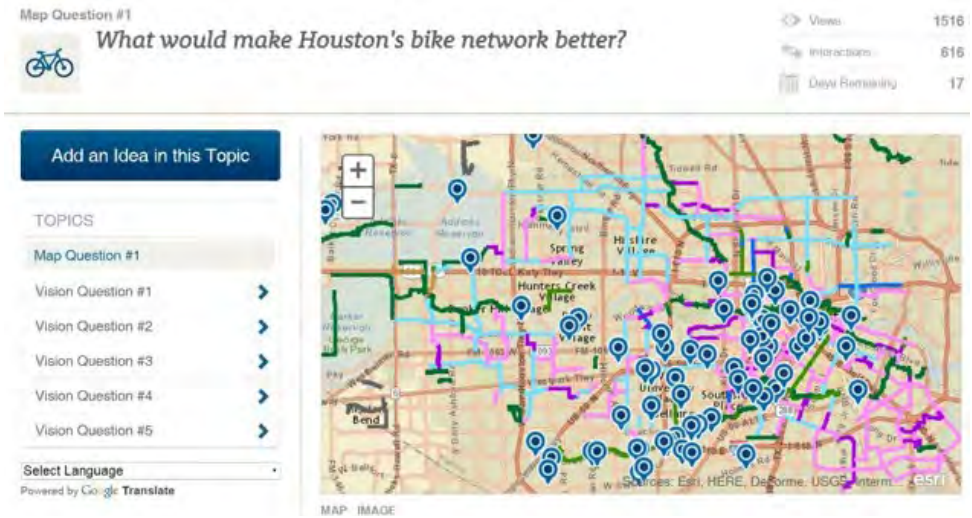
Participants drawing map ideas at June 9th public meeting (left)

Online Tools and Outreach

To reach as broad of an audience as possible for the Houston Bike Plan, a project website was set up and provided the following tools for community input:

- An online discussion forum which asked for input on the same five goal statements as the public meetings
- An interactive map that allowed participants to draw ideas such as routes and needed connections, as well as allowed for others to comment on those ideas (Figure 3.5)
- An online survey in both English and Spanish
- Meeting in a Box, an opportunity for anyone to host their own public meeting with all the activities and tools available online to download

Figure 3.5 Online Screenshot of Discussion Forums and Interactive Feedback Map



In order to drive as many participants to the public meetings and website tools as possible, the project team promoted the meetings at community events and partnered with local organizations to inform the community of the Bike Plan, opportunities to be involved, draw and provide comments on maps, and sign up to receive future information about the project. Additionally, Bike Plan posters and postcards were distributed at bike shops, libraries, multi-service centers, businesses, METRO buses and train cars, Parks and Recreation community centers, and more.

Opportunities to participate through the online tools were available throughout the public engagement period from May 30th to July 20th. During that time period, the online survey was taken by 2,895 people, the discussion forum had 130 comments, and the interactive map had 387 ideas. Participants in the online survey were representative of:

- A wide geographical area with higher participation in areas that have greater levels of existing bicycle facilities such as within the I-610 Loop and the Energy Corridor,
- A variety of ethnic groups with a majority being Caucasian,
- Millennials and baby boomers over other age groups,
- Individuals with income higher than the regional average, and
- A greater number of men than women.

Overall, the input received through the website tools echoed what was heard at the public meetings and community events. Additionally, across varying ages, incomes, and locations across the city, similar feedback regarding existing conditions, challenges, and opportunities for improvement of the bicycle network were echoed.

In an effort to create partnerships and extend the outreach of the project, particularly to populations not reached through online methods, the Meeting in a Box was developed and utilized with assistance from BikeHouston and the Energy Corridor Management District. The Meeting in a Box contained materials consistent with what was provided in public meetings and online tools.

The online survey was designed to help inform the Bike Plan about goals, specific barriers that reduce the amount of people biking today, why people do or do not bike, their preferences for facilities, and demographics of those interested.

Overall, the survey reached a wide geographical area encompassing most of the larger Houston region, however, survey participants tended to concentrated more within areas that have higher levels of existing bicycle facilities such as within the I-610 Loop, southwest Houston, and the Energy Corridor. Additionally, survey responses showed consensus across geographic and demographic factors for a majority of the survey questions, particularly those relating to goals, barriers, facility preferences, and their reasons for bicycling.

The online map received 387 individual "ideas" that noted locations of barriers, desired facilities or connections, and other information such as facility conditions. The ideas noted on the online maps were highly consistent with the comments that were drawn on the maps in the public meetings.

In addition to the online map, online participants could provide vision/goal comments intended to be consistent with the goal cards in the public meetings. There were 130 discussion comments on the vision/goals statements. Online participants could also "like" comments as a method to vote on them and signal agreement. The 130 comments received over 1,300 "likes" which provided significant insight as to the

Figure 3.6 Online Survey Goals

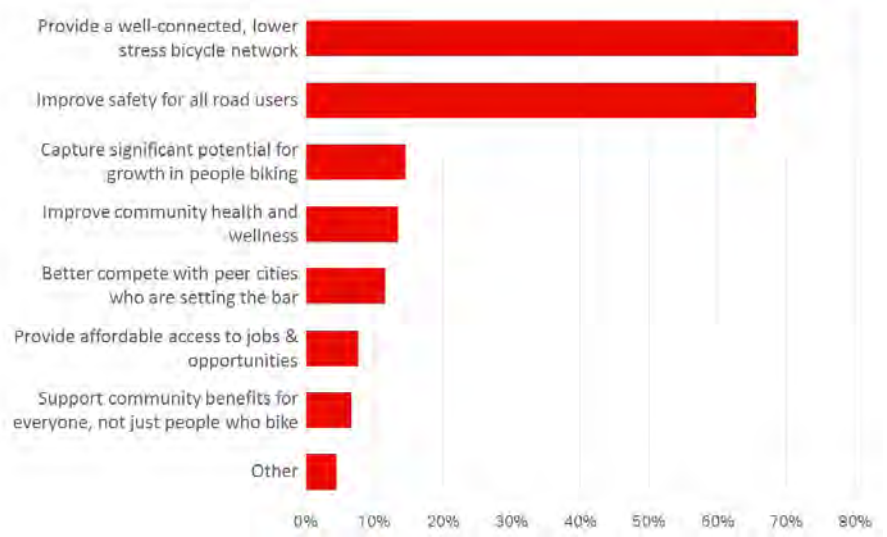


Figure 3.7 Barriers to More People Riding Bikes in Houston

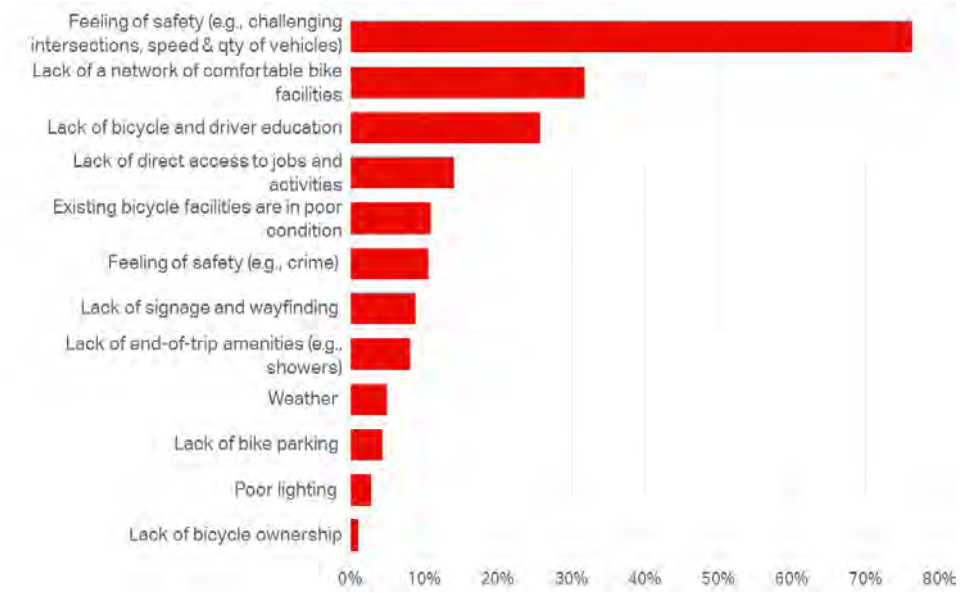
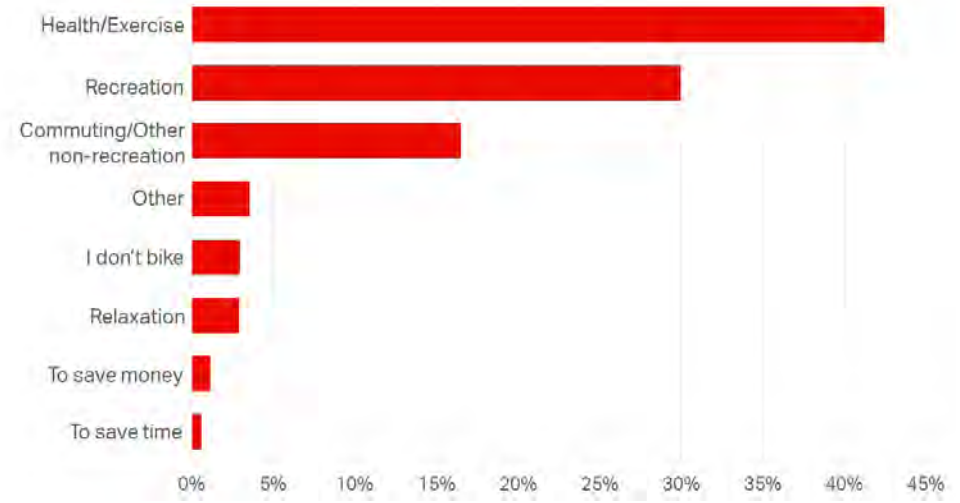


Figure 3.8 Why People Ride a Bike



level of importance of the goal areas. The data in Figure 3.4 (on page 6) includes the online comments and likes with the goals comments from the public meetings to show comprehensively the level of support in each of the goal areas.

Overall, public comment from online tools and public meetings were complimentary and consistent. Residents in areas throughout Houston had similar goals for the Bike Plan. Additionally, barriers and preferences were highly consistent between various areas of the city indicating a high degree of need throughout Houston.

An analysis of the Houston Bike Plan survey responses reveals that safety, increased access, and improved infrastructure are key elements for the Bike Plan to address to be successful at increasing biking in Houston (Figures 3.6 & 3.7).

A majority of the respondents (83%) identified themselves in the "Enthused and Confident" or "Interested but Concerned" rider categories. These are people who would prefer not to share the road with vehicles and would ride more often with improved facilities.

As shown in the Existing Conditions Chapter, the current network has many low-comfort gaps limiting access to activity and job centers. This is reflected in the barriers identified that prevent more people from bicycling in Houston (Figure 3.7).

A majority of the trips made by survey participants are for health and exercise or

recreational purposes (Figure 3.8). For these trips, people can define more easily their route and riding environment than if they need to make a specific trip, such as traveling to work. There is likely an opportunity to increase the number of people who primarily bike for other reasons, such as commuting, or support people who currently bike to experience more trip types.

In order to better understand which types of bike facilities survey respondents perceive as desirable, the survey provided a visual preference question on which types of bikeway facilities the respondent would most want to ride. In addition, a similar question was asked about which types of bicycle parking options respondents would prefer to use.

The survey provided images of six types of facilities that ranged from off-street trails, dedicated facilities withing the street right-of-way, and on-street shared facilities. As identified in Figure 3.9, both off-street shared use paths or trails and on-street separated bike lanes received a majority of the preference with 74% and 73% respectively (survey respondents could pick their top 2 choices). These results indicate that dedicated facilities, separated from vehicle traffic with some type of barrier are likely to encourage increased biking levels in Houston. This was also a theme of the open comments provided to the survey with a significant number of people requesting a network of high comfort bikeways that would

Figure 3.9 Bikeway Preferences



Figure 3.10 Bike Parking Preferences



support more of their trips. The preference of the facility types is consistent across survey respondents and correlates with the desired goals and identified barriers to more people bicycling in Houston.

In addition to bikeway facilities, bike parking facilities are an important amenity that facilitates more people biking by addressing concerns about bicycle storage. Preferences for bicycle parking facilities, as shown in Figure 3.10, are more variable than bikeway facilities, but indicate that secured facilities, such as bike lockers or stations, and bike racks are desirable. Survey respondents could pick any number of parking facilities they would use. Secured bicycle facilities are most appropriate for long term storage, such as all day, while bike racks are more appropriate for short term bicycle parking, at places such as restaurants, businesses, schools, libraries, or other destinations of interest. Of particular interest is the 34% of survey respondents that indicated they prefer to use a sign post or whatever is available. This indicates that convenience is important and that bike parking should appropriately address this need at destinations.

GOAL STATEMENT DEVELOPMENT

In order to best create aspirational, yet attainable goals for the Bike Plan, all public and stakeholder input was gathered and compiled in connection to the existing conditions. Four major goal areas stood out: improving safety, increasing access, increasing ridership, and developing and maintaining facilities. Each of these goal areas are shown in greater detail on the following pages (Figures 3.12 to 3.15) and include specific goal statements, supporting information from the public meetings, online tools, and the assessment of existing conditions.

Improve Safety

Overwhelmingly, safety was an important topic in the public meetings and online feedback. The goal to improve safety focuses on creating a bicycle network that is safe for users of all ages by improving bike facilities, focusing on educating bicyclists and drivers of all ages, and properly enforcing bicycle laws such as the 3-feet clear passing law (Vulnerable Road User Ordinance).

Increase Access

Access to high-quality bicycling opportunities was another area of focus for many people. The goal to increase access was derived from map ideas and a significant number of comments. The goal focuses on creating an easily accessible network throughout the City of Houston comprised of high comfort bikeways. Feedback focused on the need for the bikeway network to connect

neighborhoods to transit, jobs, and activity centers including schools, parks, and libraries to better allow people to safely bike for many trip purposes. Comfortable access to facilities and destinations was also consistently a highly discussed topic amongst the public.

Increase Ridership

The Bike Plan will be successful if it helps more people get out and ride a bicycle in the city. The goal to increase ridership focuses on supporting an enhanced bikeway network by utilizing programs and policies to increase the mode share of bicycling for all types of trips in Houston. The intent of these policies and programs is to encourage people who don't bike as much as they would like to today, or not at all, to bike more. Many of these programs and policies include things that Houston is doing today, including Sunday Streets, a Complete Streets policy, organized bike rides, and an online bike safety program. However, there are many activities that can support a culture of bicycling in Houston, such as bike parking requirements, promotion of bike-friendly businesses, outreach programs, and more. These have been shown as successful in other peer cities to Houston.

Develop and Maintain Facilities

The last goal to develop and maintain facilities is largely related to the need to improve existing infrastructure and develop new facilities that are part of a high comfort network. Comments focused on improved bike parking and other end-of-trip amenities, such as showers at people's place of work or school.

A key theme was ensuring maintenance of the bicycle network. This included feedback on the condition and cleanliness of existing bike lanes. Feedback received included wanting a better means for bicyclists to identify needed maintenance or repair to the City. Bikeway sweeping programs were discussed as methods to ensure facility quality and that safety is upheld.

Figure 3.11 Vision, Goals and Sample Metrics

Vision: By 2027 Houston will be a Safer, More Accessible, Gold Level Bike-Friendly City

Area	*Goal Statement*	*Example Metrics*
Improve Safety	To provide a safer bicycle network for people of all ages and abilities through improved facilities, education, and enforcement	• # of bicycle fatalities • # of bicycle related crashes
Increase Access	To create a highly accessible, citywide network of comfortable bike facilities that connects neighborhoods to transit, jobs, and activity centers, including schools, universities, parks, and libraries	• % population and jobs within ½ mile of a high-comfort bike facility
Increase Ridership	To exceed average ridership levels in peer cities by implementing policies and programs that enable more people to ride bicycles and encourage healthy, active transportation choices	• Commute mode share • # of permanent count stations • % adults meeting minimum recommended weekly activity
Develop and Maintain Facilities	To develop and sustain a high-quality bicycle network, including both bikeways and end-of-trip facilities	• Miles of bikeways per capita • % bikeways in good or better conditions

Figure 3.12 Goal 1 - Improve Safety

GOAL

Improve Safety

To provide a safer bicycle network for people of all ages and abilities through improved facilities, education, and enforcement

SUPPORTING INFORMATION

PUBLIC MEETINGS

20% of comments on goals were about improving safety through well-designed facilities, increasing education for both bicyclists and drivers, and enforcing laws for people who drive and bike.

ONLINE TOOLS

76% of survey responses indicated the lack of a feeling of safety was the #1 barrier to bicycling in Houston. More than 200 online forum comments identified improving safety for people who bike as an important goal of the HBP.

EXISTING CONDITIONS

67% of bicycle crashes occur at intersections where conflicts with vehicles are highest. Houston falls below many peer cities with a higher than average bicycle fatality rate of 11.2 per 10,000 bicycle commuters. (Alliance for Biking & Walking 2014 Benchmarking Report)

Figure 3.13 Goal 2 - Increase Access

GOAL

Increase Access

To create a highly accessible, citywide network of comfortable bike facilities that connects neighborhoods to transit, jobs, and activity centers, including schools, universities, parks, and libraries

SUPPORTING INFORMATION

PUBLIC MEETINGS

30% of comments on goals focused on easy access to facilities that provide connections and a seamless bicycle network throughout the city.

ONLINE TOOLS

72% of survey responses identified providing a well-connected lower stress bicycle network should be the top goal of the HBP. 33% of forum discussions identified increasing bicycle access as a priority.

EXISTING CONDITIONS

Only 38% of the population and 46% of jobs are within 1/2 mile of a high comfort bike facility. A majority of schools, libraries, community centers, and multi-service centers are not within 1/4 mile of a high comfort bike facility.

Figure 3.14 Goal 3 - Increase Ridership

GOAL

Increase Ridership

To exceed average ridership levels in peer cities by implementing policies and programs that enable more people to ride bicycles and encourage healthy, active transportation choices

SUPPORTING INFORMATION

PUBLIC MEETINGS

Complete streets, bike parking requirements, bike-friendly businesses, outreach programs, and increased funding were identified as important tools to improve the bicycle culture in Houston.

ONLINE TOOLS

Over 150 online forum comments identified health benefits as the reason they ride a bike. 42% of survey respondents also indicated health as the primary reason they ride a bike, followed by 30% recreation and 16% commuting.

EXISTING CONDITIONS

Houston's 2015 Sunday Streets program has been very successful averaging 20,000 attendees at each event (gohealthyhouston.org). Houston falls below peer cities with a 0.5% commute mode share and only 51% of adults meeting recommended physical activity levels. (Alliance for Biking & Walking 2014 Benchmarking Report)

Figure 3.15 Goal 4 - Develop and Maintain Facilities

GOAL

Develop and Maintain Facilities

To develop and sustain a high-quality bicycle network, including both bikeways and end-of-trip facilities

SUPPORTING INFORMATION

PUBLIC MEETINGS

Maintenance of existing facilities (improving riding surface, cracks, replace striping/signage) identified maintenance as a priority issue. A bike lane sweeping and debris removal program was identified as a needed improvement.

ONLINE TOOLS

Over 70% of survey participants selected shared use paths/trails and separated bike lanes as preferred facilities. Feedback identified a lack of bicycle parking and end-of-trip amenities, such as showers, as barriers to increasing bicycling in Houston. 25% of online forum comments discussed the importance of safe, comfortable infrastructure.

EXISTING CONDITIONS

Less than 30% of dedicated bike facilities are up to current standards. Houston ranks well below peer cities with only 1.1 miles of bike facilities per square mile. (Alliance for Biking & Walking 2014 Benchmarking Report)

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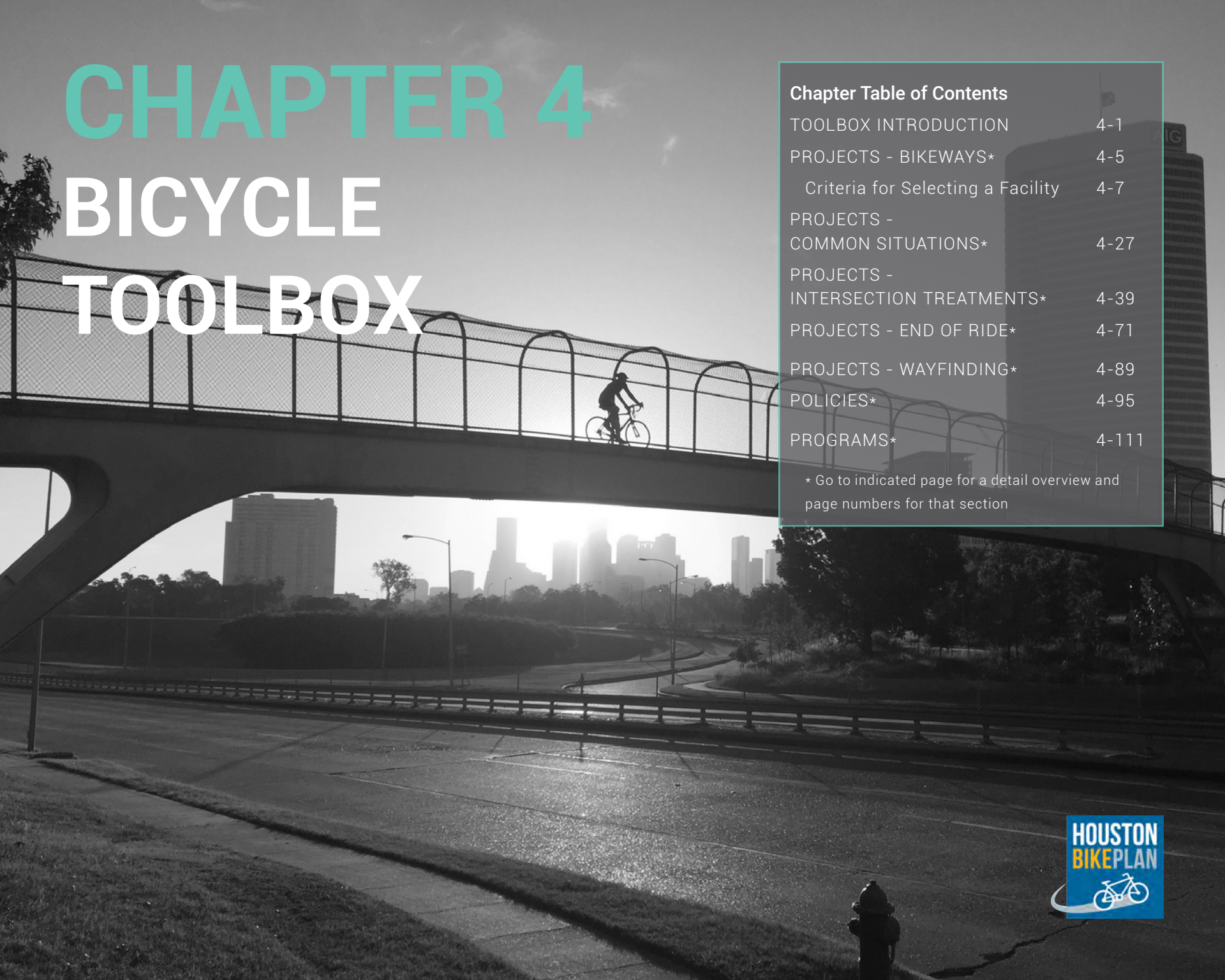
CHAPTER 4
BICYCLE TOOLBOX



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HOUSTON BIKEPLAN

04

BICYCLE TOOLBOX



Achieving the goals for bicycling in Houston outlined in **Chapter 3: Vision & Goals** will take a holistic improvement approach across the City. This chapter of the Houston Bike Plan (HBP) provides a "toolbox" of recommendations for the City of Houston to move forward and capture the opportunities to make Houston a more bicycle friendly city. Sustaining progress will require focus in multiple reinforcing areas and will involve many stakeholders and partners working with the City to implement the plan.

This toolbox contains approaches and recommendations for projects, policies, and programs, that create meaningful opportunities to improve biking in Houston and move the city towards becoming a Gold-Level Bicycle Friendly City. The design and function of bikeway projects greatly impacts the experience of people riding. The tools described here outline project approaches that improve level-of-comfort, which is important for attracting more people and trips to bicycling. Policies can more holistically and seamlessly impact how bicycling is regulated and integrated into the city. Programs can support and educate more people about the benefits and opportunities in bicycling.

Great Bicycle Friendly Cities happen when these are in alignment to support an overall culture of bicycling in a city.

The Bicycle Toolbox is divided into three sections:

Projects: This section contains detailed design descriptions and critical elements for the design and development of bikeway projects. This includes bikeway corridors, intersection treatments, end-of-ride amenities, and connections that form the basis for a large part of the experience of riding a bicycle safely and comfortably in Houston.

The tools identified build on and incorporate elements of many other national and international guidelines for the development of bicycle facilities and tailors the recommended approach to the Houston context. Recommendations for the design of bikeway projects have been developed to support the goal of expanding the high comfort bikeway network. As discussed in Chapter 2 and shown in Figure 5.1, Level of Comfort is a rating from 1 (high LoC) to 4 (lower LoC) for each roadway or bicycle facility based upon the exposure of people on bicycles to traffic. These recommendations are focused on creating LoC 1 and LoC 2 facilities for off-street bikeways, as well as dedicated and shared facilities in street right-of-ways.

This section also provides recommended approaches when faced with common design challenges such as the challenge of Houston's many boulevard roadways with substandard bikeways.

Figure 4.1: General Guideline for Level of Comfort Assessment

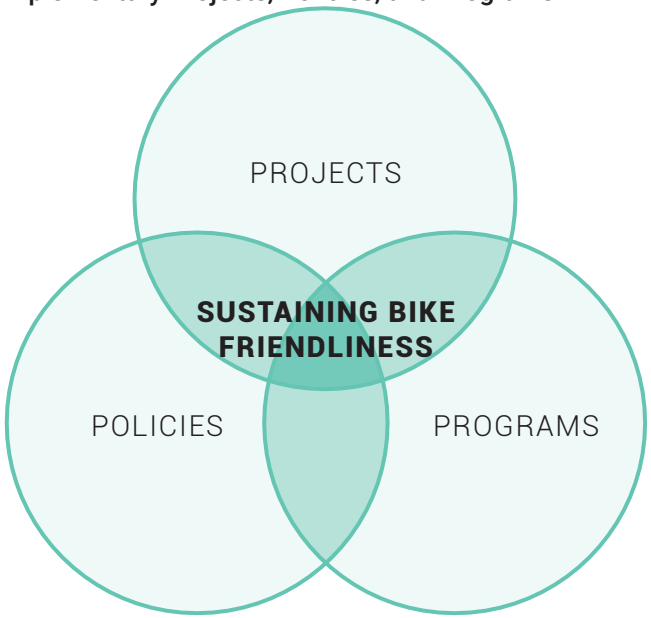


Policies: This section contains recommendations for the regulatory, enforcement and evaluation approaches to bicycling in Houston. Policies are complementary to Projects and Programs in that they can formalize the approach to consistent project development and set a framework for programs to successfully support a bicycle friendly culture. Policies can also define incentives that would improve safety, access, and amenities for people biking.

Programs: This section contains recommendations for programs that improve education and encourage the support of more people of all ages, abilities, and backgrounds to bicycle in Houston. Best practices are identified as those that can be employed by the public, non-profit, and private sectors to encourage more bicycling within the community. It also identifies approaches for better data and information gathering to support decision making related to Projects and Policies.

Sustaining Bicycle Friendliness: While each of these toolbox areas alone provides benefits for bicycling, transformative community change will occur when these three areas overlap (Figure 5.2). Projects, policies, and programs are all separate, but have definite areas that overlap in purpose. For example, a Bike Share Program can provide many more people with access to bicycles, but if projects are not developed that give them a comfortable place to ride, the program will not reach its full potential. Great bike lane projects may not make a significant impact in a community if residents in the area do not have access to quality bicycle parking, access to repairs shops, or programs to provide high quality education. It is only when Projects, Policies and Programs are aligned that a community achieves a change in bicycle friendliness.

Figure 4.2: Sustaining Bicycle Friendliness: Complementary Projects, Policies, and Programs



While projects typically have the greatest influence on the experience people have when bicycling, policies and programs also play an important role in providing a high comfort city-wide network. Policies can influence things like speed limits and traffic signals, both of which influence the comfort and safety of people biking. Policies regarding transit integration or cut-through areas can also have an impact as they can create a greater level of connectivity.

Programs can facilitate safer bicycling through bicycle trainings or provide education and enhance awareness for drivers. Some programs focus on creating bicycle groups for school children or commuter buddies so that people can easily bike together, which increases the feeling of safety and comfort.

The toolbox provided in this chapter leverages best practices and proven approaches that will independently improve the level of comfort for people biking in Houston, and, when utilized together, will elevate Houston to a Gold-Level Bicycle Friendly City as defined by the League of American Bicyclists.

Existing City of Houston Toolbox

It is important to recognize that the City of Houston already supports many of the items outlined in this toolbox. The 2015 update to the City's Infrastructure Design Manual is very explicit about requiring context sensitive design and consideration of all roadway users. The following guidelines are called out and contain more detail on many of the tools outlined in this document.

- ITE Recommended Practice: Designing Walkable Urban Thoroughfares: A Context Sensitive Approach
- Texas Manual on Uniform Traffic Control Devices (TMUTCD), Texas Department of Transportation
- Guide for the Development of Bicycle Facilities, AASHTO
- Urban Street Design Guide, National Association of City Transportation Officials (NACTO)
- Urban Bikeway Design Guide, National Association of City Transportation Officials

Additional guidelines and best practices such as FHWA's Separated Bike Lane Planning and Design Guide, the CROW Design Manual from the Netherlands, Boston Complete Streets, Portland Bicycle Plan for 2030, and San Diego Bicycle Design Guidelines were also useful references.

This toolbox compiles many of the tools into one place for reference and builds upon these guides to address issues identified as part of the HBP process. The approaches described here are tools and approaches and should be applied using sound judgment for where they are appropriate and in close consultation with City of Houston staff as new projects are developed.

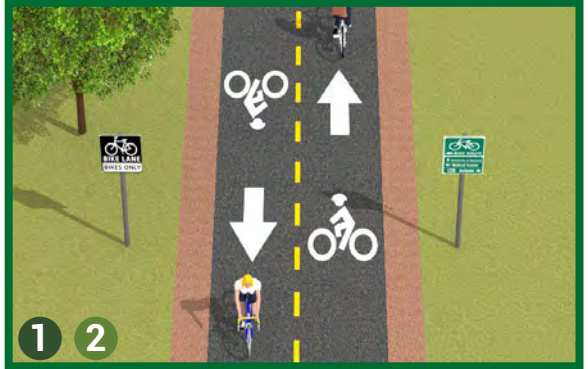
Projects - Bikeways

Bike Facility Comfort Level Symbols

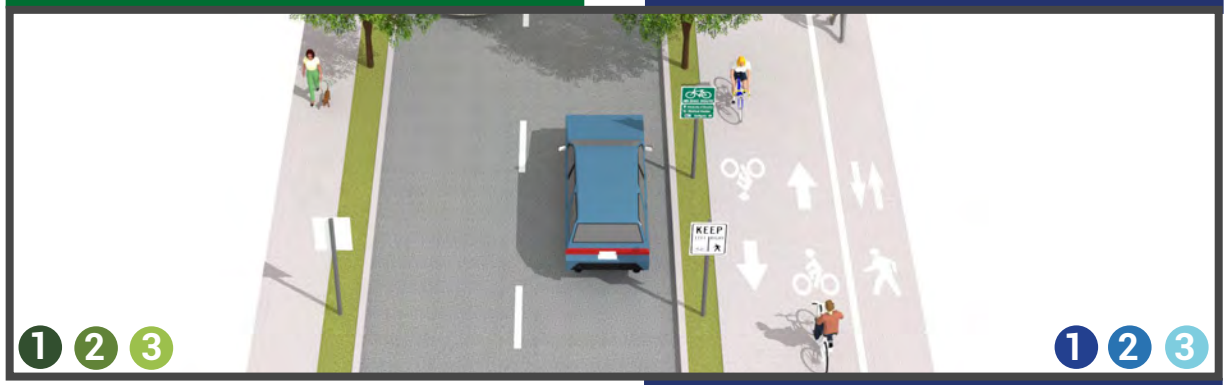
1 1 1 Higher Comfort
2 2 2
3 3 3 Less Comfort

OFF-STREET

4.1 Off-Street Bike Path 4-23

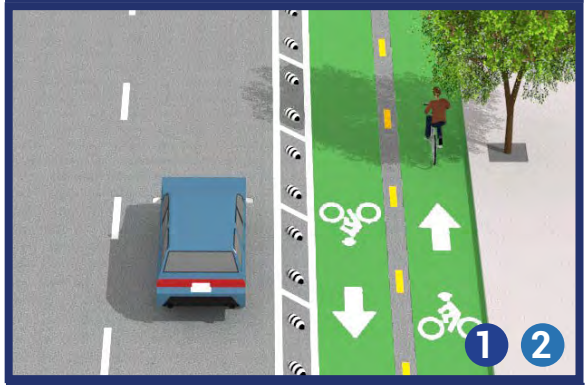


4.2 Side Path.....4-25



DEDICATED IN STREET RIGHT-OF-WAY

4.3 Separated Bike Lane 4-9



4.2 Side Path.....4-25

4.4 Bike Lane 4-13



Important Note: Where blue line segments are shown on the bikeway maps for future bikeways, they indicate Dedicated in Street Right-of-Way (R.O.W.) facilities. Since the specific design of these is not developed as part of this Plan, these may be implemented as Separated Bike Lanes, regular Bike Lanes or Side Paths. Implemented bikeways will be determined through final design and engineering for the corridor.

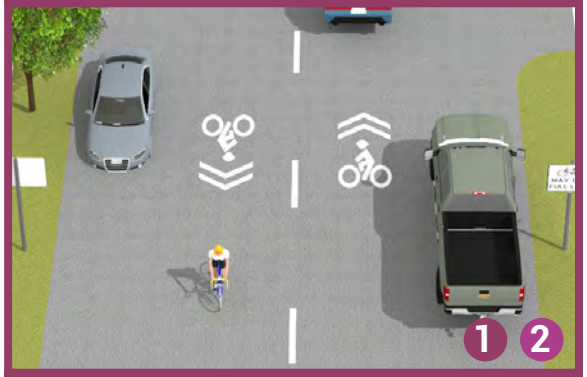
Figure 4.3:
Bikeway Typologies

SHARED ON-STREET

4.5 Neighborhood Bikeway 4-17



4.6 Neighborhood Shared Street ...4-19



4.7 Shared Lane.....4-21



Recommended Bikeway Projects

Recommended bikeways should be planned to expand the high comfort bicycle network in the City of Houston. Detailed assessment of a particular corridor should determine the final implementation of a bikeway. This includes both new bikeways and retrofits to corridors that have low comfort facilities or could be improved. Streets without bikeways may still be appropriate for people bicycling, either because they are low speed, low volume neighborhood streets or the person bicycling is comfortable sharing the road with existing traffic.

The bikeway tools are color-coded to align with the City of Houston Long Range Bikeways Map detailed in Chapter 5.

Some corridors may be shown on the map in blue indicating a plan for a dedicated bikeway along a particular street corridor, but through detailed planning and engineering of the corridor a side path may be determined as a more appropriate tool. This is why Side Paths are shown in both the Off-Street (Green) and the Dedicated in Street R.O.W. (Blue) columns of facilities. If constructed the bikeway would be shown in green on bikeway map.

When developing new bikeway facilities, those assessed at Level of Comfort 1 and 2 are considered part of the high comfort bike network. New bikeways that do not at least meet criteria for Level of Comfort 3 are not recommended.

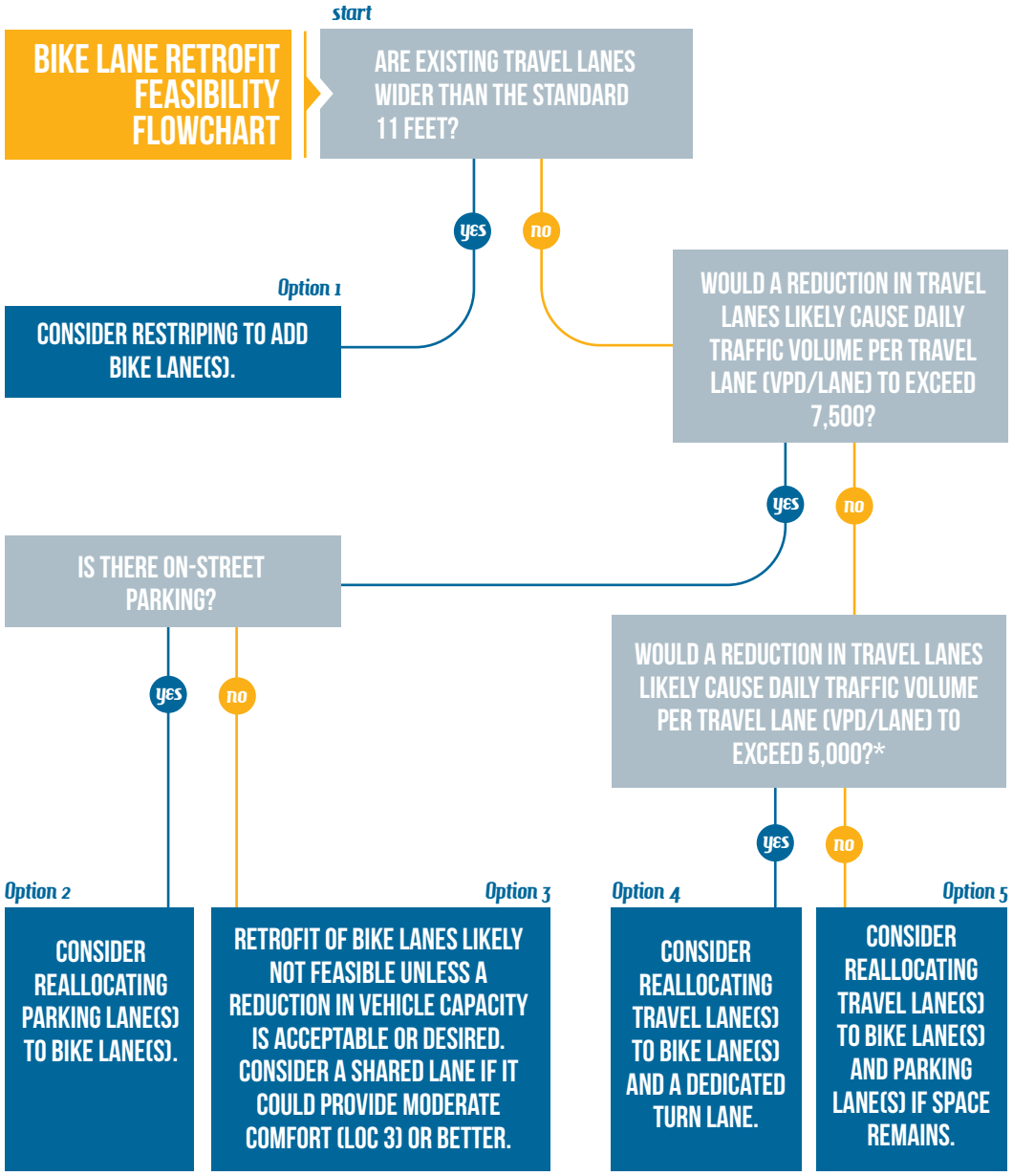
Criteria for Selecting a Bikeway Facility

These charts provide a guideline and thought process for determining what kind of facility to use. Of course, individual contexts will vary, and no rule is absolute.

The left chart shows criteria for determining where an existing roadway can accommodate a bike facility without reconstruction.

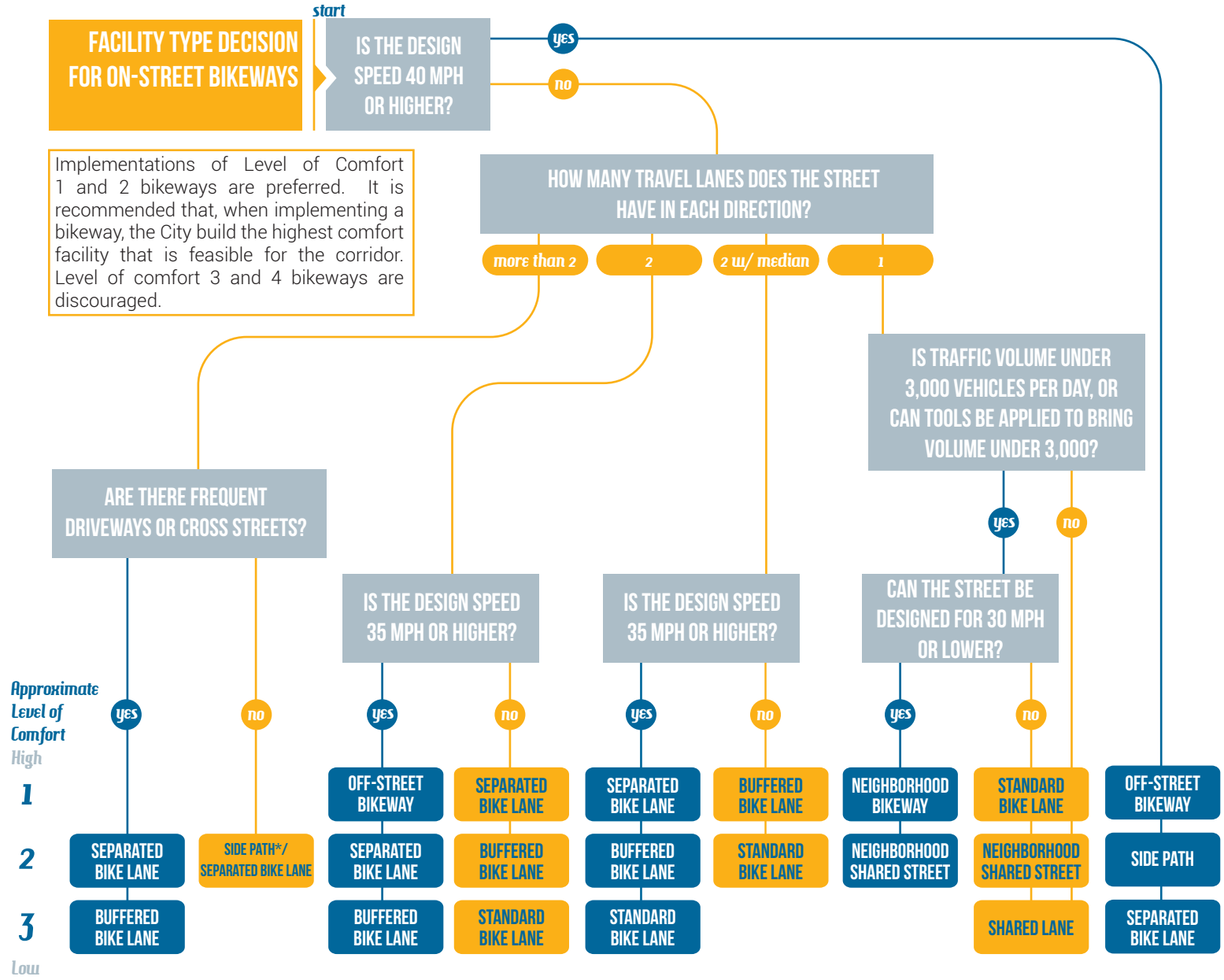
The right chart shows criteria for determining what facility type is appropriate on any roadway. Level of comfort 1 and 2 bikeways are preferred. While Level of Comfort 3 facilities are shown here, they will not expand the high level of comfort network.

Figure 4.4: Bike Lane Retrofit Feasibility Flowchart



* Assessment may also consider projected future traffic volumes in determining whether retrofit is feasible.

Figure 4.5: Facility Decision Tree For Street Right-of-way Bikeways Flowchart



* Consideration should be given to designating side paths as one-way bikeways and providing them on both sides of a street corridor.
Note: Current and projected vehicular demand is taken into consideration as a part of any comprehensive design changes to the roadway.

Dedicated in Street Right-of-Way

4.3 One-Way Separated Bike Lane



Salt Lake City, UT

1
2

DESCRIPTION

Dedicated street space for bikes separated from traffic with physical raised delineators.

This is typically the highest quality on-street facility for most people bicycling.

Referred to in NACTO as "One Way Protected Cycle Track".

Detailed in FHWA's Separated Bike Lane Planning and Design Guide.

BENEFITS

Provides high level of comfort.

Perception of safety for cyclists.

Clear definition of street space for cars.

Separation of people bicycling and people walking.

APPLICATION

Streets with multiple lanes, high traffic volumes, high parking turnover, or congested conditions.

Along streets with high bicycle volumes and/or high traffic speeds.

May be used with or without adjacent parking.

On-streets with available pavement space or right-of-way, regardless of traffic conditions.

ELEMENTS

1. The lane is clearly marked with pavement markings and signs.
2. The desirable one-way cycle track width is 6 feet or greater. Minimum width in constrained locations is 5 feet. In areas with high traffic, wider lanes may be appropriate.
3. The minimum buffer width is 2'. If parking is located alongside the lane, the buffer must be at least 3' so that car doors do not swing into the bike lane.
4. Alternate#1: The lane may be separated from traffic by a painted buffer with "armadillo" cycle lane delineators.
5. Alternate #2: The lane may be separated from traffic by a continuous curb if a maintenance plan is in place to sweep the lane.
6. The lane is separated from the sidewalk by a standard curb.

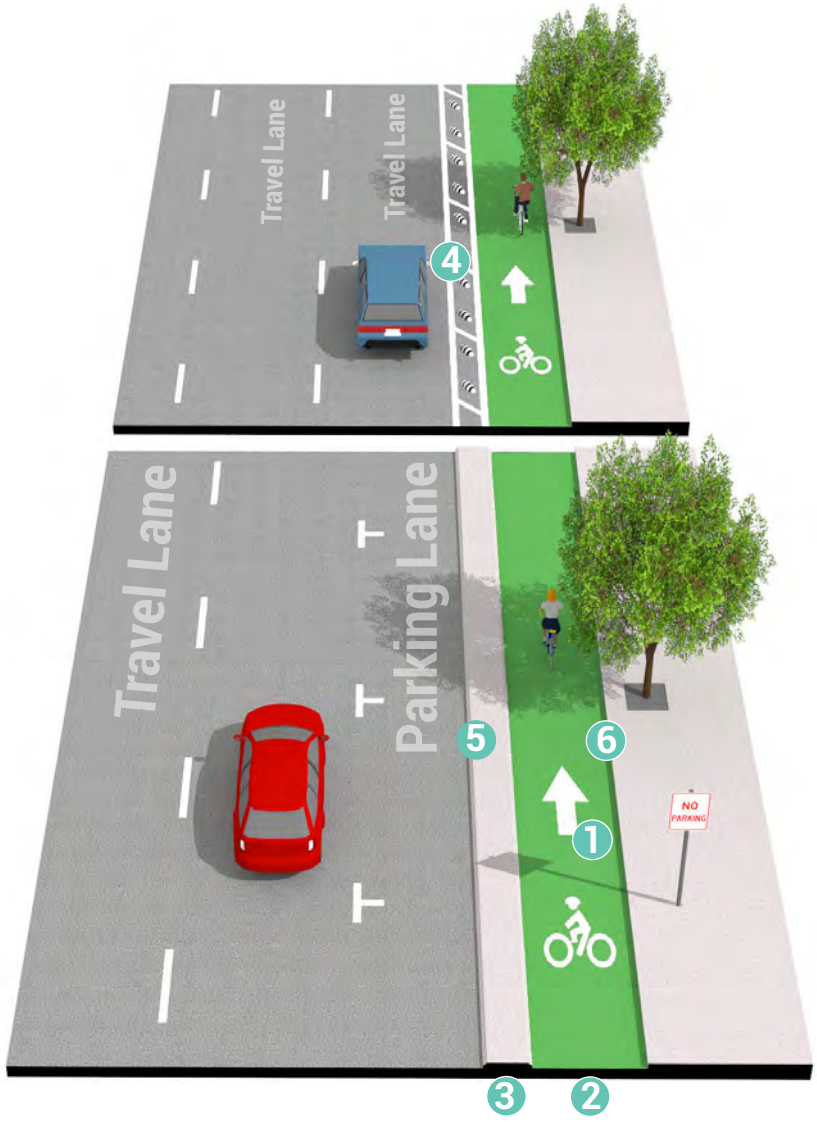
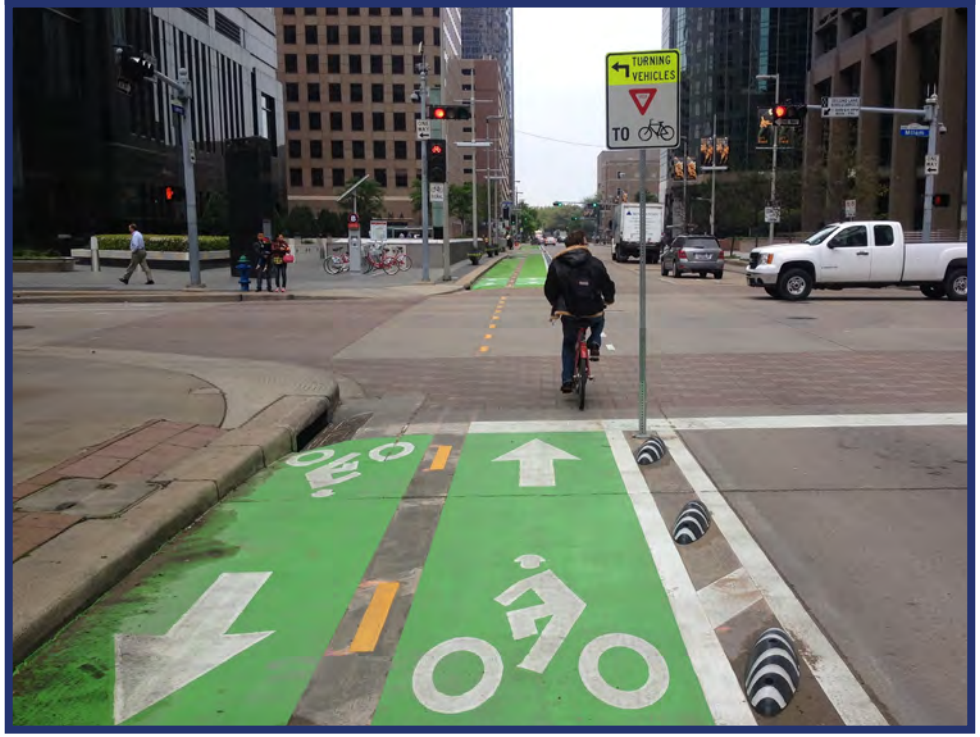


Figure 4.6: One-Way Separated Bike Lane

Dedicated in Street Right-of-Way

4.3 Two-Way Separated Bike Lane



Houston, TX

1
2

DESCRIPTION

Dedicated street space for bikes separated from traffic with physical delineators.

Referred to in NACTO as a "Two Way Cycle Track."

BENEFITS

Provides high level of comfort.

Perception of safety for cyclists.

Clear definition of street space for cars and bicycles.

Separation of bicycle and people walking.

APPLICATION

One-way streets where 2-way bike traffic is desired for connectivity.

Two-way streets where bike destinations or connecting trails are primarily on one side of the street.

Streets with multiple lanes, high traffic volumes, high parking turnover, or congested conditions.

Along streets with high bicycle volumes.

May be used with or without parking.

On streets with available pavement space or right-of-way, regardless of traffic conditions.

ELEMENTS

1. The lane is clearly marked with pavement markings and signs. Green paint is optional for use where visibility is important.
2. The desirable two-way cycle track width is 12 feet. Minimum width in constrained locations is 8 feet. In areas with high traffic, wider lanes may be appropriate.
3. The minimum buffer width is 2'. If parking is located alongside the lane, the buffer must be at least 3' so that car doors do not swing into the bike lane.
4. Alternate#1: The lane may be separated from traffic by a painted buffer with "armadillo" cycle lane delineators.
5. Alternate #2: The lane may be separated from traffic by a continuous curb if a maintenance plan is in place to sweep the lane.
6. The lane is separated from the sidewalk by a standard curb.

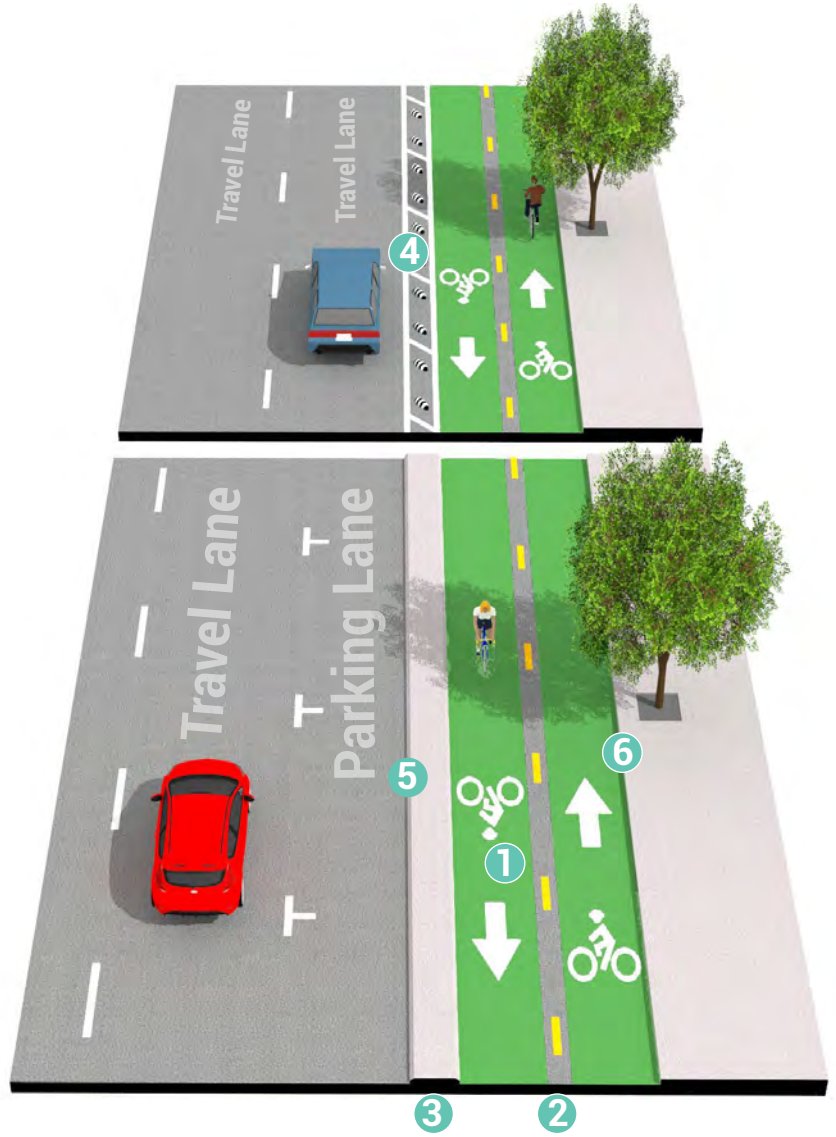
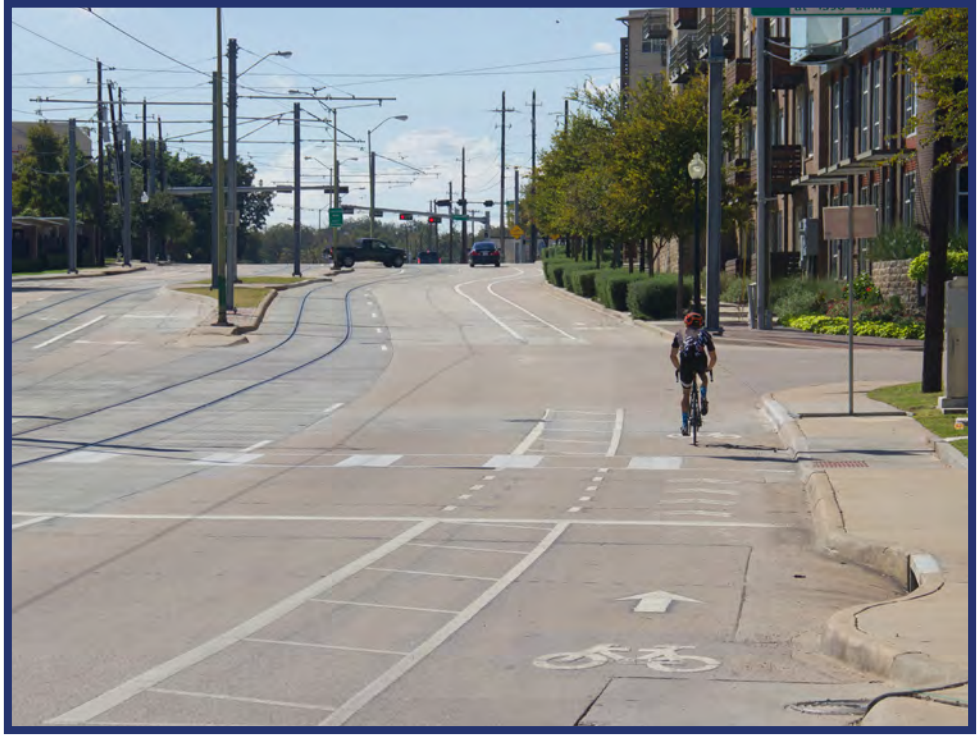


Figure 4.7: Two-Way Separated Bike Lane

Dedicated in Street Right-of-Way

4.4 Bike Lane



Portland, OR

1
2
3

DESCRIPTION

Dedicated street space for bikes separated from traffic with striping.

BENEFITS

Higher level of comfort than mixed traffic.

Creates separation between people biking and automobiles.

Perception of safety for cyclists.

Clear definition of street space for cars and bicycles.

Separation of bicycles and people walking.

APPLICATION

The minimum recommended on-street facility for streets with ≥ 3,000 motor vehicle average daily traffic or travel speeds ≥ 25 mph.

May be used on local streets in some specific situations.

ELEMENTS (BUFFERED BIKE LANE)

1. The lane is clearly marked with pavement markings and signs.
2. The desirable lane width is 6 feet. Minimum width in constrained locations is 5 feet. In areas with high traffic, wider lanes may be appropriate. The recommended minimum ridable surface adjacent to a gutter or longitudinal joint is 4 feet.
3. The minimum buffer width is 2'. The buffer consists of painted lines only.

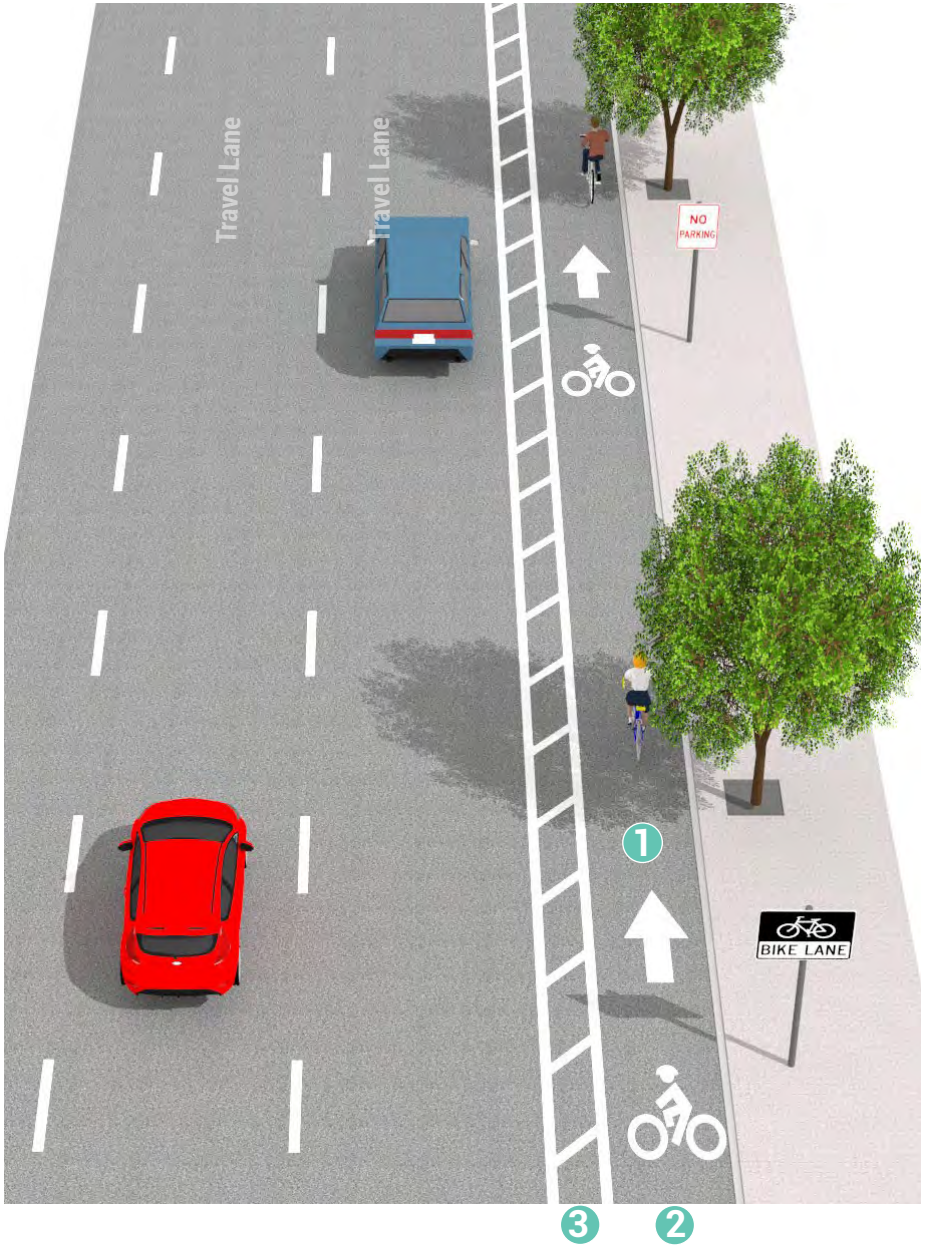


Figure 4.8: Bike Lane

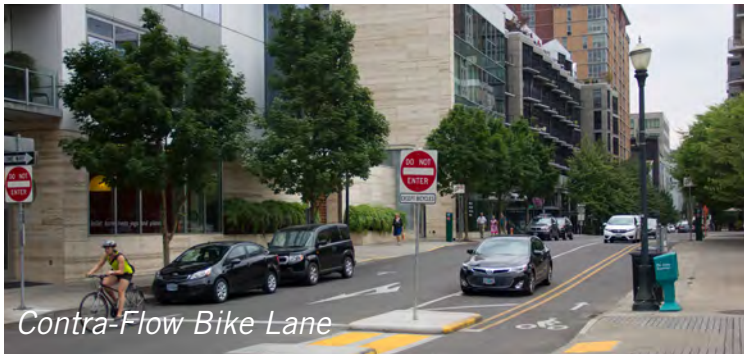
Dedicated in Street Right-of-Way

4.4 Bike Lane *Variations*



Bike Lane Without Buffer

Grand Rapids, MI



Contra-Flow Bike Lane

Portland, OR



Left-Side Bike Lane

Portland, OR

ELEMENTS (BIKE LANE WITHOUT BUFFER)

Lanes without buffers are recommended where there is not enough width for a buffered or separated bike lane. If used adjacent to a parking lane, sufficient width should be provided for people biking to avoid having to ride in the door zone.

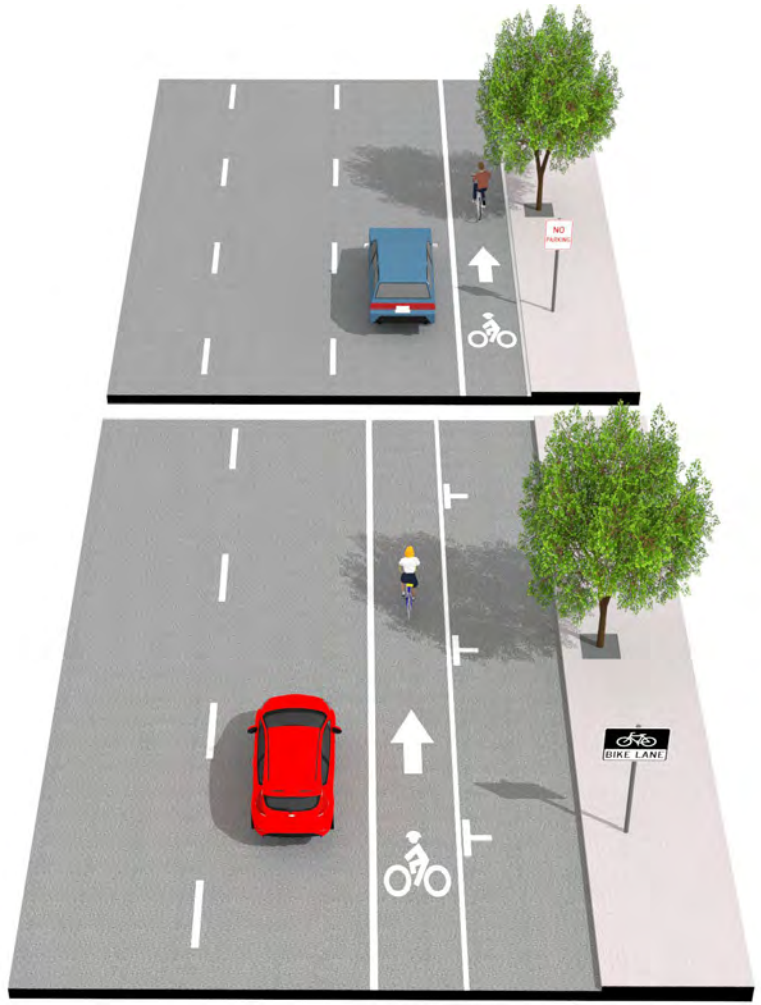


Figure 4.9: Bike Lane Without Buffer

ELEMENTS (CONTRA-FLOW BIKE LANE)

Contra-flow bicycle lanes allow people biking to ride in the opposite direction of motor vehicle traffic. Thus, the street is two-way with bikes and cars in one direction and only bikes in the other.

Use where the contraflow path closes an important gap in the network and other alternatives are not feasible. This is often evidenced by people biking riding the wrong way on the street or riding on the sidewalk.

Where speeds exceed 35 mph or traffic volumes are high, a separated bike lane is desirable for this condition.

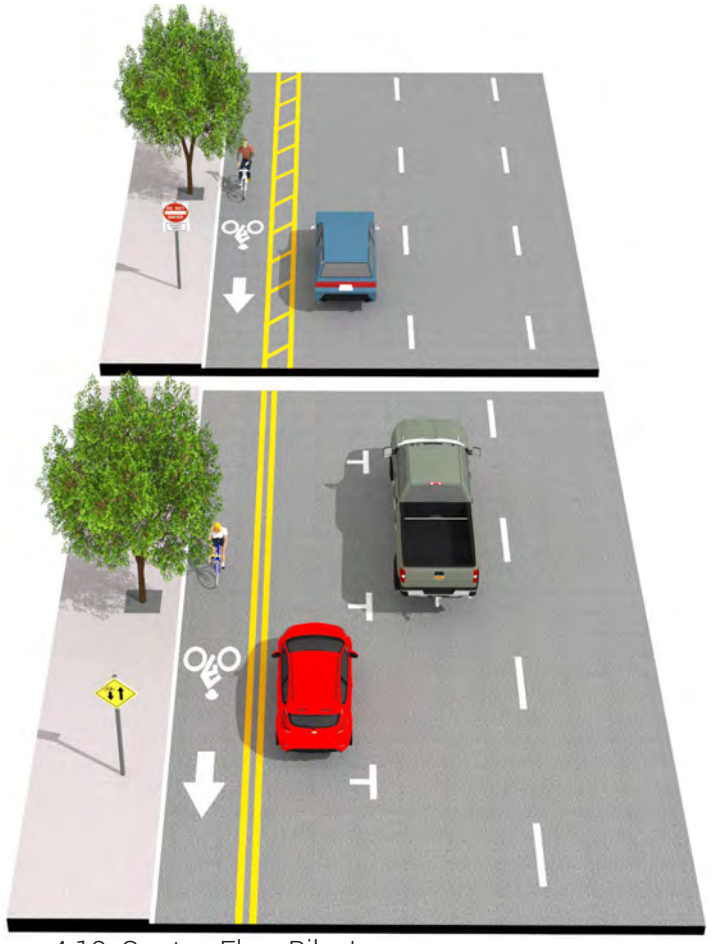


Figure 4.10: Contra-Flow Bike Lane

ELEMENTS (LEFT-SIDE BIKE LANE)

A left-side bike lane is identical to a standard bike lane but is located on the left side of a one-way street.

Use where there is heavy transit or loading activity in the right lane, on streets with a high volume of right turns, or where a left side lane better connects to other bike facilities or the majority of destinations.

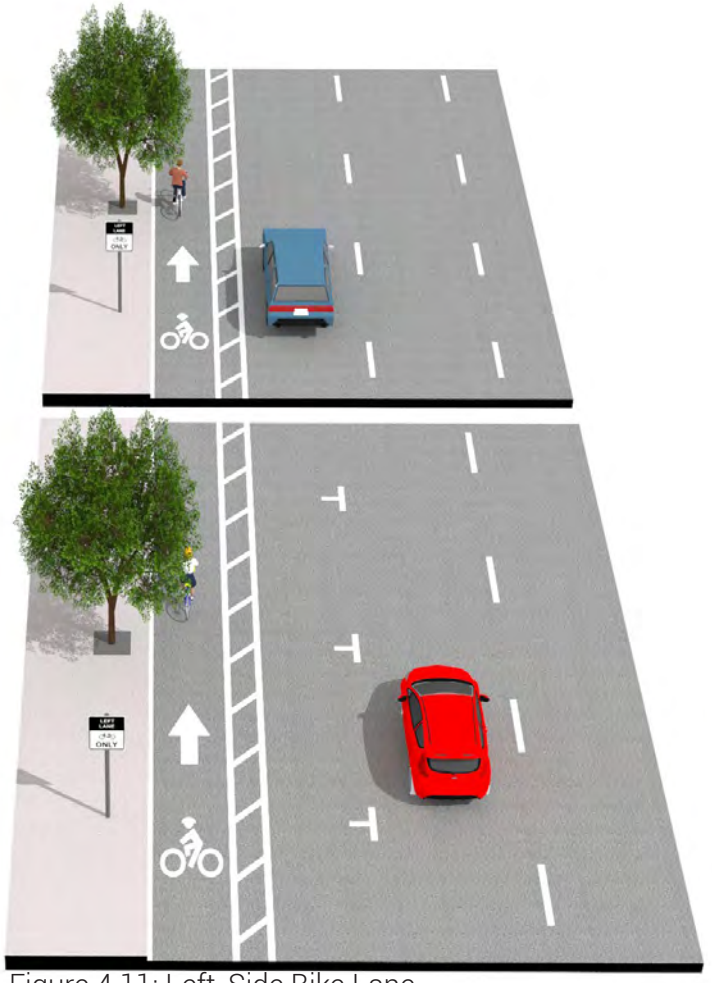


Figure 4.11: Left-Side Bike Lane

Shared On-Street

4.5 Neighborhood Bikeway



Seattle, WA

1

DESCRIPTION

Neighborhood bikeways combine three essential elements:

- Street design limits vehicle speeds and volumes to make riding in mixed traffic comfortable.
- Treatments to allow people biking to safely cross intersecting arterials
- Bicycle signage and wayfinding

Referred to in NACTO as "Bicycle Boulevards".

BENEFITS

Allows people biking to mix safely with vehicle traffic.

Maintains a good level of comfort by minimizing traffic speeds and volumes.

Creates through routes by setting up safe crossings of intersecting streets.

Improves safety for people walking.

Reduces impact of vehicle traffic on neighborhoods.

APPLICATION

Neighborhood bikeways are recommended for residential streets with ≤ 1,500 vehicle average daily traffic and where speeds are 30 mph or less. Thoroughfares are not suitable as neighborhood bikeways.

Neighborhood Bikeways may be best implemented in conjunction with the Neighborhood Traffic Management Program (NTMP), which addresses traffic related problems in residential neighborhoods, including excessive vehicular speed and cut-through traffic. The NTMP has developed a toolbox of "traffic calming" measures, including speed cushions, traffic circles, median islands, curb extensions, and diversion techniques, which may be used to reduce traffic speed and volumes.

ELEMENTS

1. The route may be marked with sharrows and bicycle signage along the length of the route, with signs in each block. These both guide people biking and keep motorists alert.

2. Lanes are not defined with markings, indicating that cars can pass people biking when it is safe.

3. Speed cushions, neckdowns, and other Neighborhood Traffic Management Program treatments slow car traffic and discourage speeding. Street parking is useful to reduce vehicle speeds.

4. Diverters and intersection treatments are used to eliminate or discourage through traffic, keeping traffic volumes down. Otherwise, the same intersection treatments at arterials that make the route useful for people biking could attract more through car traffic. The bikeway should have priority over intersecting local streets to minimize how often people biking need to stop.

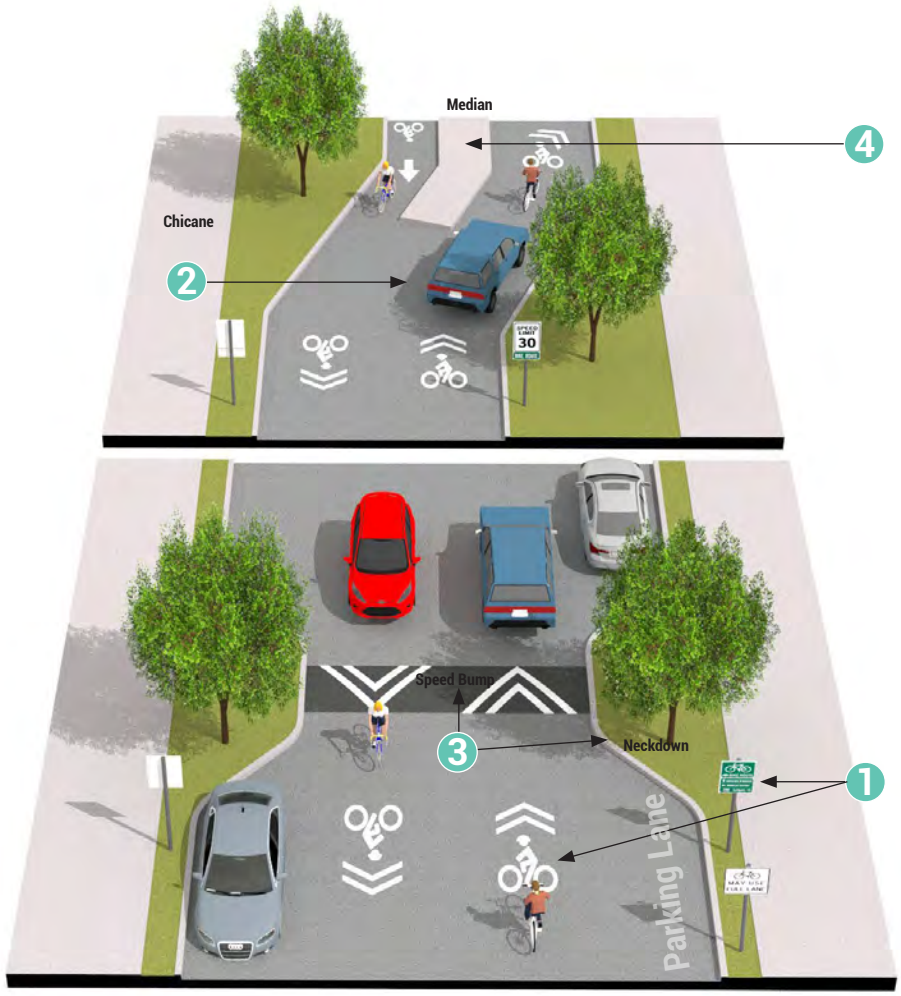


Figure 4.12: Neighborhood Bikeway

Shared On-Street

4.6 Neighborhood Shared Street



Houston, TX

1
2

DESCRIPTION

Low speed, low volume residential street shared by motor vehicles and bikes and marked with "Bike Route" signs. Unlike a neighborhood bikeway, a shared street does not include additional treatments to manage speed or volume.

BENEFITS

Clearly defines a bike route in a bikeway network.

Places bikes on streets where current conditions provide a relatively high level of comfort.

APPLICATION

Neighborhood shared streets are recommended for residential streets with ≤ 1,500 motor vehicle average daily traffic where speeds are 30 mph or less.

Streets with traffic signals on intersecting arterials should be carefully assessed for appropriateness as neighborhood shared streets since the signals may attract more through traffic.

Neighborhood shared streets should be reviewed periodically to make sure that traffic conditions still provide a high level of comfort or if additional tools may be appropriate to improve safety and comfort.

ELEMENTS

1. The route is marked with bicycle signage along the length of the route. These both guide people biking and keep motorists alert. Sharrows may be used to supplement the signs.

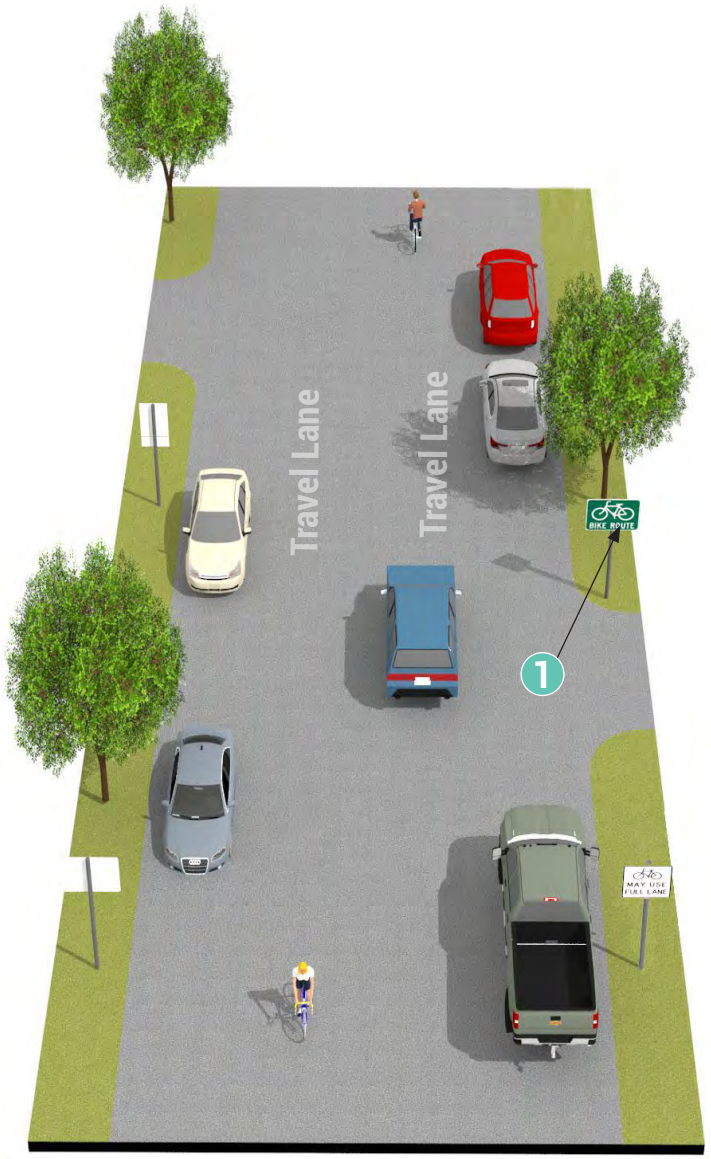
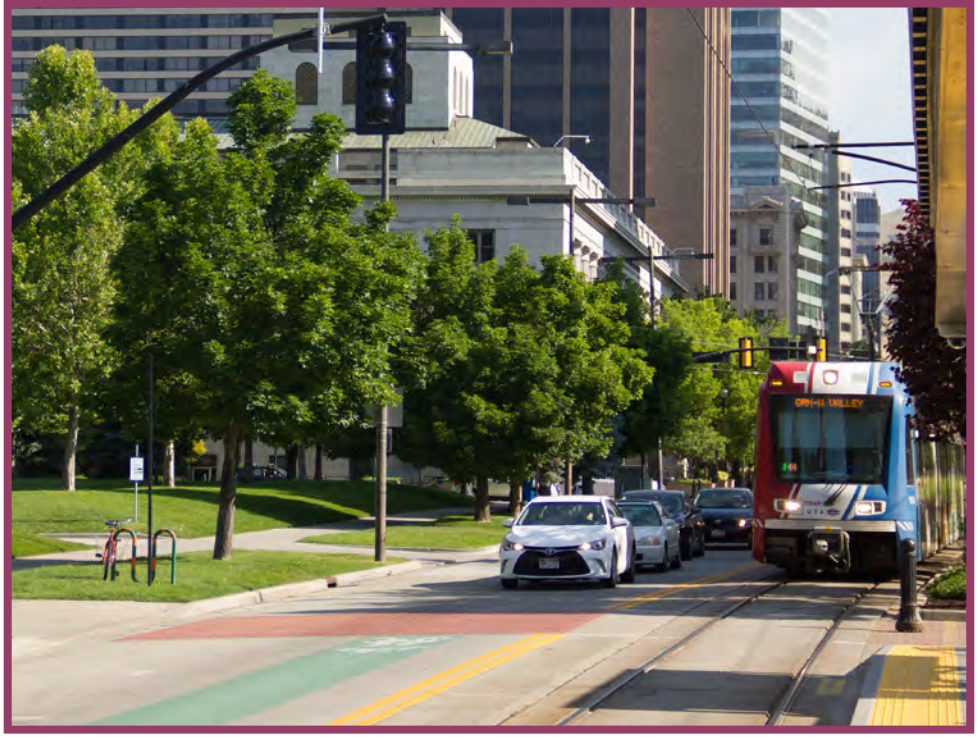


Figure 4.13: Neighborhood Shared Lane

Shared On-Street

4.7 Shared Lane



Salt Lake City, UT

3

DESCRIPTION

Lane shared by motor vehicles and bikes marked with "Bicycle May Use Full Lane" R4-11 signs and "sharrow" pavement markings.

Referred to in NACTO as "Colored bike facilities" and "Shared lane markings"

BENEFITS

Alerts motorists to bicycles.

Guides people biking through bikeway network.

APPLICATION

In situations where there is not enough space to provide separate facilities and a higher comfort bikeway is not currently possible.

In situations where traffic speeds and volumes are low enough for mixing of vehicular and bicycle traffic. This typically will be a lower comfort bicycle facility.

Shared lanes should never be applied to streets with a posted speed over 35 mph and are more appropriate on lower speed streets.

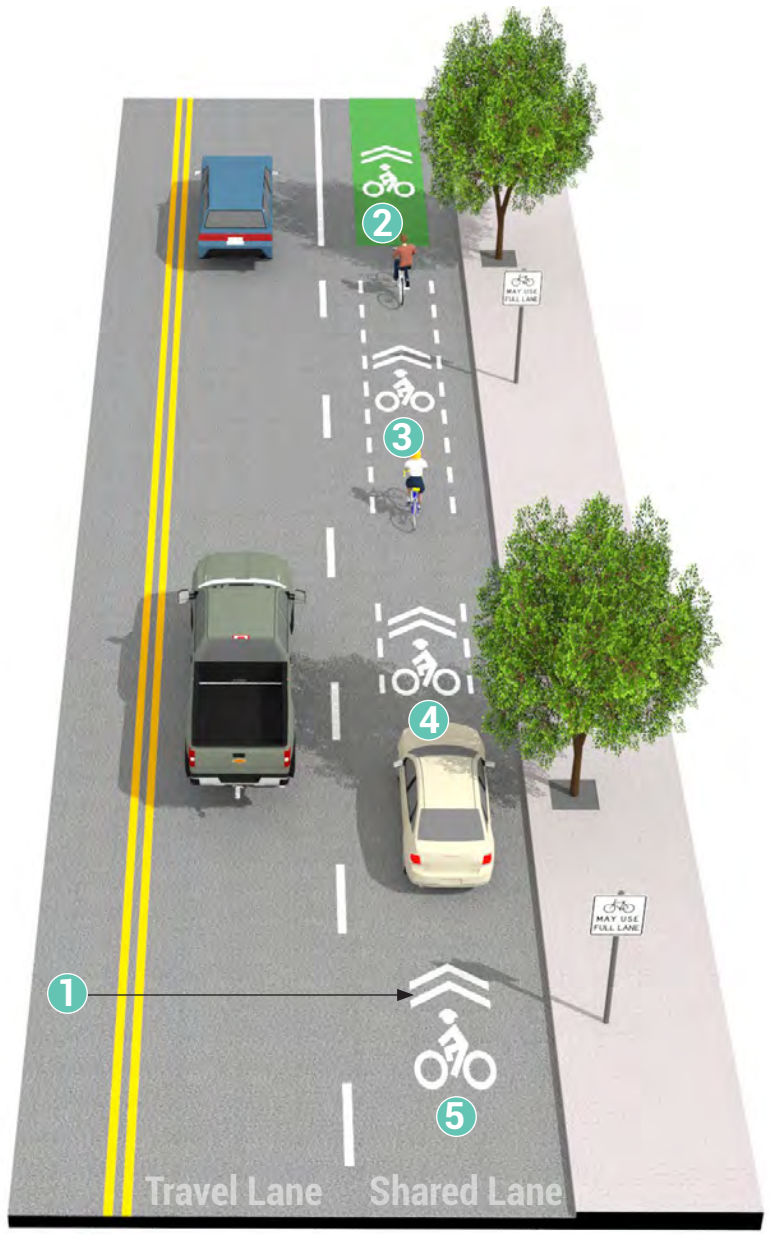
Can be applied to streets with 1 traffic lane in each direction but will work better with 2 traffic lanes in each direction.

In general, the higher the traffic volumes, traffic speeds, and intensity of turning movements are, the more visible the pavement markings should be.

May be appropriate on select non-local streets where a high comfort facility is not feasible and traffic speeds and volumes are low.

ELEMENTS

1. Markings in the center of a traffic lane indicate that bikes may use the full lane.
2. Alternate 1: "Priority shared lane" in green paint with sharrow markings. This is the highest cost and most effective treatment and should be considered where many vehicles are turning or changing lanes, where traffic volumes are relatively high, and where cars tend to move faster.
3. Alternate 2: Continuous dashed lines with sharrow markings.
4. Alternate 3: Dashed lines at sharrow markings only.
5. Alternate 4: Sharrow markings with no lines. This is the lowest cost but also least visible treatments.

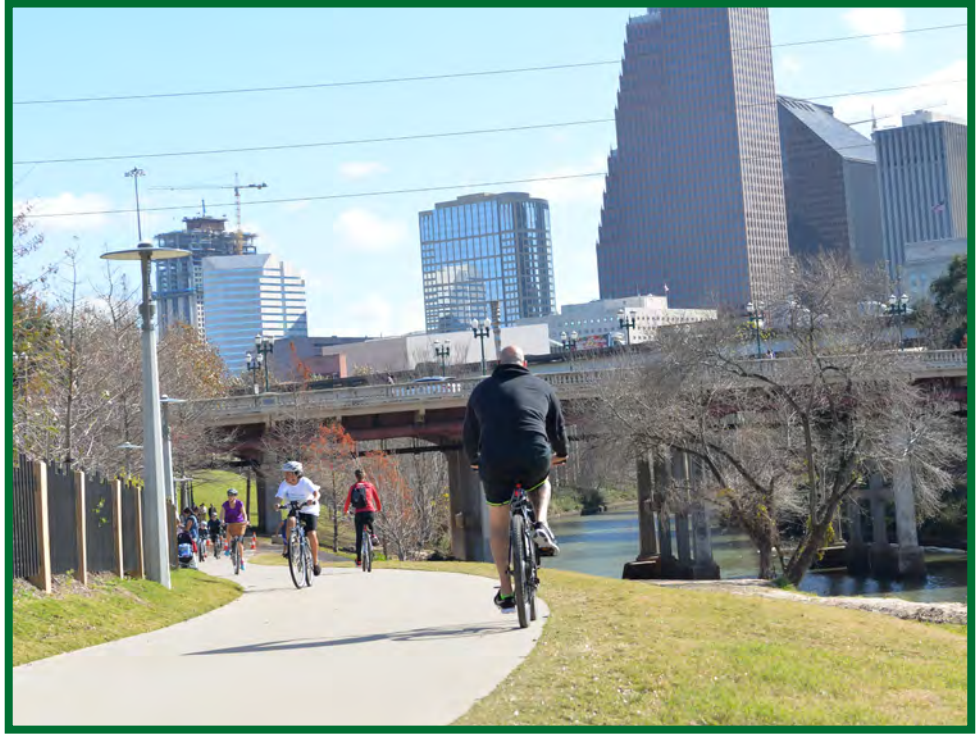


MARKING OPTIONS

Figure 4.14: Shared Lane

Off-Street

4.1 Off-Street Bike Path



Buffalo Bayou
Houston, Texas

1

2

:

:

DESCRIPTION

An off-street path is a connection for people walking and people bicycling outside of street right-of-way, often with grade separation from cross traffic.

For trails in Harris County Flood Control District rights-of-way, refer to the HCFCD "Trail Sponsor Guidance Document."

BENEFITS

High level of comfort with few vehicle conflicts and large buffer from parallel traffic.

Attractive for leisure riding and longer trips.

Can provide bypass around major barriers like freeways and railroads.

Can allow higher bicycle speeds if grade-separated from cross traffic and limited conflicts with people walking and jogging.

APPLICATION

Along bayous and drainage easements.

In rails-to-trails and other utility corridors.

In and adjacent to regional and community parks.

Parallel to freeways in an off-street right-of-way.

As a connection in areas with disconnected roadway networks.

ELEMENTS

1. Use signs and markings to indicate whether people walking and people biking share space on the path or have separate paths.
2. Alternate 1: Shared bicycle and walking path. The desirable two-way off-street bike path width is 12 feet. Minimum width in constrained locations is 8 feet.
3. Alternate 2: Path with separate lanes for bicycles and people walking include a two-way bike lane with the desired width of 12 ft (minimum 8 ft), and a walking lane with a minimum width of 5 ft (wider preferred). Walking and cycling paths do not need to remain directly adjacent.
4. Alternate 3: Bicycle only path. The desirable two-way off-street bike path width is 12 feet. Minimum width in constrained locations is 8 feet. Provide a parallel walking path.
5. Periodic rest areas are useful to both people biking and people walking.
6. Signs provide directional information and distance.

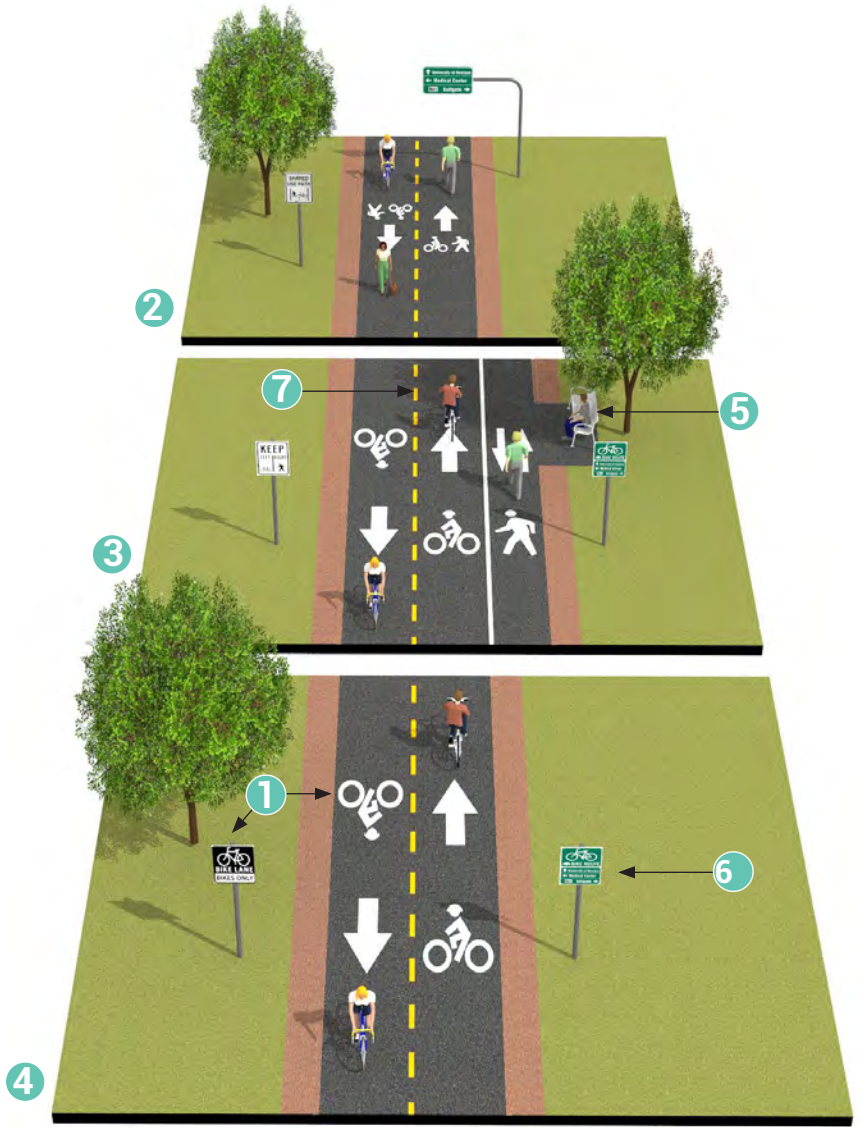
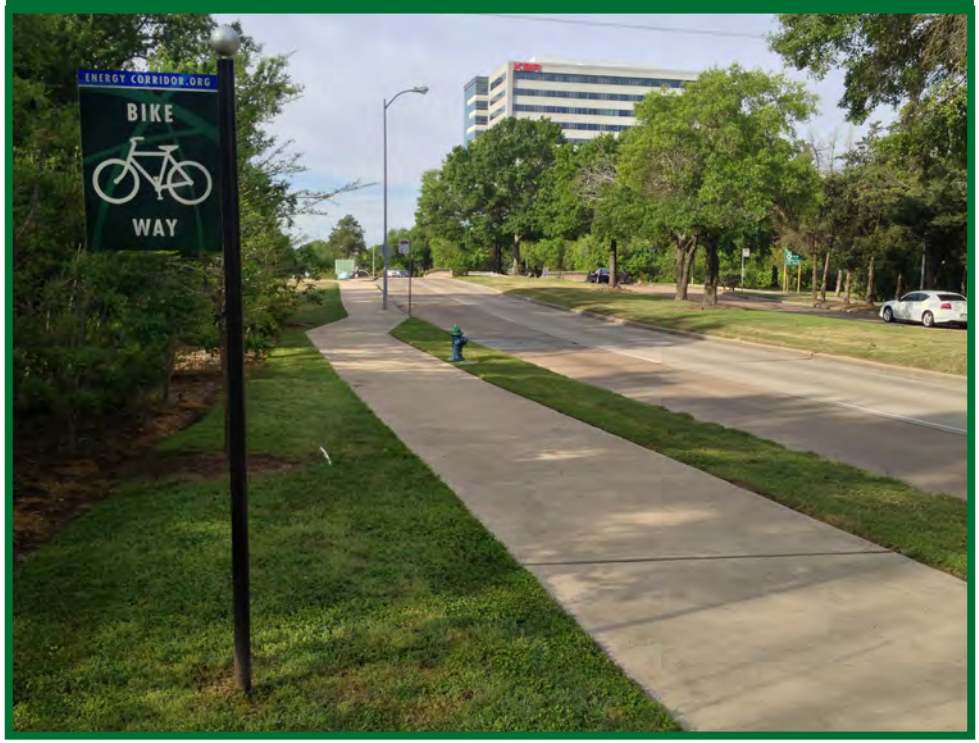


Figure 4.15: Off-Street Bike Path

Off-Street

4.2 Side Path



Houston, TX

1
2
3

DESCRIPTION

A side path is a path alongside a street but outside the roadway curbs, either shared by bicycles and people walking or for bicycles only.

May be implemented in place of an on-street dedicated bikeway in appropriate locations.

BENEFITS

Reduces conflict by separating bicycle and vehicular traffic.

Provides perceived sense of safety to casual riders.

Provides an option for adding a bike route along an existing corridor with space behind curb or where easement may be available.

APPLICATION

Along streets with high traffic volumes and speeds.

As a continuation of off-street paths.

As a retrofit on existing roadways where right-of-way permits.

May not be desirable in areas with high volumes of people walking or with closely spaced driveways.

Generally better suited to residential areas than commercial areas.

ELEMENTS

1. The path is at sidewalk level, separated from the roadway by a curb or a ditch.
2. Alternate 1: Shared path, use in locations with low person walking traffic or other constraints. Minimum recommended width is 8 feet although 10 feet is preferred.
3. Alternate 2: Separate bicycle and walking paths. This can be implemented as a one-way path on each side of the street or as a single two-way path. Minimum recommended two-way bikeway width is 8 feet although 10 feet is preferred and walking lane width is 5 feet. If a one=way bike path is provided, a one-way bike path width of 5 feet plus a 5 foot sidewalk is acceptable.
4. The path is protected from the adjacent roadway lane with a planted buffer or a buffer strip of contrasting paving materials. Recommended minimum buffer width is 1 foot (measure from back of curb.) If parking is provided, recommended buffer is 3 feet.
5. Bike signage makes clear that bicycles may use the path.

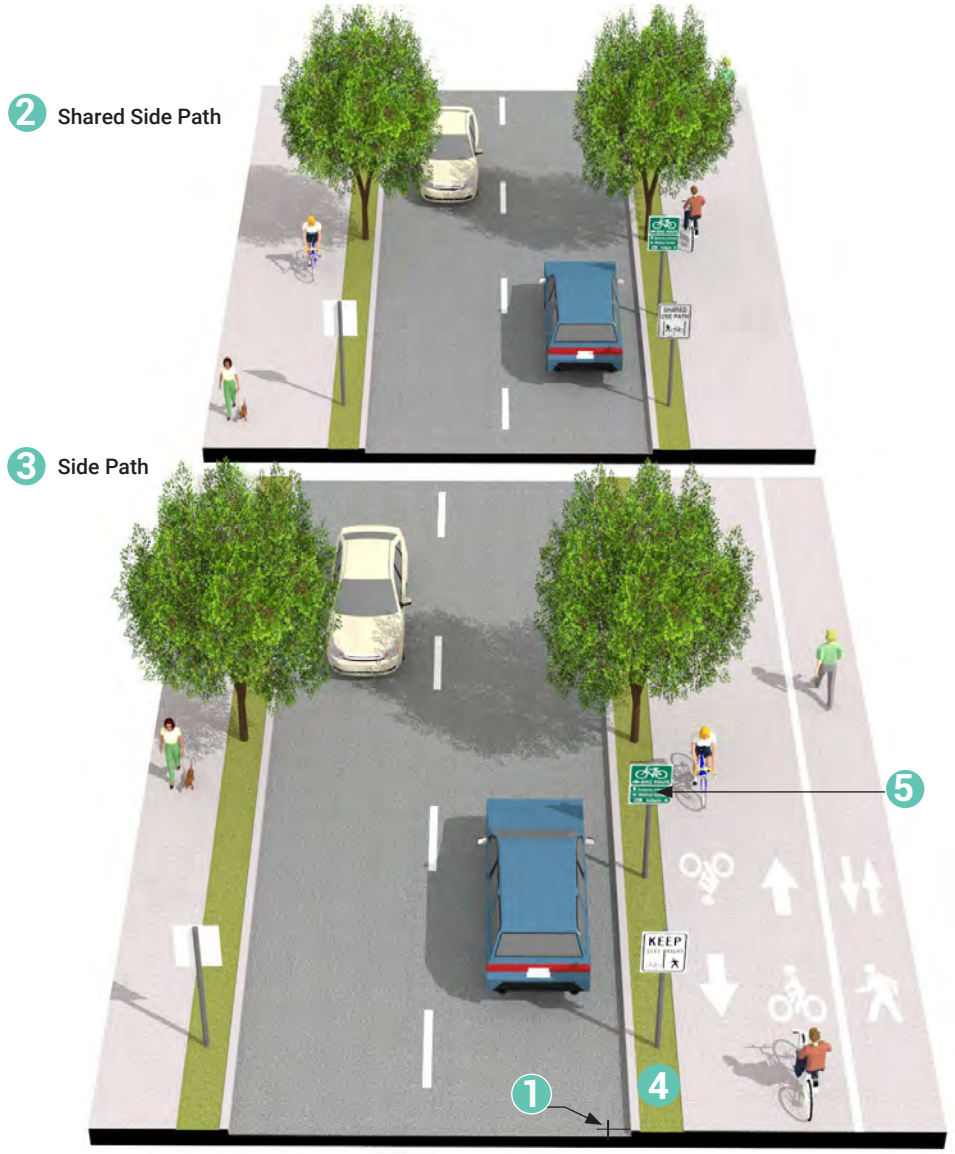


Figure 4.16: Side Path

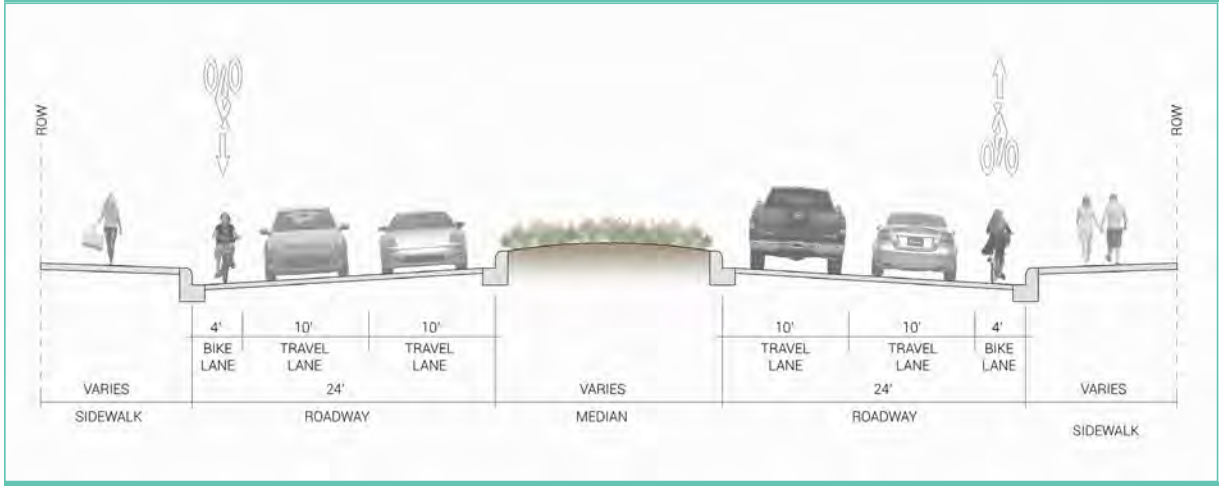
Projects - Common Situations

Common Road Sections

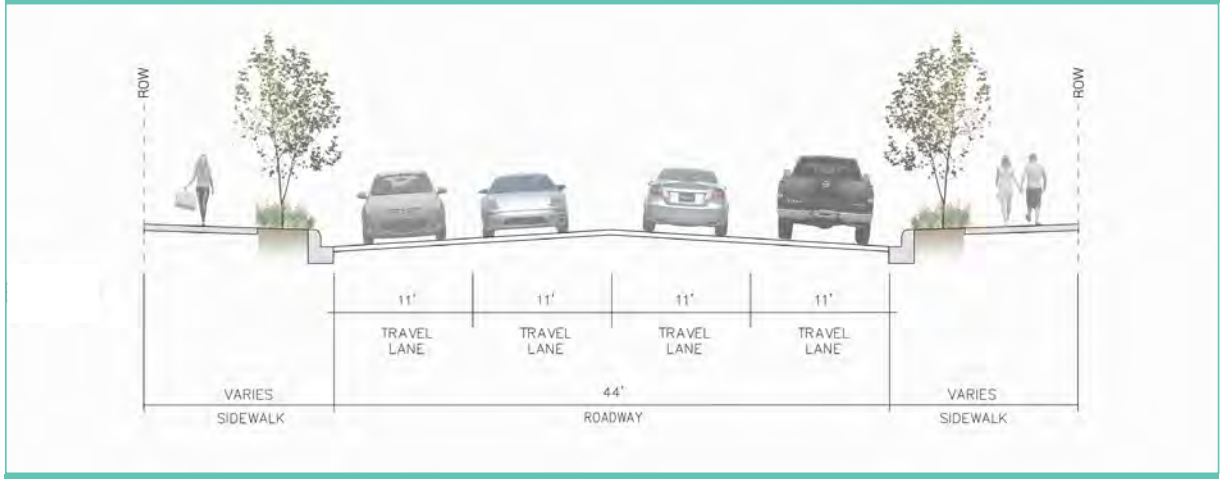
Since many Houston roadways have been built under the same set of standards, some roadway sections are very common across the city. Thus, certain challenges – and opportunities – will reoccur again and again as the city builds out its high-comfort bikeway network. This section shows the options for integrating bikeways in some of these sections. Additionally, this section provides guidance on appropriate crossings of thoroughfares where intersections are not signalized.

COMMON ROAD SECTIONS

Boulevards with 24' Roadway Sections 4-29



4 lane roadways 4-35



Minor Crossings at Thoroughfares 4-37

Common Road Sections

Boulevards with 24' Roadway Sections



Houston, TX

COMMON SITUATION

Many older sections of Houston are designed as median boulevards with 24' roadways on each side of the median. In previous projects, bike lanes have been retrofitted onto these boulevards, creating narrow lanes. This leads to discomfort as well as potentially unsafe passing scenarios.

POTENTIAL SOLUTION

The 4' bike lane is a below standard lane width and often leads to conflicts with gutter pans and drainage inlets. Furthermore, it is difficult for vehicles to follow the City's 3 foot passing ordinance while staying in their travel lane adjacent to the bike lane. The 10' driving lanes can be too narrow for large vehicles.

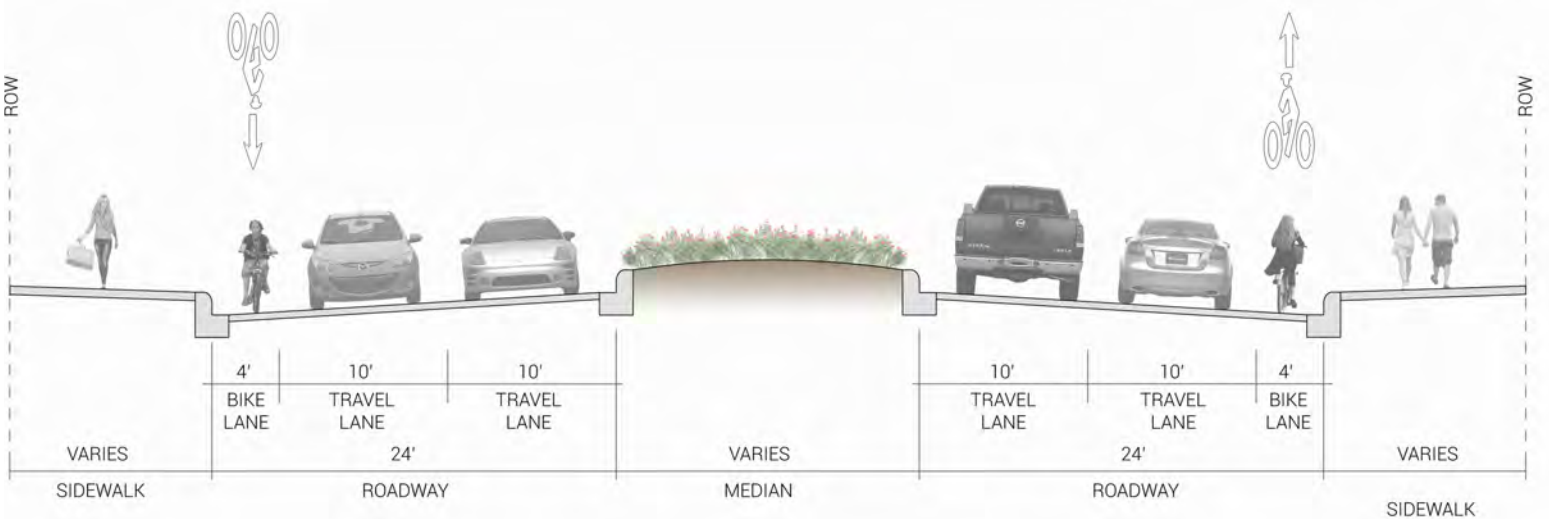
The section of these boulevards should be reimagined with the safety and comfort of people biking in mind. Several options are available to make a more bike-oriented roadway, some requiring larger right-of-ways and wider medians than others. Where no improvements are reasonably possible it may be advisable to remove the below standard bicycle facility and provide an alternate route.

The options presented on the following pages illustrate potential approaches to take into consideration. These can provide wider, more comfortable bike facilities, through consideration for design options such as narrowing medians, removing travel lanes, reallocating pedestrian realm space, adding buffers, or where appropriate, sharing the road. Which options are appropriate in a specific situation will depend on context, and the City of Houston will need to review each situation to identify the preferred approach.

EXISTING SECTION

0 Existing 4' Bike Lane / 10' Travel Lanes

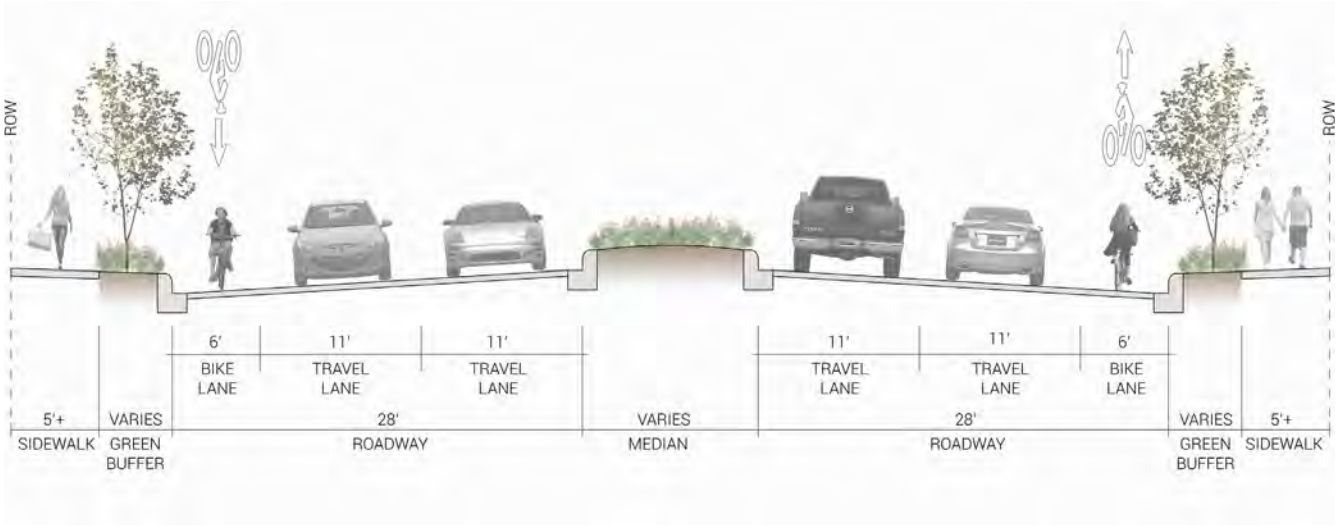
Narrow distances between people biking and vehicles lead to conflicts and an uncomfortable and uninviting biking experience, particularly if there is a gutter or other debris that collects in the bike lane.



ALTERNATIVE OPTIONS

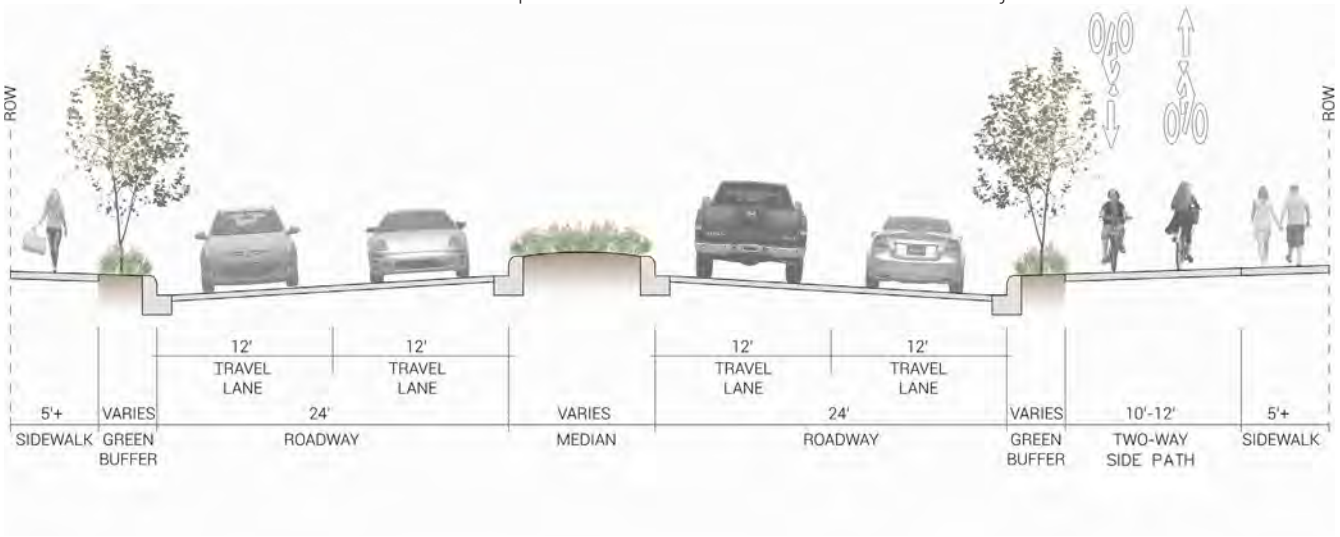
1 Narrowed Median

By narrowing the median, the bike lane can be widened to 6 ft, which is the preferable width for one-way bike lanes. Travel lanes are widened, leading to safer distances between rider and vehicle. This option works best in scenarios with wide medians.



2 Side Path - Two Way Bike Lane

By removing the bike lanes from the roadway, vehicle travel lanes are widened to comfortable 12 foot lanes (or 11 ft lanes with a 2 ft gutter). Bicycle traffic is moved behind one curb as a two-way bike path adjacent to a person walking zone. This option works best in scenarios with wide sidewalks and minimal conflict points on one side of the street or with all the major destinations on one side.



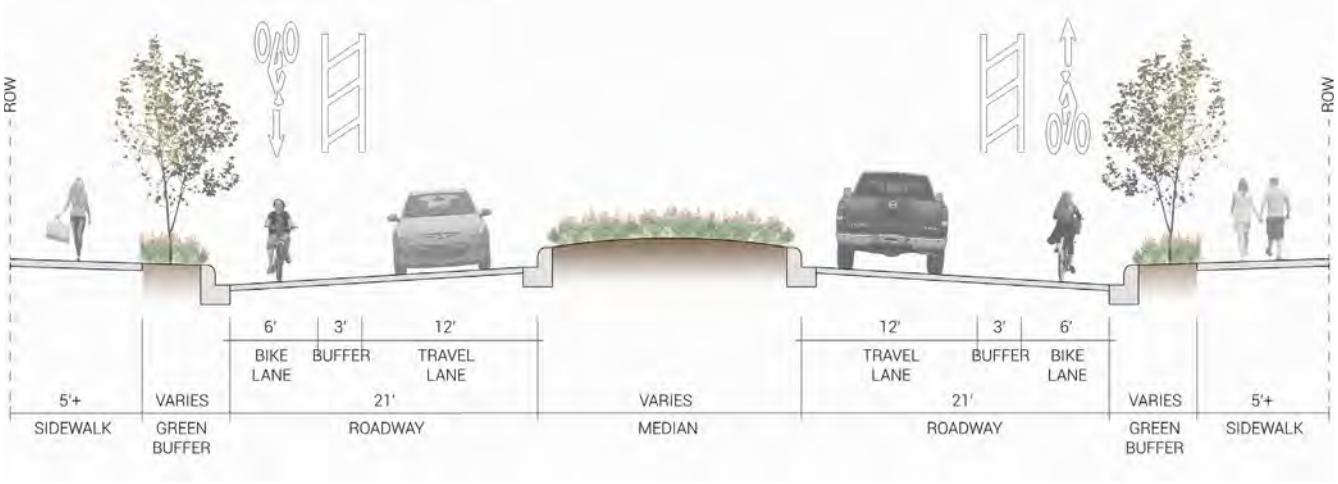
3 Side Path - One Way Bike Lane

By removing the bike lanes from the roadway, vehicle travel lanes are widened to comfortable 12 ft lanes (or 2 - 11 ft lanes with a 2 ft gutter). Bicycle traffic is moved behind the curbs in one-way bike lanes on each side of the street. This option works best in scenarios with wide person walking realms with minimal conflicts from trees and other potential obstructions.



4 Convert Travel Lane to Bike Lane

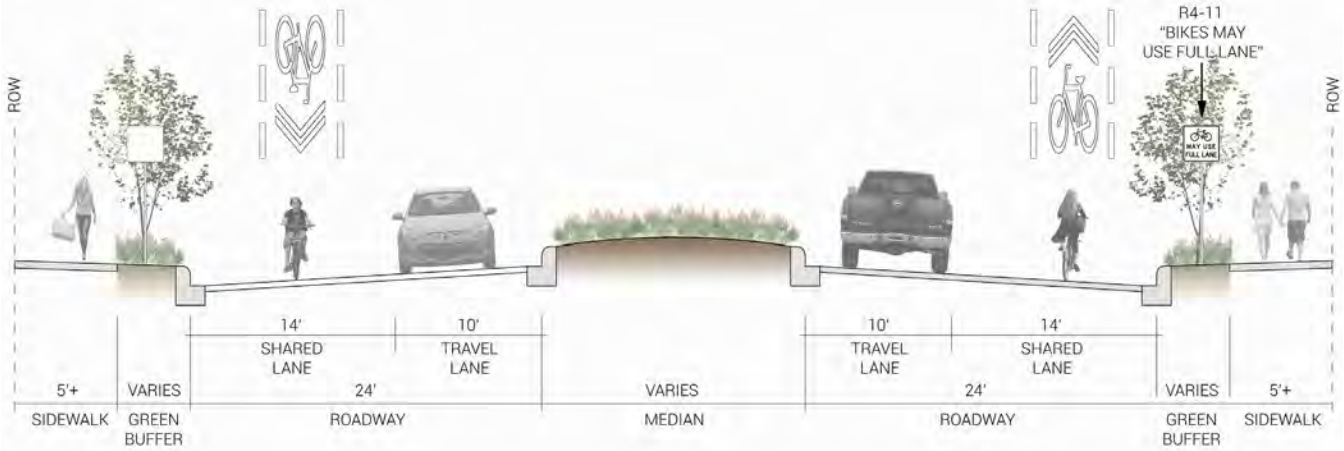
By removing a vehicle travel lane, a buffered bicycle lane can be inserted. This increases rider comfort and potentially reduces vehicular traffic/speed. This option works in scenarios where neither the sidewalk nor the median can change in width and/or existing traffic volumes can be accommodated by fewer traffic lanes. Additional width could be allocated to widen the median and/or pedestrian realm.



ALTERNATIVE OPTIONS (CONT.)

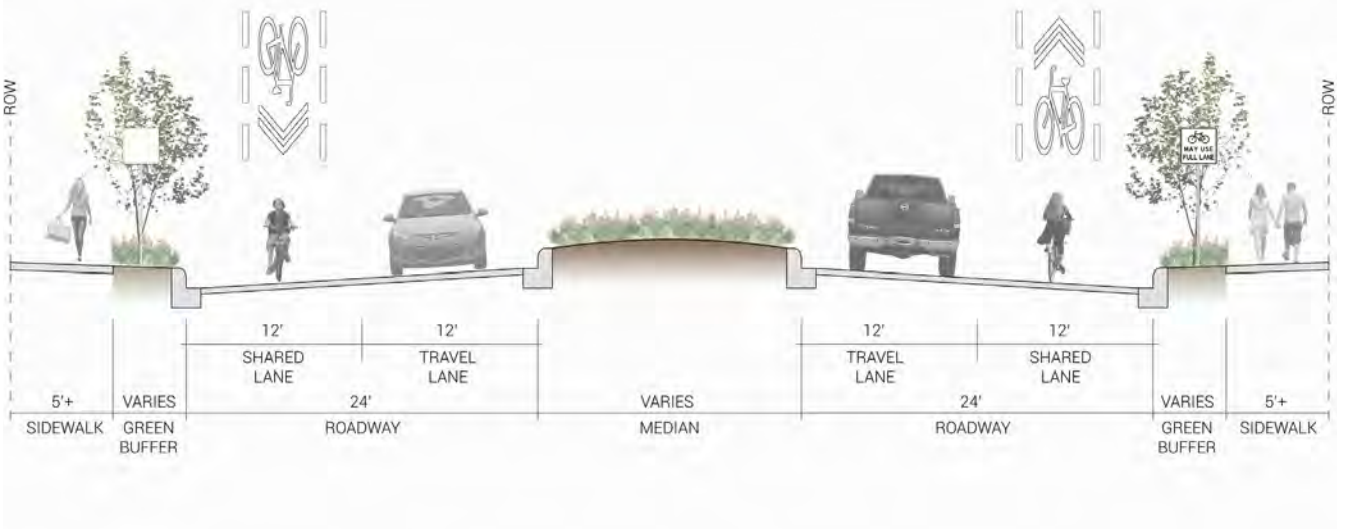
5 Shared Lane - Wide Outside Lane

By converting the 24' roadway to two travel lanes, a wider 14' shared lane can be marked and signed on the outside lane, with a narrower travel lane adjacent to the median. This may allow for easier vehicular passing of bicycles, allowing a car to pass a person bicycling without leaving the lane while keeping the 3 foot safe passing space required by city ordinance. This option works in scenarios where neither the sidewalk nor the median can change in width and should only be used in low traffic, low speed scenarios where people biking can ride comfortably with vehicular traffic. Wide lanes should be monitored to ensure they do not encourage excessive travel speeds. This treatment is typically not applicable to thoroughfares.



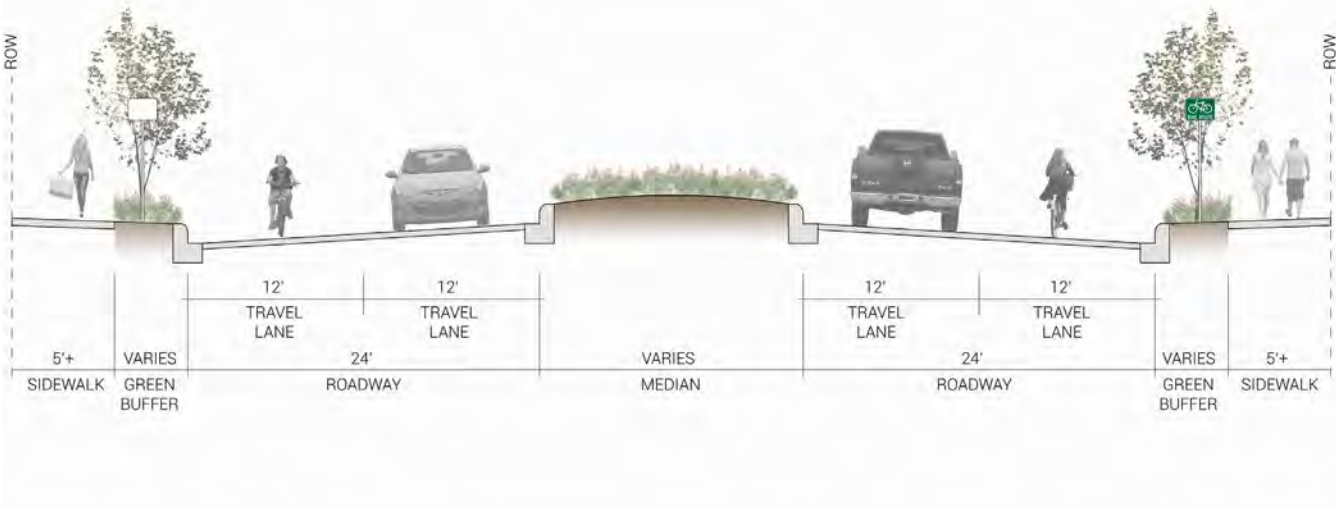
6 Shared Lane - Narrow Outside Lane

By converting the 24' roadway to two travel lanes, a narrow shared lane with can be marked and signed. This option works in scenarios where neither the sidewalk nor the median can change in width and should only be used in low traffic, low speed scenarios where people biking can ride comfortably with vehicular traffic. This may be more appropriate than option 5 in areas with significant truck traffic. This treatment is typically not applicable to thoroughfares.



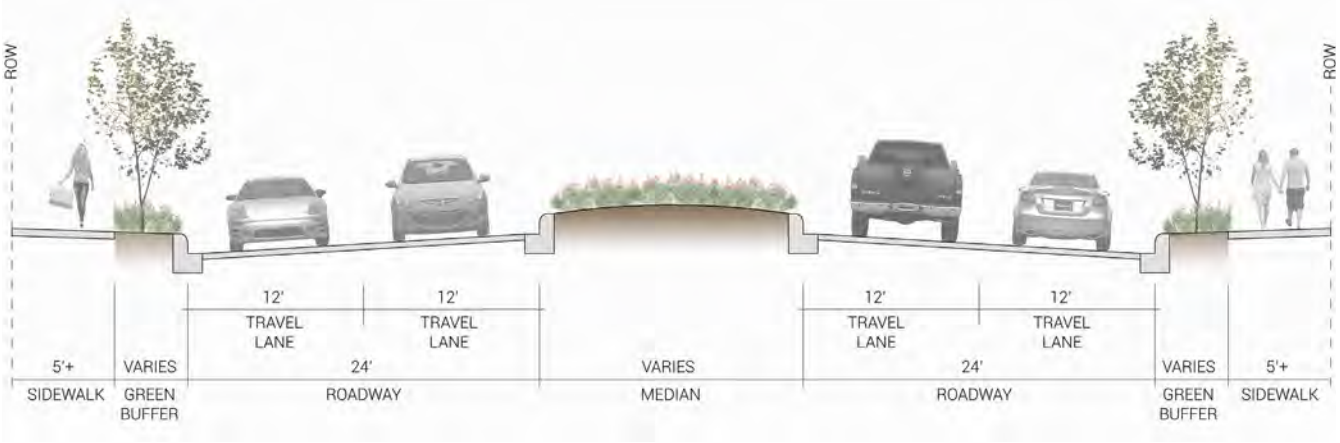
7 Shared Street

By removing the bike lanes from the roadway, vehicle travel lanes are restriped to 2 - 12 ft lanes and the roadway can be designated as a Bike Route. "Bike Route" signs should be placed periodically along the route. This option should only be used in low traffic, low speed scenarios where people biking can ride comfortably with vehicular traffic, preferably on non-arterial neighborhood streets where other approaches have been determined to not be possible.



8 No Bike Facility

In scenarios where neither the sidewalk nor the median can change in width, and traffic volumes and speed do not allow for the safe application of shared lanes, the bike lanes should be removed and relocated to more appropriate streets. Confident cyclists may still utilize this roadway but it would not be designated on bikeway maps.



Common Road Sections

4-Lane Roadways



Houston, TX

PROBLEM

There are significant stretches of major arterial and collector streets in Houston with a 4-lane cross section. These streets do not include any bicycle facilities, though some are designated as bicycle routes. They are also compromised by the lack of turn lanes which can limit the capacity of the street as vehicles waiting in the inside lanes to turn significantly reduce the traffic capacity of the street. Four lane roads frequently experience higher crash rates due to lack of dedicated space for turning vehicles leading to conflicts with through traffic (Road Diet Informational Guide, FHWA-SA-14-028, November 2014, section 3.1.) In many cases, these streets do not have additional right-of-way available.

POTENTIAL SOLUTION

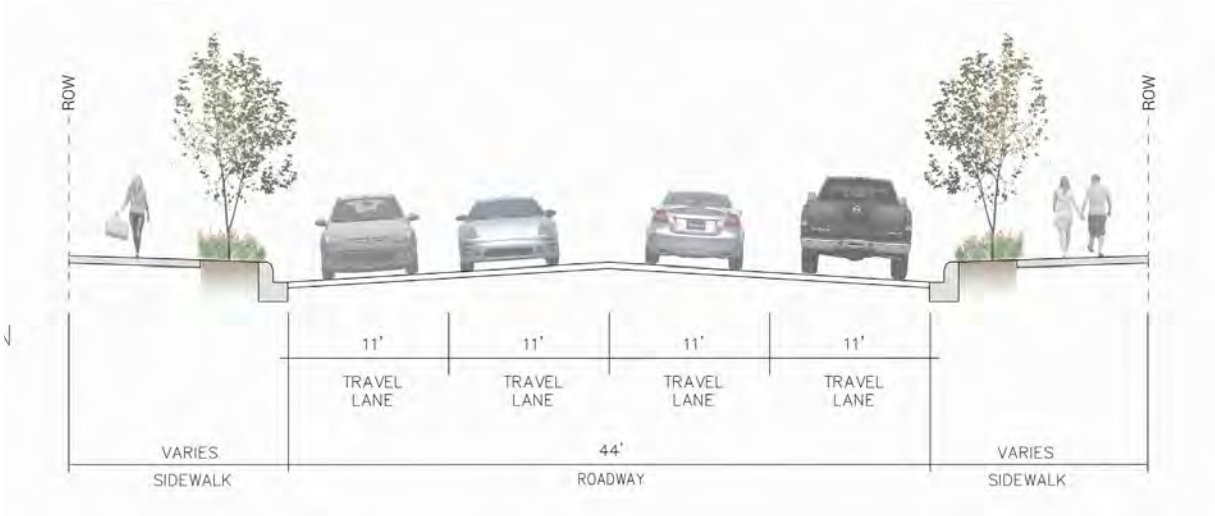
In many cases, optimizing a roadway by changing the cross-section from two traffic lanes in each direction to one through lane in each direction with a center turn lane would smooth traffic flow and provide comparable traffic capacity. Many studies have looked at these 4 to 3 lane conversions and found the street is adequately handling equivalent or greater traffic volumes, sometimes up to 20,000 vehicles per day. (Road Diet Informational Guide, FHWA-SA-14-028, November 2014, section 3.3.5.)

By reallocating the traffic lanes, space is freed up to add bike lanes. On a street with significant bike volumes, this can actually lead to a meaningful increase in traffic capacity since bicycles are not in the regular traffic lanes.

EXISTING SECTION

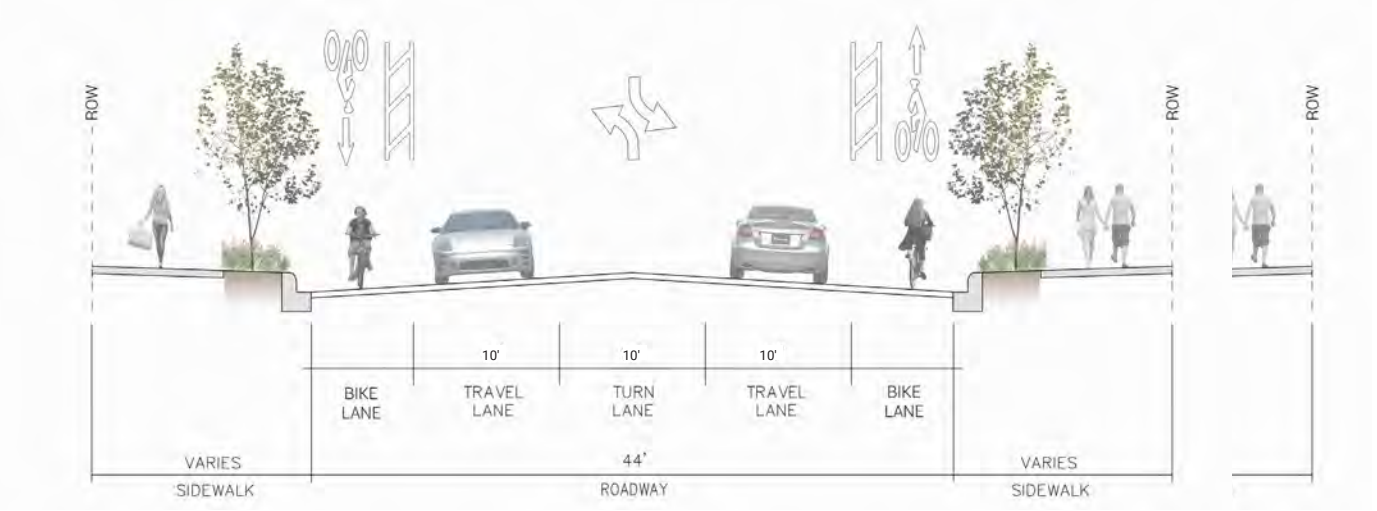
0 Existing 4-Lane Roadway Section, 11' Travel Lanes

Four 11 foot lanes add up to a 44 ft roadway section.



1 One-Way Buffered Bike Lanes

Using 10 foot traffic lanes allows for a buffered bike lane in each direction in the same pavement section. This is only one possible conversion; other cross sections, such as unbuffered lanes or two-way buffered bike lanes are also possible.



Common Situations

Minor Street Crossings at Thoroughfares



Toucan Crossing
Tuscon, AZ

PROBLEM

While neighborhood streets and other minor roadways with fewer vehicles and lower speeds may typically be more comfortable for people biking, there are a significant number of instances where these roadways cross thoroughfares with much higher traffic volumes and speeds. Many times these intersections are not signalized and do not meet recognized signals warrants. These intersections can pose difficulty for people biking to cross the street and require close attention to ensure they address the challenge of crossing for all users of the intersection. Many times the person biking must wait for traffic in both directions to clear before crossing, which results in significant wait times and difficulties judge both directions simultaneously for appropriate gaps.

POTENTIAL SOLUTION

Utilizing intersection treatments such as crossing markings, advanced signage, median enhancements or refuge islands and innovative traffic control approaches can be effective methods of optimizing the intersection for people crossing on bikes.

NACTO states that at unsignalized crossings of major streets, treatments should result in decreased crossing distances and improve visibility for bicyclists and/or enhance the general awareness of the crossing. Treatments that are potentially appropriate for streets with three or fewer travel lanes and speeds under 35 mph include advance warning signs, curb extensions, intersection crossing markings. and raised intersections.

Crossings of major streets with three or more travel lanes and posted speeds over 35 mph should aim to improve safety and comfort for bicyclists. Potentially appropriate treatments include median refuge islands, traffic beacons and other intersection traffic control devices outlined in this Bike Plan Toolbox or other best practice design guidelines.

EXAMPLES







All images:

Portland, OR bicycle boulevard treatments

Source: NACTO

Projects - Intersection Treatments

Recommended Intersection Treatments

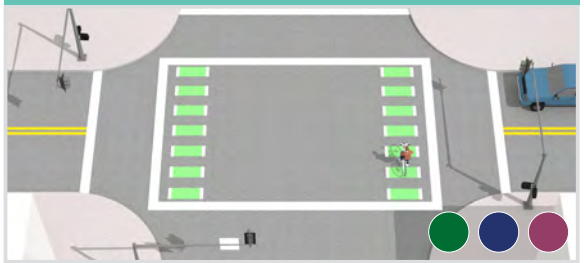
Intersection treatments are critical in creating a high-comfort bikeway network. Intersections are the points of maximum conflict between people on bicycles and people in cars, and thus will determine the Level of Comfort of the entire route.

The treatments are color-coded to show which bikeway types they are compatible with.

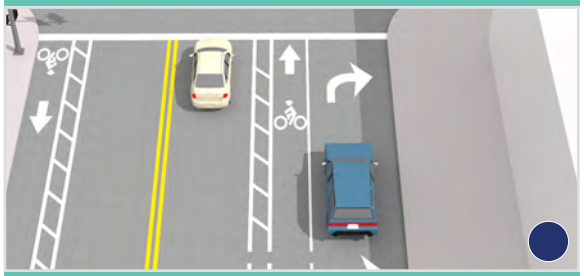
Bicycle intersection designs are evolving rapidly. Thus, national and statewide standards, including the Texas MUTCD, do not include all of these types and special design approvals may be required.

INTERSECTION TREATMENT

4.8 Intersection Crossing Markings 4-41



4.9 Turn Lane Treatments 4-43



4.10 Bike Box 4-49



4.11 Two-Stage Turn Queue Box....4-51



INTERSECTION TREATMENT

4.12 Protected Intersections.....4-53



4.13Beacons 4-55



4.14 Median Refuge Islands.....4-57



4.15 Neighborhood Intersections...4-59



SIGNALING

4.16 Bike Signal Treatment 4-61

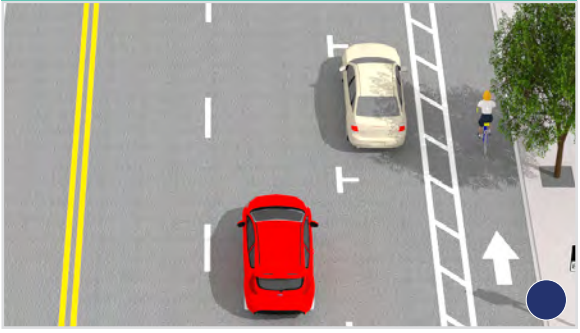


SPECIAL CONDITIONS

4.17 Floating Bus Stop.....4-63



4.18 Parking Protected Bike Lane..4-65

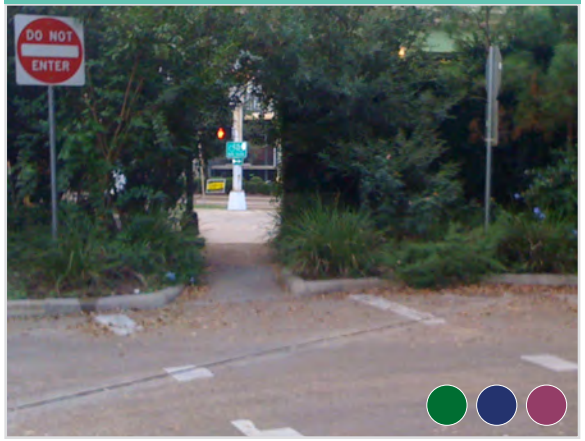


CONNECTIONS

4.19 Bridges / Tunnels 4-67



4.20 Shortcuts 4-69



Off-Street

Dedicated

Shared

Intersection Treatment

4.8 Intersection Crossing Markings



Chicago, IL

- **Off-Street**
- **Dedicated**
- **Shared**

DESCRIPTION

Intersection crossing markings indicate the intended path of people biking across an intersection with dashed lines and optional green paint.

BENEFITS

Makes bicycle movements through an intersection more predictable.

Raises awareness for both people biking and motorists in potential conflict areas.

Reinforces correct yielding behavior by indicating that through people biking have priority over turning vehicles or vehicles entering the roadway from driveways or cross streets.

Helps people biking maintain a straight and direct path through the intersection.

APPLICATION

Across signalized intersections, particularly through wide or complex intersections where the bicycle path may be unclear.

Across Stop or Yield-controlled cross-streets.

Across driveways.

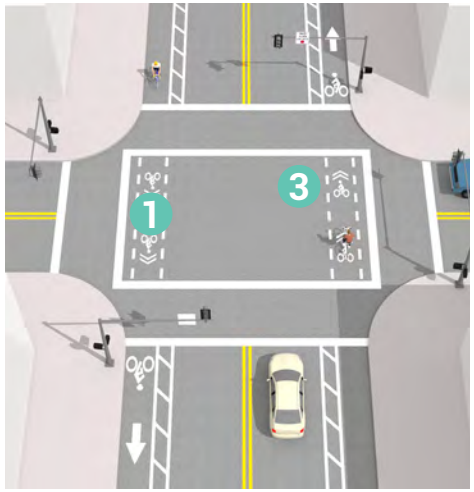
Use where needed, not applicable for all intersections.

ELEMENTS

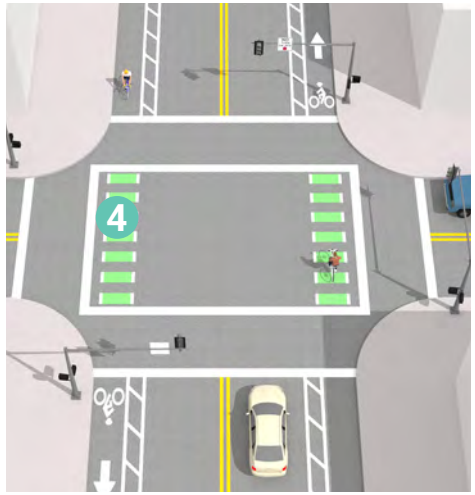
1. Match width and positioning of the bike lane so that people biking can cross the intersection in a direct path.
2. Dotted lines should be 2 foot lines with 2 to 6 foot spacing.
3. Provide shared lane markings in high conflict areas positioned in the center of driving lanes for high visibility. On two-way paths, use markings in opposite directions in the two lanes.
4. Use green paint in particularly high conflict areas or as part of bikeways where the entire length of the bikeway is painted green.

INTERSECTION MARKINGS

Conventional Markings

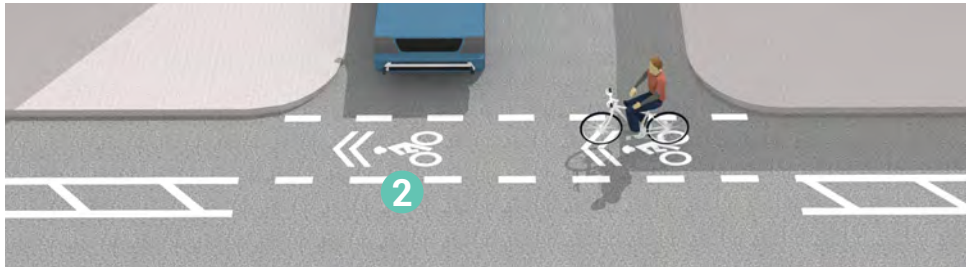


High Conflict Markings



DRIVEWAY MARKINGS

Conventional Markings



High Conflict Markings

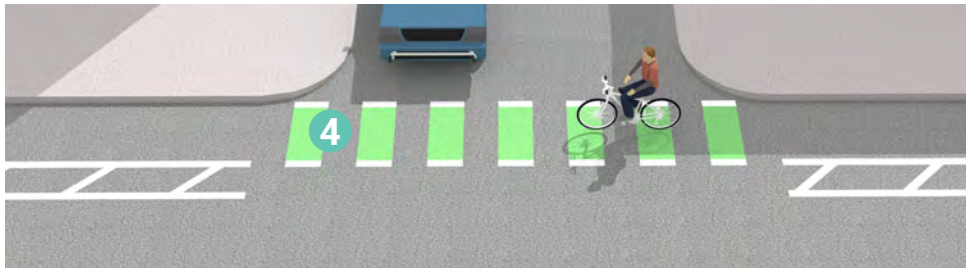


Figure 4.18: Intersection Crossing Markings

Intersection Treatment

4.9 Turn Lane Treatments



Portland, OR

Dedicated

DESCRIPTION

Turn lane treatments resolve conflicts between people biking and right-turning cars at intersections.

Design treatment should seek to increase visibility and limit conflicts and risk of people biking being hooked by turning vehicles.

Intersection Treatment

4.9.1 Turn Lane Through Lane

DESCRIPTION

In a through lane treatment, turning vehicular traffic crosses over the bike lane into its own vehicular turn lane, which begins just ahead of the intersection (replacing a parking lane or landscaping). The width and direction of the bike lane is uninterrupted.

BENEFITS

Places people biking between traffic going straight and turning traffic, making traffic flow when light turns green easy and conflict-free.

Separates conflict point between people biking and turning cars from the intersection, allowing drivers to focus on one conflict at a time.

Provides people biking with a clearly defined area to wait at a light.

APPLICATION

Where separation of turn movements from bicycle/vehicle weaving is beneficial and bike lane can be maintained through the intersection.

ELEMENTS

1. Bike lane width matches mid-block bike lane.
2. Bike lane is located between the turn lane and the through lane.
3. Dotted lines signify a merge zone.
4. Right-turn only lanes should be designed appropriately and should be no longer than necessary to accommodate the appropriate queues. Fast moving traffic on both sides can be uncomfortable for people biking.
5. Use green paint in particularly high conflict areas or as part of bikeways where the entire length of the bikeway is painted green.

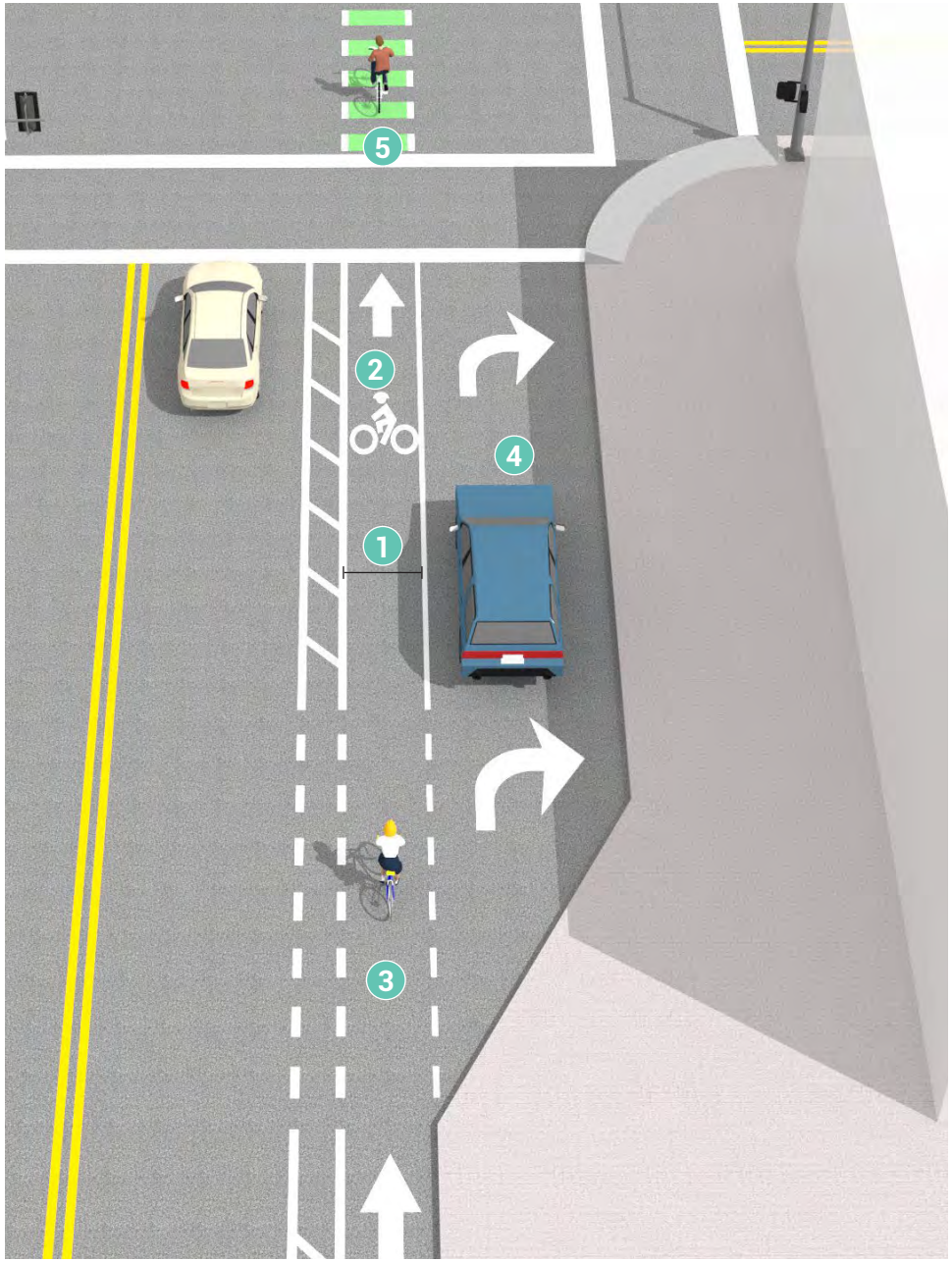


Figure 4.19: Turn Lane



Right Turn Treatment

Portland, OR

Intersection Treatment

4.9.2 Turn Lane
Bend-In Crossing

DESCRIPTION

A bend in crossing treatment pushes the bicycle lane out directly adjacent to a narrowed combined vehicular through/turn lane.

BENEFITS

Promotes visibility in advance of the intersection.

APPLICATION

On cycle tracks and bike lanes adjacent a combined through/right turn vehicular traffic lane.

Where increased visibility is required to minimize conflict between through people biking movements and turning vehicles.

ELEMENTS

1. Bicycle lane continues all the way to the intersection.
2. The sidewalk bumps out to follow the bike lane. This move forces the person driving to notice and acknowledge the person biking.

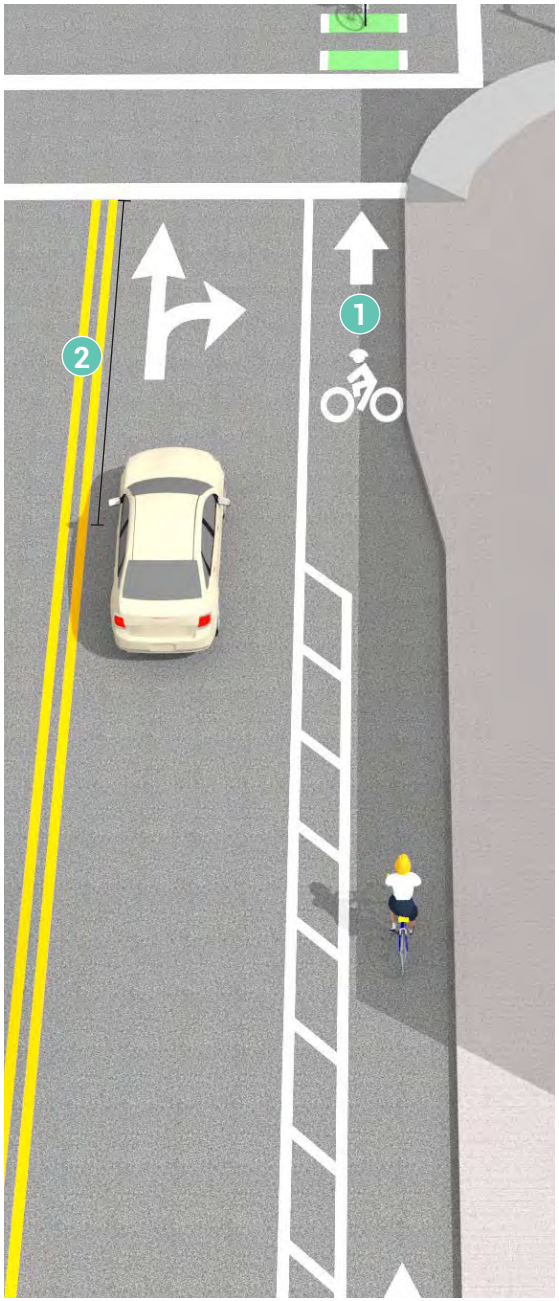


Figure 4.20: Bend-In Crossing

Intersection Treatment

4.9.3 Turn Lane Mixing Zone

DESCRIPTION

The bicycle lane ends in advance of the intersection, where a shared right turn and bicycle lane is provided.

BENEFITS

Clarifies bicycle and driver behavior better than simply ending a bike lane.

APPLICATION

On streets where there is a right turn lane but not enough space to maintain a bicycle lane at the intersection.

Typically lower level of comfort than a through lane or combined lane treatment.

ELEMENTS

1. Bicycle lane ends where the right turn lane begins.
2. Turn lane is fully shared between people on bicycles turning right or going straight and people in cars turning right. People on bicycles may use full lane.

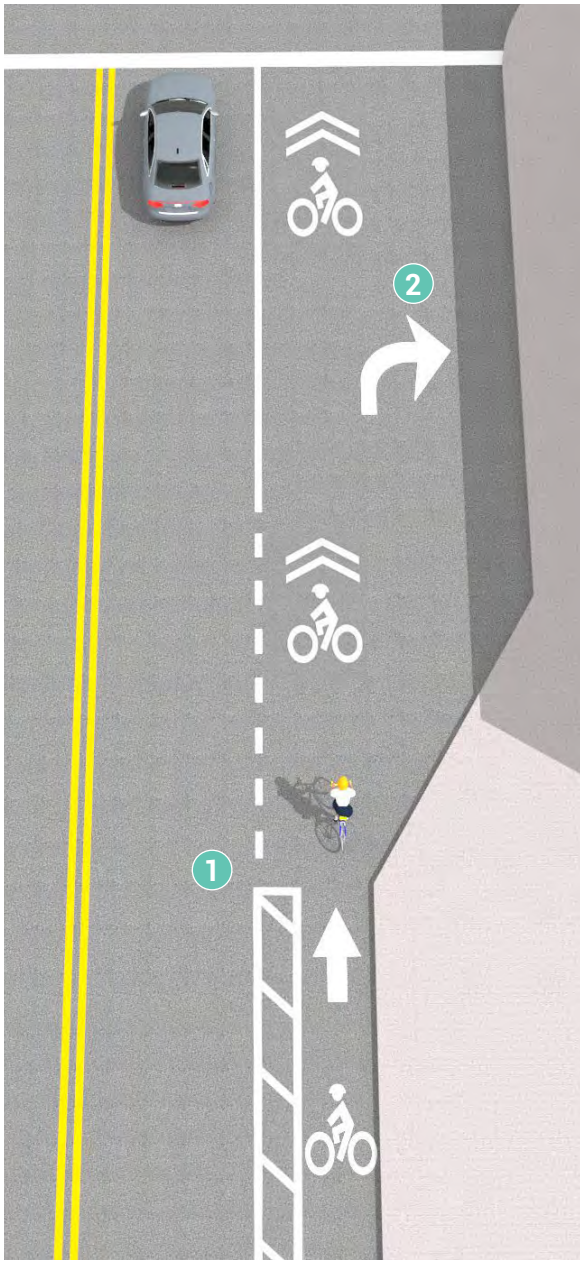


Figure 4.21: Turn Lane - Mixing Zone

Intersection Treatment

4.9.4 Through Lane Mixing Zone

DESCRIPTION

The bicycle lane ends in advance of the intersection where a shared through, right turn and bicycle lane is provided.

BENEFITS

Clarifies bicycle and driver behavior better than simply ending a bike lane.

APPLICATION

On streets where there is not enough space to maintain a bicycle lane at the intersection and no right turn lane.

Typically lower level of comfort than a through lane or combined lane treatment.

ELEMENTS

1. Bicycle lane ends before the intersection
2. Turn lane is fully shared between people on bicycles turning right or going straight and people in cars turning right or going straight. If there is only one lane in each direction, the same lane will also accommodate left turns. People on bicycles may use full lane.



Figure 4.22: Through Lane - Mixing Zone

Intersection Treatment

4.10 Bike Box



Portland, OR

Dedicated

DESCRIPTION

A Bike Box is a designated area at the head of a traffic lane at a signalized intersection that provides people biking with a safe place to wait during a red light.

BENEFITS

Increases visibility of people biking.

Can facilitate person biking left turns by allowing people biking who arrive at the intersection when the light is red to shift to the left.

Helps prevent 'right-hook' conflicts with turning vehicles at the start of the green indication by positioning the person biking ahead of the car.

Provides an area for groups of people biking to wait at an intersection.

APPLICATION

On 2 to 4 lane streets with bike lanes at signalized intersections.

For use only in special circumstances with high bike usage.

May be combined with two stage turn box.

ELEMENTS

1. The Bike Box is ahead of the stop bar for cars. Stop lines and a "wait here" legend mark the point where people in cars would stop at a red light. Extend bike box to the street centerline.
2. Right turns on red are prohibited.
3. The bike lane leads into the bike box.
4. Consider use of bicycle detection devices for activating signal

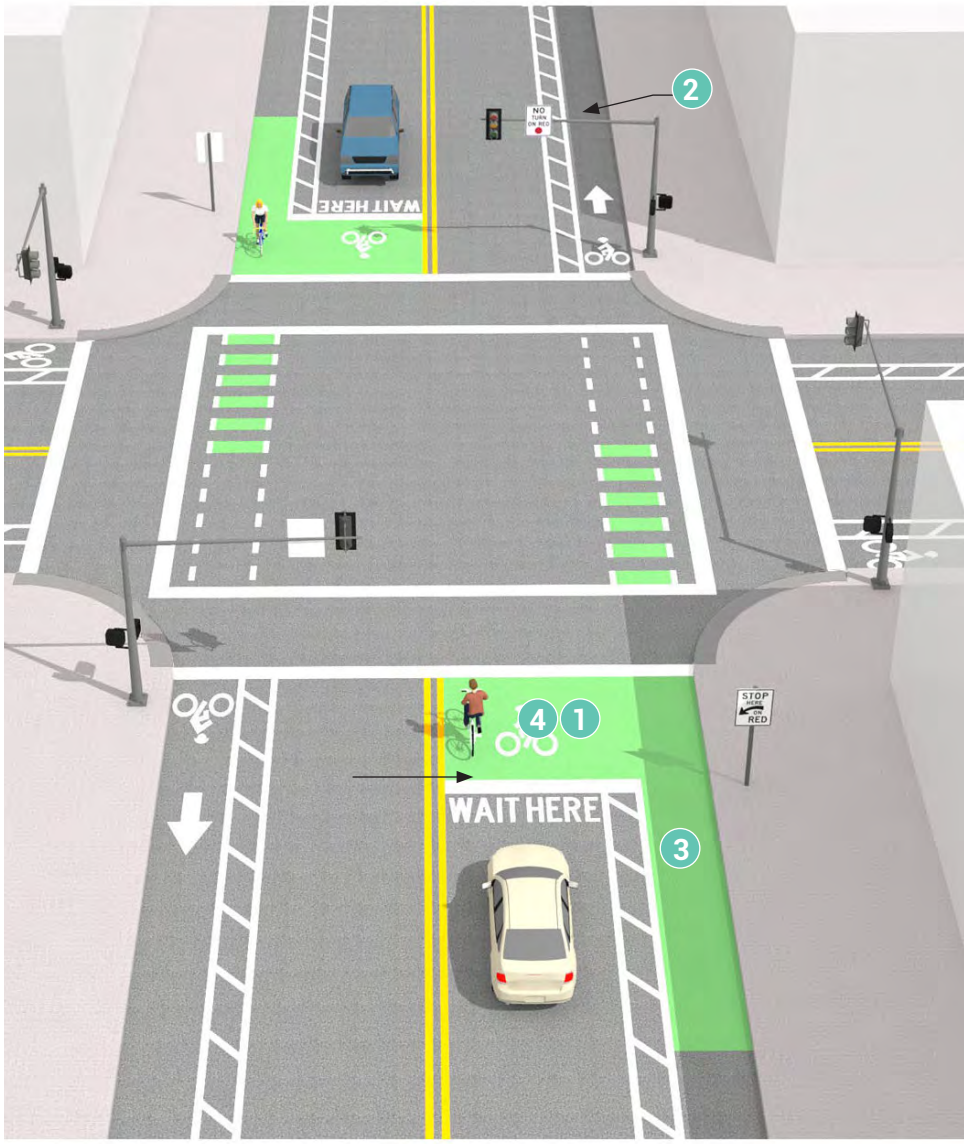


Figure 4.23: Bike Box

Intersection Treatment

4.11 Two-Stage Turn Queue Box



Portland, OR

Dedicated

DESCRIPTION

Two-stage turn queue boxes offer people biking a safe way to to make left turns at multi-lane signalized intersections from a right side bike lane, or right turns from a left side cycle track or bike lane. Two-stage turn queue boxes may also be used at unsignalized intersections to simplify turns from a bicycle lane or cycle track, for example, onto a bicycle boulevard.

BENEFITS

Improves a person's ability to bike safely and comfortably make left turns.

Provides a formal queuing space for people biking making a two-stage turn.

Reduces turning conflicts between people biking and motor vehicles.

Separates turning people biking from through people biking.

APPLICATION

At signalized and unsignalized intersections.

Along roadways with high traffic speeds and/or traffic volumes.

Along multi-lane roadways.

Where a significant number of people biking turn left from a right side facility.

Along cycle tracks.

To safely navigate light rail tracks adjacent to bike lane.

For use only in special circumstances with high bike usage.

ELEMENTS

1. An area is designated to hold queuing people biking and formalize two-stage turn maneuvers. This is in a protected area, such as within an on-street parking lane or between the bicycle lane and the crosswalk. The queue box is positioned laterally in the cross-street to promote visibility of people biking. The queue box may also be positioned laterally in the cross street parking lane rather than in front of the travel lane.
2. Right turns on red are prohibited to keep the queue box protected.
3. A bicycle signal, with leading bicycle interval, may be installed in conjunction with the two-stage turn queue box.
4. Consider use of bicycle detection devices for activating signal

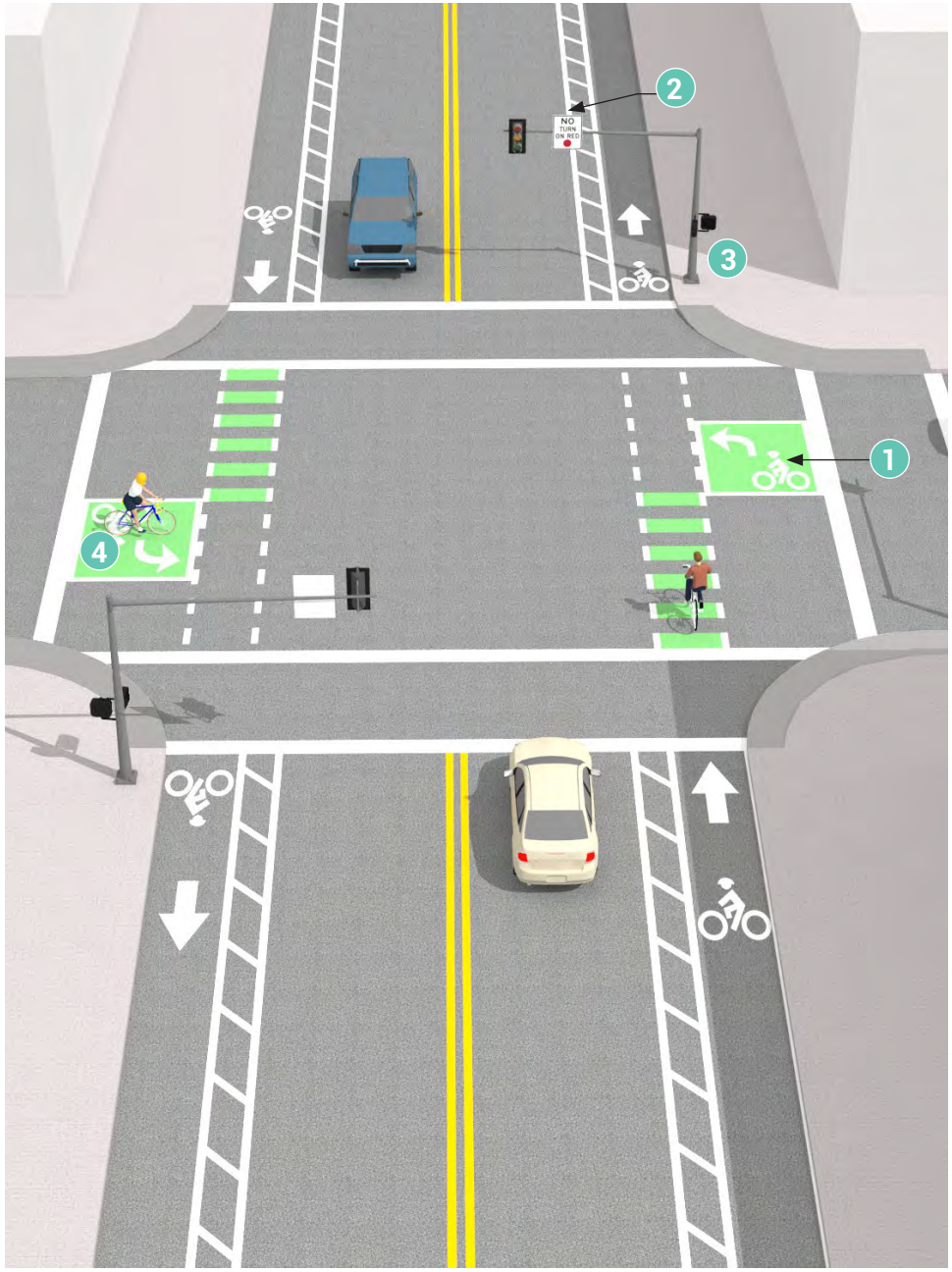


Figure 4.24: Two-Stage Turn Queue Box

Intersection Treatment

4.12 Protected Intersections



Austin, TX

Dedicated

DESCRIPTION

A signalized intersection that provides a full bicycle lane encircling it.

BENEFITS

Provides clearly designated area for all movements, including turns.

Allows people biking to wait in fully protected areas.

Places bicycles in highly visible area where they can be seen by cars turning right alongside them.

APPLICATION

Use where two separated bike facilities meet.

Use where separated bike facility meets a roadway with a high bicycle volume.

Long term maintenance needs to be considered in design and placement of curbs.

ELEMENTS

1. A green colored bike lane extends all the way around the intersection, between the crosswalks and the intersection.
2. People biking may advance into the waiting area at the corner to wait for the light. Here, they will be highly visible to the cars waiting behind them.
3. A curb protects the waiting area.
4. Bike signal phasing accommodates the crossing.

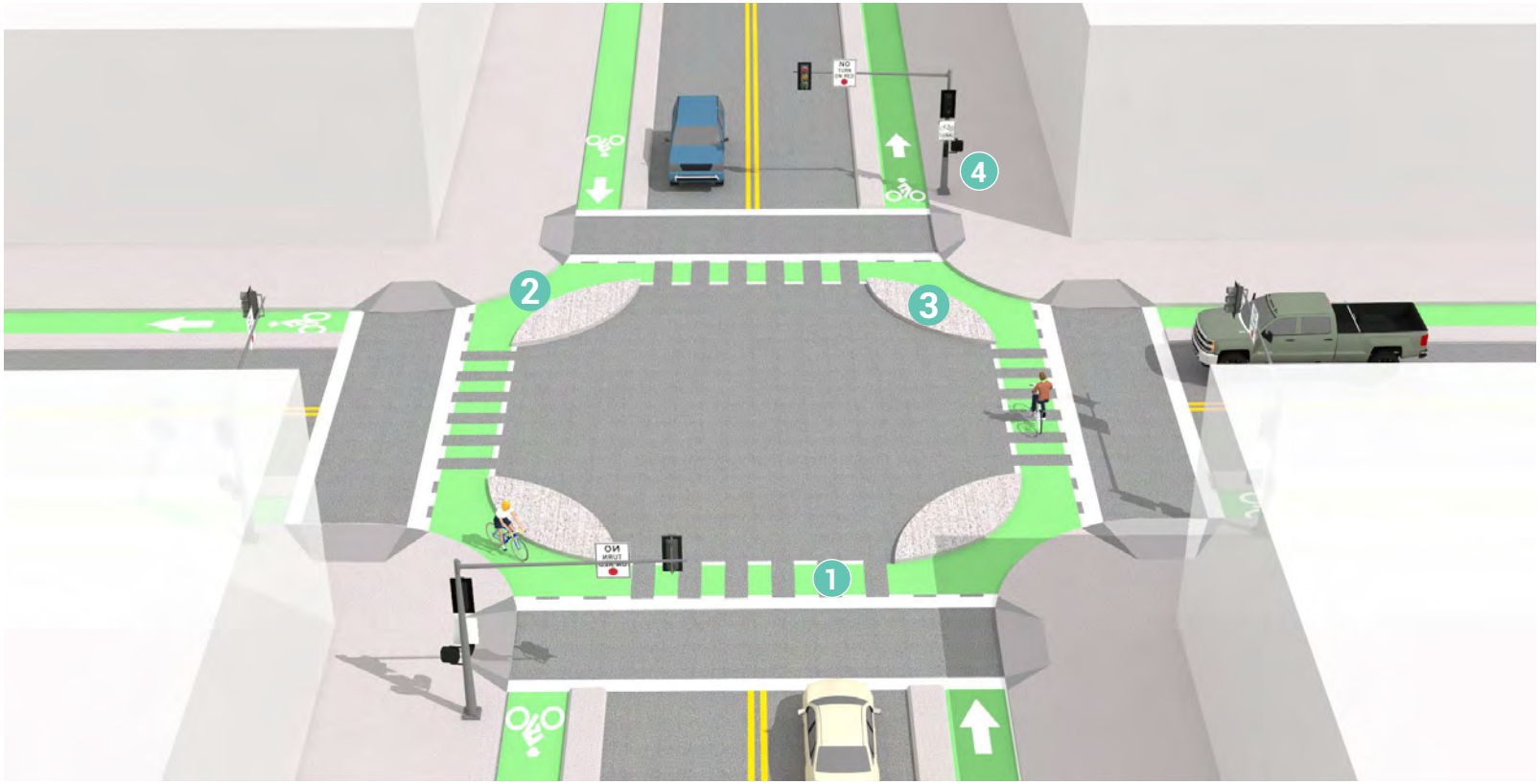
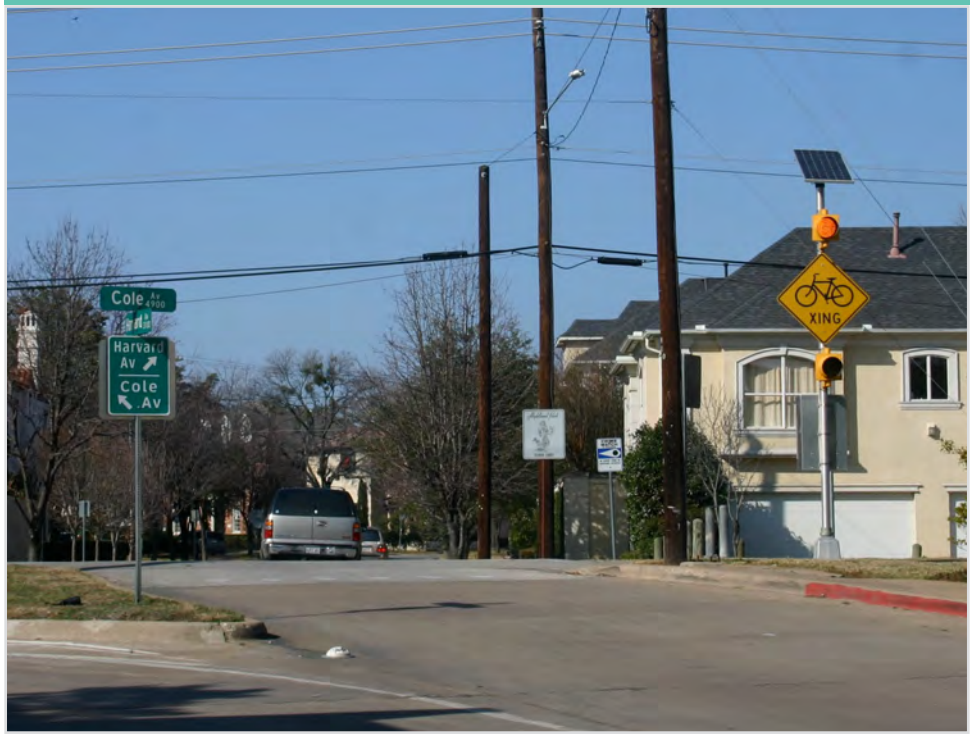


Figure 4.25: Protected Intersection

Intersection Treatment

4.13 Beacons



Dallas, TX

Off-Street

DESCRIPTION

Active warning beacons are user-actuated amber flashing lights that supplement warning signs at un-signalized intersections or mid-block crosswalks.

ACTIVE WARNING BEACON

BENEFITS

Offers lower cost alternative to traffic signals and Toucans.

Significantly increases driver yielding behavior at crossings when supplementing standard crossing warning signs and markings.

APPLICATION

At locations where bike facilities cross roads at mid-block locations or at intersections where signals are not warranted or desired.

TOUCAN

BENEFITS

Creates gaps for people biking to cross busy streets.

Can be implemented when a conventional signal warrant is not met or where a conventional traffic signal is not desired due to the potential to increase traffic volumes.

APPLICATION

Where bike routes intersect major streets without existing signalized crossings.

At mid-block crossings of major roadways with high crossing volumes.

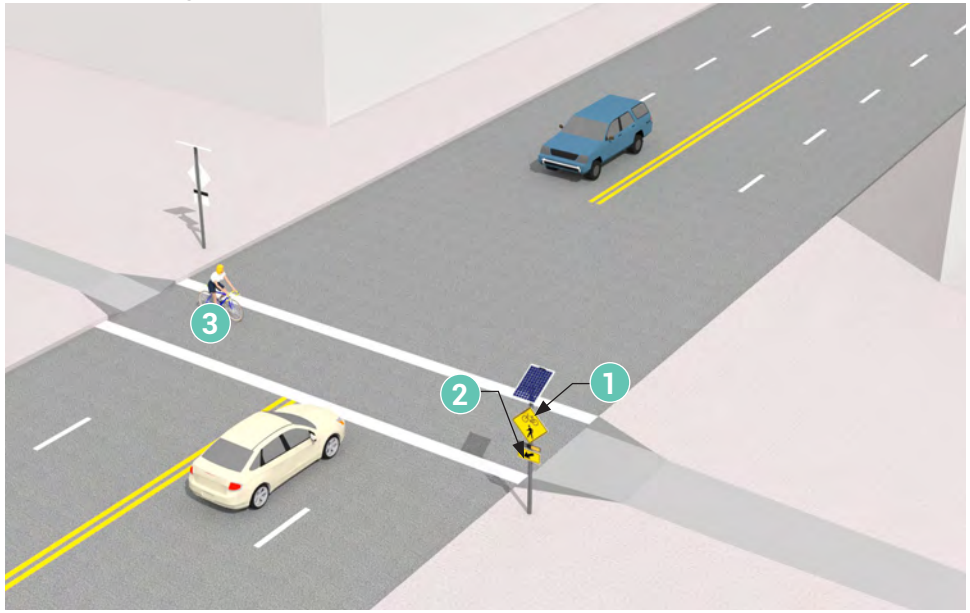
ACTIVE WARNING BEACON
ELEMENTS

1. Active warning beacons are installed on the side of the road. There may be secondary installations in center islands or medians.
2. Push button actuation is provided so people biking can activate the signal without dismounting.
3. Active warning beacons supplement standard person walking and bicycle crossing signs and markings.

TOUCAN
ELEMENTS

4. Traffic signal heads alert traffic to crossing people on bicycles and people on foot.
5. Where present, right turn movements are typically stop controlled
6. The installation includes suitable signs and pavement markings.

Active Warning Beacon



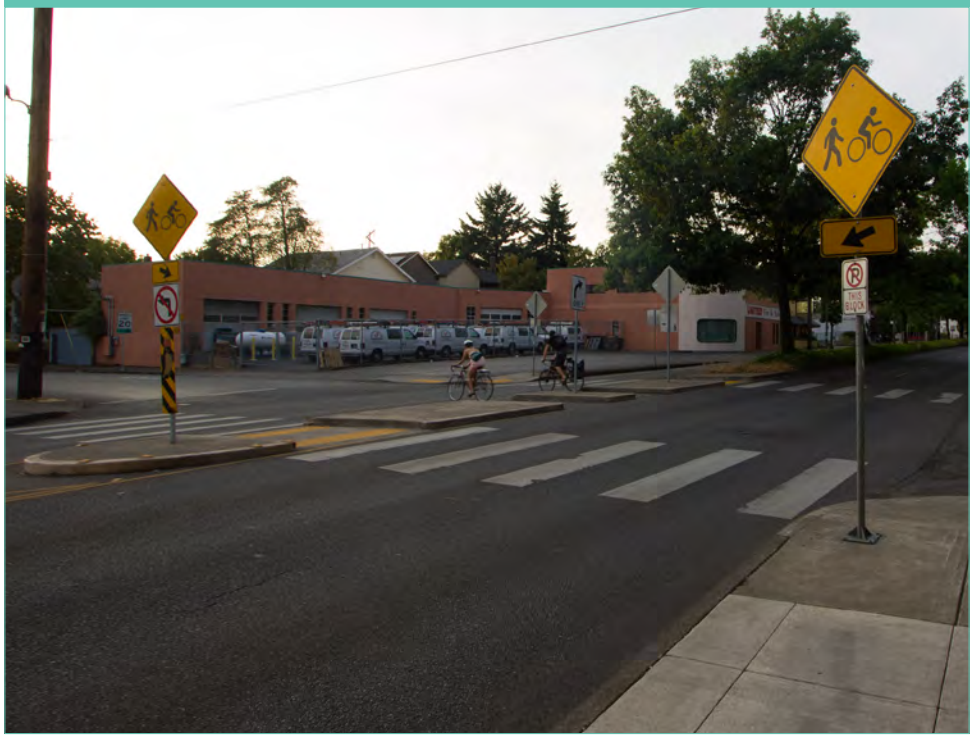
Toucan



Figure 4.26: Beacons

Intersection Treatment

4.14 Median Refuge Island



Portland, OR

- **Off-Street**
- **Dedicated**
- **Shared**

DESCRIPTION

Median refuge islands are protected spaces placed in the center of the street to facilitate bicycle and person walking crossings of two-way streets by allowing people biking and people walking to navigate only one direction of traffic at a time.

BENEFITS

Allows people biking to more comfortably cross streets.

Provides a protected space for people biking to wait for an acceptable gap in traffic.

Reduces the overall crossing length and exposure to vehicle traffic for a person biking or person walking.

Calms traffic on a street by physically narrowing the roadway and potentially restricts motor vehicle left turn movements.

Establishes and reinforces bicycle priority on bicycle boulevards by restricting vehicle through movements.

APPLICATION

Where a bikeway crosses a moderate to high volume or high-speed street.

At key bicycle and pedestrian connections.

Where it is desirable to restrict vehicle through movements, a median can double as a divider to prevent cut-through traffic on a bicycle route.

ELEMENTS

1. Where a median refuge is intended for use by people on bicycles, the median should be designed to comfortably accommodate the use of a bicycle
2. On a two-way street, the median refuge is placed between the opposing directions of travel.
3. At signalized intersections, push buttons or other detection methods may be provided to actuate the signal head.
4. The median refuge can be carried across the entire cross street approach to act as a divider to prevent cut-through traffic on a bicycle route.

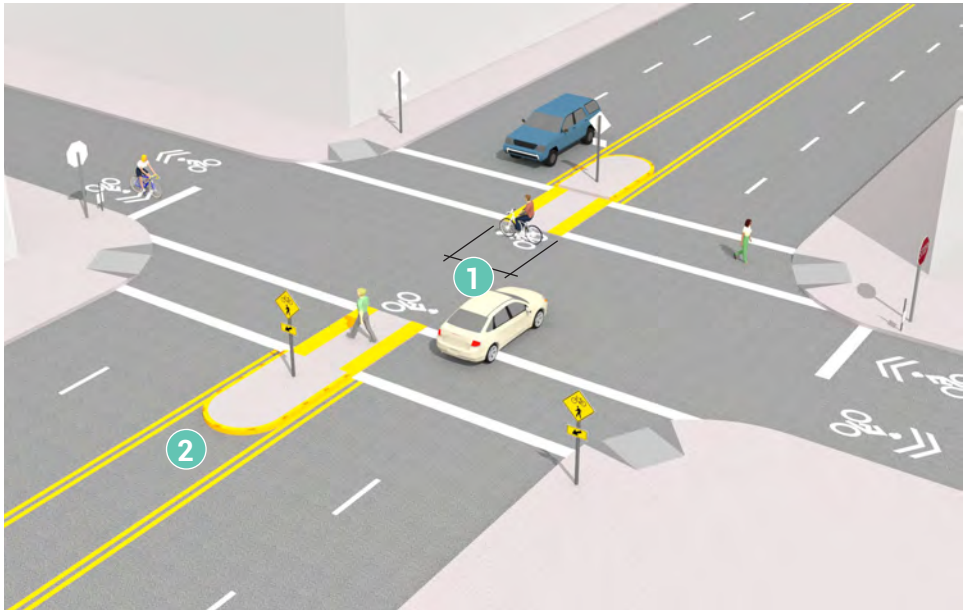


Figure 4.27: Barrier Refuge

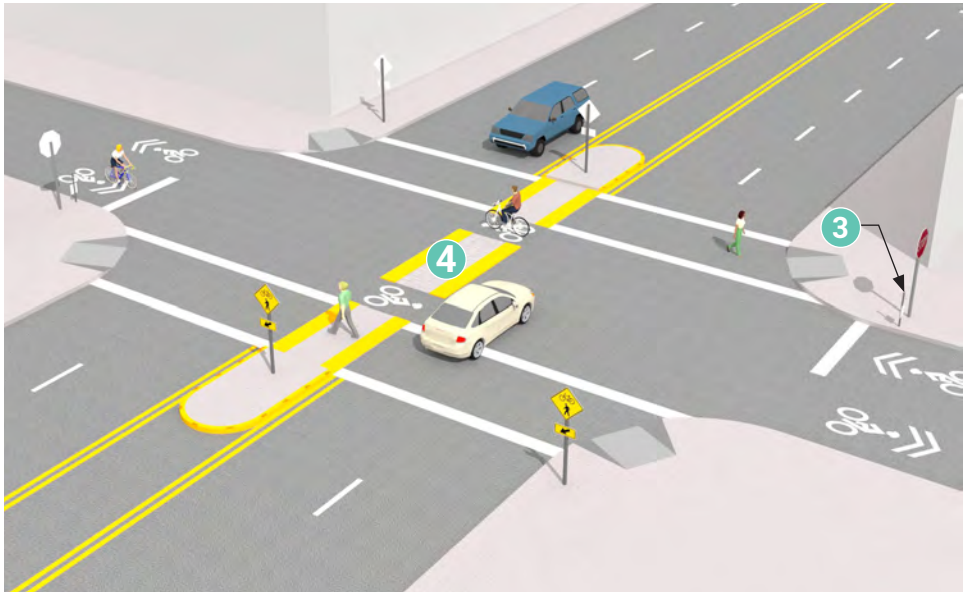


Figure 4.28: Median Refuge Island

Intersection Treatment

4.15 Neighborhood Bikeway Intersections



Portland, OR

Shared

DESCRIPTION

Neighborhood bikeways function best when they have low traffic and a continuous flow. Design for crossings of minor streets can give the right-of-way to bicycle traffic, with stops signs only present on the intersecting street. Geometric design elements may also be considered in order to reduce speed and volume where necessary.

BENEFITS

Provides uninterrupted route through neighborhoods.

Protects people biking at minor intersections.

Manages vehicle volume on Neighborhood Bikeways, providing a more comfortable and safer route.

APPLICATION

On Neighborhood Bikeways.

In conditions which modification to traffic are necessary.

ELEMENTS

1. Stop signs on intersecting streets, give the right-of-way to traffic on the Neighborhood Bikeway, while the city does not typically mark stop bars on neighborhoods streets, they may be beneficial for safety purposes on some corridors.

2. Provide bicycle safety treatments, such as mini roundabouts, curb extensions, and median islands where necessary to improve the safety of people bicycling.

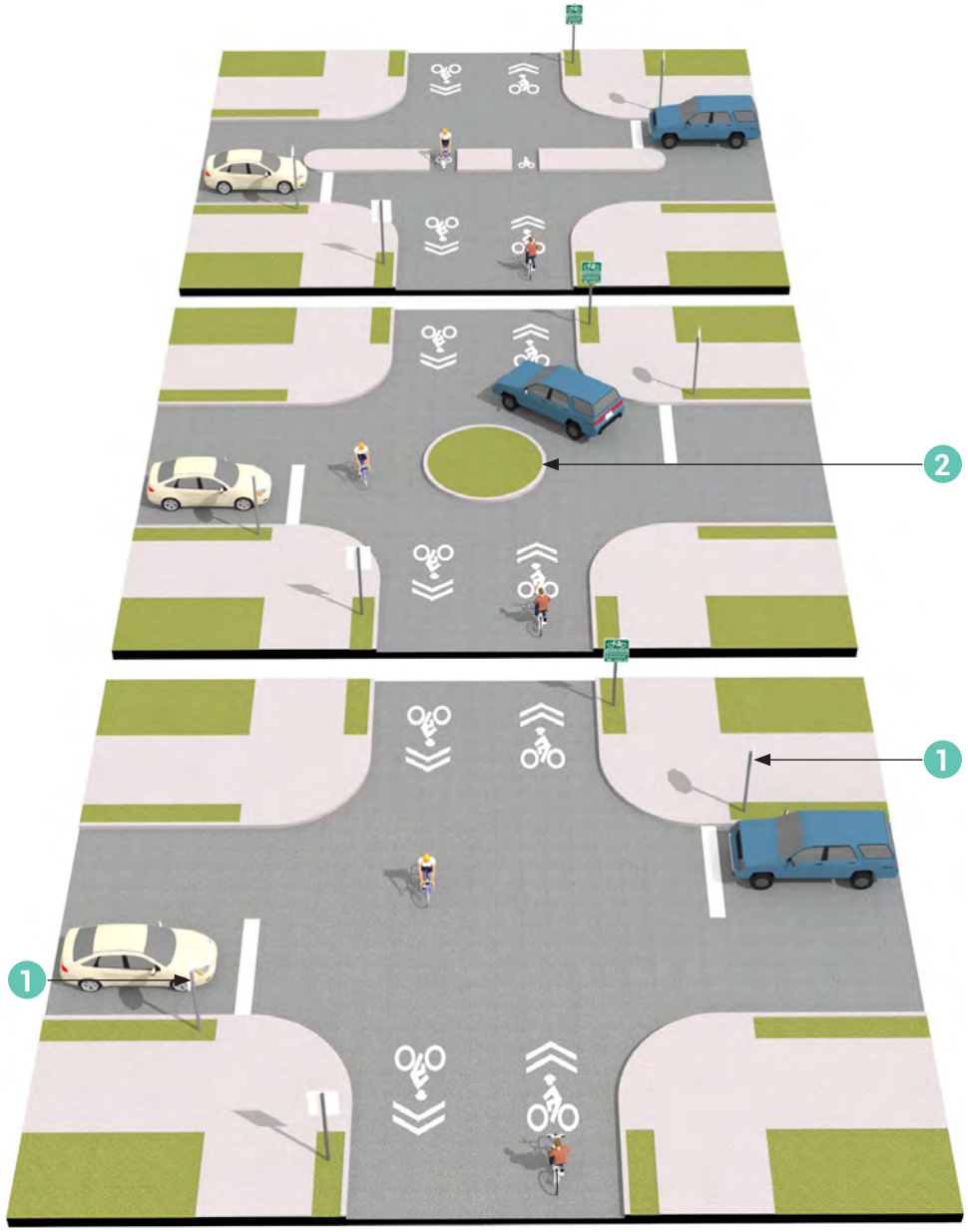
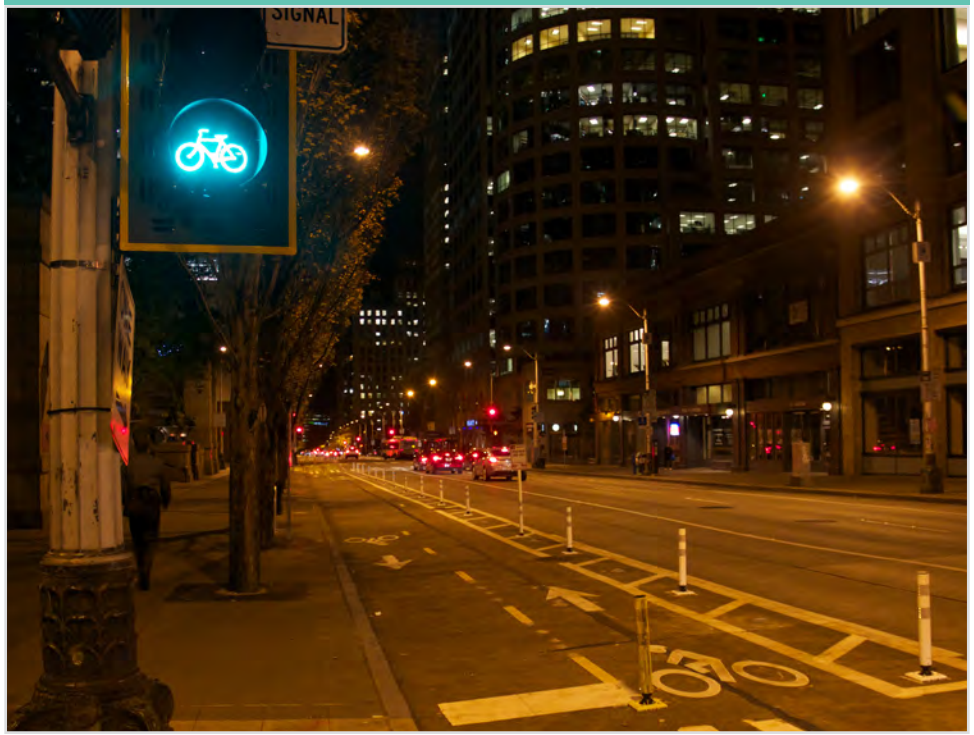


Figure 4.29: Bike Crossings of Minor Streets

Signaling

4.16 Bike Signal Treatments



Seattle, WA

- **Off-Street**
- **Dedicated**
- **Shared**

DESCRIPTION

The operation of bicycle signals can be implemented to allow for safer and more efficient bicycle operations.

BENEFITS

Allows for dedicated bicycle phasing at a signalized intersection.

Can allow bicycle leading interval, giving people on bicycles a green light before people in cars, to increase visibility in the intersection.

Supports contraflow bicycle movements at a traffic signal.

Clarifies bike movements.

APPLICATION

Design for bicycles at all signalized intersections.

ELEMENTS

1. The bicycle signal is in a location clearly visible to oncoming bicycles and is marked with a "Bicycle Signal" sign.
2. Either provide a bicycle signal on each phase or activate through loops or another detection method. Push buttons for bikes are not desirable.
3. Consider a bike leading interval so that people on bicycles can start across the intersections first.

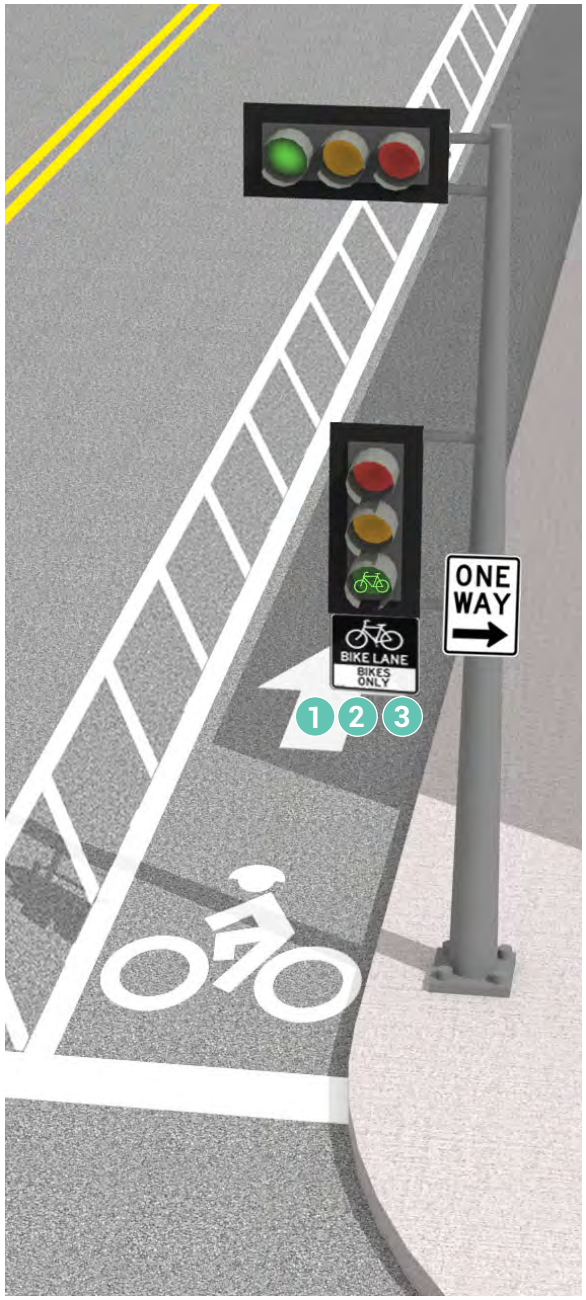
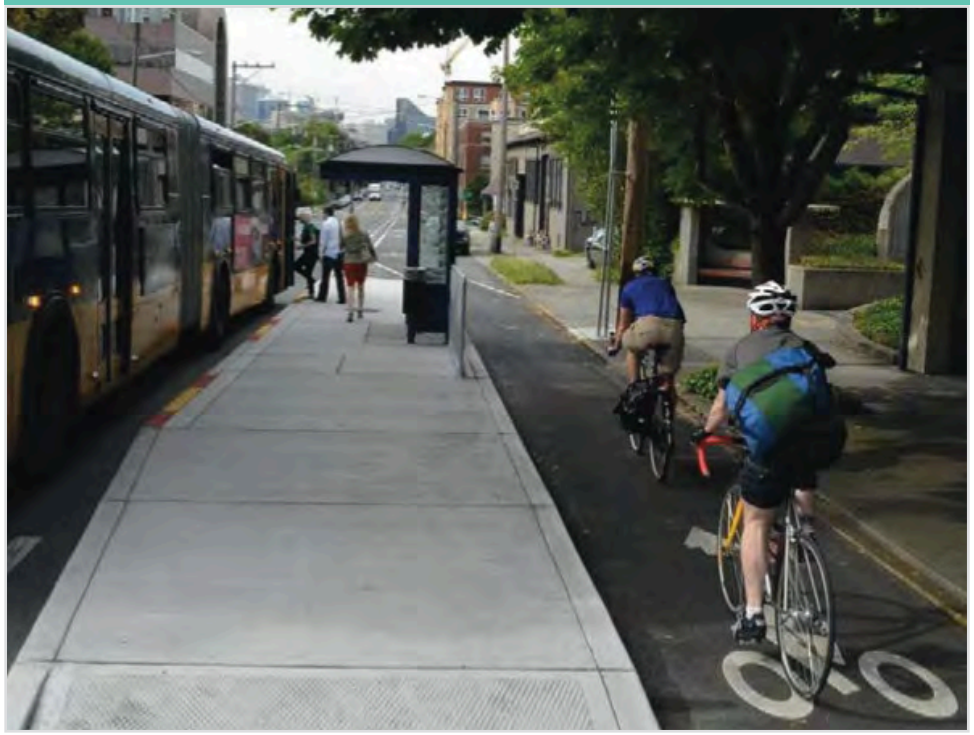


Figure 4.30: Bike Signal Treatments

Special Conditions

4.17 Floating Bus Stop



Seattle, WA

Dedicated

DESCRIPTION

Floating bus stops are median islands with bus stop facilities that are located between the vehicular traffic lane and bike lane, allowing bicycle traffic to pass behind the island without interruption.

BENEFITS

Prevents conflict between stopped buses and moving bicycle traffic.

Allows uninterrupted flow of cyclists past bus stop locations.

Prevents merging bus conflicts at bus stops.

APPLICATION

In locations where high-transit traffic volumes and frequent stops interrupt the bicycle travel lane. Should be considered on any street that has a bicycle lane and frequent transit route(s).

Can be applied on streets where parking lanes are located. The parking lane would terminate and the bicycle lane would shift into that lane.

In instances with no parking lane, if adequate right-of-way space exists, the bicycle lane and sidewalk would bulb away from the street into the person walking realm.

ELEMENTS

1. The island is designed both for ADA accessibility to the bus and the expected volumes of passengers.
2. The island accommodate the length of a city bus (40 ft.). If the route is served by 60 foot articulated buses, it is correspondingly longer.
3. The bicycle lane angles around the median island. This slows bicycle traffic down to prevent conflicts between people walking and biking.
4. ADA accessible ramps and adequate crosswalks next to the bus stop direct person walking safely across the bike lane. The crosswalk should be raised to emphasize pedestrian right-of-way.

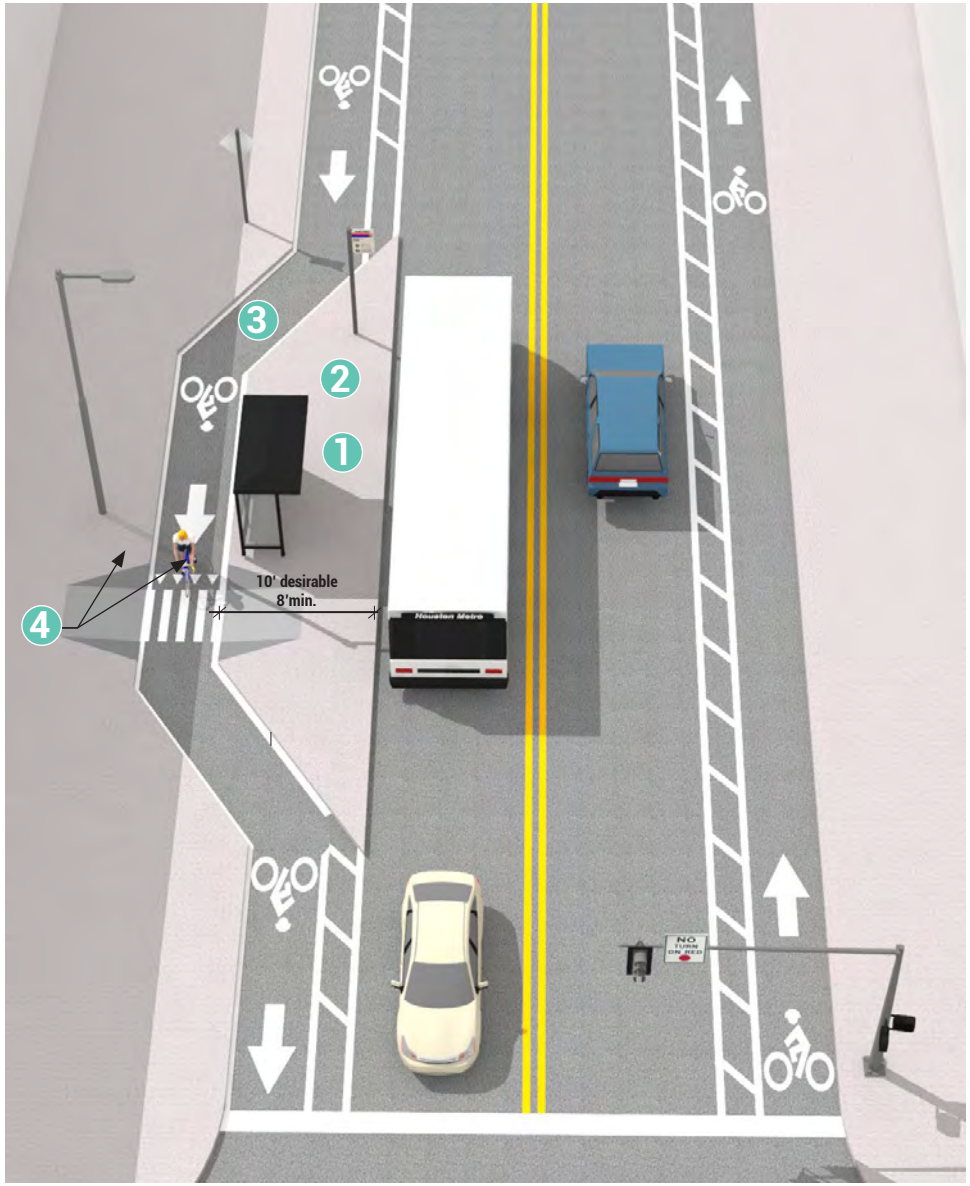


Figure 4.31: Floating Bus Stop

Special Conditions

4.18 Parking Buffered Bike Lane



Chicago, IL

Dedicated

DESCRIPTION

Parking buffered bikeways create a separated bikeway facility where a row of parking and a striped buffer is used to create separation between the bikeway and moving traffic.

Bike lanes adjacent to curbside parking lanes should be implemented based on guidance for standard bike lanes with special care taken to eliminate door zone conflicts.

BENEFITS

Provides a safer more comfortable environment for people biking, particularly on high volume high speed commercial streets.

Reduces risk of 'dooring' compared to a bike lane and eliminates the risk of a doored bicyclist being run over by a motor vehicle.

Reduces likelihood of illegally parked vehicle blocking bike lane.

APPLICATION

On roadways with bicycle lanes and significant parking demand where space allows.

Where parking can provide an additional buffer to people riding in the bike lane to feel comfortable.

Where parking can be integrated with transit stops to provide multimodal corridor.

Where design can allow adequate visibility i for motorists and cyclists.

ELEMENTS

1. Provide adequate striped buffer to minimize risk of dooring. Consider raised barriers to prevent illegally parked vehicles from blocking the bikeway.
2. Eliminate parking in advance of intersections and driveways to ensure visibility for cyclists and motorists.
3. Design may include floating transit stop islands integrated into parking lane, particularly where there are no conflicts with turning movement.
4. Colored pavement may be used to increase visibility and definition at conflict points such as driveways.

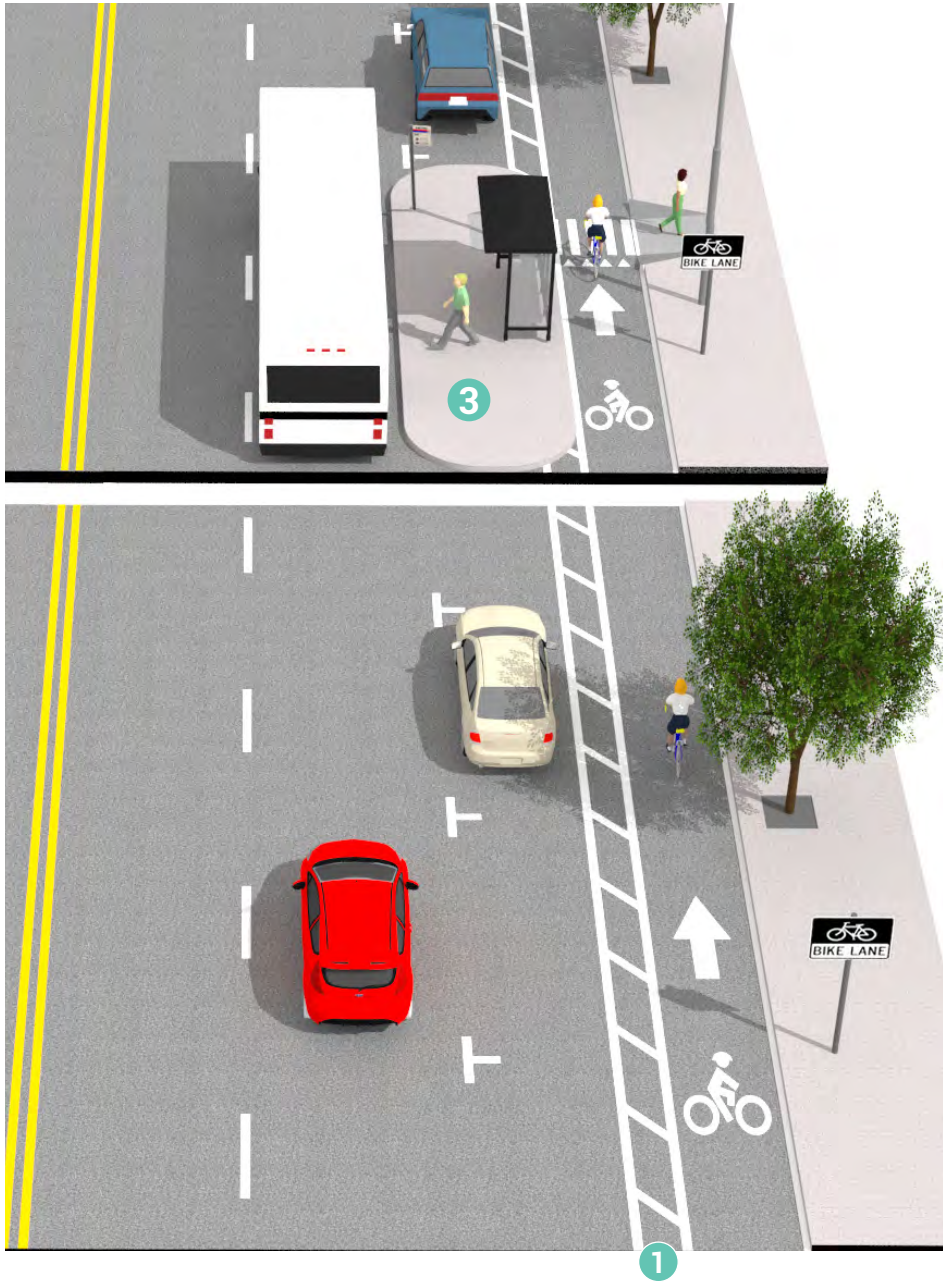


Figure 4.32: Parking Buffered Bike Lane

Connections

4.19 Bridges / Tunnels



Houston, TX

Off-Street

Dedicated

DESCRIPTION

Bridges and tunnels or over-and-under crossings provide safe grade-separated crossing at major intersections and other obstacles.

BENEFITS

Eliminates conflict between people biking and heavy vehicular traffic.

Provides connections over or under impassable barriers such as waterways, railroads, and highways.

Connects disjointed areas.

APPLICATION

In locations where an impassable barrier exists (highway, waterway, railroad tracks, extreme grade change, and high traffic crossing).

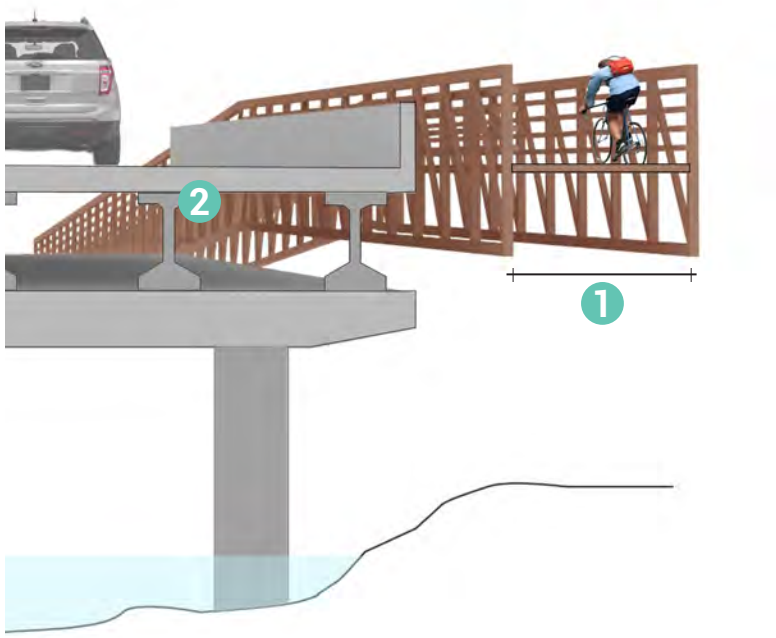
Typically applied to Off-Street Paths.

BRIDGE ELEMENTS

1. The two way bridge path should be sufficiently wide for two way bike traffic to pass comfortably.
2. If the bridge is used by pedestrians, slopes must comply with ADA Standards.

TUNNEL ELEMENTS

3. The two-way tunnel path should be sufficiently wide for two way bicycle traffic to pass comfortably.
4. Consider appropriate overhead clearance requirements in design.
5. If the underpass is used by pedestrians, slopes must comply with ADA Standards.
6. Safety and security measures should be considered (proper lighting, line of sight).
7. Drainage should be considered at low points to prevent unsafe biking conditions and blockage of route.



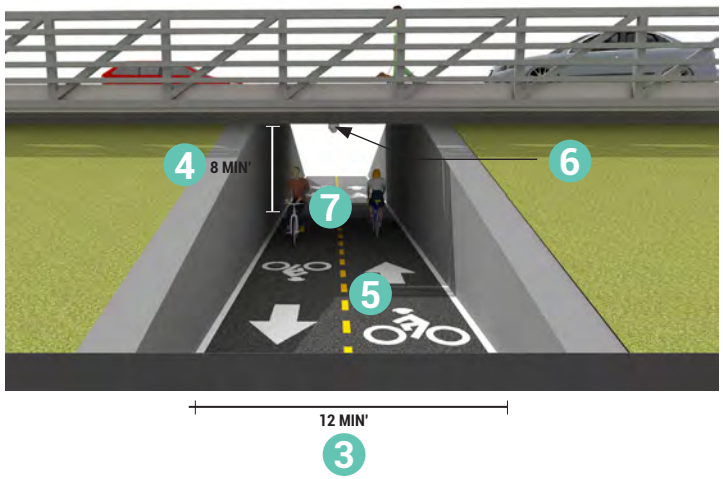


Figure 4.33: Bridges / Tunnels

Connections

4.20 Shortcuts



Houston, TX

Off-Street

Dedicated

Shared

DESCRIPTION

A bicycle and person walking only connection between on-street bicycle facilities to enable more direct bicycle trips than could be made solely by using the street network.

BENEFITS

Creates quicker bicycle trips.

Avoids indirect, long trips if street network only were used.

APPLICATION

Provide shortcuts where they allow more direct connections between bicycle routes.

Provide shortcuts where they connect additional neighborhoods to the bicycle network.

Provide shortcuts where they allow people biking to make trips on low-traffic streets and avoid congested areas or high-speed traffic.

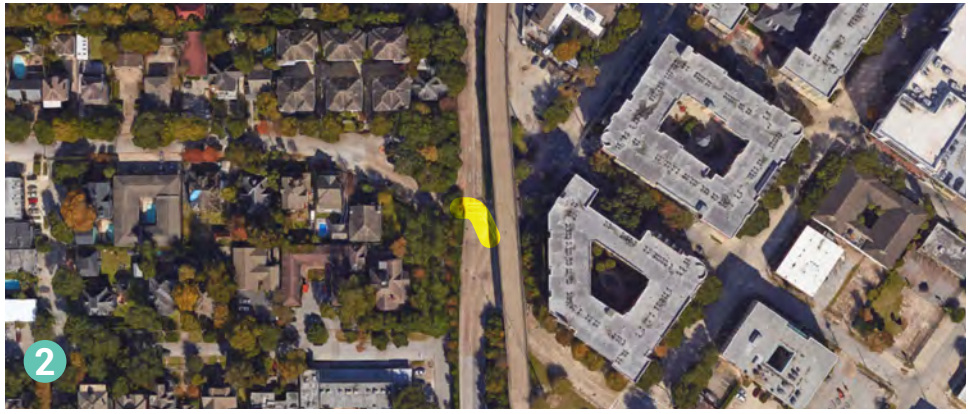
EXAMPLES

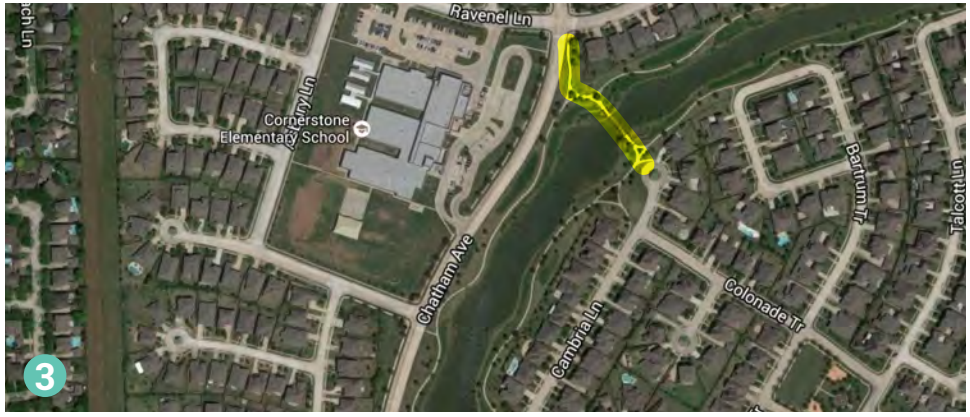
1. Davis, CA: A short off-street trail connects high-comfort low-traffic side streets where the only other alternative would be a high-speed, high-traffic arterial through a cloverleaf interchange.

2. Houston, TX: Hawthorne Street and Hollman Street are connected with a person walking crosswalk and a short path.

3. Sugar Land, TX: A bridge and paths connected to residential streets and cul-de-sacs creates a direct connection between two neighborhoods, making the trip from one side of the lake to another a 0.1 mile trip instead of a 1.4 mile trip.







Projects - End of Ride

PARKING

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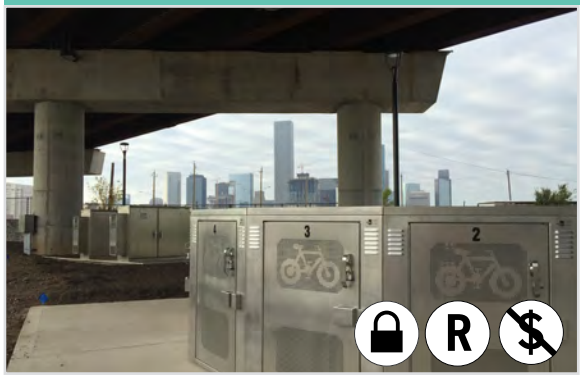
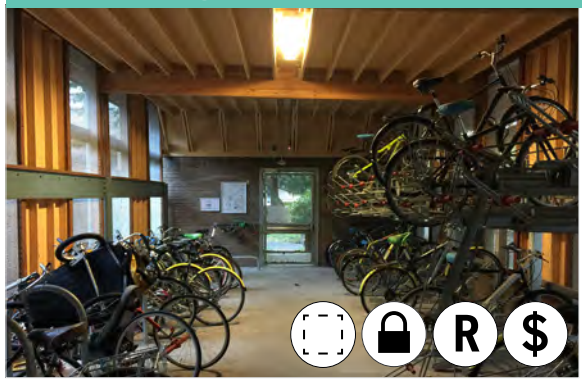
4.22 Bike Lockers 4-75



4.23 Bike Cage 4-77



PARKING

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4.26 Bike-and-Ride 4-83



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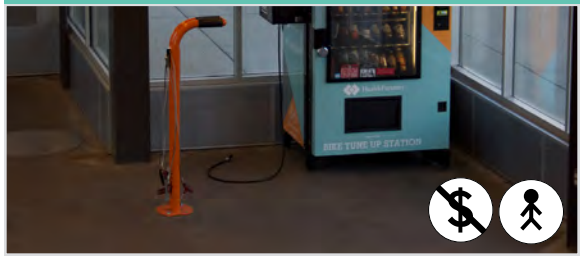

NETWORKS

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4.31 Bikes on Transit.....4-88



Most Secure

Can be reserved

Relatively expensive to implement

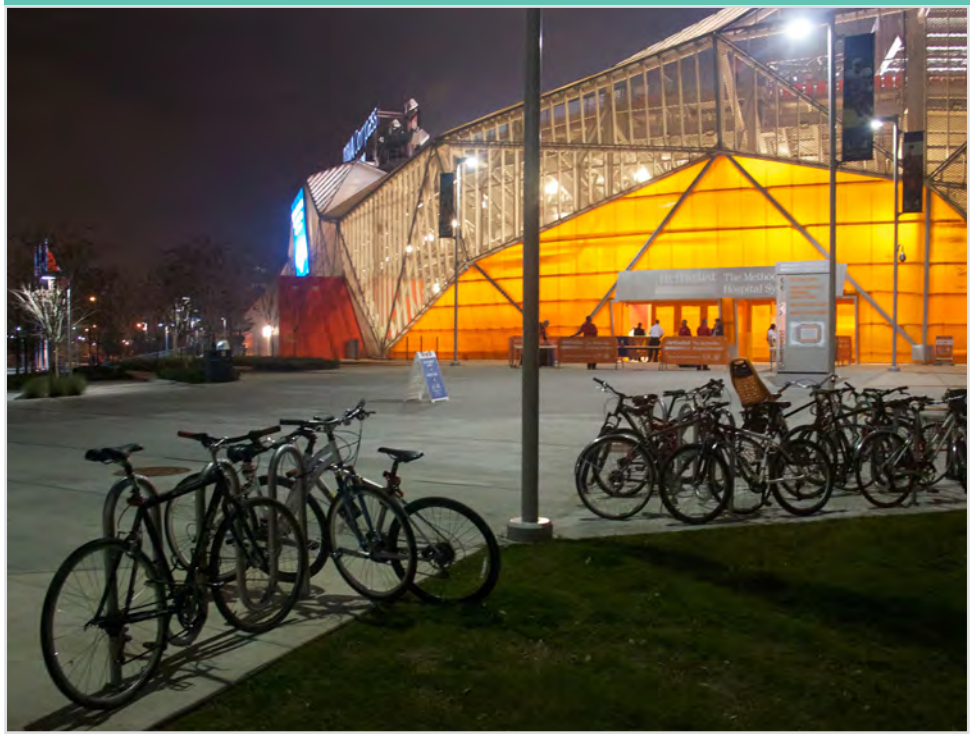
Relatively inexpensive to implement

Requires significant property

Requires operating staff

Parking

4.21 Bike Racks



Houston, TX

DESCRIPTION

The bike rack is a parking solution for temporary visitors. It is a simple, permanent structure that allows guests with their own locking mechanism to secure the bike frame and one or both wheels.

BENEFITS

Provides low-cost bike parking.

Creates a highly visible indication that bikes are welcome.

APPLICATION

Use widely near front doors of any building other than single-family residential.

Locate in person walking realm every block or less in dense commercial zones.

Locate at transit stops.

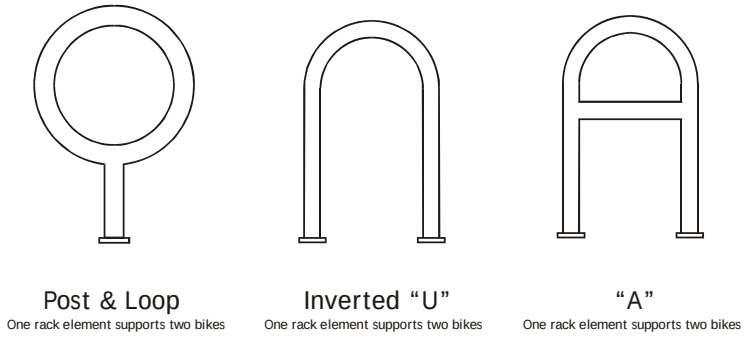
See the "policies" and "programs" sections for ways to encourage the installation of bike parking.

ELEMENTS

- Bike racks are, first and foremost, functional objects. While custom designs can be a distinctive element, all bike racks must be easy to understand and use.
- Support the bicycle upright by its frame in two places. Enable the frame and one or both wheels to be secured.
- Racks should be spaced so that there is adequate spacing between bicycles (recommended 36" on center spacing).
- Accommodate locks securing the frame and both wheels (preferably without removing the front wheel from the bicycle).
- Do not impede or interfere with person walking traffic. There should be 30"-36" of space between the curb/edge of building and the end of the bike rack, as well as 30"-36" of space between the end of the bike rack and the person walking corridor. This is to allow adequate space for the bicycles, as well as prevent tripping by people walking and protrusion into vehicular lanes.
- Provide adequate lighting for security, ease of riding, and as a part of wayfinding to identify the location of the parking area.
- Locate the rack to be visible to passersby to promote usage and enhance security.

RECOMMENDED

One rack element supports two bikes and can lock both the frame and one or two wheels.



NOT RECOMMENDED

These racks options do not properly support the bike or provide adequate security.

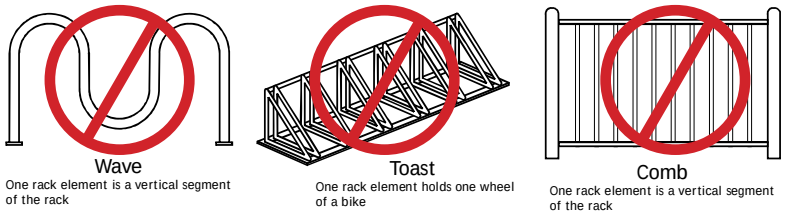


Figure 4.34: AASHTO Recommended Types of Bicycle Racks

RECOMMENDED CONFIGURATION

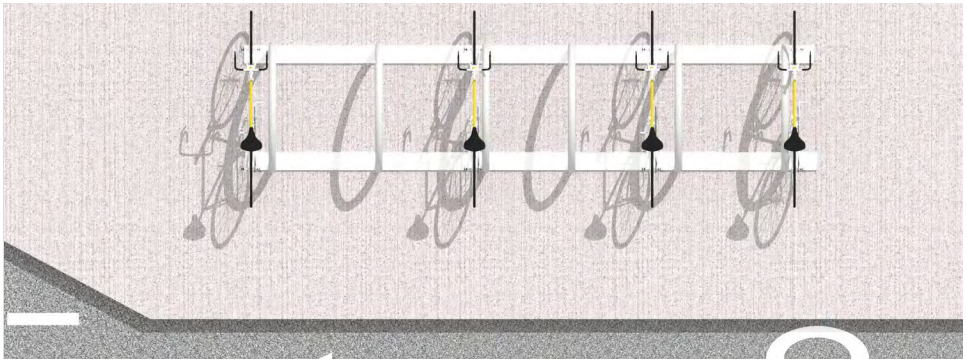


Figure 4.35: Bike Racks

Parking

4.22 Bike Lockers



Houston, TX

DESCRIPTION

These are stand-alone enclosures designed to hold one bicycle per unit. Each unit is secured with a separate locked door. Each unit is rented monthly to an individual bike commuter for a nominal fee. Alternatively, units are secured with a subscription smart card system that allows any registered user to use any locker.

BENEFITS

Provides an additional level of security over bike racks.

Protects bicycles from the elements.

Provides a long-term parking solution.

Encourages bicycle commuting.

APPLICATION

Appropriate at any location where the same people will bike every day.

At employment locations.

At college campuses.

At transit stops.

See the "policies" and "programs" sections for ways to encourage the installation of bike parking.

ELEMENTS

1. Lockers can be controlled with traditional key systems or through preferred subscription systems. Subscription locker programs allow more flexibility within locker use by not restricting access for a user to a single locker. These are typically controlled through magnetic card reading systems.
2. Adequate lighting should be required for security, ease of riding, and as a part of wayfinding to identify the location of the parking area.
3. Adequate signage should indicate that the facility is a long-term parking facility.
4. Signage with directions for use and membership should be posted.
5. Several bike locker configurations exist. The basic locker is typically wedge shaped, and can be organized in a radial or rectangular shape. Final configuration should depend on spatial constraints and accessibility.
6. If stacked, the top lockers should be equipped with wheel tracks to aid in moving the bicycle to the upper level.
7. Adequate space should exist between the person walking sidewalk and the bike lockers to allow for maneuvering and pre-ride preparations.
8. Adequate space should exist between lockers and bikeway to allow users to pass those loading and unloading bicycles into a locker. Refer to locker manufacturer specifications.

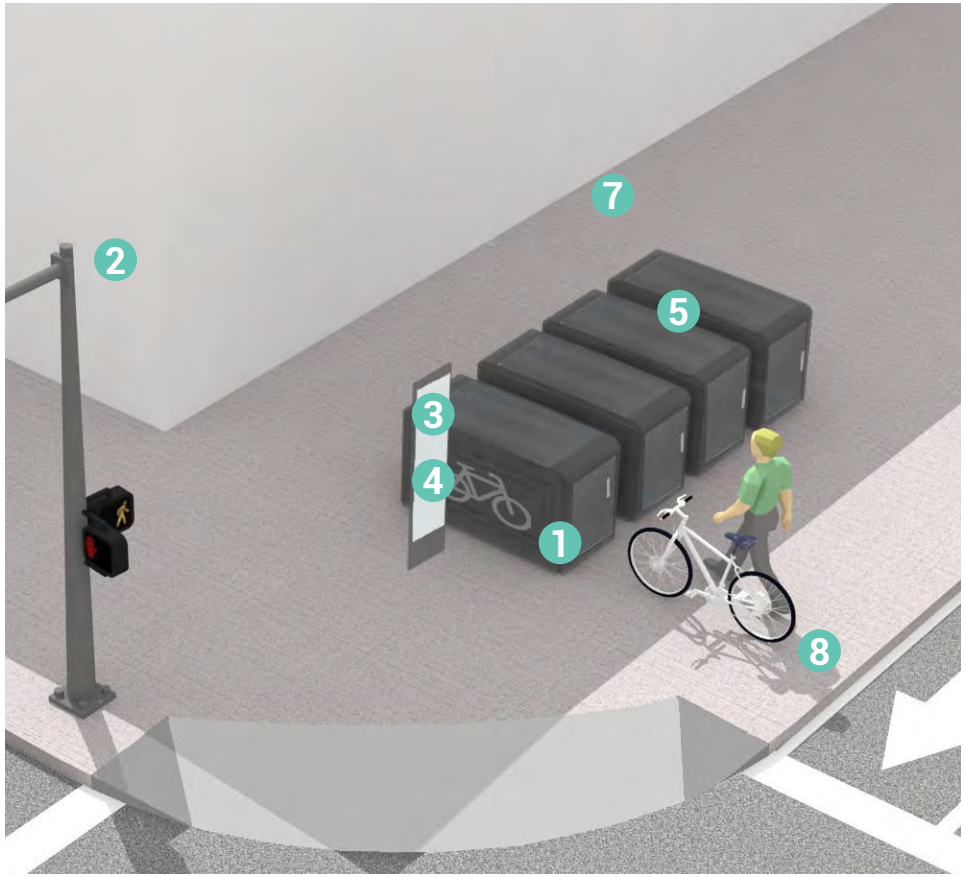


Figure 4.36: Bike Lockers

Parking

4.23 Bike Cage



Portland, OR

DESCRIPTION

These are un-staffed locked shared enclosures that hold dozens of bicycles and are accessible only to subscribers.

BENEFITS

More secure than bike racks.

Higher capacity than bike lockers.

Protects bikes from rain and other outdoor elements.

APPLICATION

At any bike destination where the same users park every day, including employment locations, colleges, and transit stops.

Locate in a prominent location.

See the "policies" and "programs" sections for ways to encourage the installation of bike parking.

ELEMENTS

1. Alternate 1: Locate in existing building or parking garage.
2. Alternate 2: Locate as a freestanding building.
3. Provide door with key card access to prevent theft and increase security. Manage car access to prevent access by unauthorized users. Facility should operate 24 hours and provide security cameras.
4. Bicycles are stored on racks or stacked racks within the facility.
5. Bicycles must have protection from the elements.
6. The station should be entirely enclosed to provide effective security. If designing an open air facility, impenetrable screening should be used.
7. Adequate lighting should be required for security, ease of riding, and as a part of wayfinding to identify the location of the parking area.
8. Adequate signage should indicate that the facility is a long term parking facility, provide instructions for users, and inform prospective users how to register.
9. Dimension based on specifications for rack manufacturer and projected demand.



Figure 4.37: Bike Cage

Parking

4.24 Bike Corral



Portland, OR

DESCRIPTION

Stand-alone enclosure designed to hold six or more bikes in an area previously used for on-street or off-street parking. Currently allowed in permanent parking space in City of Houston Infrastructure Design Manual.

BENEFITS

Provides additional bike parking in high demand areas.

8-10 bicycles can park in a location that would hold 1 car or truck.

Highly visible.

APPLICATION

Use in locations with high bike parking demand where there is not sufficient space on sidewalk or private property for racks.

See the "policies" and "programs" sections for ways to encourage the installation of bike parking.

ELEMENTS

1. Mark ends of corral with parking blocks, planters, or other visible physical barriers.
2. See City of Houston Infrastructure Design Manual for recommended dimensions.
3. May stripe with diagonal stripes.

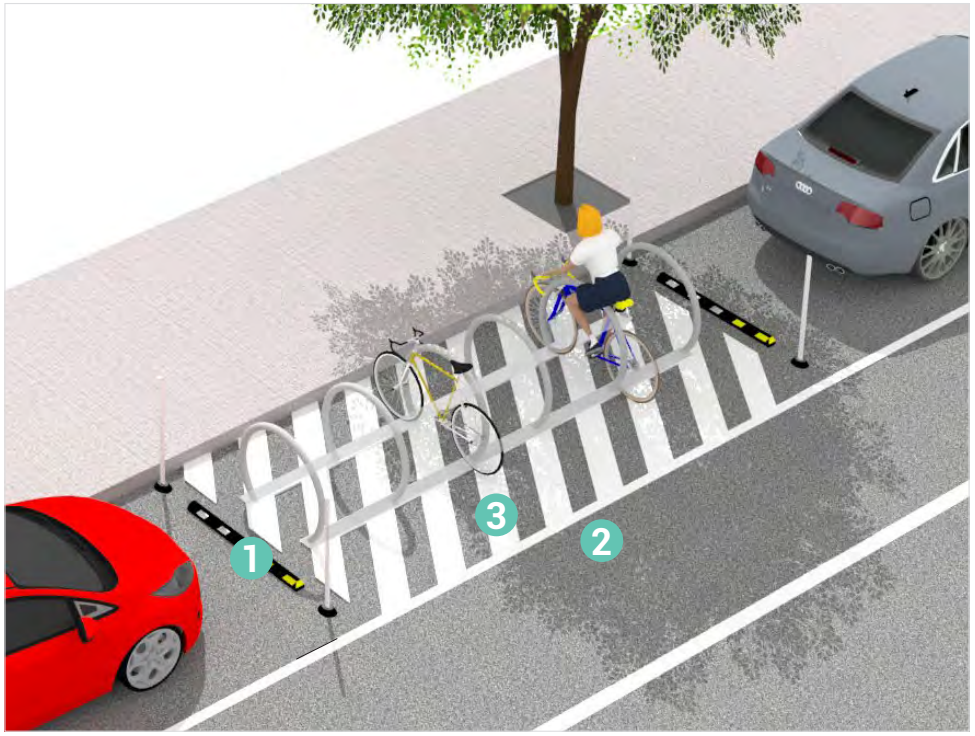


Figure 4.38: Bike Corral

Parking

4.25 Bike Station



Berkeley, CA

DESCRIPTION

These are staffed locations that provide bike valet parking with an attendant as well as other person biking-oriented amenities such as showers/lockers, bicycle supplies, repair stations, and rental options. See San Francisco Bicycle Parking Guidelines.

BENEFITS

Provides an additional level of security.

Protects bicycles from the elements.

Provides long-term parking solution.

Encourages bicycle commuting.

Provides person biking with additional amenities for personal hygiene and bike care.

APPLICATION

At major transit hubs.

In major employment centers.

At colleges or other major destinations.

ELEMENTS

1. Facility hours can be limited based on staffing. It is often appropriate to co-locate with a 24-hour bike cage.
2. The attendant receives and returns bikes for valet parking, sells supplies, repairs bikes, and provides information.
3. Bicycles are stored on racks or stacked racks behind the attendant's desk.
4. Facility is completely enclosed and air conditioned.
5. Provide self-service bike repair station with air pump and tools.
6. Provide an area behind the counter for paid bike repair services.
7. Provide shelving to sell bike supplies include tires, parts, helmets, and gear.
8. Provide prominent signage.



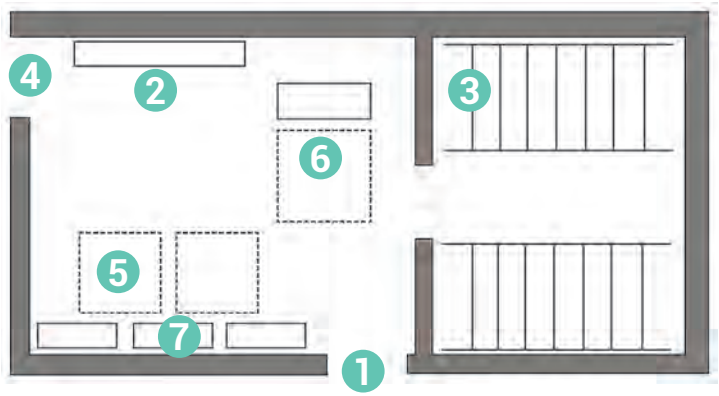


Figure 4.39: Bike Station

Connections

4.26 Bike-and-Ride



Ottawa, ON

DESCRIPTION

Parking provided at transit stops so that people can travel to/from transit on a bicycle without taking their bike on the bus or train.

BENEFITS

Extends the reach of transit to several miles beyond the transit stops.

Connects residential areas to transit ,increasing the transit catchment area.

Provides "last mile" connection from transit stops to employment not directly on transit.

APPLICATION

Provide at all major transit hubs, including Park & Rides, transit centers, and rail stations.

Provide at on-street bus stops where demand exists and space is available.

Provide on routes where on-vehicle bike space is regularly filled.

ELEMENTS

- Use bike racks, bike corrals, bike lockers, bike cages, or bike stations as appropriate.
- Where parking that requires a subscription (bike lockers or bike cages) or is not available 24 hours (bike station) is used, also provide bike racks.
- Locate bike parking as close to the transit stop as possible. Bike parking should be as close or closer than vehicle parking (except for ADA spaces).

Connections

4.27 Trail head



San Antonio, TX

DESCRIPTION

A trail head is parking area with convenient access to an off-street bike trail.

BENEFITS

Provides access to recreational trails for users who cannot comfortably bike to the trails.

Creates greater visibility of trail access point.

APPLICATION

Where major off-street paths meet convenient road access and right-of-way is available.

At parks adjacent to off-street paths.

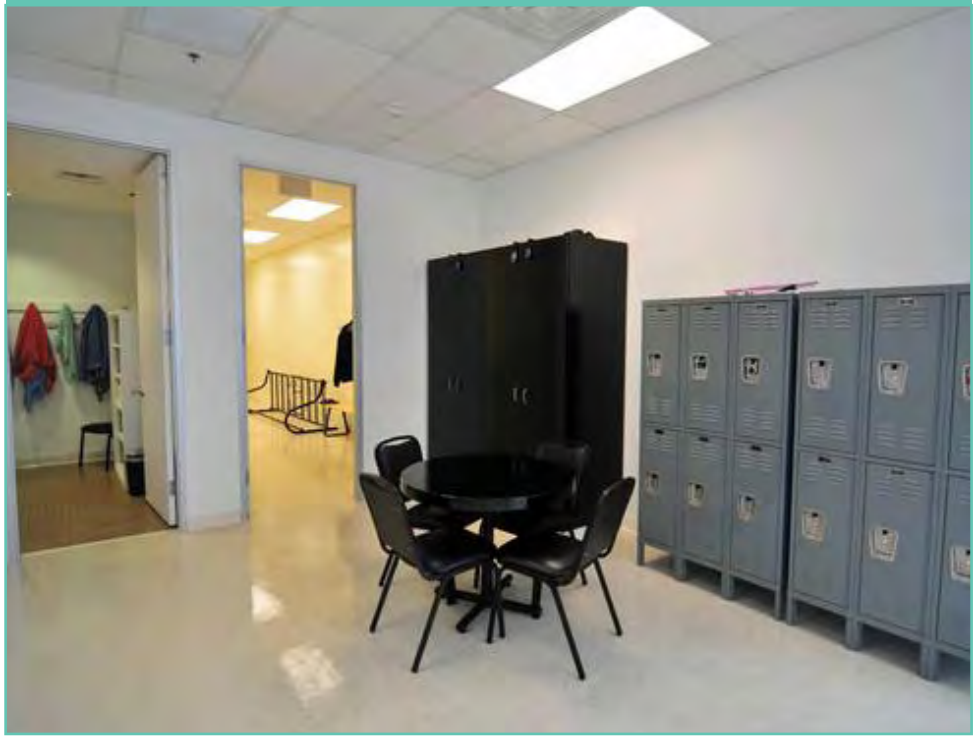
Person walking access and bicycle access should be prioritized over vehicle access.

ELEMENTS

- A trail head serves as a highly visible gateway and should be attractive and welcoming.
- Ensure that vehicle circulation and parking does not make it difficult or dangerous for people biking to reach the facility from surrounding streets.

Support

4.28 Lockers / Showers



Austin, TX

DESCRIPTION

Lockers and showers to allow riders the ability to shower and change when they arrive at their final destination.

BENEFITS

Allow people biking to wash and change after a ride.

Supports year-round bicycling in Houston weather.

Makes it easer for people who have jobs that require business casual or business attire to commute by bike.

APPLICATION

Locate in offices under the management of property owners.

Locate at colleges under the management of the college administration.

Locate in fitness center near employment or other destinations in conjunction with quality bicycle parking.

Maintenance and management are critical. An agency with staff and budget must be identified to operate.

Use is typically limited to subscribers who agree to the terms of use guidelines and are given access cards. Lockers are reserved.

Support

4.29 Bike Repair Station



Minneapolis, MN

DESCRIPTION

Stations with a selection of tools tied down with cables, a fixed hand pump, and a rack for holding a bicycle while working on it. Vending machines with parts, especially tubes, may be provided.

BENEFITS

Allows people biking to keep their bikes in good condition and repair breakdowns.

APPLICATION

Any location with high bike usage.

ELEMENTS

- Provide a rack to suspend a bike.
- Provide common tools for inflating and changing tires, maintaining chains, and adjusting seats and handlebars. Attach tools to rack with cables so they cannot be removed.
- Provide clearance to access bike without blocking circulation.
- Provide a vandal-resistant vending machine and stock with common tubes and other parts.
- Provide lighting.
- Ensure regular inspection, restocking, and maintenance.

Networks

4.30 Bikeshare (Houston B-Cycle)



Houston, TX

DESCRIPTION

A station where riders can check-out and check-in bikes either by buying a daily membership at the station with a credit card or by using a yearly subscription smart card.

BENEFITS

Make biking easy for people who do not have bikes or do not have their bike with them.

Can be attractive to recreational or tourism users.

Allows trips without having to utilize personal bicycle.

Can expand reach of transit network.

Can replace many short vehicle trips.

APPLICATION

Create network of stations spaced to allow access to many other destinations (e.g., every 1/4 mile).

Align with bikeway network to support safe, comfortable riding opportunities.

Locate at major destinations, including, places of employment, colleges, retail, entertainment, cultural institutions, civic buildings, and dense residential.

Locate at light rail stations, major transit stops, and transit centers to expand the reach of the transit system.

ELEMENTS

- Select highly visible locations.
- Provide sufficient space to allow for circulation without blocking any surrounding bikeways.

4.31 Bikes on Transit



Houston, TX

DESCRIPTION

Provisions for transit riders to take bicycles on board transit vehicles.

BENEFITS

Extends the reach of transit to several miles beyond the transit stops.

Connects residential areas to transit.

Provides "last mile" connection from transit stops to employment not directly on transit.

APPLICATION

Provide accommodations for bikes on all transit vehicles as currently provided by Houston METRO.

ELEMENTS

- Provide external bike racks or underfloor bike storage bins on all buses.
- Provide open floor space for bikes in all trains. Internal bike racks should also be provided.

Projects - Wayfinding

SIGNAGE + WAYFINDING

4.32 Comprehensive Wayfinding System 4-91



MUTCD Signage

WAYFINDING INTEGRATION

4.33 Integration into Building Wayfinding 4-93



4.34 Integration into Transit Wayfinding.....4-94



COH
City

Parks Department

METRO

Building Owners

Signage + Wayfinding

4.32 Comprehensive Wayfinding System



Portland, OR

COH

DESCRIPTION

A comprehensive set of signs that guides people biking from their origin to their destination along safe connected routes.

BENEFITS

Guides cyclists to their destinations .

Highlights high comfort routes and key connections.

Increases awareness of the bicycle network.

Encourages ridership by making people aware of possible destinations.

APPLICATION

Provide signs along the entire designated bicycle network.

Give highest priority to existing high comfort facilities, links to bayou trails, and useful but non-obvious connections.

MUTCD compliance and standardization support efficient ongoing maintenance.

Coordinate with Houston Parks Board-implemented Bayou Greenways wayfinding system.

ELEMENTS

1. Follow MUTCD standards for placement and size of signs.
2. The design of signs may vary and can include distinctive branding for neighborhoods, the Bayou Greenways network, or specific routes. All signs placed on streets (as opposed to off-street trails) should incorporate an MUTCD bicycle symbol to clearly indicate they are intended for people biking, not cars or people walking.
3. All directional signs should include destinations and distances. Distances to destinations should be shown directly on the trail such as parks and civic buildings, to neighborhoods on the trail, and to major activity centers (Downtown, Texas Medical Center, UH/TSU, Greenway Plaza, Uptown, Westchase, Energy Corridor, Greenspoint.) All signs should show distances; minutes may be added to encourage people to explore new destinations.
4. Decision signs should be placed in advance of all turns (near side of the intersection) or decision points along the bicycle route. Where there are multiple routes to the same destination, such as a shorter lower comfort route and a longer higher comfort route, it may be appropriate to include additional information.

.

CONFIRMATION SIGNS

Indicate to people biking that they are on a designated bikeway. Make motorists aware of the bicycle route.



DECISION SIGNS

Mark the junction of two or more bikeways. Inform people biking of the designated bike route to access key destinations.



TURN SIGNS

Indicate where a bikeway turns from one street onto another street. Can be used with pavement markings.



Figure 4.40: Source: NACTO Bike Route Wayfinding Signage System

Wayfinding Integration

4.33 Integration into Building Wayfinding



Portland, OR

DESCRIPTION

Signs guiding people biking from an on-street or off-street bicycle route to bicycle parking on the grounds of a building or campus.

BENEFITS

Helps people biking find available parking.

APPLICATION

Include in all public buildings by policy.

Encourage in all private buildings.

ELEMENTS

- Integrate signs with building wayfinding.
- Provide signs at regular spacing in visible locations.

Wayfinding

4.34 Integration into Transit Wayfinding



Portland, OR

DESCRIPTION

Signage at light rail stations, transit centers, and Park-and-Rides showing connections between transit and bicycle routes.

BENEFITS

Guides people biking from the bike network to transit.

APPLICATION

Provide signs from the bicycle path to the station platform or bus boarding area wherever the bicycle network connects to a transit facility.

ELEMENTS

- Make sure that signs follow a rider's entire path from the transit vehicle to the citywide bicycle network.

Policies

COH
City

ISD

PA
Public Agencies

TxDOT

METRO

Building Owners

The icons above are used in this section to identify responsibility of the recommendation and coordination that may be required.

Policies play a critical role in creating an environment for cycling.

Over the past half century, cities, states, and the federal government have shaped transportations policies around the needs of people in cars. Since bicycles are distinctly different from cars, some of these policies disadvantage people on bicycles and make bicycling less safe or less convenient.

There are many opportunities to make a significant difference with relatively small changes in policy.

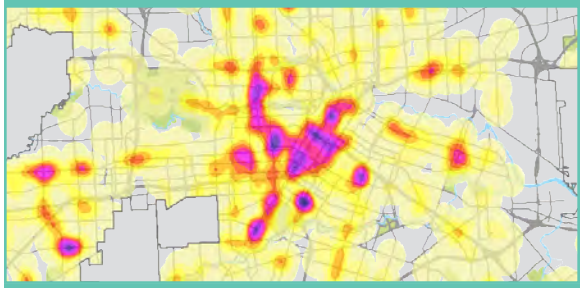
4.35 Complete Streets 4-98



4.36 CIP Process 4-99



4.37 Safety and Vision Zero 4-99



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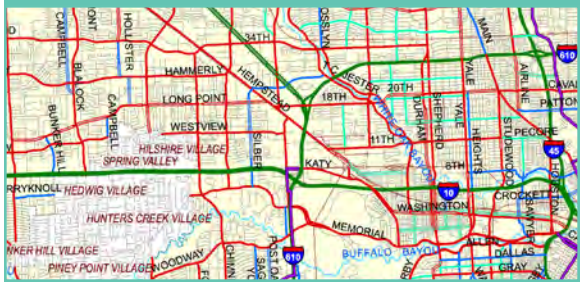

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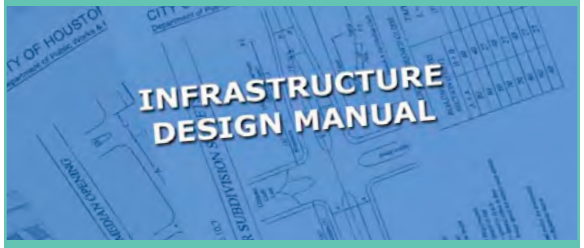

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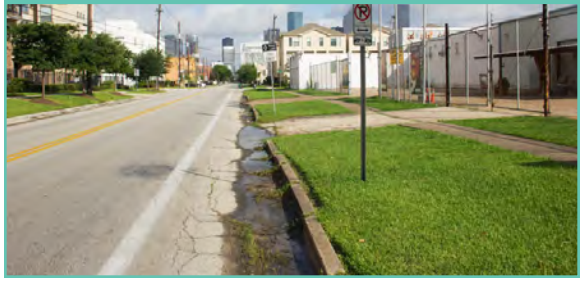

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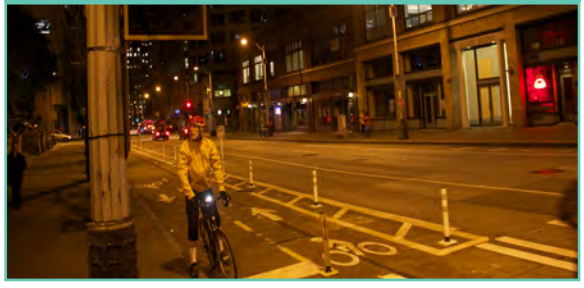

4.47 Bikes on Sidewalks Ordinance 4-106



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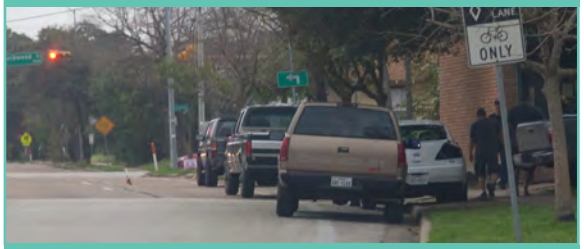

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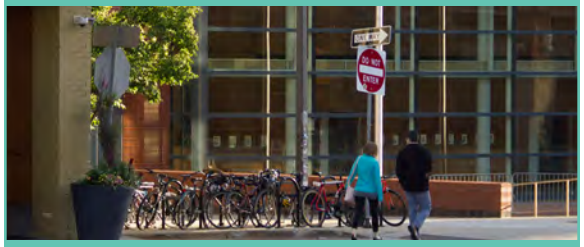

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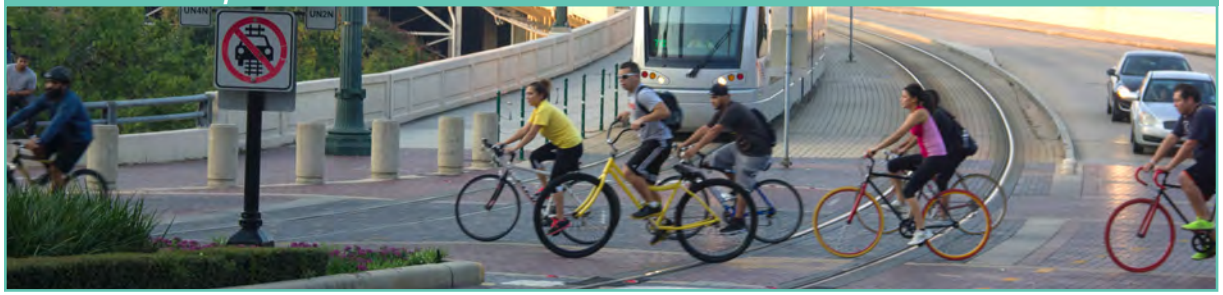
Texas Department of Transportation

Standard Specifications

Policies

4.35 Complete Streets



Houston, TX

COH

The city's complete streets policy, developed through a Mayoral Executive Order, has been a critical step towards developing more context sensitive street designs that take all users into consideration. But success will ultimately be measured by the continued development of completed networks for people traveling using all modes of transportation. That will require hard decisions. Building a complete street is easy where right-of-way is unconstrained and budgets are unlimited. That is rarely the case.

Where options are constrained, true complete streets thinking requires considering all modes equally given the surrounding land use context. This is a significant change from how the city and the region have designed roads and developed our existing bikeway network. The traditional approach has not resulted in a complete bikeway network. It may be possible to achieve a complete network by acquiring additional right-of-way or by building a parallel facility on another street. However, these options add cost and if that additional cost moves a project further back into future Capital Improvement Plans, the improved network is delayed. In some cases, creating a complete bicycle network within budget constrains will require providing fewer vehicle lanes than originally desired.

RECOMMENDATIONS

Further ingrain complete streets and context sensitive design principals into city policies and standards.

Complete streets and context sensitive design should be considered as an ordinance, not just an executive order.

Policies

4.36 CIP Process



Houston, TX

COH

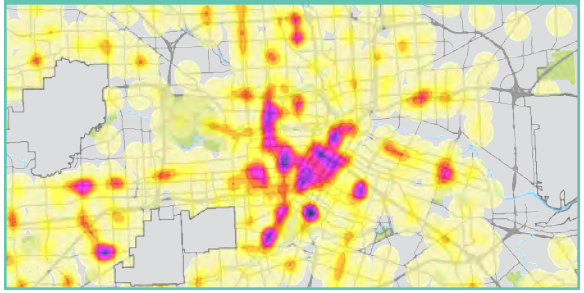
The Capital Improvement Plan process which prioritizes streets for reconstruction primarily considers traffic volumes and pavement conditions in prioritizing corridors for study and reconstruction.

RECOMMENDATIONS

Capital Improvement Plan criteria should be updated to allow projects which close key gaps in the bicycle network or improve bicycle safety to be prioritized.

Policies

4.37 Safety and Vision Zero



Houston, TX

COH PA

Crashes and people's sense of safety are key factors in the decisions people make in moving around the city. This impacts people's quality of life regardless of their mode of travel. The most vulnerable road users, including people walking and biking, can be most negatively impacted by safety challenges.

RECOMMENDATIONS

Adopt Vision Zero: a goal of eliminating traffic fatalities on city roadways.

Adopt a systematic approach to identify and address root cause issues to reduce the number of serious and fatal crashes that occur in the city.

Develop a forensic approach to identify opportunities to improve safety related to any fatal crash regardless of cause.

Policies

4.38 Major Thoroughfare Plan

COH

The Bicycle Master Plan should work alongside the Major Thoroughfare Plan to shape the city's transportation network. Because bicycles move at a fraction of the speed of cars, distance matters more to a person biking than to a driver. Thus, major bicycle routes often must be spaced more closely than major thoroughfares, and streets not designated in the Thoroughfare Plan may need to be bike routes.

In addition, current right-of-way designations are insufficient to allow the inclusion of bikeways. For example, typical 4 lane roadways are set as standard 80 ft right-of-way. Assuming 2 - 6 ft bike lanes, 4 - 11 ft travel lanes, a 16 ft median and two 10 ft pedestrian realms, all typical standard dimensions for that design element, it equals 92 ft. Standard 80' right-of-ways would require some trade off to support multimodal street design or acquisition of additional right-of-way.

The MTFP is a regulatory document directly impacting private development through right-of-way dedication, building setbacks, and other requirements. Unlike the MTFP, the Bike Plan is a guide for implementing bicycle facilities by public agencies, and has no regulatory impact. The Bike Plan does have a potential impact on MTFP designations. Adding a bicycle facility can modify the right-of-way needs for a particular street. The recommendations of the Bike Plan are only one component that determines the amount of ROW needed for a street. Some streets will need additional considerations for parking, transit, vehicular lanes, medians and pedestrian needs. Additional analysis is needed to consider all of the modes of transportation for a street and its ultimate ROW needs.

The City regularly performs this analysis, for example, through its sub-regional mobility studies and its preliminary pre-engineering studies, and proposes amendments to the MTFP accordingly with the ROW needs determined in these studies. The Bike Plan alone does not provide adequate design detail to determine the ROW need of a street or its MTFP designation. Updates to the MTFP take into consideration the Houston Bike Plan and future plan updates, completed sub-regional mobility studies, and other applicable plans

RECOMMENDATIONS

Coordination is required where a bike route is on a street also designated on the thoroughfare plan. Staff should evaluate the designated bike routes to make sure that the current thoroughfare designation, right-of-way width, and number of lanes and propose adjusted designations where required. Standard right-of-ways for particular lane counts should also be reviewed and policies such as Chapter 42 amended as needed to support the development of multimodal corridors.

Policies

4.39 Bike Connections in New Developments



Toronto, Ontario

COH

Frequently, development standards do not take bicycle connectivity into account when sites are developed.

RECOMMENDATIONS

City development ordinances should be updated to require all new developments to provide safe bicycle connections from surrounding public roadways to the front doors of all buildings. Development standards should also be updated to provide bicycle-only "shortcuts" where cul-de-sacs or a lack of roadway connections would require people biking to go more than 1/4 mile out of their way to reach a surrounding roadway. This recommendation complements and builds upon a similar mobility recommendations in the City of Houston's Northwest Sub-regional Study completed in 2015.

Policies

4.40 Infrastructure Design Manual



Houston, TX

COH

The city's Infrastructure Design Manual, which guides the design of every city street, should be updated to include the tools in this toolbox. While the City of Houston has proven itself capable of designing great bike facilities with the focused attention of city staff and the hiring of consultants with deep bicycle expertise, this is not possible on every project. Incorporating bicycle facilities in the IDM, with standard details, will enable high quality design facilities to be realized on a "typical" street project, regardless of the designer.

RECOMMENDATIONS

The Infrastructure Design Manual, which guides the design of every city street, should be updated to include tools in this toolbox. IDM standards should also be examined to consider their bicycle safety impacts on streets where cars and bikes share right-of-way.

Policies

4.41 Construction Coordination



Houston, TX

COH

Houston is a growing city and new development projects and roadway and utility construction projects continue to impact the streets and bikeways in the city. Given the limited network of existing high comfort bikeways in the city, when one is disrupted by a construction project, there can be limited alternatives for people bicycling to make their desired trips. These impacts occur on city streets and also the network of off-street bike paths. Continued expansion of the bikeway network will provide more alternatives but also more potential locations that may be impacted by roadway and development construction projects.

Currently, policies in the city require addressing these impacts on a street corridor when they are linked to impacts in vehicle traffic lanes but specific bikeway issues tend to be handled in an ad hoc fashion. Off-street facilities, frequently maintained by the City of Houston Parks Department or partners like the Houston Parks Board, also have limited ability to require the provision of a detour when construction impacts the use of a trail or path.

The City of Seattle recently developed a new Construction Management Plan policy to handle construction in walking and biking hotspots to try and modernize its policy for working with developers to incorporate a multi-modal approach to these issues. This policy develops stricter requirements when bikeways and sidewalks can be impacted by construction projects and the required mitigations.

RECOMMENDATIONS

Develop Construction Management Planning policies that support the City of Houston's ability to require the mitigation of impacts to the bikeway network due to construction projects. This should include maintaining the existing bikeways where possible and the provision of a suitable alternative where closure is required for any meaningful amount of time. The City should also take the lead in providing quality alternatives and other mitigations when performing roadway or utility construction projects as part of CIP projects.

Policies

4.42 Dedicated Funding Source



Houston, TX

COH

There is currently no dedicated funding source for bikeway projects. This includes both the capital funds required to build or stripe new facilities or funds for ongoing maintenance. Without dedicated and predictable funding, implementation of the bikeway plan becomes challenging. This also presents challenges when trying to communicate and discuss priorities with the community as lack of reliable funding makes time lines difficult to set.

RECOMMENDATIONS

Develop dedicated funding source/stream for bike project as capital and/or operations projects. Find ways to allow projects to be funded and implemented more rapidly than allowed by current CIP process.

Policies

4.43 Pursue Funding Opportunities

COH

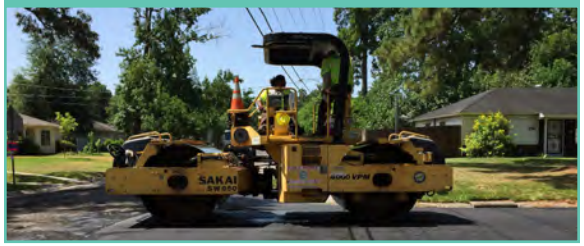
The City of Houston has typically avoided using federal funds for transportation projects (except very large ones) deeming the management of the projects not worth the additional funding. With city finances tight, federal grant funds could be valuable in moving more projects forward and expanding the high-comfort bicycle network sooner.

RECOMMENDATIONS

The city should look at ways to use federal funds and other available sources either by applying for funds directly or by partnering with other organizations that already use federal funds, such as management districts, METRO, or the Texas Department of Transportation. This can be done most effectively by packaging improvements into larger projects, such a long connected routes or upgrades to entire neighborhoods.

Policies

4.44 Include Bike Facilities in Restriping / Overlays



Houston, TX

COH

One of the ways that many cities are expanding their bikeway network is to implement pavement marking changes as part of regularly scheduled street maintenance. As street surfaces are overlayed, which improves the riding surface of a street without a complete rebuild, the City of Phoenix has been reviewing projects for the potential of adding bicycle facilities. Where capacity exists, either through narrowing vehicle travel lane widths or reallocation of space, new pavement markings have been applied to include bikeway facilities including bike lanes and bike routes. This has been done both with grant funding obtained by the city as well as through regular maintenance programs.

Regular maintenance of on-street pavement markings and street restriping programs are another opportunity to improve and expand the bikeway network. As streets that have been identified as potential bikeways are restriped, new comfortable bike lanes and intersection enhancements such as bike boxes can be considered. These may require modifications to existing traffic signal timing or detection which should be considered in the implementation of the programs.

RECOMMENDATIONS

When streets are overlayed, or pavement markings are maintained, street corridors on the City of Houston Bikeway Map should be reviewed and bikeways and intersection improvements should be included where possible. This will likely require additional oversight of maintenance projects by the City's Traffic Operations Division. Improvements that are made through maintenance projects should be captured on the City's existing bicycle map and in performance metrics collected by the city. New projects should be celebrated as expansions of the high-comfort bikeway network.

Policies

4.45 Speed Limits



Portland, OR

COH

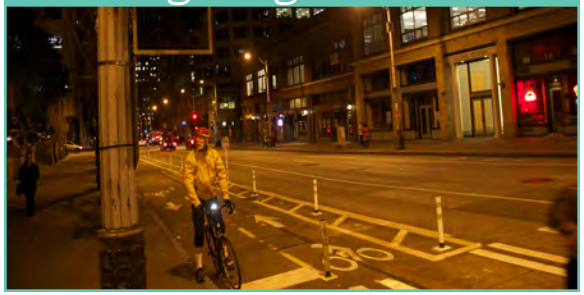
State law sets speed limits in urban areas at 30mph unless designated otherwise. However, the state permits cities to set speed limits as low as 25 mph on streets of four lanes or less that are not state highways. There is a dramatic difference in bike safety and level of comfort between these speeds. FHWA's "Bicycle Road Safety Audit Guidelines and Prompt Lists" cites studies which showed that the percentage of people biking killed or severely injured on streets with 30-35 mph speed limits was twice as much as on streets with 20-25 mph speed limits.

RECOMMENDATIONS

The city should support legislative action to allow a citywide speed limit of 25 mph for neighborhood streets, including neighborhood bikeways.

Policies

4.46 Lighting



Seattle, WA

COH

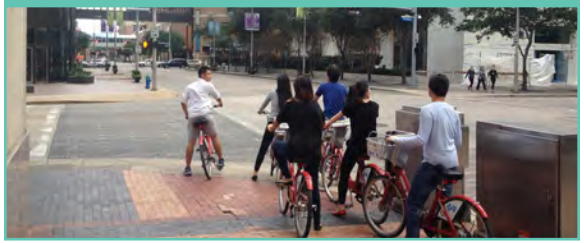
Roadway lighting in the City of Houston is installed and maintained by CenterPoint Energy to standards agreed upon by CenterPoint and the City of Houston. This lighting is intended to be adequate for on street lighting. In cases where lighting does not exist or a facility is off-street, enhanced lighting may be provided. AASHTO calls for average maintained horizontal illumination levels of 5 lux to 22 lux.

RECOMMENDATIONS

Where possible, provide lighting on off-street trails that form a key part of the city's bicycle network and cannot be avoided at night by the use of parallel safe on-street facilities.

Policies

4.47 Bikes on Sidewalks Ordinance



Houston, TX

COH

Current city ordinance restricts riding a bicycle on the sidewalk in commercial zones. Without many attractive alternatives, sidewalks are often the most comfortable place to ride in commercial areas that have many destinations people want to reach by bicycle.

RECOMMENDATIONS

The City Ordinance should be updated to allow people biking to ride on sidewalks. The Ordinance should continue to require people biking to yield to people walking.

This would match general current practice and take an ordinance that is not currently enforced off the books.

Policies

4.48 Bike Crossing of Minor Street



Portland, OR

COH

Where people biking cross a major street and no traffic control is provided to enable them to cross, they must either detour out of their way to the nearest signal (which by city standards could be 1/4 mile away) or risk crossing at that location.

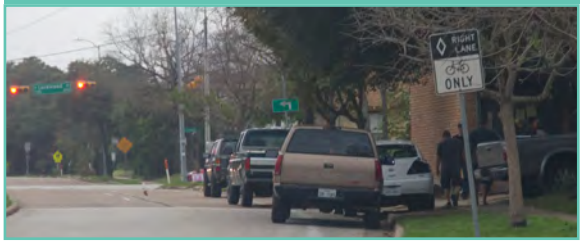
Under current city practices, where a well-traveled bike path crosses a minor street, the path has stop signs, while the street does not. This stopping and starting has a much greater impact on people biking than on a vehicle. It also encourages law-abiding cyclists to use arterials instead of off-street bike paths.

RECOMMENDATIONS

As bicycle volumes increase, monitor and consider appropriate treatments of bicycle paths crossing minor streets on a case by case basis.

Policies

4.49 Prohibit parking in bike lanes



Houston, TX

COH

Currently, parking is allowed in on-street bike lanes unless there is specific signage prohibiting people from parking their vehicles there. Placing signage along existing and future bike lanes would be costly and create significant additional sign clutter.

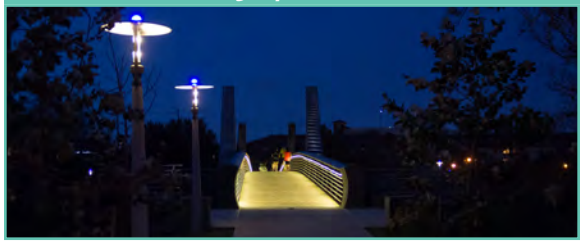
While not universal, in many cities such as Chicago, parking in a bike lane is illegal and subject to ticketing and a fine and does not require the additional of a "No Parking in the Bike Lane" sign. In Chicago the fine for parking in a bike lane is $150.

RECOMMENDATIONS

Develop an ordinance prohibiting parking in a bike lane at all times subject to ticketing, fine ,and/or towing of the vehicle. Coordinate with education of police department to support enforcement of the new regulation.

Policies

4.50 24 hr operation of trails in city parks



Houston, TX

COH

As part of the transportation network people utilize bikeways at all hours of the day. However, many Houston parks are open from dawn to dusk, meaning people riding home later at night would be entering a park when it is officially closed.

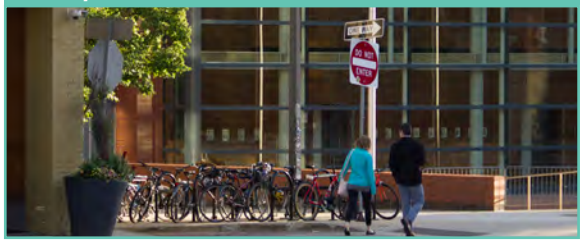
Some cities, such as St. Louis, have developed special provisions that allow people bicycling to access the park to utilize the trail for their trip. Signage at the park can create the exception to allow passing through the park but still prevent park use during off-hours for other uses. Where feasible, lighting for the trail should also be provided.

RECOMMENDATIONS

Develop a provision in the standard park operating hours that allows people bicycling to utilize a trail on the bikeway network through the park 24 hours a day.

Policies

4.51 Bike Parking Requirements



Grand Rapids, MI

COH

City parking ordinances require bicycle parking for new office, recreation, food and beverage, and retail uses, and allow additional bike parking to be substituted for car parking.

RECOMMENDATIONS

This ordinance should be expanded to require or create incentives for bike parking at all buildings except single-family residential, to apply to buildings that are remodeled even if the building use is not changed, and to require bike parking to be within 100 feet of the front door of the building.

Parking should be designed both for short term users, like retail customers, and longer term users, like employees.

Policies

4.52 Bike Facilities at Public Buildings



Houston, TX

PA COH

Convenient bike parking is critical to support an increase in bike usage. The City and other agencies can be role models in providing quality parking to people working at or visiting their facilities.

RECOMMENDATIONS

Every City-owned building should provide conveniently located, well-lit bike parking located in a highly visible secure location. The City should work with other public agencies to adopt similar policies.

Policies

4.53 Bike Friendly ISDs



Hutto, TX

School aged children are one of the most accessible and important groups of potential people biking. Yet, many do not receive formal training and encouragement to ride.

RECOMMENDATIONS

The City should work with school districts to encourage biking to school by providing secure bike parking, setting clear policies on bike riding to school, providing safety training as part of the curriculum, and regularly communicating to parents and students.

Policies

4.54 Agency Coordination

Texas Department of Transportation

Standard Specifications

PA COH

Achieving the City's Vision of a bicycle friendly city will require coordination with many partner agencies. As the City builds out its bikeway network and implements policies and programs to improve bicycling, there will be an increase in instances that key bikeways and connections will be on roadways or easements that are controlled by other agencies such as TxDOT, Harris County, or neighboring cities like Bellaire, West University Place, or Missouri City. Each of these entities has or is developing bikeway projects that will connect to the overall City of Houston plan. Many City bikeways intersect streets, frontage roads, toll roads and drainage easements managed by these other agencies.

A lack of coordination can lead to gaps or missed opportunities in a well-connected bikeway network, making trips more difficult for people bicycling in the city. Therefore, it will be important that the City facilitate conversations on network

connectivity, bikeway design elements, and policies to support a consistent experience for people biking. Where possible, the City should advocate for projects that are aligned with the goals outlined in the Bike Plan. Success in achieving the goals, including increased bicycle ridership and improved access to a high-comfort citywide bikeway network accessible by people of all ages and abilities, can be impacted by how partner agencies implement bikeway projects. For example, implementing low-comfort facilities, such as shared lanes on higher speed roadways, is not aligned with the recommendations and guidance in this Plan. On these roadways, a Separated Bike Lane or a Side Path would be a better solution.

RECOMMENDATIONS

Coordinate with adjacent cities and agencies such as TxDOT, Harris County, and METRO to align the recommendations in the plan with their plans and projects. Existing forums like H-GAC's Pedestrian and Bicycle Subcommittee can be utilized.

Additionally, a **City of Houston Bikeway Program Advisory Committee** comprised of community members, advocacy groups, and public agencies, should be established for coordination and prioritizing future efforts. Targeted meetings should be held on a regular basis to discuss coordination on specific projects and help set the overall vision and priorities for Bike Plan implementation. This is detailed further in **Chapter 6: Implementation Strategies.**

The city can also encourage the use of elements and approaches outlined in this chapter to create consistent bikeway designs, wayfinding approaches, and riding experience for people bicycling in and near the City of Houston.

The City of Austin's 2014 Austin Bicycle Plan also recognizes the importance of coordination with other agencies and provides special considerations for TxDOT roadways. The City of Houston should work with TxDOT to identify the appropriate bikeway types and tools that are pertinent to TxDOT facilities within the City and develop an agreed-upon approach to coordinating and constructing bikeways as identified in the Bike Plan.

Programs

PROGRAM TOOLKIT

Programs make up an important but often overlooked component in creating a successful culture of cycling within a city. Uniquely, successful programs may be put into practice by a number of different stakeholders including the City of Houston, management districts, advocacy organizations such as BikeHouston, private businesses, and individuals. Each of these stakeholders plays a role in building a supportive environment for people who ride bikes.

Throughout the country and world, there are literally thousands of bicycle programs, and new ones are being created all the time. While not exhaustive, this toolkit identifies major programs, some of which are already taking place in Houston and could be expanded, and others that would be newly introduced.

Broadly, the programs have been classified in five categories:

- **Certifications**
- **Outreach**
- **Bicycle Access and Repair**
- **Data and Technology**
- **New Facilities and Maintenance**

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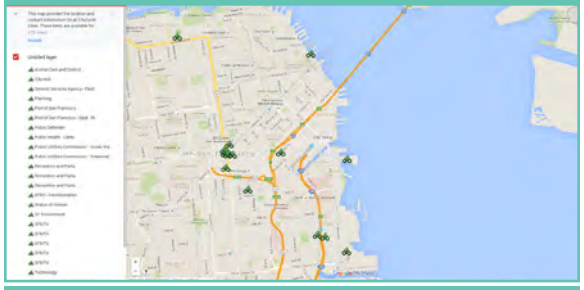

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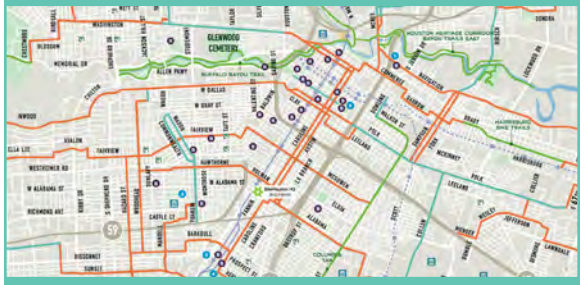

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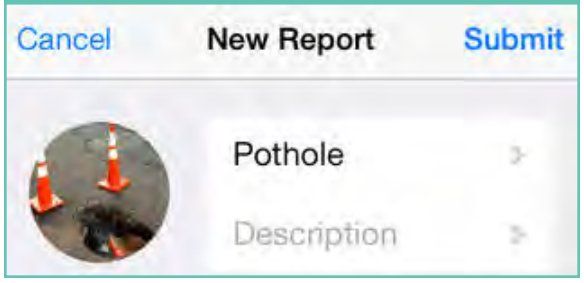

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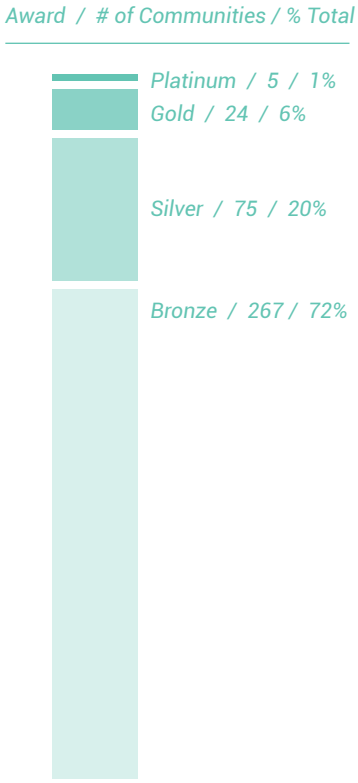
Engineering

Education

Enforcement

Encouragement

Evaluation



Houston is one of five Texas communities that have received a Bicycle Friendly Community designation from the League of American Bicyclists, and is one of 252 communities across the country that have received the bronze award.

Source: League of American Bicyclists, Current Bicycle Friendly Communities Fall 2015

Programs - Certifications

4.55 Bicycle Friendly Certifications



POTENTIAL IMPLEMENTERS

The City of Houston, Bicycle Advocacy Organizations, Universities, and Private Businesses.

DESCRIPTION

The Bicycle Friendly Community (BFC) program is administered by the League of American Bicyclists, which guides communities in understanding the opportunities to improve conditions for bicycling. The League has identified focus areas, known as the "Five E's", for creating a bicycle friendly community: engineering, education, encouragement, enforcement, and evaluation/planning.

Engineering addresses the design of the bicycle network and roadway conditions, total mileage of facilities, and access to public transportation.

Education includes public outreach, bicycle classes for adults, and support for schools.

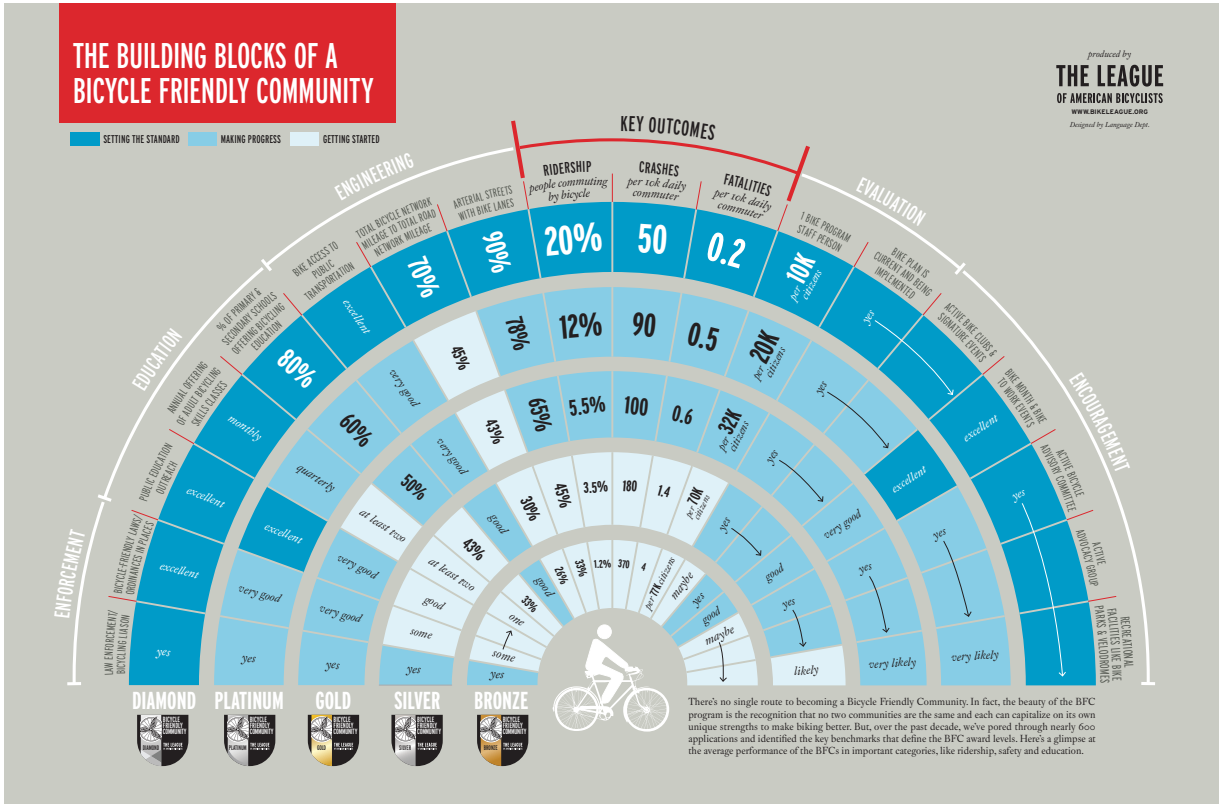
Enforcement is achieved through the creation, enforcement, and interpretation of bicycle-friendly laws and ordinances.

Encouragement is achieved through active bike clubs and events, which are supported by an active bicycle advisory committee and advocacy group.

Evaluation of an actively implemented bike plan is supported by bike program staff that help achieve desired outcomes, such as increased ridership and a reduction in crashes and fatalities.

Houston was awarded the bronze-level designation in 2013 and has a goal of achieving the gold-level by 2027. Advancing from bronze to gold in ten years is unprecedented, but achievable with diligent outreach and implementation efforts by the City and its partners in all five areas. Bloomington, Indiana is pursuing the ambitious goal to reach platinum-level from gold in five years, an initiative that has been led by the Bloomington Platinum Bicycle Task Force. Bloomington's implementation strategy details action items for each target including yearly targets for key indicators, cost estimates, and involvement of lead and supporting agencies.

Bicycle Friendly designations may also be pursued by universities and businesses,



The Building Blocks of a Bicycle Friendly Community

Source: League of American Bicyclists

important pillars of support for the City's effort to improving bicycling conditions for student and employee commuters. Many businesses and universities in Houston may already be well positioned to apply, and the League is a great resource that provides a roadmap for improvements. The League offers a Quick Assessment on their website for those interested in applying.

RECOMMENDATIONS

A Gold Bicycle Friendly Community designation is an explicit goal of the Houston Bike Plan. In addition, the City of Houston should coordinate with local universities to create campus bicycle plans and encourage applications for Bicycle Friendly Universities.

The City, management districts, and local advocacy groups should develop programs to assist and encourage private companies to apply for Bicycle Friendly Business designations by providing audits and advice. A specific target – perhaps 100 in 2 years – for increasing the number of bicycle friendly businesses in Houston should be set as goal for this encouragement.

Bike Safety Training
Source & image courtesy of The Source, thesource.metro.net

Programs - Outreach

4.56 Bike Safety Training



POTENTIAL IMPLEMENTERS

The City of Houston, Municipal Courts, Bicycle Advocacy Organizations.

DESCRIPTION

Confusion over traffic laws can make it challenging for drivers, people biking, and people walking to coexist. Many members of the local non-profit BikeHouston are certified as League Cycling Instructors by the League of American Bicyclists and offer courses that guide participants at all levels: from basic riding skills to advanced lessons on riding in traffic and avoiding crashes. Although these courses are offered for a fee, the organization also partners with communities for free safety events.

RECOMMENDATIONS

The City of Houston can increase its role in providing courses to the general public by offering free classes throughout the city at easily accessible locations. Los Angeles Metro did just that in 2015, and used a $224,000 grant from the California Office of Traffic Safety to provide free bike safety courses across the region during Bike Week. Classes were offered at three skill levels: Entry Level, Traffic Skills 101, and Intermediate Commuting.

The City can also partner with BikeHouston to offer additional courses and expand their offerings including building upon the on-line training available at bikeed.org. that has been sponsored by the City of Houston.

Boston Bikes was able to educate citizens on safe biking habits and to determine their level of knowledge on the subject with a single tool, an urban cyclist quiz. The City of Houston can improve on Boston's clever quiz in a number of ways. The City should create an online quiz with questions of greater depth and more critical thinking whose results can then be run to determine relevant statistics such as helmet and light use, intersection precaution, and several other topics of interest outlined in the Bike Plan. The quiz questions should be easily modified to gain insight into a variety of topics that change with every analysis. Its results can serve to inform future programming. Another way to widen the sample of feedback is to enter the participants into a raffle that incrementally distributes a box of prizes. In doing so, the quiz keeps participation up through incentives.

Programs - Outreach

4.57 Defensive Cycling



Defensive Cycling
Source & image courtesy of The Center for Cycling Education, thecce.org

POTENTIAL IMPLEMENTERS

The City of Houston, Bicycle Advocacy Organizations.

DESCRIPTION

In many communities, people biking are viewed as rule breakers. Unlike driving, safe cycling is not commonly taught in our country. In Houston, adult cyclists who break traffic laws and receive citations have the option to dismiss the citation and waive the fine by taking a Defensive Cycling course.

The course teaches participants about laws that apply to people biking and empowers them to practice safe bicycling behavior.

RECOMMENDATIONS

Include defensive cycling in annual police officer training and require police officers to proactively inform cyclists about their options.

Programs - Outreach

4.58 Bike Shop Outreach

POTENTIAL IMPLEMENTERS

The City of Houston, Bicycle Advocacy Organizations.

DESCRIPTION

Bike shops are a central component of bike-friendly communities. In addition to a business that sells, rents, and repairs bikes, bike shops often act as social centers and promote cycling by offering classes on riding skills, maintenance, and repairs.

The Portland Bureau of Transportation keeps an up-to-date list of local bike shops on its website. Activities and services are broken down into four categories: shops that offer repair-space by the hour; clinics and group classes; individual tutoring or small-group instruction; and in-depth professional training. The City's bike map also shows the location of bike shops and includes a list of contact information.

RECOMMENDATION

Maintain a list of bicycle shops and their contact information and publish the information on the City's website. Bike shops can also be integrated into printed maps and other material as sponsors or just as community information.

Bike Trains
Source: mynorth.com
Image courtesy of elgruponorte.org

Programs - Outreach

4.59 Bike Trains / School Bus



POTENTIAL IMPLEMENTERS

The City of Houston, School Districts, Bicycle Advocacy Organizations, Parent Associations.

DESCRIPTION

When safe routes to schools are available but underutilized, initiating a "bike train" can create excitement and overcome doubts about safety by helping children learn safe routes, teaching riding skills, and building community among neighbors and families. Norte!, a youth cycling non-profit in Traverse City, Michigan, used a $25,000 Safe Routes to Schools grant to organize The Great Traverse City Bike Train Experiment, a city-wide effort to create better connectivity between public schools.

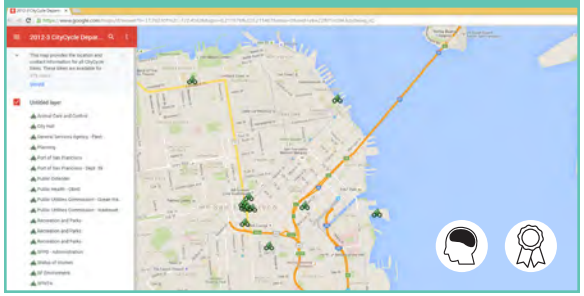
Through the program, adult guides led elementary and middle school students on rides through their neighborhood streets and explored safe urban paths to different schools. The desired outcomes include: more confident cyclists, increased self-esteem for children, reduced traffic congestion, and stronger social connections between friends and neighbors.

RECOMMENDATIONS

In coordination with local school districts, The City of Houston should develop an annual "Bike-to-School" day and coordinate with advocacy organizations and parent associations to develop a bicycle safety program in conjunction with City-wide Bike Trains.

Programs - Outreach

4.60 Commuter Outreach



Commuter Outreach source & image courtesy of Department of the City and County of San Francisco, sfenvironment.org

POTENTIAL IMPLEMENTERS

The City of Houston, Management Districts, Bicycle Advocacy Organizations.

DESCRIPTION

Outreach to employers about commuting options can encourage them to promote bicycling. Outreach can help employers understand and address conditions that keep employees from cycling, such as a lack of shower facilities. In addition to providing information, employers can host "lunch and learn" events, employee challenges, and other programs to educate and encourage commuters. Non-profit organizations have proven to be strong partners in implementing these programs.

In addition to commuting, work-related trips to job sites and meeting locations present an opportunity to partner with employers and provide company bikes, or bike share memberships. The City and County of San Francisco initiated the CityCycle program to provide bicycles for each city department that employees can use when traveling to meetings, site visits, etc.

One specific program for employers is the Parking Cash Out Program. By offering free parking spaces, employers inherently subsidize employees who commute by car. A Parking Cash-Out Program allows employees who bike, walk or take transit to receive a cash subsidy, rather than paying for a parking space they do not use. These subsidies create a more equitable situation that allows car-free employees to offset costs, such as bike maintenance or transit fare, or simply keep the cash.

California law requires a Parking Cash-Out Program be initiated by businesses that employ over 50 people and subsidize employee parking. The City of Santa Monica, for example, implements the program as a part its Emission Reduction Plan and offers incentives to reduce the number of employer-subsidized parking spaces.

RECOMMENDATIONS

Houston's Management Districts, which typically do a significant amount of outreach to the businesses within their boundaries, are a terrific opportunity for commuter outreach. The City of Houston can team with management districts to craft programs specific to each district.

Safe Routes Ambassadors Sources & image courtesy of Chicago Department of Transportation, chicagocompletestreets.org

Programs - Outreach

4.61 Safe Routes Ambassadors



POTENTIAL IMPLEMENTERS

The City of Houston, School Districts, Bicycle Advocacy Organizations, Parent Associations.

DESCRIPTION

The percentage of children walking and biking to school in the US has dropped drastically since the 1970s. Parents choose to drive their children to school instead, often due to concerns about safety. In addition to creating safer roadway conditions through physical improvements, the City may create a Safe Routes Ambassadors program, like one initiated in Chicago.

The City of Chicago's Department of Transportation offers two programs: the City of Chicago's Safe Routes Ambassadors and the City of Chicago's Bicycling Ambassadors. Ambassadors visit schools twice; first for a safety presentation, and then to conduct an outdoor workshop that applies lessons from the presentation. The program is funded by a grant from the Illinois Department of Transportation, Division of Traffic Safety and by the Chicago Department of Transportation (CDOT), with staffing assistance from the Active Transportation Alliance.

RECOMMENDATIONS

In coordination with local school districts, The City of Houston should develop a Safe Routes Ambassadors program. Bicycle advocacy organizations and parent organizations may be able to provide volunteers for the program. The City should set a target for the program.

Programs - Outreach

4.62 Incentive Programs

POTENTIAL IMPLEMENTERS

Bicycle Advocacy Organizations, H-GAC.

DESCRIPTION

Cycling has many benefits: it is a fun and healthy physical activity, an affordable transportation option, and allows commuters to breeze through rush hour traffic congestion. Several incentive programs have helped cyclists realize these benefits with rewards, prizes and discounts.

Zap Twin Cities enters frequent users (eight or more rides per month) into a drawing for rewards. Similarly, NuRide (available in Houston) allows users to redeem commuting points earned by biking, carpooling, taking transit, and other "green" modes of transportation. Capital Bike Share of Washington DC area offers member benefits that include discounts at participating local businesses.

RECOMMENDATIONS

Expand awareness of NuRide and the required resources to support its growth.

Programs - Outreach

4.63 Guaranteed Ride Home

POTENTIAL IMPLEMENTERS

City of Houston, Management Districts, Employers.

DESCRIPTION

The creation of a Guaranteed Ride Home program helps riders mitigate unpredictable situations that can discourage people from biking, including the possibility of inclement weather, riding at night because of unscheduled overtime, a flat tire, or a family emergency. Houston METRO already has a similar program for transit riders. The Alameda County Transportation Commission offers a Guaranteed Ride Home Program that is supported by the Bay Area Air Quality Transportation Fund for Clean Air. All permanent full-time and part-time employees who are employed within the county, and live within 100 miles of their work site are eligible to participate. Participants can register for this free service, which allows them to take a rental car, car share, or taxi ride, and submit their receipt for reimbursement of the cost.

RECOMMENDATIONS

Create a Guaranteed Ride Home program for people who bike to work in conjunction with management districts or private businesses.

Driver Education
Source & image courtesy of San Fransisco Bicycle Coalition, sfbike.org / Bike Cleveland, bikecleveland.org

Programs - Outreach

4.64 Driver Education



POTENTIAL IMPLEMENTERS

The City of Houston, Bicycle Advocacy Organizations, METRO.

DESCRIPTION

As more cyclists and drivers share roadways, increased awareness and education is needed to guide their interactions. The San Francisco Bicycle Coalition has partnered with the City and private companies to train thousands of drivers, including 1000+ taxi drivers per year, on making safe turns, loading and unloading, person biking rights, and general rules of the road. The Coalition coordinated with the San Francisco Municipal Transportation Agency to develop a Muni Operator training video, that is regularly viewed by transit operators. The trained professional drivers lead by example and help create safer streets. This type of course could be a valuable exercise for the Houston Police Department, whose officers are responsible for interpreting and enforcing safety laws. Bike Cleveland organizes a two-day seminar for officers on Enforcement for Pedestrian & Bicycle Safety that covers common causes of person walking and bicycle crashes; person walking & bicycle laws; and protocol for investigating & reporting a crash.

RECOMMENDATIONS

Develop a driver education program including enhanced education on bicycling specifically targeted at those who spend a great deal of time on Houston's roads and who are regulated by the City. This includes all City of Houston employees, METRO bus drivers, commercial vehicle drivers, and taxi drivers (including Uber and Lyft.) The Houston Police Department and the city's Fleet Management program would be key participants.

Implement a program through the city courts where those with traffic violations, especially those involving a person on a bicycle, can take driver education courses to dismiss their charges.

Programs - Outreach

4.65 Bike Commuter Buddy



POTENTIAL IMPLEMENTERS

Bicycle Advocacy Organizations

DESCRIPTION

Commuting by bike can be intimidating: dealing with weather, choosing a safe route, navigating through rush hour traffic, and even deciding what to wear can be the difference between choosing to bike or drive. "Bike Buddy" programs connect interested cyclists with experienced riders who act as mentors, teach skills, and build community.

Bike East Bay is a non-profit based out of Oakland, CA that connects people with "bike buddies." Interested participants sign up online to be connected with a buddy. The free program is supported by organization volunteers.

RECOMMENDATION

Support and advertise the development of a Bike Buddy program.

Programs - Outreach

4.66 Better Block



POTENTIAL IMPLEMENTERS

City of Houston, Bicycle Advocacy Organizations.

DESCRIPTION

"Better Block" is an event and demonstration tool that is designed to promote street-life and help communities reimagine the physical environment. The events provide an opportunity to "test" bike lanes, sidewalk bulb-outs, landscaping, parklets, and other streetscape components. These interventions allow the public and implementation partners to experience the proposed right-of-way design. Several better block events have been initiated by volunteer groups and non-profit partnerships in Houston.

RECOMMENDATION

Institutionalize temporary projects as an outreach technique for new projects.

Bike Commuter Buddy Source & image courtesy of Bike East Bay, bikeeastbay.org

Organized Bike Rides
Source: City of Fort Worth, fortworthtexas.gov
Image courtesy of: People For Bikes, peopleforbikes.org

Programs - Outreach

4.67 Open Streets



POTENTIAL IMPLEMENTERS

City of Houston

DESCRIPTION

Open Streets events transform streets into active spaces where people can walk, bike, dance, and socialize. They can be one-time or recurring events, where streets are closed to traffic for a full day or a few hours. The City of Houston has had a successful Open Streets program, Sunday Streets, since Spring 2014. The event is organized by the Department of Health and Human Services and sponsored by Cigna.

RECOMMENDATION

Expand Sunday Streets HTX to a year round event with the goal of moving to weekly or multiple times per month.

Programs - Outreach

4.68 Organized Bike Rides



POTENTIAL IMPLEMENTERS

City of Houston, Bicycle Advocacy Organizations.

DESCRIPTION

Hosting a city-organized bike ride encourages physical activity in communities, provides face-time between the public and city staff, and an opportunity to discuss bicycle facilities and rules of the road in an informal setting.

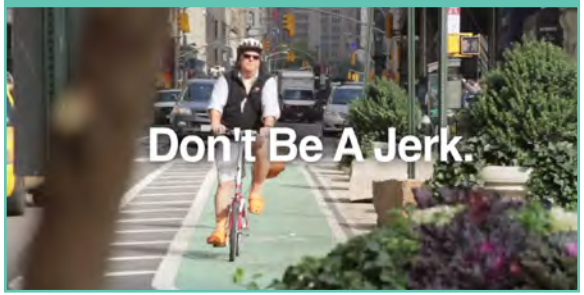
Mayor Betsy Price of Fort Worth leads a regular Rolling Town Hall across the City, often joined by Council members and Bike Fort Worth representatives. The ride is 5 to 7 miles long and stops at parks, community centers, and other neighborhood destinations.

RECOMMENDATION

Build on existing rides like Bayou Bikers and Tour de Houston to develop a regular schedule of group rides with city staff to promote the Bike Plan.

Programs - Outreach

4.69 Awareness Campaigns



Awareness Campaigns
Source & image courtesy of New York Department of Transportation

POTENTIAL IMPLEMENTERS

City of Houston, Bicycle Advocacy Organizations.

DESCRIPTION

Awareness campaigns can be targeted to inform the public about laws and consistent concerns that need to be addressed. Campaign messages should be tailored to local needs and concerns.

For example, after experiencing a 262% increase in commuter cycling, the New York City Department of Transportation initiated a "Don't Be A Jerk" bike safety campaign that humorously highlights issues like riding with traffic (not against), yielding to people walking, and staying off sidewalks.

In the City of Portland, the Smart Trips program targets a specific neighborhood for a door-to-door campaign to help educate people about their opportunities to walk or bike to work and the available resources that are available to help them do it. This has been shown to lead to a significant increase in walking and biking mode share. This approach can also be combined with outreach on transit or other opportunities.

RECOMMENDATIONS

Develop an awareness campaign upon completion of the Bike Plan in order to publicize the results of the Plan.

Develop/partner to implement a targeted outreach program similar to Smart Trips to build awareness of opportunities to bike and share other programs that are available to people (e.g., Commuter Buddy).

Develop a safety campaign targeted at both people in cars and people on bicycles.

Programs - Outreach

4.70 Bicycle Patrol Training



POTENTIAL IMPLEMENTERS

Houston Police Department

DESCRIPTION

The Houston Police Department has a fleet of 361 bikes and has bike patrols operating in a majority of its stations. They serve a variety of purposes, patrolling in major activity centers, neighborhoods, regional parks, airports, and special events, There are many benefits to bike patrols, including being able to access areas that a car cannot, and ability to engage with the community by breaking down the physical barrier of an automobile.

Over 900 officers are trained to conduct bicycle patrols. This training is voluntary; officers must complete an 8 hour Bike Orientation class along with a 32 hour Bike Certification class. Once an officer completes the training, the officer is considered "Bike Certified" and can work Bike Patrol on-duty and on extra-employment.

Additionally, this type of training helps officers better understand the needs and challenges that people biking face on roadways, and learn the rights and responsibilities of a cyclist. HPD also offers an optional Bike Refresher class that officers can take on a yearly basis, and an optional Bike Maintenance class.

HPD also orients all officer on bicycles. A roll call training video updated all officers on the rules of the road for motorists and cyclists, bike safety, and the safe passing ordinance, and two departmental circulars were also released to all officers in regard to the Safe Passing Ordinance. Training for new officers includes the same information.

Raleigh, North Carolina trained all its sworn officers in a "Bicyclist Safety and Law Enforcement" program in 2011, and the Chicago Police Department has put extensive efforts in training new bike patrol, with the allocation of $2 Million to assemble specially-equipped bikes for its expansion of 200 bike patrol assignments in the city's most dangerous neighborhoods.

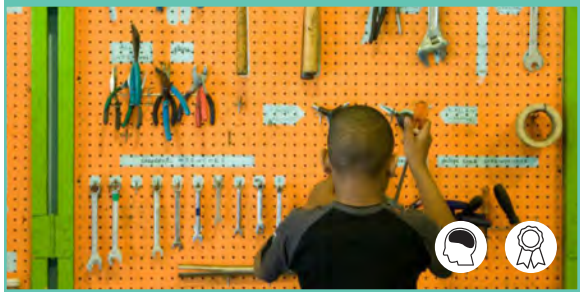
RECOMMENDATIONS

The Houston Police Department should require all sworn officers to complete a more extensive bicycle safety and law enforcement course

The Houston Police Department should continue to expand the bike patrol and encourage more officers to get bike patrol training.

Programs - Access and Repair

4.71 Earn-a-Bike



Earn-a-Bike
Image courtesy of Nick De La Torre, Chronicle

POTENTIAL IMPLEMENTERS

The City of Houston, Bicycle Advocacy Organizations.

DESCRIPTION

Earn-a-Bike programs increase access to bikes and empower youth and adults who spend time developing valuable skills by building their own bike. Typically, these programs are organized through non-profit organizations that require participants to volunteer a certain amount of time in return for the training, space and materials to build their own bicycle. Volunteers learn how to build, repair, and maintain cycles through collaboration and hands-on experience.

These organizations often host special volunteer hours to encourage women, children, and other underrepresented groups to participate. Compared to bike giveaways, these types of programs empower participants, who leave the experience with new skills and a bike they can be proud of.

RECOMMENDATION

Support additional earn-a-bike programs, especially in undeserved communities and at elementary and middle schools.

Bike Repair Workshops Source: LADOT Bike Program, ladotbikeblog.wordpress.com Image courtesy of: Caltech Bike Lab, caltechbikelab.blogspot.com

Programs - Access and Repair

4.72 Bike Repair Workshops



POTENTIAL IMPLEMENTERS

The City of Houston, Bicycle Advocacy Organizations.

DESCRIPTION

Casual riders are often intimidated by simple problems that are actually easy to repair. Sometimes, these simple problems keep casual riders off the road for several months at a time. Many non-profit organizations offer bike repair workshops to empower people to fix their own bikes. The classes can cover general maintenance skills, flat tires, parts identification, cleanings, safe riding skills, map reading, and connections with transit. These workshops also give riders access to specialized tools for maintenance and repair.

In addition to workshops, cities can install service stations in parks and other places with heavy bike traffic. These self-service stations include tools for changing flat tires, adjusting brakes and derailleurs, and inflating tires. The LA DOT Bike Program (Los Angeles) installed stations with funding from a $17,000 grant by the Bikes Belong Foundation.

RECOMMENDATION

The City and/or partners should create a system of bicycle repair stations, targeting major trails, bicycle parking facilities, libraries, and multi-service centers.

The City can support advocacy groups and bicycle shops which offer bike repair workshops, especially in undeserved communities.

The City can support advocacy groups and bicycle shops which offer bike repair workshops, especially in underserved communities, by providing venues, organizing logistics, and marketing the workshops.

Programs - Access and Repair

4.73 Bicycle Co-op



POTENTIAL IMPLEMENTERS

Non-profit organizations, University programs, bike shop owners.

DESCRIPTION

Bicycle co-ops provide affordable bikes and bike repair. These are typically non-profit organizations that are operated by volunteer support and funded by grants. They may also rely heavily on donated supplies to build and repair functioning bicycles.

Fort Collins Bicycle Co-op is dedicated to providing bikes to people who can't afford to purchase one, educating neighbors on all bike-related issues, reclaiming old bikes, and providing for those in need through donated bicycles and other charity events. The organization has a variety of programs that are designed to serve the various needs of the community, including mountain bike outings with undeserved youth and a partnership with the city to help recover stolen or abandoned bikes.

RECOMMENDATIONS

The City should look for opportunities to partner with similar organizations, such as the Third Ward Bike Shop, to determine how partnerships can be developed to achieve common goals. The City can facilitate partnerships between community-based non-profits and bike groups, help develop the proposals, and seek grant funding.

Bicycle App
Source: City of Toronto, toronto.ca
Image courtesy of Dandy Horse, dandyhorsemagazine.com

Programs - Data and Technology

4.74 Integrated Bicycle App



POTENTIAL IMPLEMENTERS

The City of Houston, Bicycle Advocacy Organizations, H-GAC.

DESCRIPTION

Online web tools and smart phone apps have become an integral part of trip and route planning, allowing people biking to avoid heavy-traffic roadways and find more bicycle-friendly routes. Existing resources like Google Maps include some functionality for cyclists. Cities can build on these resources by developing an open-source platform for city data and inviting web developers to create apps that are designed specifically for cyclists.

Many cities, including Toronto, San Fransisco and Minneapolis have developed official apps and on-line platforms. Cycling Toronto allows cyclists to record their routes, which can be shared with peers and used to inform city planning efforts. Toronto's app has approximately 3,700 users and features GPS route mapping, real-time trip stats, location of water fountains and bike share stations. The app also provides personalized information, including data on calories burned, greenhouse gas offset, and distance traveled. With enough use, apps can also provide useful data to planners, revealing the most used routes and undeveloped desire lines for cyclists.

RECOMMENDATION

Develop a bicycling app on the model of Toronto's to inform people who bicycle and collect data for the City's use.

Programs - Data and Technology

4.75 Data Collection



POTENTIAL IMPLEMENTERS

The City of Houston, Bicycle Advocacy Organizations.

DESCRIPTION

Improving bicycle-related data collection is crucial to understanding and planning for demand and behavior. Data collection provides information about usage before and after infrastructure is improved and to track demand as a means to support future infrastructure investments.

New York City, Seattle, and San Francisco all use the National Bicycle and Pedestrian Documentation (NBPD) methodology to count bicycles and people walking citywide. Counts are collected quarterly in January, May, July, and September - at PM peak (5-7pm), off peak (10am-noon), and Saturday (noon -2pm) time periods at each location.

RECOMMENDATION

The City should expand its existing count program to conduct regular bicycle counts throughout the city including both spot counts and fixed location counts that provide data on seasonality and overall trends.

Data Collection Source: National Bicycle and Person walking Documentation Project Image courtesy of Los Angeles County Bicycle Coalition, la-bike.org

Programs

4.76 Maps



Houston, TX

POTENTIAL IMPLEMENTERS

The City of Houston, BikeHouston.

DESCRIPTION

Even with smartphones and online mapping, paper maps are an invaluable tool for understanding the network and discovering new trails.

RECOMMENDATIONS

Continue to update high-quality, easy-to-read, pocketable paper maps of the trail system. Distribute through outreach channels and make available online.

Programs - Facilities and Maintenance

4.77 "Adopt-a- . . ." Program

Adopt-A-Bike Path Program
County of Los Angeles

POTENTIAL IMPLEMENTERS

The City of Houston

DESCRIPTION

Poor maintenance of bicycle facilities can severely limit their usefulness to the public and the network. At the same time, the costs of maintenance on a city wide level can be difficult. An "adopt-a-bicycle lane" or "adopt-a-trail" program, modeled on similar programs for bus shelters or roadways, would provide additional funding for bicycle specific maintenance. Generally, organizations or individuals are recognized with signage for their contributions.

RECOMMENDATION

The City should develop "adopt-a-....." program for bicycle infrastructure.

Programs - Facilities and Maintenance

4.78 Infrastructure - 311



POTENTIAL IMPLEMENTERS

The City of Houston

DESCRIPTION

311 provides a useful service for residents throughout Houston. People who bicycle can currently provide feedback on the existing 311 system, a specific code for bicycle related comments will allow them to be sorted and tracked separately.

RECOMMENDATION

The City should add a 311 code for bicycle specific feedback to track overall performance on bicycle related issues.

The city should add specific service request categories for bicycle-related items not currently listed in the 311 systems, like debris in a bike lane or bicycles not being detected by signals.

Programs - Facilities and Maintenance

4.79 Safe Routes to Schools



POTENTIAL IMPLEMENTERS

ISDs

DESCRIPTION

When children ride their bikes to school, children are healthier and both parents and school districts save money.

A safe routes to schools program focuses capital improvements on enabling safe trips for school aged children to get to school. The City of Houston already has this program for children walking to school; it can be expanded to include greater focus on biking as well.

RECOMMENDATIONS

The City should work with school districts to identify safe bike routes to schools from neighborhoods within their attendance zones, and to prioritize improvements within those zones in city projects.

Programs - Facilities and Maintenance

4.80 Bike Rack Grant Program



Houston, TX

POTENTIAL IMPLEMENTERS

The City of Houston

DESCRIPTION

End-of-trip facilities are an important component of a complete bicycle trip. A bicycle network that does not include adequate and convenient parking is unlikely to encourage more people to ride. Two barriers to better parking are access to quality bicycle racks to install (see Bicycle Parking in this chapter for a description of preferred racks) and the process to permit them for placement on city right-of-way. As the Houston Health Department has done recently, grants can be a good way of making bike racks accessible to people who would not otherwise be able to afford them. The Health Department obtained a grant and is working through a process that will allow new bike racks to be installed with partners who are interested. Harris County Health and Environmental Services Department also obtained a grant which allowed the installation of bicycle racks at light rail transit stations.

It is also important to have a clear process for where bike racks can be installed if considering placing them in the public right-of-way. This includes requirements for placement and clearance for the racks so as not to create hazards, or block sidewalk or other travel ways. It also includes a straightforward permitting process to allow bike racks to be installed in convenient and useful locations.

RECOMMENDATIONS

Develop grant programs that make it possible for more people to have access to quality bike racks.

Develop permitting process as necessary to readily set criteria for installation and allow bike rack installations to be permitted in appropriate locations.

Programs - Facilities and Maintenance

4.81 Maintenance



Houston, TX *Source: BikeHouston*

POTENTIAL IMPLEMENTERS

The City of Houston

DESCRIPTION

One of the most common points of feedback on the current bikeway network in the Houston region is the variable and often poor condition of the existing bikeways. This includes debris, ponding, and pavement and gutter conditions that make riding in some existing bike lanes difficult and potentially dangerous where the risk of falling or swerving into travel lanes is possible. Issues also include the degraded or substandard quality of some off-street facilities in parks and along easements or bayous.

The problem is exacerbated when bike lanes or trails are narrow and below current desirable standards. As the City and its partners expand the bikeway network and bring existing bikeways up to standard, the challenge of maintenance will grow.

Cities have adopted various strategies to maintain bikeway facilities including spot maintenance programs, which can be tied to community feedback. These often use programs similar to Houston's 3-1-1 program to address issues with riding surfaces, encroaching vegetation, faded markings, missing signage, or drainage issues. Partnerships are also critical. Adopt-a-bikeway type programs or partnerships with local entities such as management districts can supplement city efforts. Advocacy Advance (A partnership between the League of American Cyclists and the Alliance for Walking & Biking) developed an overview guide that discussed how cities and states across the US have addressed maintenance issues and provides additional strategies for implementation. (http://www.advocacyadvance.org/docs/Maintenance.pdf)

RECOMMENDATIONS

Maintenance should be a key factor in the design of new bicycle facilities and fully thought through as new facilities are implemented. Materials should be chosen to minimize life cycle maintenance requirements while supporting a safe and high-comfort riding experiences. Thought should be given to where higher cost elements (e.g., green pavement marking) will have the biggest benefit. On-street bicycle facilities should be maintained or enhanced as part of routine roadway maintenance though it may be beneficial to prioritize bikeway maintenance

issues as a tool to help address the safety of more vulnerable roadway users.

The City should develop a maintenance program to improve the conditions of the existing bikeway infrastructure including street sweeping, pavement repair, and striping. This can be developed through the use of city funds, partnerships with the private sector, and public programs such as adopt-a-bike lane. The City should also define a minimum level of maintenance for bicycle facilities. Current funding levels will not allow the City of Houston to achieve the desired level of maintenance and should be addressed as new facilities are developed and will require new sources of funding and higher funding levels.

CHAPTER 5
NETWORK PLAN & MAP

Chapter Table of Contents

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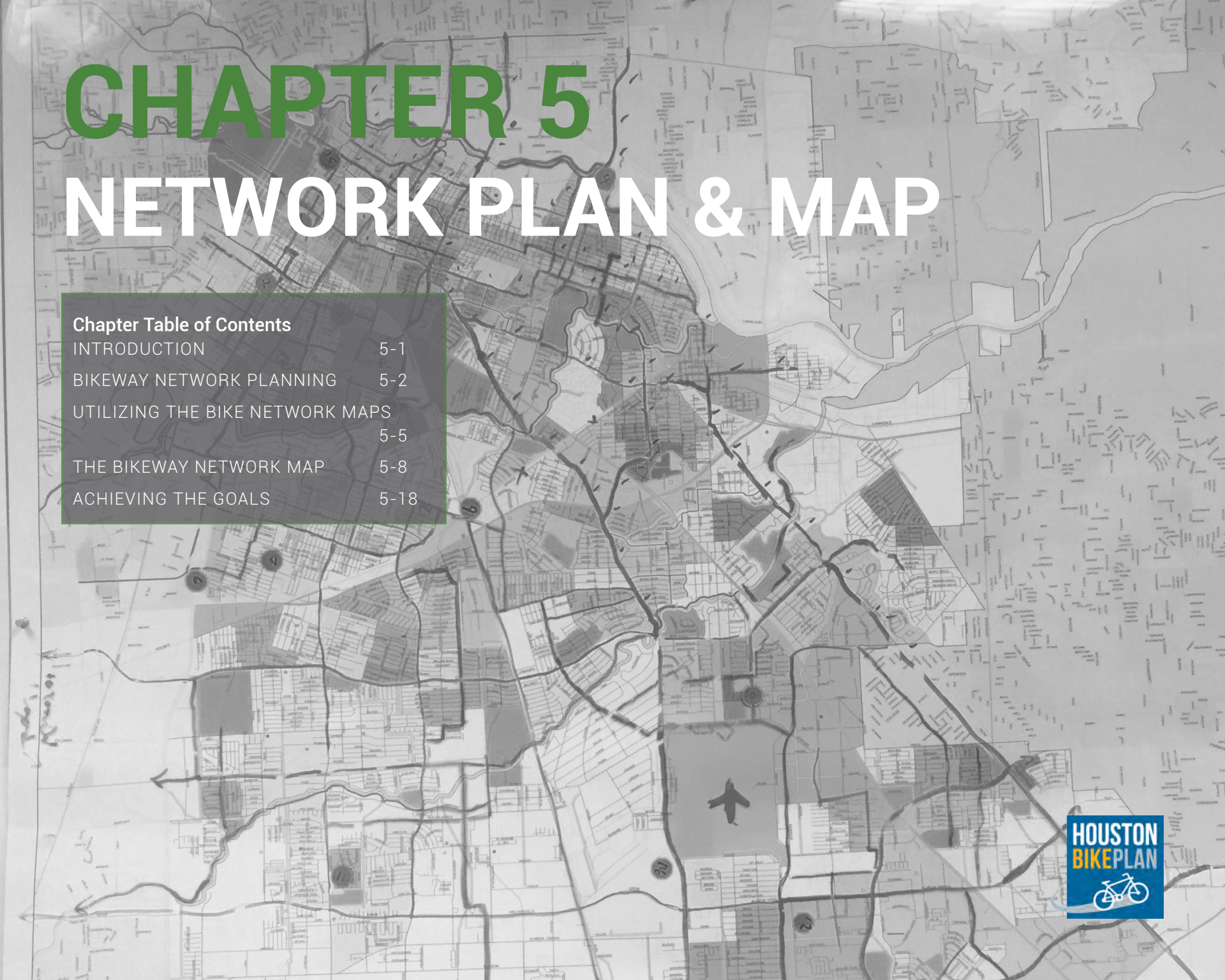
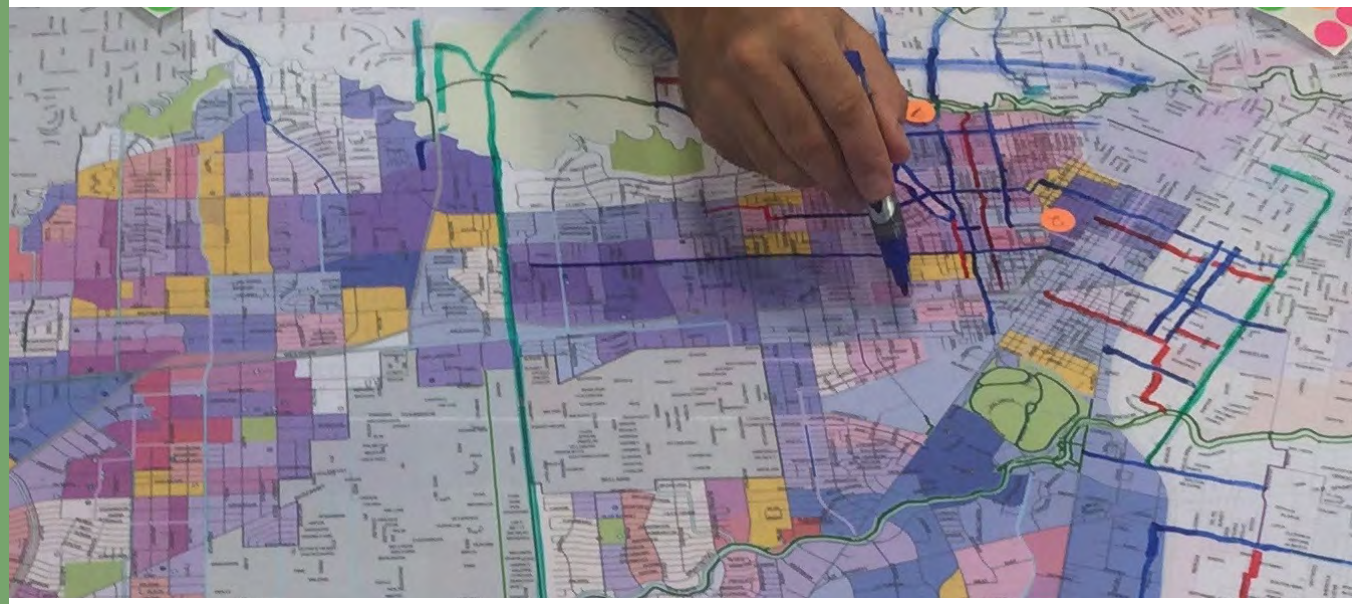


05

NETWORK PLAN & MAP



The bikeway design elements, policies, and programs outlined in **Chapter 4: Bicycle Toolbox** set the approach for helping Houston realize the goal of becoming a more bike-friendly city as described in **Chapter 3: Vision & Goals**. Significant public feedback and input from stakeholders indicated that a low-stress, well-connected bikeway network is the most critical need that must be addressed in order to move Houston toward its goals. Over 70% of respondents to the bike plan survey identified this as one of the top two priorities to improve biking in the city and many people cited gaps in the existing bikeway network as the biggest impediment to more people biking.

To develop the Bike Plan's bikeway network, the study team gathered for a week-long workshop to begin the process of mapping the future bicycle network in the City of Houston. Existing infrastructure, assessment of comfort levels, and planned projects identified in **Chapter 2: Existing Conditions & Opportunities** served as a baseline and starting point for the network. Ideas for new facilities were based on public input, along with travel demands, demographic data, and the team's knowledge and experience of bicycling in Houston. This plan was refined through input from stakeholders, further research of specific field conditions, and coordination with other implementation entities including Management Districts, Tax Increment Reinvestment Zones (TIRZs), Harris County, and adjacent cities that have been working on bikeway improvement projects.

The draft network developed by the Houston Bike Plan team was refined through input from the funding partners, Bicycle Advisory Committee (BAC), and through feedback gathered from the

public at meetings throughout February, March, and April 2016 (detailed in **Chapter 6: Implementation Strategies**). Every comment was considered and specific suggestions were evaluated against the goals of the Bike Plan to determine if a change was needed.

The resulting network, presented in this chapter, is a long-term vision, to be implemented over multiple time horizons. The network plan identifies programmed components that are funded and scheduled to be implemented as well as projects that have the potential to be implemented in a shorter, five year time frame if funding were available. Additionally, key projects are identified that would yield the greatest benefits in terms of city-wide network connectivity.

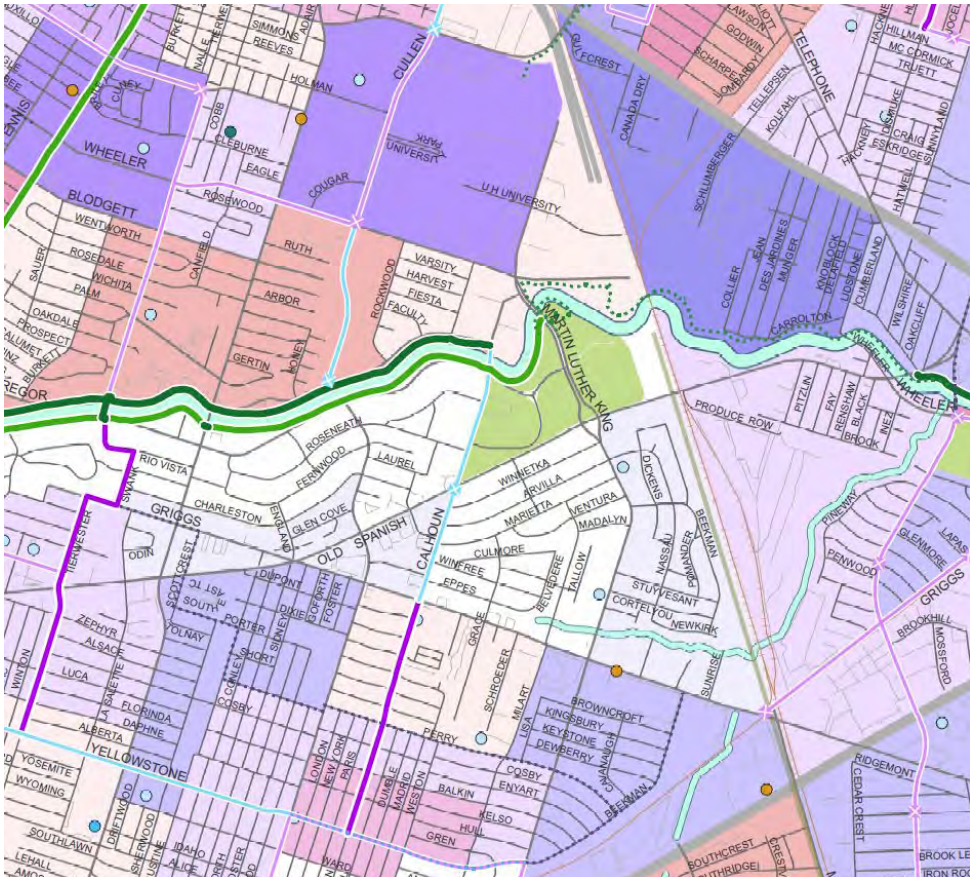
BIKEWAY NETWORK PLANNING

The network planning workshop was a collaborative effort involving City of Houston staff representing three departments (Planning & Development, Public Works & Engineering, and Parks & Recreation) and the consulting team. Members of the Bicycle Advisory Committee were also invited to participate in one portion of the workshop to observe the approach and process, and to provide feedback on the draft plan.

The team devoted a full week to the network planning workshop. Maps posted around the room showed population density, job density, poverty density, major destinations, management districts, TIRZ boundaries, existing bikeways, and bicycle facilities recommended in previous planning studies. Other resources at the team's disposal included the City of Houston Major Thoroughfare and Freeway Plan, traffic counts, right-of-way information, and Google Earth aerial imagery. The specific comments collected during the first public outreach phase were sorted by geographic area and reviewed periodically to ensure they were addressed as part of the planning process.

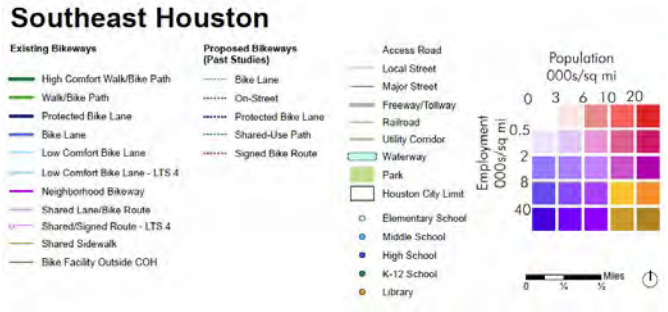


The Houston Bike Plan Team works on bikeway recommendations for northwest Houston during the network planning workshop.



A closer view of the table map showing job and population density, existing bikeways, and recommendations from past studies (above).

The legend for the network planning workshop table maps (right).



Drawing the Lines

To develop the plan, the city was broken into eight sections and each was the focus of a detailed design exercise. Working as a group, the team developed recommendations on a table map zoomed into one portion of the city at a time. The map for each section depicted roads, parks, bayous and drainage channels, population and job density, and the location of schools and libraries, along with existing bikeways and proposed bicycle facilities from previous planning efforts.

Proposed facilities for the Bike Plan were drawn and classified as 'Off-Street' (green), 'Dedicated in Street Right-of-Way' (blue) or 'Shared On-Street' (purple). Blue lines were drawn on streets where dedicated space such as a bike lane or side path will likely be required to meet the goal of providing a high-comfort bikeway. Purple lines were used on lower speed, low volume streets where high-comfort shared lanes are realistic.

More detailed facility specifications - for instance, whether a bike lane should be buffered or not - will be determined in the engineering and design phase of specific projects in consultation with **Chapter 4: Bicycle Toolbox**. The facility type (green, blue, or purple), may also be reconsidered in the design phase based on the and community engagement, the desired level of comfort, roadway design, and available right-of-way.

In developing the map, careful attention was given to ensure continuity of bikeways in adjacent areas of the city. The focus

was on developing a cohesive citywide network, linking areas of housing, jobs, major destinations and activity centers, providing connections across longer distances, and connecting to major off-street bikeways such as bayous, parks, and other trails.

The density of proposed bikeways in a particular section of the city was typically aligned with the density of activity, the connectivity of the roadway network, and availability of off-street corridors. Neighborhood routes that deliver connectivity benefits or had been prioritized through other plans were included while those that simply run within a neighborhood were typically not.

Existing conditions information was referenced to assess the feasibility of each recommendation in light of available information about existing right-of-way, roadway configuration, and traffic demands. Ideas and concepts requiring additional research or coordination were noted. The team continuously compared the progress of the draft network to public feedback from the corresponding area to confirm that all ideas were taken into consideration.

Toward the end of the network planning workshop week, members of the Bicycle Advisory Committee were invited to provide additional input on the progress.

At the end of the workshop, the working maps were photographed and the proposed lines were transferred to GIS software to aid in review, analysis, and mapping.

The Bike Plan is a master plan similar to other City master plans that outline the City's long range vision, goals and recommendation for policies, programs and projects. It is also a component plan required by the City's Complete Streets Executive Order. Master plans are adopted by City Council Motion and not ordinance.

The facilities shown on the maps are recommendations for future facilities, representing corridors along which bicycle facilities should be considered along the corridor. Having a recommended facility in the Plan on a street does not mean the facility must be built on that street; nor does the Plan prohibit a facility from being built if the facility is not shown on a map in the Plan.

Although the Plan does not require agencies to construct in accordance in the Plan, it does compel agencies who are improving streets to consider the Plan as they develop plans and design for any improvement along the corridor. Final decisions on the design and location of bicycle facilities will only happen after additional analysis and public engagement. In some cases, detailed planning, design and community feedback may determine a more appropriate route to serve the same connection. If so, the proposed bikeway may be relocated elsewhere within the same general corridor.

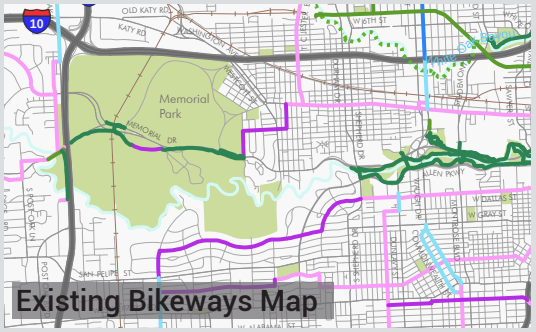
Important Note on Bike Plan Maps:

The lines on the maps represent transportation corridors that are recommended for bicycle facilities. Public engagement beginning no later than the preliminary engineering phase will be conducted prior to the determination of the specific location and design for all new bike facilities.

Blue lines shown on short-term and long term-maps as future projects represent dedicated bicycle facilities within the street right-of-way. A side path within the right-of-way could be implemented where appropriate, based on context, design considerations, and community input.

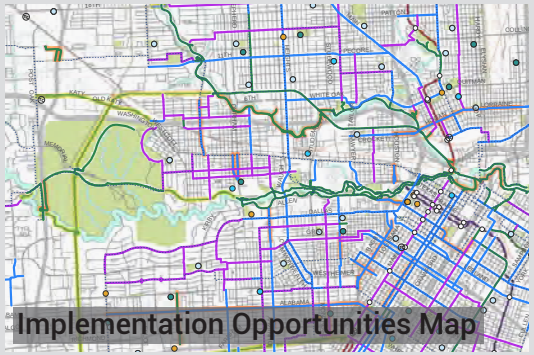
HOW TO UTILIZE THE BIKEWAY NETWORK MAPS

The bikeway network maps developed in this chapter are provided in greater detail online in both static and interactive versions on the Houston Bike Plan and Houston Bikeways Program websites. It is recommended that the city maintain the following bikeway maps to communicate and manage the development of the bikeway network.

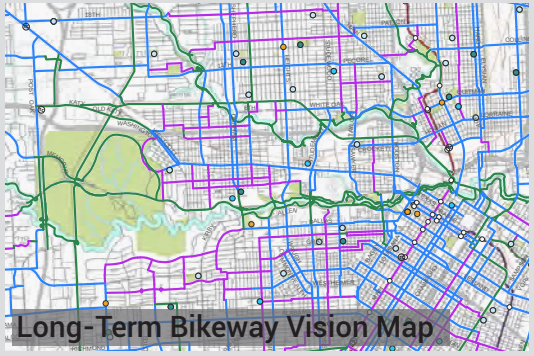


Existing Bikeways Map

The **Existing Bikeways Map** should be available and primarily utilized to communicate the existing network to people for ***trip planning***. This map should include facility type and level of comfort details so that all bicyclists can select routes aligned with their skill and comfort level. This map should be updated as new bikeway segments are implemented or, where no dedicated bikeways exist, new bikeway segments are assessed for level of comfort. A version of this map should be made readily available in an easy-to-carry, easy-to-read, pocket-sized format as well as an online tool.


Implementation Opportunities Map

The **Short-Term Implementation Opportunities Map** serves as a tool to ***identify, track, and manage near-term implementation*** projects. This includes funded projects as well as potential implementation projects that are feasible and possible with limited resources. This map serves as a coordination platform for city projects and opportunities, partner implementation coordination, and development coordination. New projects should be added to this map as they are identified for potential implementation by the City and regional partners. The map should be developed to help support future grant applications, calls for projects, and project prioritization.


Long-Term Bikeway Vision Map

The **Long-Term Bikeway Vision Map** outlines the corridors where bikeways are desired to support the city's goals of providing citywide access to safe, comfortable bikeways that connect many people to many jobs, activity centers, and destinations. This map should link with the city's overall plan for complete streets implementation and serve as the framework for the development of new facilities. It should be a key input as new roadway corridors are constructed or roads are redone through the CIP program, or constructed by other entities.

On the maps, blue lines represent dedicated bikeways within the street right-of-way. A side path within the right-of-way could be implemented where appropriate, based on context, design considerations, and community input. For example, some corridors may be shown on the map in blue indicating a plan for a dedicated on-street facility with the public street right-of way along the corridor, but through detailed planning and engineering a side path within the public right-of-way may be determined as a more appropriate design for the bike facility. This is why side paths are shown in both the Off-Street column (Green) and the Dedicated On-Street column (Blue) of facilities in the Bicycle Toolbox in Chapter 4. . If constructed as a side path, the bikeway will be shown in green on updated maps of existing bikeways.

The Bike Plan map recommends bike facilities along a broad range of on and off-street corridors. In general, the study team attempted to use local and collector streets where feasible as they often provide the most comfortable and safe route for a bicyclist. However, local and collectors streets do not always provide direct, convenient connections between neighborhoods or provide access to important destinations. In some areas of the City, there is not a well-connected roadway network other than the major thoroughfares. Recognizing these challenges, the League of American Bicyclists recognizes the value of thoroughfares in a bicycle network, and includes percentage of arterial streets with bike lanes as one of its benchmarks in achieving a silver or gold bike-friendly community rating. In order to create a well-connected network some major thoroughfares are also included as part of the overall bikeway network.

ThinkBike

The unique context of Downtown Houston and an opportunity to engage international experts supported an additional workshop to build more detailed consensus around

ThinkBike Workshop - Downtown Houston

Source: Rice Design Alliance



recommendations for Downtown bicycle infrastructure. To this end, the City of Houston and the Downtown Management District sponsored a workshop in mid-October called ThinkBike. Consultants from the Dutch Cycling Embassy were brought in to provide expertise on worldwide best practices, and the public was invited to hear from them and provide input. A diverse group of engineers, planners, architects, property owners, developers, city staff, advocates, and students were invited to take part in the two-day working session which culminated in a public presentation of bikeway recommendations for Downtown Houston. Those recommendations were incorporated into the draft network plan presented here.

Updates to the Bike Plan Maps:

Based on additional community input after this document was developed, the several additional changes will be made to the online versions of the final draft Bike Plan maps (Note: These changes will not be made to the maps included within this document, only to large format and online maps.)

- Center Street between Houston Avenue and Detering Street and Detering Street between Center Street and Washington Avenue have been added as shared on-street facilities to the short-term implementation opportunities map following additional public comment, outreach, and analysis.
- Ranchester Road between Town Park Drive and Bellaire Boulevard has been added as a dedicated in street ROW bikeway to the short-term implementation opportunities map as a result of a pre-engineering study for need area N-2016T-0010.
- W. Airport Blvd. between Hiram Clarke and Rosehaven Drive, change from green (off-street) to blue (dedicated on-street). This reflects a programmed TxDOT project.
- Elmside and Woodchase in Westchase as green (off street) on the long- term visions map. Westchase District is actively designing a side path along these streets from Westheimer to the Centerpoint trail south of Westpark Drive. This project has been discussed with PWE including a new traffic signal to cross Richmond.
- Walnut Bend Lane from Olympia to Cedar Creek, Cedar Creek from Walnut Bend to Blue Willow, Blue Willow from Cedar Creek to Riverview, and Riverview from Blue Willow to Harbor Oaks as shared on-street; Harbor Oaks from Riverview to Beltway 8 frontage as dedicated (Blue). These are part of as connection north to Terry Hershey Park.
- Chimney Rock south of Orem has been changed from long-term to short term.
- Bikeways on Lamar Street between Bagby Street and Buffalo Bayou and Holman between Smith and Louisiana have been added to the existing facilities map
- Boheme from BW8 to Memorial Drive (shared on-street) and Woodway between Bering Ditch and Winrock Blvd. (off-street) added to long-term map.
- Briargreen Drive between Richmond Ave. and Piping Rock Lane added as shared on-street bikeway to long-term map to provide additional connectivity.

BUILDING THE BIKEWAY NETWORK MAP

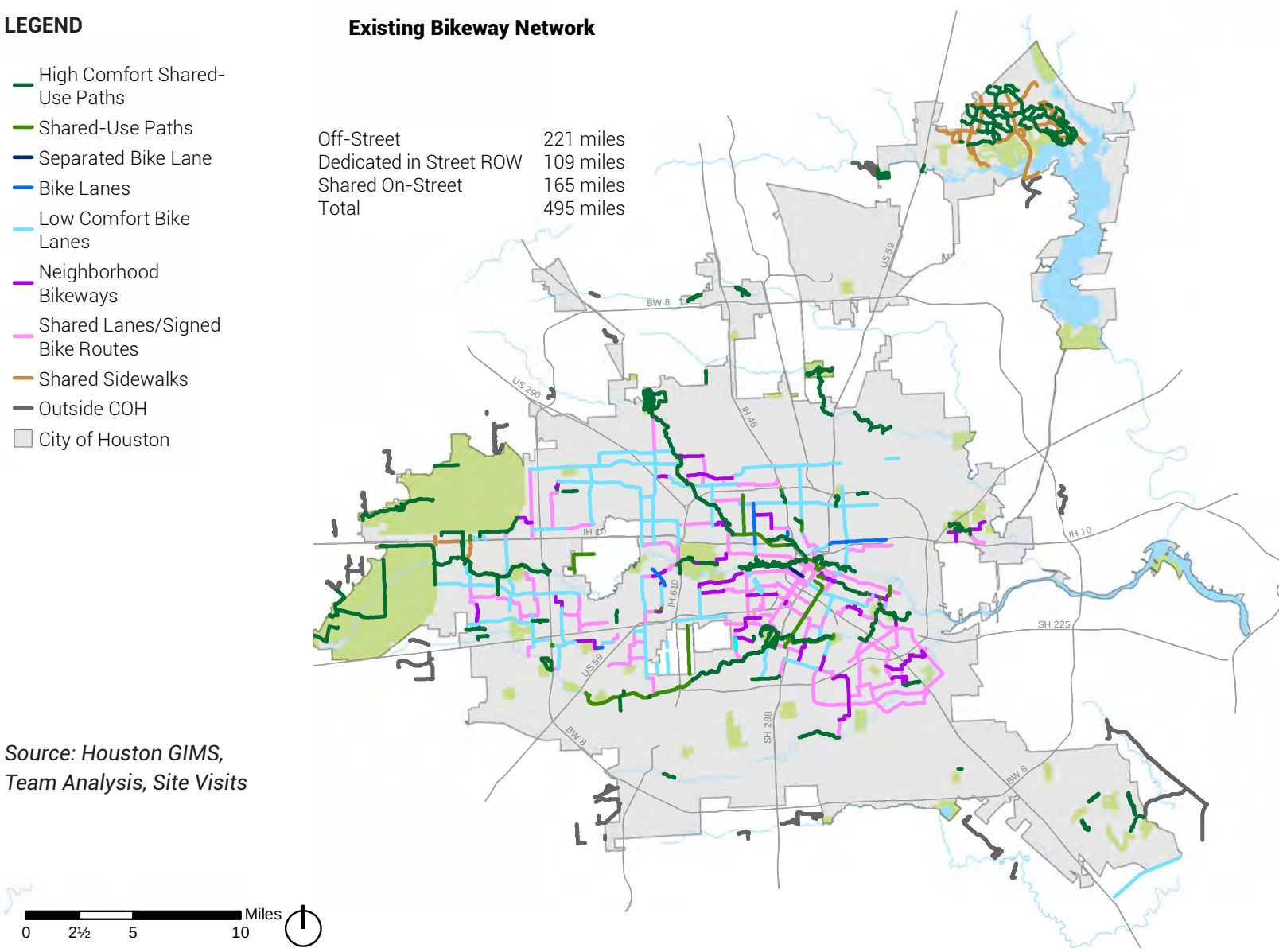
A starting point for building out the Houston Bicycle Network Map is the system of bikeways already in existence. Figure 5.1 shows the existing Houston Bikeway Network using the bikeway types presented in **Chapter 2: Existing Conditions & Opportunities**.

Two of those bikeway types, however, were defined as low-comfort facilities with a level of comfort 3 or 4. Given the Bike Plan's goal to create a "citywide network of comfortable bike facilities," it was determined that Low Comfort Bike Lanes and Shared Lanes/Bike Routes on high-volume streets should not be part of the toolbox going forward. While these bikeway facilities will remain on streets and on the map of existing bikeways for the time being, the long-term goal will be to phase them out, either by upgrading or replacing them with parallel, high-comfort bikeways.

Of the approximately 500 miles of bikeways in the current network, only about 260 miles meet the definition of high-comfort facilities. Figure 5.2 shows the remaining network when the low-comfort bikeways are excluded. With the exception of the major bayou and rails-to-trail corridors, limited connectivity currently exists among high-comfort bikeways, which are primarily off-street paths and neighborhood routes.

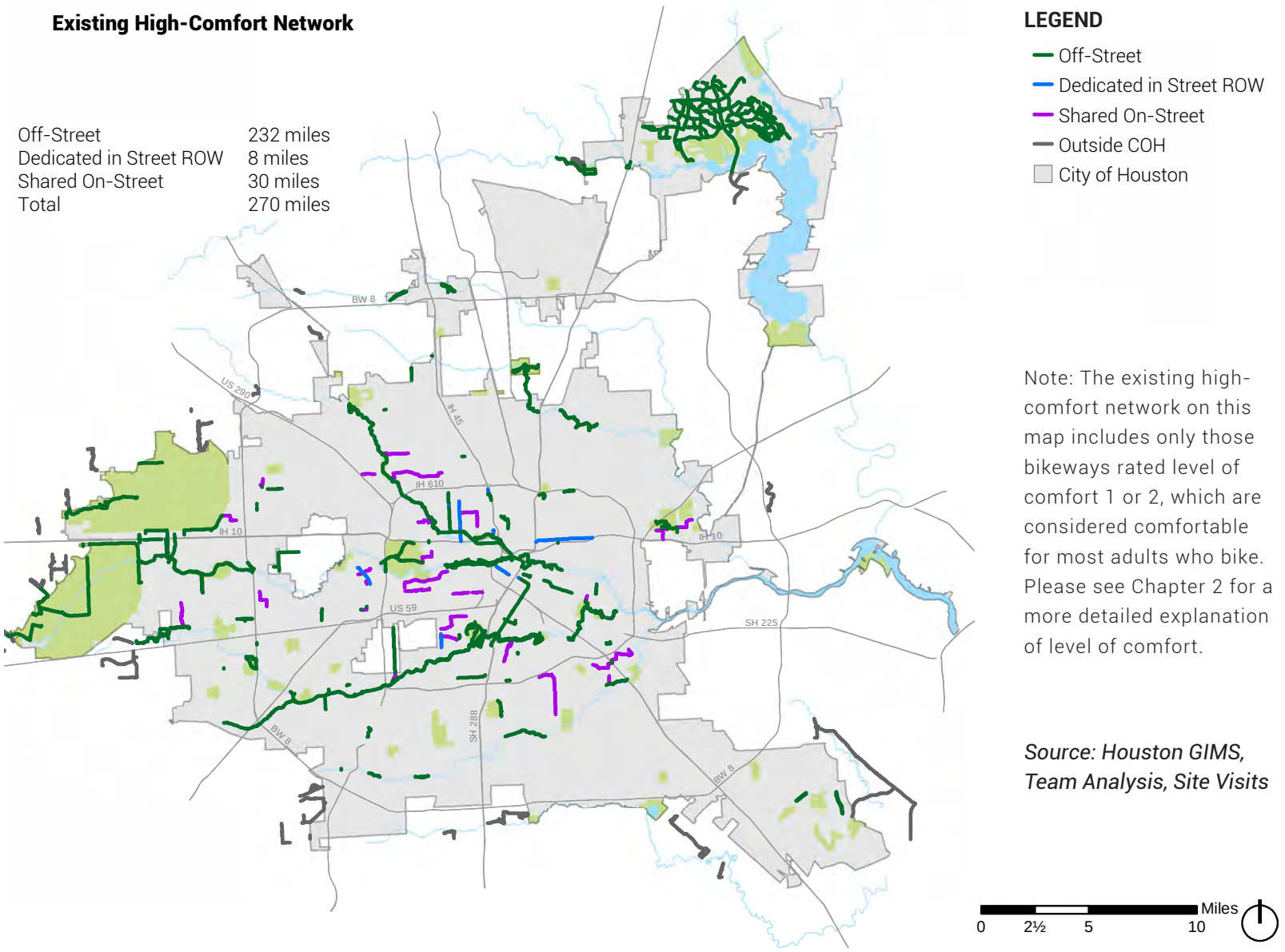


New White Oak Bayou Trail connection to the Leonel Castillo Community Center under construction but already getting use. Project funded by a TIGER Grant award to the City of Houston and the Houston Parks Board



Source: Houston GIMS, Team Analysis, Site Visits

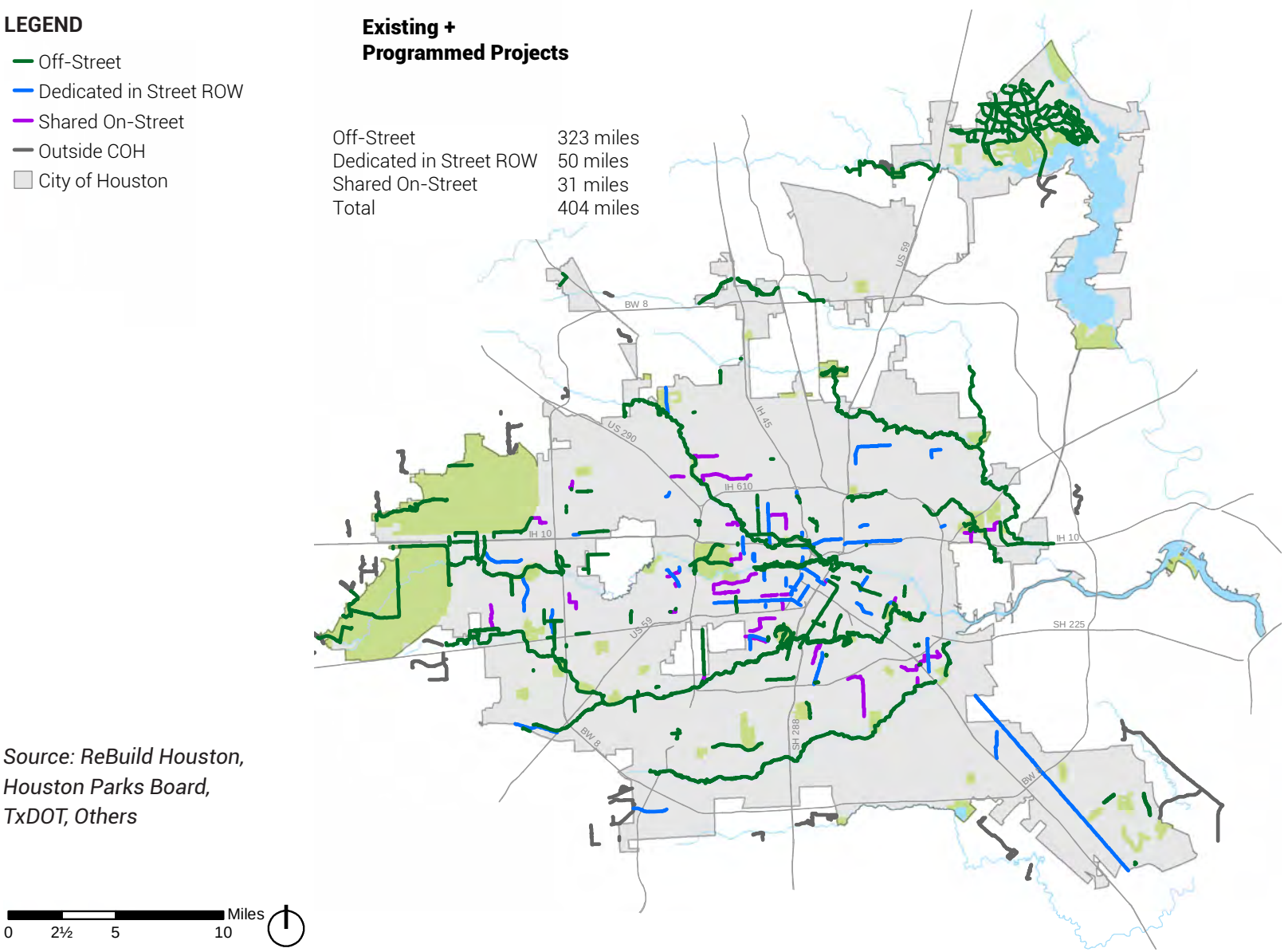
Figure 5.1: Existing Bikeway Network



Note: The existing high-comfort network on this map includes only those bikeways rated level of comfort 1 or 2, which are considered comfortable for most adults who bike. Please see Chapter 2 for a more detailed explanation of level of comfort.

Source: Houston GIMS, Team Analysis, Site Visits

Figure 5.2: Existing High-Comfort Bikeways



Source: ReBuild Houston, Houston Parks Board, TxDOT, Others

Figure 5.3: Existing High-Comfort Bikeways and Programmed Projects

Where We Can Be in 5 Years

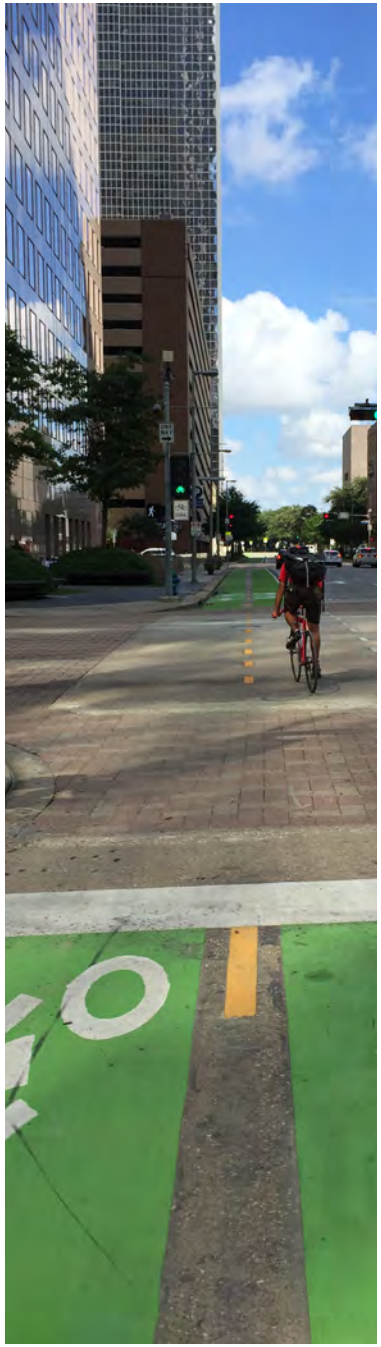
A number of projects throughout the region currently in development include or are anticipated to include bikeway facilities. These include projects funded through Bayou Greenways 2020, the Houston-Galveston Area Council's Transportation Improvement Program (TIP), Management Districts and TIRZs, and the City of Houston Capital Improvement Program (CIP).

Figure 5.3 shows the high-comfort bikeway network with the addition of these programmed projects. Some 91 miles of off-street paths (shown in green) and 42 miles of dedicated in street R.O.W. bikeways (shown in blue) are expected to be added in the next five years or so, generally completing the major bayou corridors within the city and adding a handful of on-street connections. The bulk of the on-street mileage consists of the TxDOT project along State Highway 3 (Old Galveston Road), City of Houston CIP projects along West Alabama Street and Hogan/Lorraine Street, and Midtown Redevelopment Authority projects along Brazos and Caroline Streets. The roughly 130 miles of programmed projects will increase Houston's high-comfort bike network to about 400 miles, a significant addition but only a small step toward a citywide network.

Beyond the projects that are already funded, progress toward a citywide network can be made most quickly by identifying opportunities for lower-cost improvements that won't require major capital construction. These often take the form of "signs and striping" projects, either designating and enhancing bike routes along comfortable, low-volume streets or retrofitting bike lanes onto streets with pavement space that can be reallocated.

Recommendations from the network planning workshop that fit these categories from a technical perspective are shown in Figure 5.4. Implementing these facilities, particularly the bike lanes, will often require trade-offs with other potential uses of space. The streets suggested for optimization of space to allow on-street bikeways (by either reallocation of vehicle lanes or on-street parking) typically have excess capacity at existing traffic volumes, so in many cases the trade-off would be against capacity for potential future traffic increases. Many cities capture these implementation opportunities through regular street striping maintenance or pavement overlay programs.

The benefits in connectivity and providing more people access to the bikeway network borne by these short-term implementation opportunities are tremendous, and a citywide network starts to emerge. The total mileage of high comfort facilities increases by 381 miles to about 780 miles. The Plan recommends that significant progress be made in building out the short term implementation opportunities map within five years, in addition to completion of the programmed projects However, critical gaps persist and some segments remain isolated.

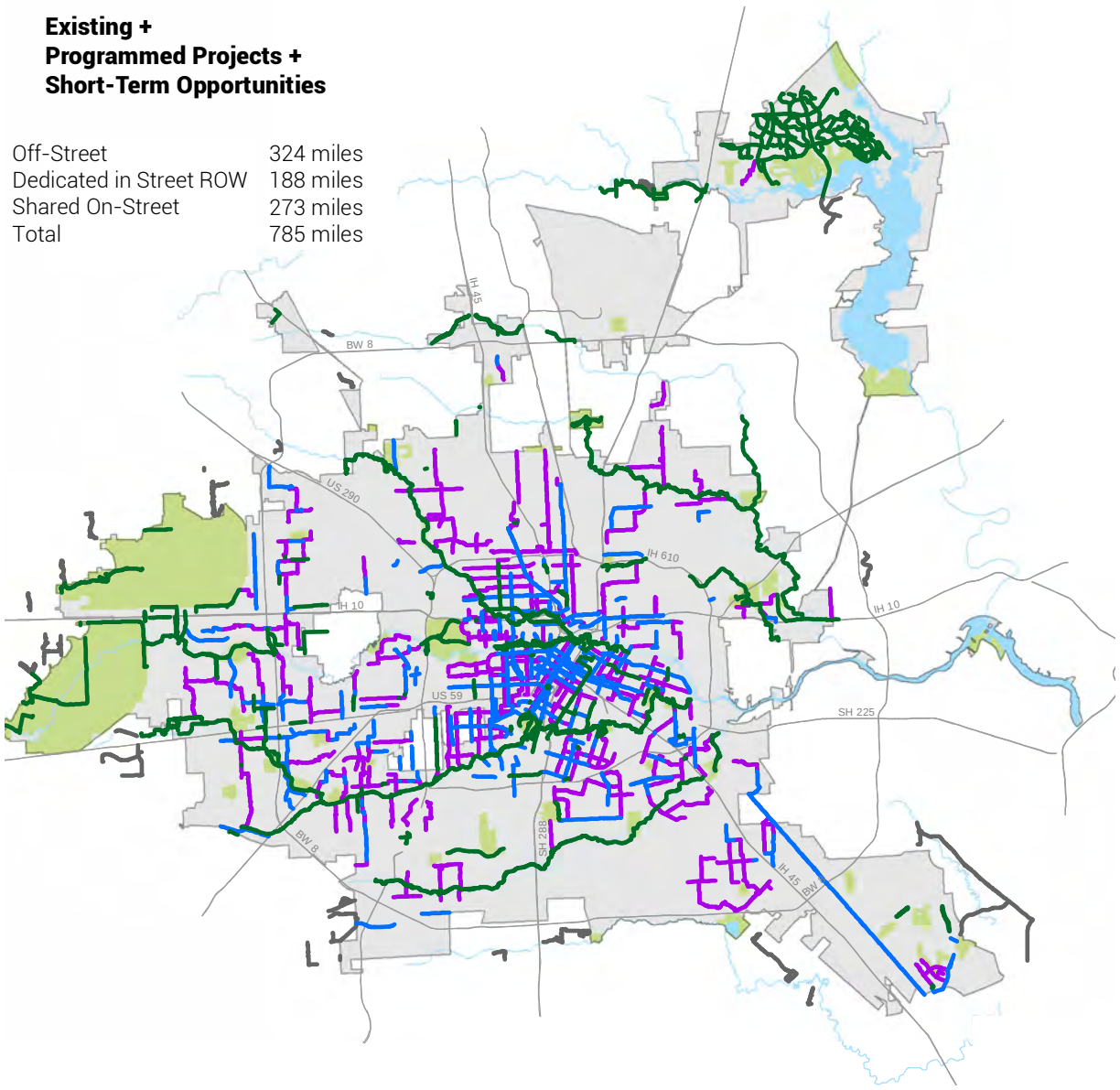


LEGEND

- Off-Street
- Dedicated in Street ROW
- Shared On-Street
- Outside COH
- City of Houston

Existing + Programmed Projects + Short-Term Opportunities

Off-Street	324 miles
Dedicated in Street ROW	188 miles
Shared On-Street	273 miles
Total	785 miles



0 2½ 5 10 Miles

Source: Team Analysis

Note: The lines on the maps represent transportation corridors that are recommended for bicycle facilities. Public engagement beginning no later than the preliminary engineering phase will be conducted prior to the determination of the specific location and design for all new bike facilities.

Figure 5.4: Existing High-Comfort Bikeways, Programmed Projects, and Short-Term Implementation Opportunities

Connecting the Pieces

In some cases there may be opportunities for off-street connections or key on-street bikeway segments to tie together the isolated segments of the citywide network.

Figure 5.5 (with projects highlighted) and Figure 5.6 show how 32 projects encompassing approximately 75 miles of key off-street paths and 12 miles of key street corridor bikeways could tie together many of the disconnected pieces of the existing and potential short-term networks. The Plan has identified these short-term implementation opportunities and the key connections as potential projects that may be implemented over the next 10 years as funding allows, and additional feasibility analysis and public engagement supports.

The short term and key connections would enable Houstonians to bicycle from Clear Lake to George Bush Park, or Tidwell Park in the northeast to Keegan's Bayou in the southwest on high-comfort bikeways. Indeed, all of the Bayou Greenways corridors would be tied into a continuous, high-comfort bikeway network.

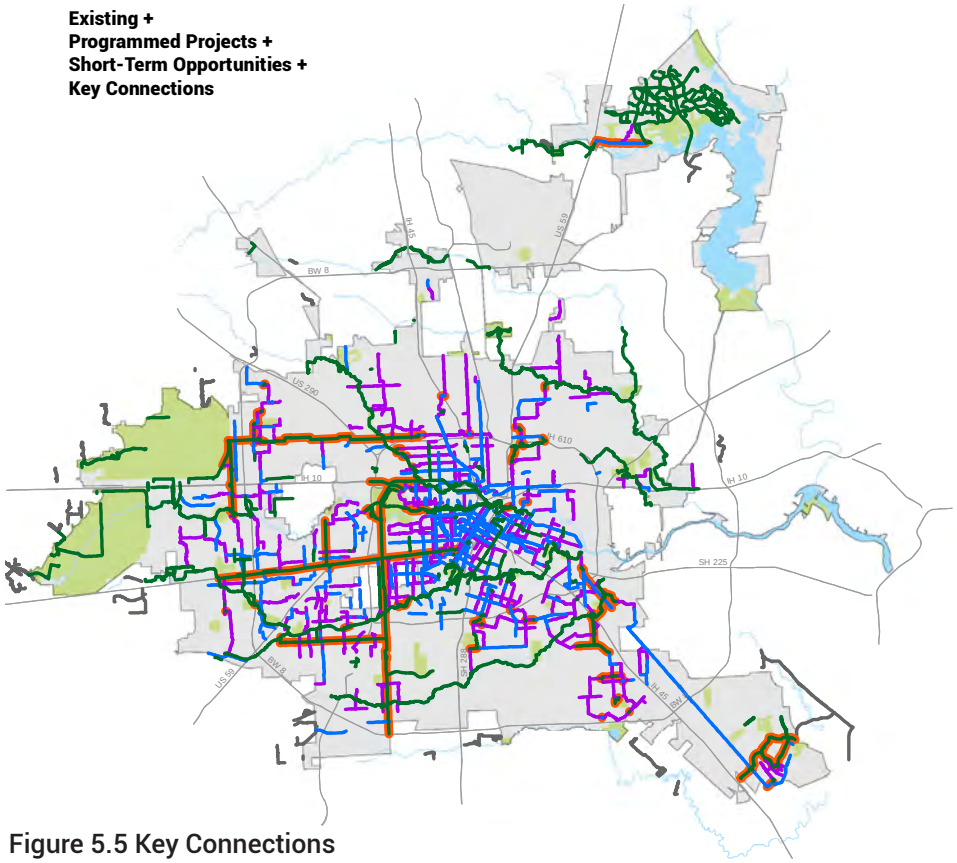
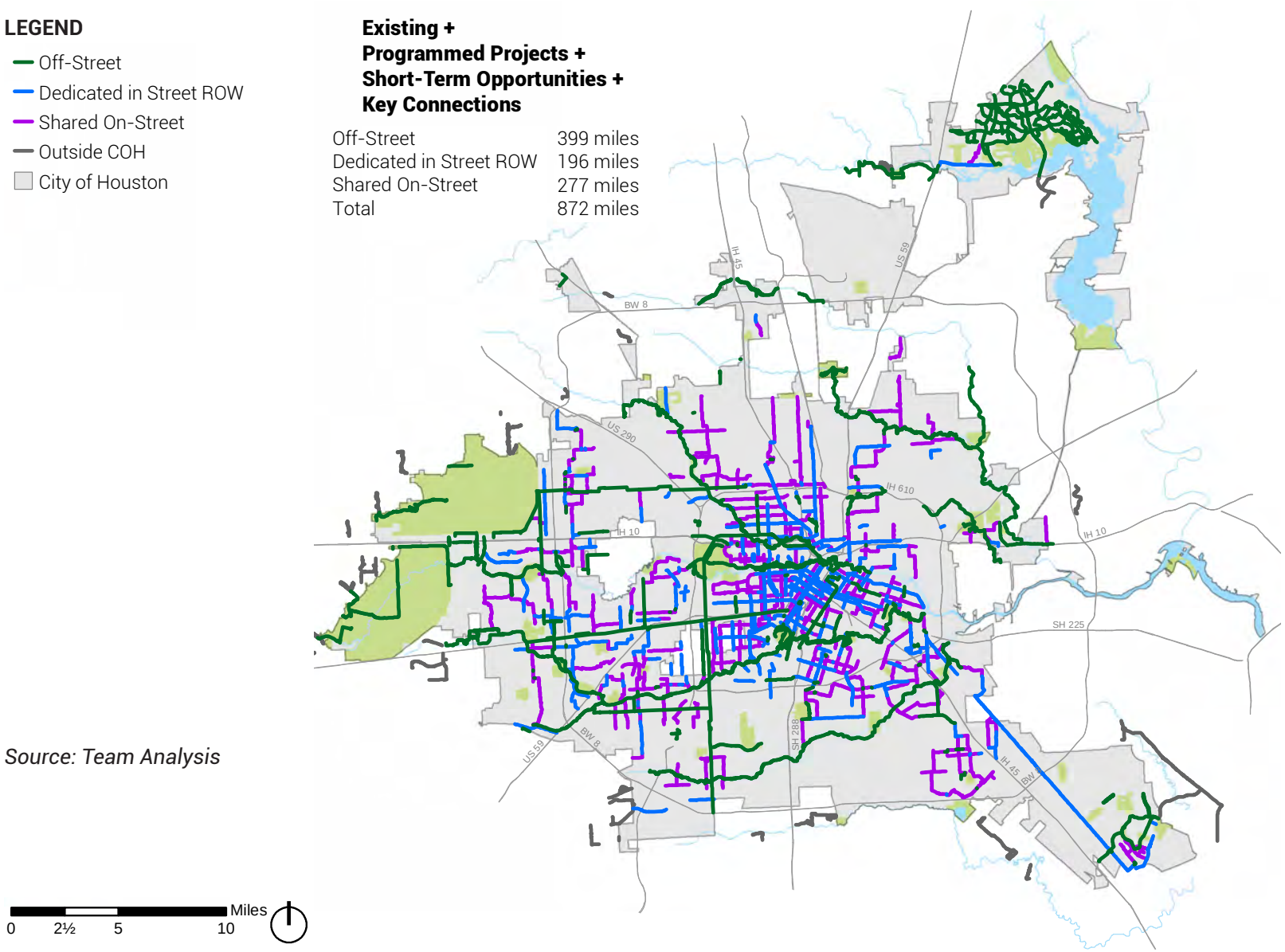


Figure 5.5 Key Connections

Note: The lines on the maps represent transportation corridors that are recommended for bicycle facilities. Public engagement beginning no later than the preliminary engineering phase will be conducted prior to the determination of the specific location and design for all new bike facilities.



Source: Team Analysis

Note: The lines on the maps represent transportation corridors that are recommended for bicycle facilities. Public engagement beginning no later than the preliminary engineering phase will be conducted prior to the determination of the specific location and design for all new bike facilities.

Figure 5.6: Existing High-Comfort Bikeways, Programmed Projects, Potential Short Term Projects, and Key Connections

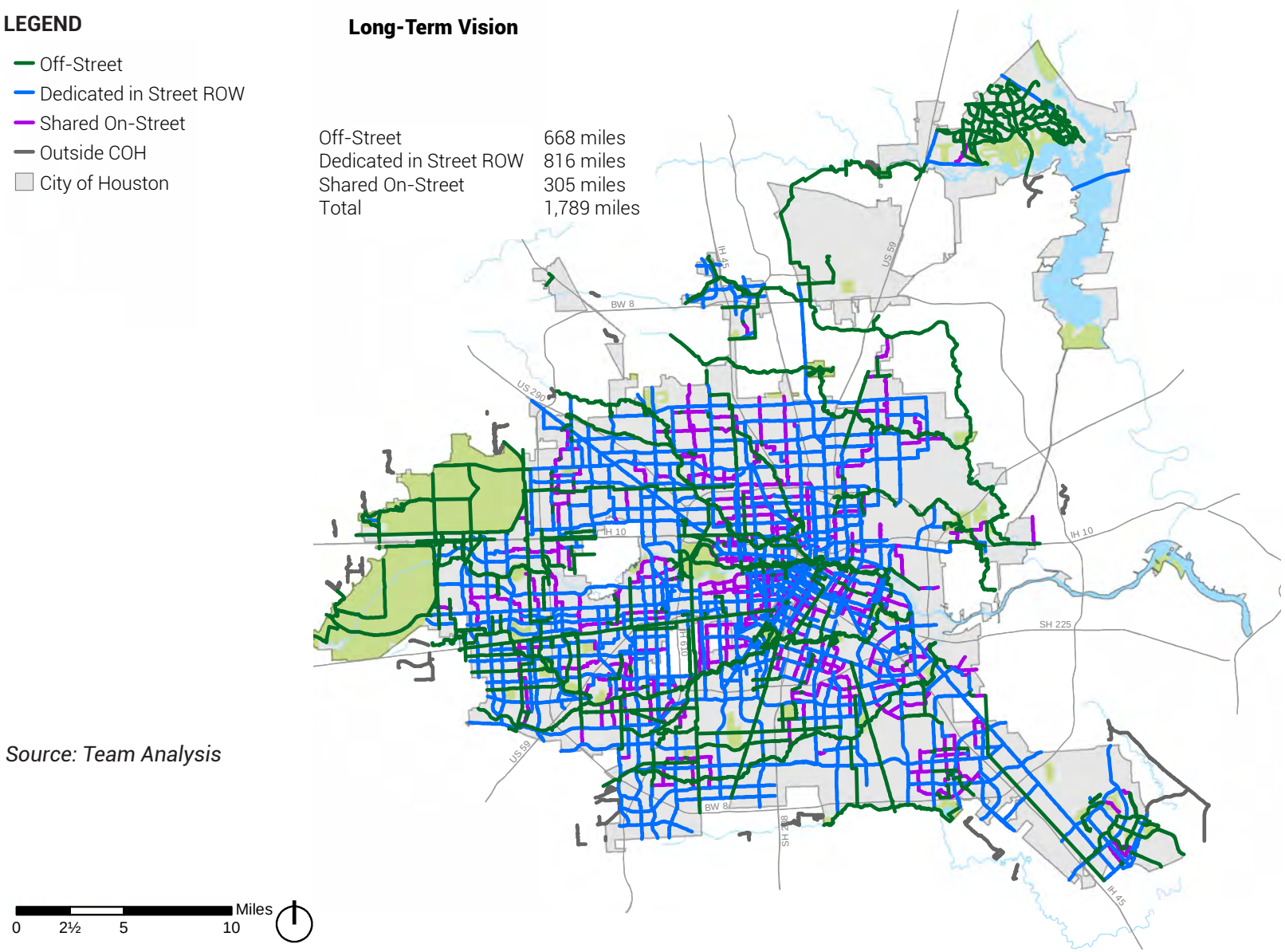
Vision for the Future

While the development of the network described in the previous section would serve most neighborhoods in the city, some parts of Houston lack a connected network of secondary streets that could accommodate comfortable bike routes or retrofitted bike lanes. Often the only option to provide a connected bicycle network in such areas is to use the major thoroughfare corridors.

Adding high-comfort bikeways to thoroughfares can be a major undertaking, requiring reconstruction of the street and potentially acquisition of additional right-of-way to meet all the needs on a corridor. Since the City of Houston CIP is fully subscribed for at least the next five years, additional thoroughfare bikeway projects will necessarily be longer-term efforts or would require a different funding source.

Figure 5.7 shows the long-term vision for the City of Houston Bikeway Network, including an expanded trail and off-street path system and many bikeways that will require street reconstruction to implement. These add 620 miles of potential in street R.O.W. bikeways, 269 miles of off-street bikeways, and 28 miles of bike routes for a full network of 1,789 miles. As noted, the implementation of many of the street corridor bikeways would occur as the streets are reconstruction. Off-street paths would typically require separate implementation projects, and some would involve coordination with neighboring jurisdictions and implementation partners.

For more discussion of how the plan could be funded and implemented, see **Chapter 6: Implementation Strategies**.



Source: Team Analysis

Note: The lines on the maps represent transportation corridors that are recommended for bicycle facilities. Public engagement beginning no later than the preliminary engineering phase will be conducted prior to the determination of the specific location and design for all new bike facilities.

Figure 5.7: Long-Term Vision for the Bicycle Master Plan

ACHIEVING THE GOALS

The ultimate objective of the Houston Bike Plan is to connect people to the places they want to go so that bicycling can be a safe and attractive option for most Houstonians. To ensure the plan delivers on the goal of increased access, it is important to assess how the proposed network would serve people, jobs, and other destinations.

Figure 5.8 shows how each phase of the proposed implementation provides access for people, including some specific populations of interest, and employment. Fewer than 40% of Houston residents currently live within one half mile of a high-comfort bike facility. This improves to about 50% when currently programmed projects are included, and about 80% with the potential short-term projects. This shows the significant opportunity from capturing these near term potential projects in making the bikeway network accessible to many more people.

However, the existence of a comfortable bikeway nearby isn't as useful to someone unless it connects to the places he or she wants to go. Once again, several dozen key projects will be necessary to join the isolated segments into the citywide network. These key implementation projects would create a functional high-comfort network and extend the reach of the bikeways further.

The long-term vision for the full network would touch over 95% of Houstonians. Those not near a bikeway are typically located in low density or relatively undeveloped areas that would be very difficult to serve in a cost-effective manner. Similar coverage numbers for population of color and individuals in poverty indicate that the bikeway network will serve Houstonians equitably and improve low-cost transportation options for the households who may benefit most.

High-comfort bikeway access to jobs within the city is poised to improve from 46% to 65% through completion of programmed projects. This could potentially reach about 85% in the short term and over 95% when the full network is realized. Note that access to jobs is not just important in its own right but also as a proxy for shopping, dining, entertainment, and other business destinations.

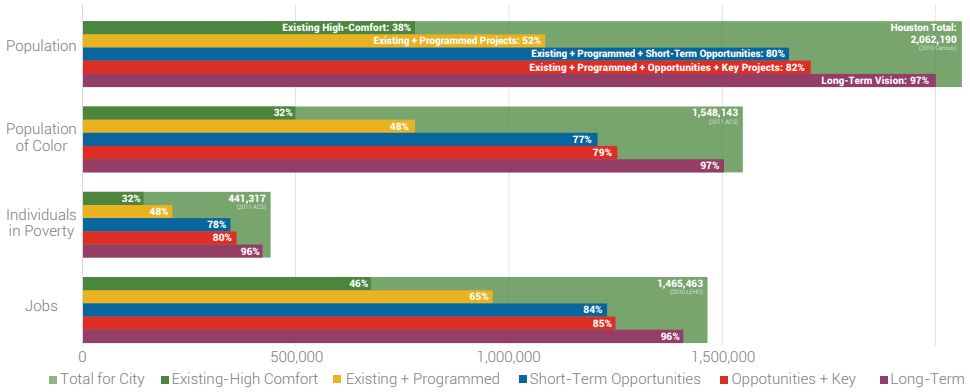
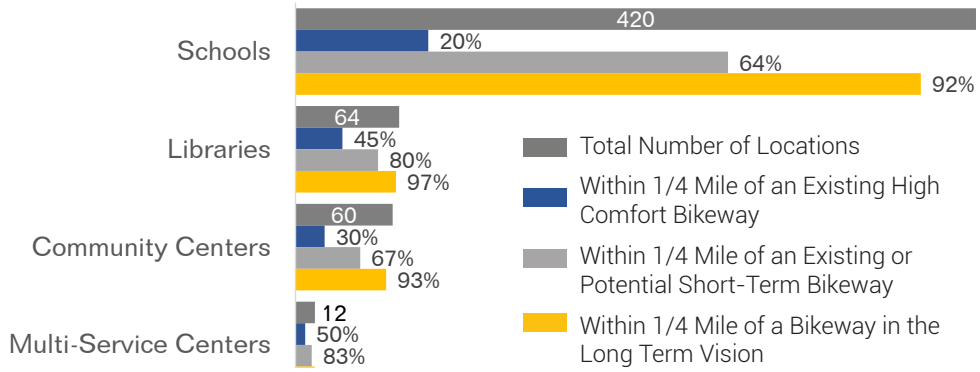


Figure 5.8: Population and Employment Coverage of the Houston Bike Plan Draft Network

Figure 5.9: Quarter Mile Access to Civic Destinations



Connections to the civic destinations previously examined in Chapter 2 are shown in Figure 5.9. Short-term and key projects could serve about 65% of schools and community centers (276 out of 420 and 40 out of 60, respectively) and about 80% of libraries and multi-service centers within one quarter mile. Full implementation will serve over 90% of the current locations of these destinations, with care needed to ensure that the "last mile" connection (or quarter mile, in this case) from the bikeway network to the civic destinations are well designed. Thoughtful planning should ensure that future civic facilities are located on the high-comfort bikeway network.

High-comfort connections to transit will be enhanced, as well. Of the 83 METRO transit centers, park & ride lots, and rail stations within or adjacent to Houston city limits, 31 are currently located within one quarter mile of a high-comfort bikeway. This will improve to 44 with programmed projects and could reach 66 with the addition of the potential short-term and key projects. The master plan will serve 81 of the 83 transit nodes, missing only two park & rides on the very edges of the city. Access to parks, which can be measured in different ways, mirrors the trends seen in the other civic destinations.

The plan described in this chapter would establish a city-wide network of high-comfort bikeways as recommended in the Houston Bike Plan's goals. By matching the bikeway network to the places Houstonians live, work, play, and learn, the network plan also delivers on the goal of access and, if implemented, will be a key component in achieving the Bike Plan's ridership objectives.

CHAPTER 6
IMPLEMENTATION STRATEGIES



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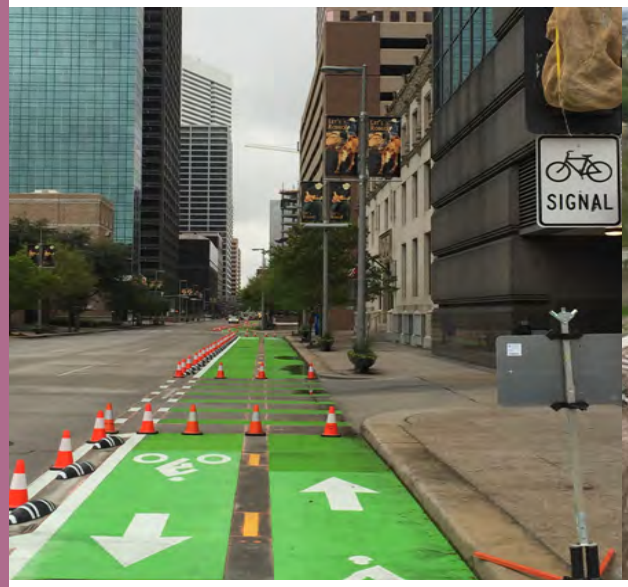
HOUSTON BIKEPLAN

06

IMPLEMENTATION STRATEGIES





FROM PLAN TO IMPLEMENTATION

The Houston Bike Plan outlines a Vision for the City to become a Gold Level Bicycle Friendly Community by 2027 with a focus on improved safety, increased access to bicycling opportunities, overall ridership growth, and an expanding network of high quality, well-maintained, high-comfort bikeway facilities. **Chapter 4: Bicycle Toolbox** develops facility, policy and programmatic tools that can be implemented or leveraged to move the city toward its goals. **Chapter 5: Network Plan & Map** outlines the corridors and opportunities to expand the high-comfort bikeway network for people bicycling throughout the City of Houston.

The Bike Plan is a master plan similar to other City master plans that outline the City's long range vision, goals, and recommendations for policies, programs, and projects; and is not regulatory. Success in achieving the Plan's Vision will only be realized through effective implementation. An effective implementation approach builds on the recommendations to identify strategies that capture opportunities, support ongoing execution, manage progress against goals, and allocate resources where they can have the greatest impact. This chapter provides an overview of community support for the Plan and outlines eight key implementation strategies and supporting recommendations for the City of Houston to focus on to move forward and improve opportunities for people bicycling in Houston. Various departments within the City will need to lead many of the initiatives. Key partnerships have also been identified within many of the strategies to leverage the resources available to the City.

COMMUNITY SUPPORT

Community support is a vital component of implementation for any project. Significant effort was made to receive comments and obtain support from stakeholders, community leaders, advocates, and the general public. The outreach effort described here focused on feedback for the draft network and built upon the first phase of community engagement that focused on developing goals as described in Chapter 3. The study team, including City of Houston staff and BikeHouston, worked together to reach people and communities in Houston through a variety of methods. BikeHouston placed particular emphasis on outreach communities that were underrepresented from other methods of input and engagement. Figure 6.1 shows an overview of the engagement methods used and the level of public response for feedback on the draft plan.

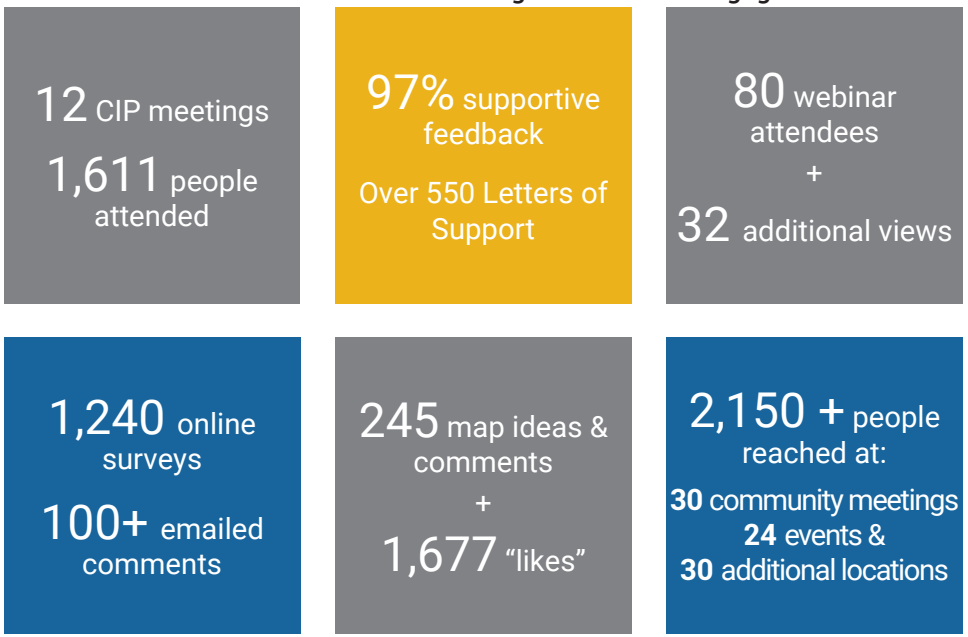
Public Meetings and Events

The study team pursued a multi-faceted approach of garnering public feedback and support by presenting at public meetings, attending existing community and civic association meetings, going to events, and engaging people during their regular activities. The input received through these methods was overwhelmingly positive. The City of Houston received a significant amount of positive feedback centered around improved safety and health as reasons to implement the Bike Plan, as well as letters of support from community organizations and management districts.

The timing of public engagement for the draft Plan coincided with the City's Capital Improvement Plan (CIP) meetings with one meeting held in each council district (two in District E) throughout the City. A short presentation about the Bike Plan was provided at each meeting, along with maps and information so people could ask questions and provide feedback. Additionally, a live webinar was hosted as an additional meeting option and was also posted on the project website for people to view at their convenience.

The City partnered with BikeHouston to extend the reach of community engagement

Figure 6.1 Public Engagement Overview



and focus on communities and people who are typically underrepresented. They attended a significant number of community meetings and events throughout the city including organized bike rides, Sunday Streets, parades, and festivals, and went to additional locations where people regularly are such as universities, transit centers, bike shops, METRO trains and buses, and more. By spending time in the community, a wide variety of people were reached and informed about the Bike Plan.

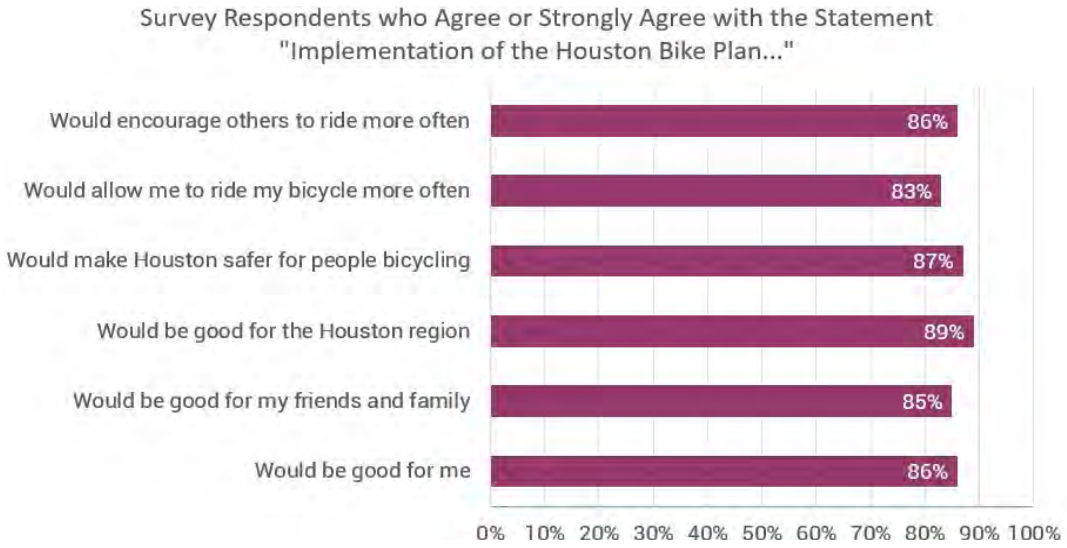
Online Resources

The draft plan, an interactive project summary, and network map were provided on the project website to provide information about the draft Bike Plan to the public. This allowed people to view the draft network in detail, understand the goals, the process of developing the plan, and proposed implementation strategies. Beyond emailing or mailing comments to the City of Houston, the website provided two tools for receiving community input:

- An online survey in English and Spanish, and
- An interactive map for participants to pinpoint ideas and allows comment on those ideas.

The online tools generated a substantial number of comments. A majority of the comments were highly positive and ranged from the importance of the Bike Plan to how the bike network will allow for safe transportation options to additional considerations for project locations and programs, and more. Figure 6.2 identifies the overall attitudes of the online survey participants regarding implementation of the Bike Plan. Between 83% and 89% of people agreed or strongly agreed that implementation of the Bike Plan would provide safer options, encourage more ridership, and overall be good for Houston.

Figure 6.2 Online Survey Attitudes



Feedback Summary

Overall, approximately 97% of feedback from all sources (online survey and map, written and email comments, community responses, and letters of support) was positive and supportive of the Plan. Feedback fell into a few key themes of improved safety, increased transportation options, greater quality of life, and benefits to health and the environment. A majority of comments also signaled support for implementation of the Bike Plan as soon as possible. Figure 6.3 shows a sample of the comments received in these themes.

A small percentage of comments were not supportive of the Plan. Reasons included requests to change the draft network citing additional or altered bikeway routes. Other comments focused on the City's financial position and a lack of funding, or concern with bicycling on roadways. This feedback was valuable in thinking through future communication strategies through implementation of the Bike Plan.

Figure 6.3 Comments About Why People Support the Bike Plan



The study team tabulated all of the public comments and identified whether or not the comment was adequately addressed in the draft plan, and if not, how to improve the recommendations. A majority of the comments focused on bicycle facilities, with some comments identifying policies or programs that could be helpful to the community to increase bicycle mode share. Adjustments to the draft network map were made with added or altered facilities where possible.

The final Bikeways map based on this feedback is the one presented in Chapter 5 of the Plan.

In total, 133 miles of additional bikeways were included in the final Long Term Bikeway network including 52 miles new off-street bikeways and 81 miles of new in street R.O.W. bikeways (shared + dedicated).

Addressing the feedback to provide more opportunities to access the bikeway network in the near term (5-10 years), the updated network identifies bikeways that increase access for an additional 5% of the City's population (87,000 people). These opportunities focused on connecting more neighborhoods, filling identified gaps in the network, and improving access to the expanding bayou greenways.

IMPLEMENTATION CONTEXT

It is important to understand the overall context and challenges that must be addressed to fully realize the positive, transformational opportunity that bicycling can be for the City.

Positive Momentum

The Houston region has made meaningful strides in implementing projects and adopting policies to become more bike friendly. The development of Plan Houston, the first general plan in the city's history, specifically calls for the development of a bicycle master plan.

Projects like the Bayou Greenways Initiative are expanding the network of high-comfort bikeways to more neighborhoods and activity centers. Updates to the Infrastructure Design Manual, policies related to context sensitive design, and the development process for CIP projects will add to the bikeway network as more projects move to final design and construction. The bike share network is on the cusp of a major expansion and more developments are locating in areas with quality access to trails and other amenities. This has all led to more people riding bicycles in the City of Houston.

Even given the positive momentum, the implementation environment will be challenging for the City of Houston over the next several years.

Funding Challenges

While a significant number of projects have dedicated funding programmed for implementation over the next five years, including projects in the City's CIP and the Bayou Greenways 2020 projects, the City of Houston budget projections indicate that there will be challenges in identifying additional resources, either in personnel, capital, or operations and maintenance to advance many additional components of the plan forward in the near term. Opportunities to leverage existing resources to meet goals of the plan are important. Additional resources will likely need to be identified to implement many of the Plan's recommendations.

Regulatory Changes

Many of the recommendations in this plan, particularly those related to policy and programmatic changes may require changes to the current regulatory environment. This may be done through modification of an existing City ordinance (e.g., riding on the sidewalk), a revision to the current city charter (e.g., operations and maintenance allocations), or change to state statutes (e.g., speed limits on local streets). Changes to any of these will require political support to enact and will likely take time to advance.

Competing Priorities

The condition of transportation infrastructure has suffered from levels of disinvestment over several decades leading to a situation where there are significant needs across the city. This presents an opportunity to expand the bicycle network by taking a multi-modal approach as new streets are built. At the same time, it creates strong competition for resources for new projects. Continuing to advocate for a holistic bikeway network leveraging all potential projects will be critical to successful implementation.

Building Strong Partnerships

The Bike Plan sets a direction for the City, but achieving success will require strong community partnerships. This includes working with advocacy organizations across the city such as BikeHouston, as well as strengthening implementation partnerships with agencies such as H-GAC, Houston Parks Board, Harris County, TxDOT, and various Management Districts and TIRZs who each are working to make their projects and areas more bike friendly. Building alignment on the efforts that partners already have underway will take some time but represents a significant opportunity to move parts of the Bike Plan forward in the short term that could not be done by the city alone.

IMPLEMENTATION STRATEGIES

The following sections of this plan represent nine strategies and supporting recommendations for the implementation of the Bike Plan. They focus on overall performance management of the plan's progress as well as some tactical strategies to translate the citywide plan to local areas and neighborhoods.

These strategies are targeted at building momentum for the plan, providing meaningful benefits and creating examples of what overall success will look like. The City of Houston and its partners should work to define leadership of these strategies and a path to implement in the near term. The City should take the lead to develop these strategies upon plan adoption.

It is recommended that as parts of the Bike Plan are implemented these strategies are revisited as part of regular 5-year updates to the plan that incorporates progress-to-date and the context at the time of the update.

Implementation Strategies and Key Recommendations for the Houston Bike Plan

1. Manage Performance Against Goals

1.1 Develop and present an annual Houston Bikeways Program Strategic Report.

1.2 Develop approach to capture data to assess performance on a regular basis and develop performance targets.

2. Prioritize and Collaborate on Policies and Programs

2.1 Develop agreed-upon roles with city departments including Houston Bikeways Program staff and partners for implementation of policies and programs identified in the Bike Plan.

2.2 Develop prioritization approach for tackling policies and programs considering resources, staffing levels, and partnership opportunities.

3. Project Development and Implementation

3.1 Develop packages of short-term bikeway projects that can be implemented within existing street rights-of-way and seek funding to implement.

3.2 Prepare key connection recommendations as a package of projects detailing benefits and costs. This package should be utilized to recruit funding partners and apply for grants as opportunities become available.

4. Develop Resource and Staffing Needs

4.1 Increase Houston Bikeways Program staff in appropriate departments in the City.

4.2 Establish the Bicycle Advisory Committee as a regular standing committee that works with City staff to implement the Bike Plan.

5. Leverage Funding Opportunities

5.1 Create a spending target with dedicated funds from the City's budget for bikeway projects and programs.

5.2 Identify and pursue funding partnerships and support from other local agencies, City departments, and private entities to leverage funds.

5.3 Pursue funding for short-term and key connection projects.

5.4 Develop bicycle facility maintenance prioritization criteria and incorporate bicycle facility maintenance as part of roadway maintenance activity as possible.

6. Build Momentum Through Pilot Projects

6.1 Create conceptual plans for specific bikeway treatments across the city.

6.2 Implement and celebrate bikeway projects to build momentum to implement the Plan.

7. Connect to Major Bicycle Thoroughfares (e.g., Bayous and Other Greenways)

7.1 Develop specific plans and policies for access to major greenway corridors to ensure safe access to these "bicycle highways" from neighborhoods and activity centers.

7.2 Coordinate with adjacent jurisdictions to provide a connected network across city lines.

8. Engage Neighborhoods to Translate Plan to a Local Level

8.1 Incorporate and refine the provided approach and tools for neighborhood level planning to connect to citywide bikeway network, in future planning projects.

8.2 Identify opportunities to apply specific policies or programs at the neighborhood level to support the growth of safe, healthy opportunities to bicycle.

8.3 Continue proactive outreach to neighborhoods and other civic groups on the Bike Plan

9. Continue to Engage the Public in the Development of Bicycle Facilities.

9.1 Incorporate public engagement on bikeway projects beginning no later than preliminary engineering i.e. the design phase of the project.

1. MANAGING PERFORMANCE AGAINST GOALS

The goals identified for the Bike Plan represent key building blocks to creating a Gold-level Bicycle Friendly Community. It will be important to measure how the City is performing against those goals. Utilizing performance metrics to monitor progress of implementing the Bike Plan will enable the City to understand the degree to which progress is being made and identify areas of focus for future improvements.

Figure 6.4 shows the performance management cycle for delivering against the goals. The performance management cycle has five key phases:

- **Assess Current Performance:** Establish the baseline from which an organization is working from, including strengths and opportunities.
- **Goal Setting:** Identify the direction for the organization in terms of performance outcomes and definitions of success.
- **Strategy Development:** Create the approach to achieving the goals.
- **Project Development:** Specific action plans to implement bikeways, policies and programs
- **Execution:** The tactical implementation of the projects.

As execution occurs, the performance cycle feedback loop is completed by assessing performance with a new baseline. Adjustments can be made to the goals or strategies based on the new starting point.

The Bike Plan has focused on the development of the first three phases of the cycle, Assessing Current Performance, Goal Setting, and Strategy Development. Specific project development and execution of the plan will be based on prioritization of the strategies and the available resources to implement projects, policies, and programs identified in the Bike Plan. Potential execution approaches will be detailed further in the discussion of other implementation strategies.

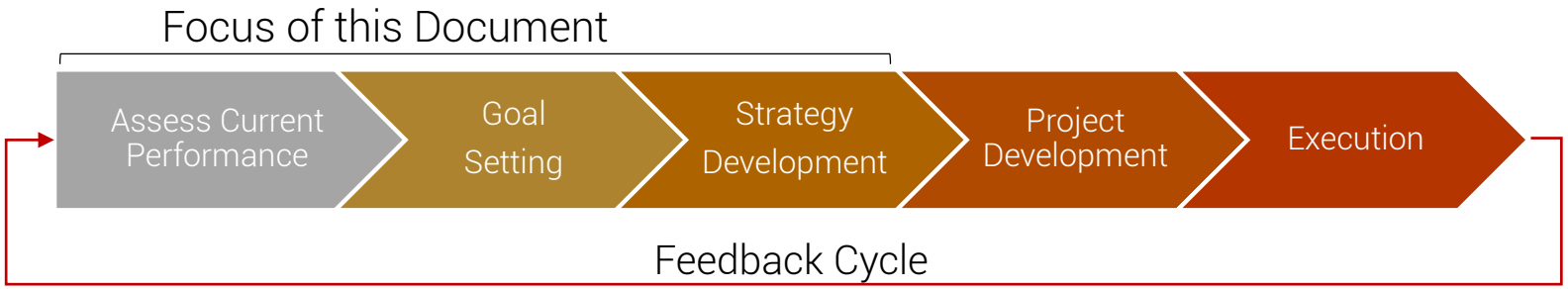


Figure 6.4 Performance Management Cycle for the Bike Plan

To support performance assessment of plan implementation, metrics aligned with each of the plan goals have been identified. There were many potential metrics considered and the proposed performance metrics have been developed through workshops with the Bicycle Advisory Committee. Metrics selected were determined to be quantifiable and aligned with evaluation criteria set by the League of American Bicyclists for Bicycle Friendly Community designation and goals outline in Plan Houston.

These performance metrics should be reviewed and updated periodically to allow the City to best assess performance, celebrate successes, and identify improvement areas. Performance monitoring will require participation from multiple City departments and external organizations. Figure 6.5 identifies the performance metrics, baseline data, recent performance trends of the data (positive, negative, or neutral), bicycle friendly community rating areas from the League of American Bicyclists, and the data source for each metric.

The City will need to collect the necessary data to establish baseline measures in a ongoing fashion. It is recommended that a Houston Bikeways Program Strategic Report outlining progress against these metrics be developed.

The report should :

- Align with the goals and approach for implementation of Plan Houston.
- Highlight progress made on implementation.
- Determine relative performance against the previous year.
- Assess trends in performance relative to the vision of Houston as a bicycle friendly community.
- Include a map exhibit(s) and be publicly available online.
- Develop updates to the strategic plan for the next year incorporating what is working and adjust as needed based on changing context, priorities, and available resources.
- Determine if metrics are still aligned with overall goals or if new metrics may be more relevant to overall goals.
- Identify priority opportunities to continue to improve.

The Bikeways Program Strategic Report will serve as a critical tool as the city works to implement the plan. It can create an ongoing avenue for the community to talk about what is working, improvement areas, and

Key Recommendation 1.1

Develop and present annual Houston Bikeways Program Strategic Report.

Key Recommendation 1.2

Develop approach to capture data to assess performance on a regular basis and develop performance targets.

Note on Setting Annual Report:
Among other roles, the Bicycle Advisory Committee (see Strategy 4) is recommended to play a key role in working with the City in achieving the ten-year vision, including the development of performance metrics and any interim targets, as well as development of the annual Bikeways report.

Figure 6.5 Goals and Performance Metrics

Vision: By 2027 Houston will be a Safer, More Accessible, Gold Level Bike-Friendly City

Goal Area	BFA Rating Areas: Enforcement	Education	Engineering	Evaluation	Encouragement	Key Outcomes	Performance Metrics	Current Performance	Performance Trend (+ - or neutral)	Data Source
Improve Safety						✓	# of bicycle related crashes reported	361	-	H-GAC
						✓	# of bicycle fatalities per 10,000 commuters	7.4	+	H-GAC, US Census
				✓			Disparity in bicycle mode share versus fatalities	3.8	+	H-GAC, US Census
		✓					# of people who complete an approved bicycle education program	TBD	N/A	TBD
					✓		# of "Bicycle Friendly Businesses"	4	Neutral	League of American Bicyclists
Increase Access			✓				% jobs within ½ mile of a high-comfort bike facility	46%	+	US Census
			✓				% population within ½ mile of a high-comfort bike facility			
							• Overall population	38%	+	US Census
							• Minority population	32%	+	US Census
							• Low income population	32%	+	US Census
			✓				% of facilities within ¼ mile of a high-comfort bike facility:			
							• Transit nodes (transit centers, Park & Rides, and light rail stations)	37%	+	METRO/City of Houston
							• Schools and libraries	23%	+	City of Houston
							• Community and multi-service centers	33%	+	City of Houston
			✓		✓		% population with comfortable access to greenways system (bayous and other trails)	21%	+	US Census
Increase Ridership						✓	Commute mode share	0.5%	-	US Census
				✓			# of permanent count stations	2	Neutral	H-GAC
				✓		✓	% growth in bicyclists observed through permanent count stations	TBD	N/A	H-GAC
				✓			# of bike boardings on Metro per year	258,094	+	METRO
				✓			# of bike share checkouts per year	98,449	+	Houston Bike Share
					✓		Annual City events that support increased ridership (e.g., Sunday Streets, Tour de Houston, Bicycle Advisory Committee meetings)	11	Neutral	City of Houston
Develop and Maintain Facilities			✓				Miles of high comfort bikeways per capita (per 10,000 people)	1.17	+	City of Houston/Census
			✓				% of bikeways in good or better condition	TBD	N/A	City of Houston
					✓		Population within ¼ mile of a bike share station	27,900	+	Houston Bike Share
					✓		Jobs within ¼ mile of a bike share station	155,600	+	Houston Bike Share
			✓				% of major transit nodes[1] with secured bike parking	4%	Neutral	METRO
				✓			Dedicated city staff (FTE) for bikeway program	1	Neutral	City of Houston

[1] Major Transit Nodes include Rail Stations, Transit Centers, and Park & Ride Facilities

Figure 6.6 Performance Metric Data Details

Performance Metric	*Data Details*
# of bicycle related crashes reported	3 year average 2012-2014 data from H-GAC (crash data)
# of bicycle fatalities per 10,000 commuters	3 year average 2012-2014 data from H-GAC (fatality data) and American Community Survey (ACS) (commuting data)
Disparity in bicycle mode share versus fatalities	3 year average 2012-2014 of the bicycle fatality rate for all roadway fatalities divided by the same 3 year average of the bicycle commute mode share
# of people who complete an approved bicycle education program	TBD
# of "Bicycle Friendly Businesses"	As of December 2015
% jobs within ½ mile of a high-comfort bike facility	2011 LEHD (Longitudinal Employer-Household Dynamics from US Census)
% population within ½ mile of a high-comfort bike facility (overall, minority, and low income)	2010 US Census block level population
Within ¼ mile of a high-comfort bike facility (transit nodes, schools & libraries, and community & multi-service centers)	2014 facility locations from METRO and City of Houston Reporting
% population with comfortable access to greenways system (bayous and other trails)	Comfortable access is defined as within ½ mile of an off-street trail of at least a mile or a high-comfort connection to such a trail
Commute mode share	ACS data – 3 year average (2012-2014)
# of permanent count stations	H-GAC is only entity with permanent counters currently
% growth in bicyclists observed through permanent count stations	Compile monthly bicycle counts to an annual number then determine growth over previous year.
# of bike boardings on Metro per year	Data is for calendar year 2014
# of bike share checkouts per year	2015
Annual City events that support increased ridership (e.g., Sunday Streets, Tour de Houston, Bicycle Advisory Committee meetings)	2015, City of Houston Reporting
Miles of high comfort bikeways per capita (per 10,000 people)	Population from 2014 ACS data
% of bikeways in good or better condition	TBD
Population within ¼ mile of a bike share station	2015
Jobs within ¼ mile of a bike share station	2015
% of major transit nodes with secured bike parking	2015
Dedicated city staff (FTE) for bikeway program	2014 Benchmarking Report (Alliance for Walking & Biking)

accelerate progress on plan implementation. Details of data sources and recommended metric calculations are provided in Figure 6.5.

As the Bikeway Program Strategic Report would identify progress as well as changes in context, priorities, and resources, it provides a basis for updating and amending the bikeway network as needed moving forward. Updates and amendments to the bikeway network should also be driven through input from the community and a Bicycle Advisory Committee. Updates based on performance and contextual changes in the community will ensure that the Bikeway network remains relevant to the City and continues to provide the greatest opportunity to meet the goals identified in the Bike Plan. While it is recommended that a Bikeway Program Strategic Report be developed and presented annually, updates and amendments to the bikeway network may not occur as frequent. The timing and frequency of potential changes should be determined by the City and Bicycle Advisory Committee.

Recent performance trends on many of the metrics show positive improvements in access to high-comfort facilities, growth in the bikeway network, bike share access, and bicycle connections on buses. Much of this is due to increases in the bikeway network from the Bayou Greenways Initiative, expansion of the bike share network, and recent increases in programs and events that encourage bicycling. While the trends largely show positive improvements, in some cases ,the trend is negative or has a low rate of improvement. Areas like safety, as measured by bicycle-related crashes and fatalities relative to commute mode share, show a negative trend. And while access to facilities and locations has improved, actual mode share for bicycle commuters has remained largely stable with only a 0.05% increase in the last American Community Survey.

In order to assess conditions most accurately, some metrics should be calculated based on three-year averages, which provide a more stable assessment of the data and evaluation of trends over time. These metrics are identified in Figure 6.6. Other metrics do not currently have data reported and a baseline will need to be established. For example, establishing a methodology to identify “good” and “better” conditions of bikeways, and identifying a reporting mechanism for comprehensively identifying how many people complete bicycle education programs annually will be necessary to track those performance on those metrics.

Specific targets for each of the metrics have not been identified through this plan. As the City begins to develop a better understanding of available resources for implementation, targets for performance metrics can be set to focus attention and resources on plan implementation. However, due to the starting point of the network and data, the City should aim towards improving performance annually.

2. PRIORITIZE AND COLLABORATE ON POLICIES AND PROGRAMS

As outlined in **Chapter 4: Bicycle Toolbox,** creating a sustainable, thriving bikeway program requires more than building bicycle infrastructure. It will require development of policies and programs that improve safety and design of the roadways, encourage end-of-trip amenities and last-mile connections, and increase maintenance, education, and enforcement programs.

Implementation will require coordination between multiple city departments, external public agencies, philanthropic and advocacy organizations, developers, and private businesses. As roles are defined, the departments that have coordinated to develop the Plan (Planning & Development, Public Works & Engineering, and Parks & Recreation) can organize and maintain accountability for their respective pieces of implementation.

They will need to work closely together. For example, Parks & Recreation and Public Works & Engineering are responsible for design decisions, implementation, and maintenance of many infrastructure projects, while Planning & Development is recommended to maintain and updating the overall bikeway network maps. It will be important that these efforts stay aligned. Additionally, the City's Health Department and Police Department will each have key roles to play, particularly with education, awareness, and enforcement with the public. There are many opportunities



2015 Bike-to-Work Day in Downtown Houston: a programmatic approach to get more people out on

for other organizations to take the lead on the implementation of recommendations in the Bike Plan. For example, BikeHouston is the logical lead on many of the educational, training, and outreach programs.

While the policies and programs identified in the Bicycle Toolbox are important to consider and implement over time, some have greater opportunity for impacting the community, some require more resources, and some will take less time than others. In a time of limited fiscal resources, it is important to prioritize policies and programs to ensure resources are used as efficiently as possible, while still making positive strides in the community. Efficient use of resources on high-impact policies and programs will also enable the City to establish a platform to fully implement the Plan as financial resources or grants become available.

On the following pages, Figures 6.7: Projects, 6.8 Policies, and 6.9. Programs outline the various non-bikeway infrastructure elements of the holistic plan and identify the roles of various City departments and organizations in implementation, potential funding partners, alignment to goals, and potential challenges to execute.

The Plan has identified a significant number of opportunities to improve bicycling in Houston presenting a challenge in determining where to start working. To address this, the tables also identify recommended near-term policies and programs to be prioritized.

Initial prioritization has been categorized into the following high-priority categories:

- Policy changes that require limited or no additional financial resources.
- Programs and projects eligible for grant opportunities.
- High-profile projects, policies, and programs that build momentum.

By focusing on these areas the City and its partners can continue to move implementation of the bicycle plan forward and build momentum for further improvements.

Figures 6.7, 6.8, and 6.9 on the following pages are not intended to be exhaustive nor exclusive. Other agencies, entities, and organizations may also play important roles in implementing the Bike Plan. Coordination between all appropriate City departments is recommended during implementation.

Key Recommendation 2.1

Develop agreed-upon roles with city departments and partners for implementation of policies and programs identified in the Bike Plan.

Key Recommendation 2.2

Develop prioritization approach for tackling policies and programs considering resources, staffing levels, and partnership opportunities.



Projects

Houston has a history and knowledge of getting transportation projects built, and bike facilities are no different to implement than roadway or transit lines.

The tables on the next three pages (Figure 6.7) show how bike projects fit into the goals of the Bike Plan and which agencies are responsible for implementing, funding, and approving them. This depends on context: Public Works is responsible for building bikeways on city streets, TxDOT for state highways, and the Parks Department for paths in parks. Private property owners also play a role, especially for parking.

Figure 6.7 Project Implementation Matrix (1 of 3)

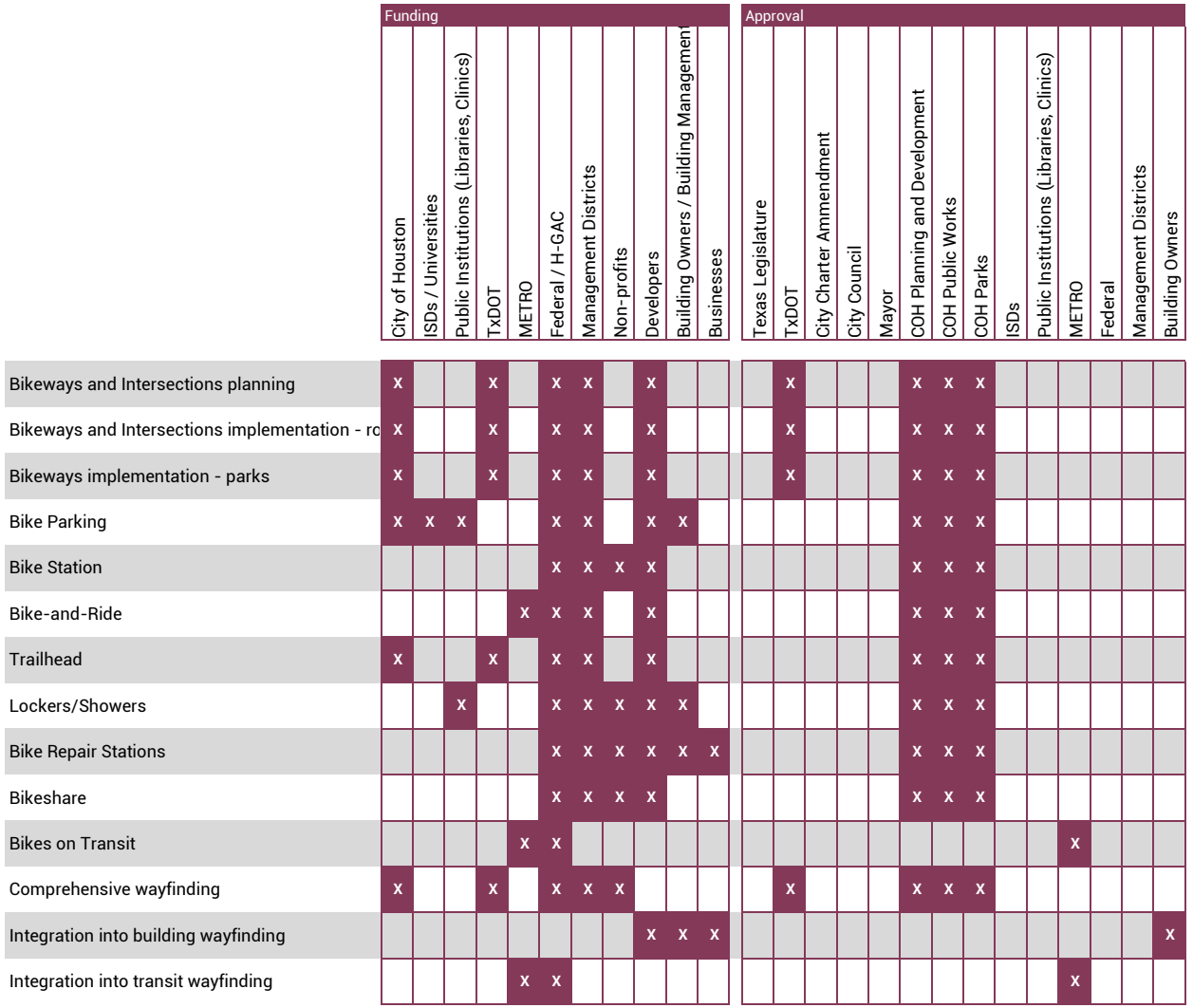
		High priority			Goals				Promotes						Requirements			
Description		High profile big moves	Potential grant priority	Low cost	Improve Safety	Increase Access	Increase Ridership	Develop and Maintain Facilities	Identifies a route	Provides a comfortable, safe, and secure path	Provides a secure place to park	Provides connections to other modes	Teaches how to ride	Helps acquire and maintain a bike	Significant Capital Cost	Small Capital Cost	Requires significant property	Requires additional staff resources
Bikeways and Intersections planning	Plan new bikeways and intersections to implement and maintain the Bikeway Map.				x	x	x	x		x						x		x
Bikeways and Intersections implementation - roads	Engineer and construct new bikeways and intersections within COH street right-of-way to implement the bikeway map.		x		x	x	x	x		x					x	x		
Bikeways implementation - parks	Engineer and construct new bikeways and intersections within COH parks to implement the bikeway map.		x		x	x	x	x		x					x	x		
Bike Parking	Build bike parking at destinations.		x	x		x	x	x			x	x				x		
Bike Station	Develop and operate a staffed bike station.	x				x	x				x				x			x
Bike-and-Ride	Develop and operate bike-and-ride facilities at more transit hubs.				x	x	x					x				x		
Trailhead	Build trailheads with appropriate bike and vehicle parking and improved access along Greenways and other off-road trails.					x	x	x				x			x		x	
Lockers/Showers	Build and operate locker/shower facilities at workplaces and educational institutions.					x	x				x				x			x
Bike Repair Stations	Build and maintain self-service bike repair stations.			x	x	x	x							x		x		x
Bike share	Operate and expand bikeshare system to more locations and neighborhoods.		x			x	x	x				x		x	x			x
Bikes on Transit	Expand opportunites to carry bikes on buses and trains.				x	x	x	x				x				x		
Comprehensive wayfinding	Implement a comprehensive wayfinding system for bicyclists along trails, streets, and at transit hubs.			x			x	x	x			x	x			x		
Integration into building wayfinding	Integrate bicycle information into building wayfinding signage (e.g., bike parking and nearby high comfort bikeways)			x			x	x	x			x	x			x		
Integration into transit wayfinding	Integrate bicycle information into transit wayfinding signage (e.g., bike parking and nearby high comfort bikeways)			x			x	x	x			x	x			x		

Figure 6.7 Project Implementation Matrix (2 of 3)

Implementation	COH Planning and Development	COH Public Works and Engineering	COH Parks	COH Police	COH Health	Houston Parks Board	Houston Bcycle	ISDs / Universities	Public Institutions (Libraries, Clinics)	TxDOT	METRO	H-GAC	Management Districts	Advocacy groups	Parks Conservancies	Non-profits	Developers	Building Owners / Building Management	Businesses
Bikeways and Intersections planning	L									X							X		
Bikeways and Intersections implementation - roads		L								X							X		
Bikeways implementation - parks			L							X					X	X	X		
Bike Parking	L	X	X					X	X		X		X				X	X	
Bike Station	L	X											X	X		X	X	X	
Bike-and-Ride		X								X	L		X				X		
Trailhead			L							X			X				X		
Lockers/Showers	L								X				X			X	X	X	
Bike Repair Stations	L												X	X			X		
Bikeshare	L	X					X												
Bikes on Transit											L								
Comprehensive wayfinding	L	X	X										X		X				
Integration into building wayfinding	L								X								X	X	
Integration into transit wayfinding											L								

L: Lead Agency or Organization for Toolbox Element
X: Meets Criteria/ Relevant for that Category

Figure 6.7 Project Implementation Matrix (3 of 3)





Policies

Policies at the local, state, and federal level play a large role in what it is like to bike in Houston. Compared to projects, policies are typically inexpensive, but the organizational and political effort required to implement them can be greater.

The following three tables (Figure 6.8) show how the policy recommendations support the Plan's goals, who would spearhead changes, and what approvals are required. The first columns of the first table highlight the changes that would be most impactful and should be considered priorities.

Figure 6.8 Policy Implementation Matrix (1 of 3)

		High priority			Goals				Promotes						Requirements			
	Description	High profile big moves	Potential grant priority	Low cost	Improve Safety	Increase Access	Increase Ridership	Develop and Maintain Facilities	Identifies a route	Provides a comfortable, safe, and secure path	Provides a secure place to park	Provides connections to other modes	Teaches how to ride	Helps acquire and maintain a bike	Significant Capital Cost	Small Capital Cost	Requires significant property	Requires additional staff resources
Complete Streets	Adopt a Complete Streets ordinance.				x	x	x	x		x								
CIP Process	Update Capital Improvement Plan criteria to allow projects which close key gaps in the bicycle network or improve bicycle safety to be prioritized.				x	x	x	x		x								
Safety and Vision Zero	Adopt a Vision Zero goal and approach for working to eliminate traffic fatalities on city roadways.	x			x		x			x								x
Major Thoroughfare Plan	Coordinate bike plan with Major Thoroughfare Plan and adjust designations as required.				x		x	x		x								
Bike Connections in New Developments	Update development ordinances to encourage and require bicycle connections in new developments.				x	x	x	x		x						x		
Infrastructure Design Manual	Update Infrastructure Design Manual to expand bicycle toolbox and bicycle facility design componenets aligned with recommendations in the Houston Bike Plan.			x	x		x	x		x								
Construction Coordination	Develop policies to mitigate impact of public and private construction projects on bike network.			x	x					x						x		
Dedicated Funding Source	Develop approach for dedicated funding for capital and operations projects				x	x	x	x		x								
Pursue Funding Opportunities	Develop coordinated approach to pursue federal and state funding to expand bikeway network.			x	x			x		x						x		x
Include Bike Facilities in Restriping/Overlays	Consider potential for bike facilities in all restriping/overlay projects.			x	x	x	x	x		x						x		
Speed Limits	Support legislation to adopt lower standard speed limits on neighborhood streets citywide.	x			x		x	x		x								
Lighting	Update lighting standards to encourage well lit on-street bikeways.				x		x			x								
Bike on Sidewalks Ordinance	Update ordinances to allow biking on sidewalks.			x	x	x	x			x								
Bike Crossings at Minor Streets	Develop approach for improving bike crossings at minors streets with significant bicycle volumes				x		x	x		x								
Prohibit parking in bicycle lanes	Adopt ordinance to prohibit parking in designated bike lanes (without need for supplemental signage).			x	x					x								
24hr operation for bike paths	Develop park rules that allows people bicycling to utilize a trail on the bikeway network through parks 24 hours a day.				x					x								x
Bike Parking Requirements	Require or create additional incentives for bike parking at all buildings except single family residential.		x	x		x	x				x					x		
Bike Facilities at Public Buildings	Provide conveniently located, well-lit. secure bike parking at all public buildings.						x				x					x		
Bike Friendly ISDs	Set district policies and programs to encourage bicycle education and biking to school.					x	x				x					x		
Agency Cooperation	Coordinate with TxDOT, METRO, adjacent cities and counties on bike related projects and design standards.					x	x			x	x					x		
Bike Rack/Station Permitting	Develop consistent approach to Bike Rack/Station permits			x		x		x			x					x		

Figure 6.8 Policy Implementation Matrix (2 of 3)

	Implementation																			
	COH Planning and Development	COH Public Works and Engineering	COH Parks	COH Police	COH Health	Houston Parks Board	Houston Bcycle	ISDs / Universities	Public Institutions (Libraries, Clinics)	TxDOT	METRO	H-GAC	Management Districts	Advocacy groups	Parks Conservancies	Non-profits	Developers	Building Owners/Building Management	Businesses
Complete Streets	L	X	X							X									
CIP		L																	
Safety and Vision Zero	L	X		X						X									
Major Thoroughfare Plan	L	X																	
Bike Connections in New Developments	L																X	X	
Infrastructure Design Manual		L																	
Construction Coordination	X	L																	
Dedicated Funding Source	X	L																	
Pursue Funding Opportunities	X	X	X		X	X	X				X	X	X	X					
Include Bike Facilities in Restriping/Overlays	X	L																	
Speed Limits		L																	
Lighting		L																	
Bike on Sidewalks Ordinance	X	L		X															
Bike Crossings at Minor Streets		L																	
Prohibit parking in bicycle lanes		L																	
24hr operation for bike paths			L																
Bike Parking Requirements	L																X	X	
Bike Facilities at Public Buildings	L							X	X										
Bike Friendly ISDs								L											
Bike Rack/Station Permitting		L																	

L: Lead Agency or Organization for Toolbox Element

X: Meets Criteria/ Relevant for that Category

Figure 6.8 Policy Implementation Matrix (3 of 3)

	Funding											Approval												
	City of Houston	ISDs / Universities	Public Institutions (Libraries, Clinics)	TxDOT	METRO	Federal / H-GAC	Management Districts	Non-profits	Developers	Building Owners/Building Management	Businesses	Texas Legislature	TxDOT	City Charter Ammendment	City Council	Mayor	COH Planning and Development	COH Public Works	COH Parks	ISDs	Public Institutions (Libraries, Clinics)	METRO	Federal	Management Districts	Building Owners
Complete Streets																	X	X	X						
CIP																		X	X						
Safety and Vision Zero	X			X	X	X										X	X	X	X						
Major Thoroughfare Plan															X										
Bike Connections in New Developments									X						X		X								
Infrastructure Design Manual																		X	X						
Construction Coordination																	X	X							
Dedicated Funding Source	X																X	X	X						
Pursue Funding Opportunities														X				X	X						
Include Bike Facilities in Restriping/Overlays																		X							
Speed Limits												X			X			X	X						
Lighting	X						X								X										
Bike on Sidewalks Ordinance															X										
Bike Crossings at Minor Streets																		X	X						
Prohibit parking in bicycle lanes															X			X							
24hr operation for bike paths																			X						
Bike Parking Requirements									X	X					X		X								
Bike Facilities at Public Buildings			X																		X				
Bike Friendly ISDs		X																		X					
Bike Rack/Station Permitting	X																	X							

L: Lead Agency or Organization for Toolbox Element
X: Meets Criteria/ Relevant for that Category



Programs

Programs require sustained effort over an extended period of time, but they are crucial in building a bicycle culture and attracting new riders. Non-profits, including bicycle advocates and community groups, can play a significant role here, but governmental entities can support them through coordination and funding.

These tables (Figure 6.9) show how the recommended programs support the Bike Plan goals and who could implement and fund them.

Figure 6.9 Program Implementation Matrix (1 of 3)

	Description	High priority			Goals				Promotes						Requirements			
		High profile big moves	Could be funded through grants	Low cost	Improve Safety	Increase Access	Increase Ridership	Develop and Maintain Facilities	Identifies a route	Provides a comfortable, safe, and secure path	Provides a secure place to park	Provides connections to other modes	Teaches how to ride	Helps acquire and maintain a bike	Significant Capital Cost	Small Capital Cost	Requires significant property	Requires additional staff resources
Bike Friendly Certifications	Work towards Gold Bicycle Friendly Community status and encourage more companies to achieve Bike Friendly Business designations.	X					X									X		
Bike Safety Training	Provide consistently available bike safety classes to the general public.				X								X			X		X
Defensive Cycling	Include defensive cycling in annual police office training and require officers to pro-actively inform cyclists about defensive cycling options.				X								X			X		X
Bike Shop Outreach	Maintain a list of bicycle shops and their contact information and publish the information online.					X	X						X	X		X		
Bike Trains / School Bus	Develop an annual "Bike-to-School" day, develop a bicycle safety program, and encourage City-wide Bike School Buses.			X	X		X			X			X			X		X
Commuter Outreach	Create outreach programs through workplaces, potentially leveraging existing commute programs.						X		X				X	X		X		
Safe Routes Ambassadors	Create group of school ambassadors to work with schools to conduct safety presentations and workshops.				X		X		X				X			X		X
Incentive Programs	Expand awareness of NuRide and provide resources to support growth.		X				X							X		X		
Guaranteed Ride Home	Create/coordinate with a Guaranteed Ride Home program for people who bike to work.		X		X		X			X						X		X
Driver Education	Implement a program through the city courts where those with traffic violations, especially those involving a person on a bicycle, can take driver education courses to dismiss their charges				X					X						X		
Bike Commuter Buddy	Support and advertise the development of a Bike Buddy program.		X				X						X			X		
Better Block	Institutionalize temporary or demonstration projects as an outreach technique for new projects.					X	X		X	X	X		X			X		
Open Streets	Expand Sunday Streets HTX to a year round event with the goal of moving to weekly or multiple time per month.	X				X	X		X				X			X		
Organized Bike Rides	Build on existing rides like Bike to Work Day, Bayou Bikers and Tour de Houston to develop a regular schedule of group rides with city staff to promote the Bikeways program.					X	X		X				X			X		X
Awareness Campaigns	Develop awareness campaign for the Bikeways program and bike resources and a bike safety campaign.			X	X		X			X			X			X		X
Bicycle Patrol Training	Require all sworn officers to complete a more extensive bicycle safety and law enforcement course and continue to expand bike patrol.				X					X						X		
Earn-a-Bike	Support additional earn-a-bike programs, especially in undeserved communities and at elementary and middle schools.		X			X	X							X				
Bike Repair Workshops	Create bike repair stations and support nonprofits proving how-to repair workshops.		X			X	X							X				X
Bicycle Co-op	Support bicycle co-ops that provide bikes and build skills for low income residents.		X			X								X				X
Integrated Bicycle App	Develop a bicycling app to inform people who bicycle and collect data for the City's or regional use.	X	X		X				X	X								
Data Collection	Conduct regular bicycle counts throughout the city.							X		X								X
Maps	Continue to update high-quality, easy to read, pocketable paper and online maps of the bike network.			X		X	X		X							X		
"Adopt-a-. . ." Program - roads	Develop "adopt-a-....." program for bicycle infrastructure in street right-of-way.							X		X								
"Adopt-a-. . ." Program - parks	Develop "adopt-a-....." program for bicycle infrastructure in parks.							X		X								
Infrastructure - 311	Create codes and categories and track bike-related issues in the City's 311 system.			X				X		X						X		
Safe Routes to School	Work with ISDs to identify safe bike routes to schools from neighborhoods.		X		X	X	X	X		X					X			
Grant program for bike racks	Develop grant programs and easy permit process for bike racks.		X															
Maintenance - roads	Develop maintenance program for bike facilities in street right-of-ways.				X		X	X		X								X
Maintenance -parks	Develop maintenance program for bike facilities in parks.				X		X	X		X								X

L: Lead Agency or Organization for Toolbox Element

X: Meets Criteria/ Relevant for that Category

Figure 6.9 Program Implementation Matrix (2 of 3)

	Implementation																			
	COH Planning and Development	COH Public Works and Engineering	COH Parks	COH Police	COH Health	Houston Parks Board	Houston Bcycle	ISDs / Universities	Public Institutions (Libraries, Clinics)	TxDOT	METRO	H-GAC	Management Districts	Advocacy groups	Parks Conservancies	Non-profits	Developers	Building Owners/Building Management	Businesses
Bike Friendly Certifications	X	X	X									X		L					X
Bike Safety Training				X	X						X	X		L		X			
Defensive Cycling				L	X											X			
Bike Shop Outreach				X	X									L		X			X
Bike Trains / School Bus	X			X	X			L								X			
Commuter Outreach	X			X	X						X	L	X	X		X		X	
Safe Routes Ambassadors				X	X			X				X		L		X			
Incentive Programs	X										X	L				X			
Guaranteed Ride Home											X	L				X			X
Driver Education				L	X						X					X			
Bike Commuter Buddy						L						X		L		X			
Better Block	X	X	X	X	X						X		X			L		X	X
Open Streets				X	L														
Organized Bike Rides	L	L			X	X								L		X			
Awareness Campaigns				X	X	L		X			X		X	L		X			
Bicycle Patrol Training				L															
Earn-a-Bike					X								X	X		L			X
Bike Repair Workshops				X	X									X		X			L
Bicycle Co-op								X						X		X			X
Integrated Bicycle App	X				X							L		X		X			
Data Collection	X	L			X					X	X	L				X			
Maps	L					X	X					X		X		X			
"Adopt-a-. . ." Program - roads		L														X			X
"Adopt-a-. . ." Program - parks			L													X			X
Infrastructure - 311		L																	
Safe Routes to School		L						X				X							
Grant program for bike racks	L				X			X	X			X		X					
Maintenance - roads		L												X					
Maintenance -parks			L																

L: Lead Agency or Organization for Toolbox Element
X: Meets Criteria/ Relevant for that Category

Figure 6.9 Program Implementation Matrix (3 of 3)

	Funding											Approval												
	City of Houston	ISDs / Universities	Public Institutions (Libraries, Clinics)	TxDOT	METRO	Federal / H-GAC	Management Districts	Non-profits	Developers	Building Owners/Building Management	Businesses	Texas Legislature	TxDOT	City Charter Ammendment	City Council	Mayor	COH Planning and Development	COH Public Works	COH Parks	ISDs	Public Institutions (Libraries, Clinics)	METRO	Federal	Management Districts	Building Owners
Bike Friendly Certifications	X						X	X			X														
Bike Safety Training	X						X	X																	
Defensive Cycling	X						X	X																	
Bike Shop Outreach	X						X	X			X														
Bike Trains / School Bus	X	X					X	X																	
Commuter Outreach	X					X	X	X		X															
Safe Routes Ambassadors	X	X					X	X																	
Incentive Programs	X				X	X	X	X	X																
Guaranteed Ride Home					X	X	X	X																	
Driver Education	X						X	X																	
Bike Commuter Buddy							X	X																	
Better Block	X						X	X																	
Open Streets	X																								
Organized Bike Rides	X						X	X																	
Awareness Campaigns	X	X				X	X	X																	
Bicycle Patrol Training																									
Earn-a-Bike	X						X	X																	
Bike Repair Workshops	X						X	X																	
Bicycle Co-op		X					X	X																	
Integrated Bicycle App	X					X	X	X																	
Data Collection	X					X	X	X																	
Maps	X					X																			
"Adopt-a-. . ." Program - roads							X	X										X							
"Adopt-a-. . ." Program - parks							X	X											X						
Infrastructure - 311																									
Safe Routes to School	X	X				X												X	X						
Grant program for bike racks						X									X		X								
Maintenance - roads																		X	X						
Maintenance -parks																		X	X						

L: Lead Agency or Organization for Toolbox Element

X: Meets Criteria/ Relevant for that Category



Utility Corridor Opportunity
in Memorial Park

3. PROJECT DEVELOPMENT AND IMPLEMENTATION

Building upon a strong foundation of policies and programs, building out the bikeway network will take significant coordination and resources. The Houston region is currently in the process of expanding the high-comfort bikeway network by leveraging programmed projects through the City of Houston's CIP or by other entities such as Management Districts and the Houston Parks Board. There are also opportunities to expand the network by implementing some of the potential short-term projects and key connections identified in **Chapter 5: Network Plan & Map**. This will require appropriate levels of resources to move the projects forward successfully.

Implementation of the next phase of high-comfort bikeways will likely involve a combination of several approaches:

- Retrofit bikeways onto existing roadways through reallocations of existing pavement or right-of-way, either proactively or as part of ongoing maintenance projects.
- Incorporate bikeway projects developed by partners including the Houston Parks Board, Management Districts and TIRZs, METRO, and others.
- Develop off-street and high-priority on-street capital projects.
- Include bikeways in City CIP projects as streets are reconstructed.

The full Bike Plan will take many years to realize due to the scope of the Plan, and the scale of Houston. The region will be able to reap the benefits of a growing bikeway network by strategically targeting implementation to link together existing bikeway corridors into a more cohesive network serving more people and destinations.

This third Implementation Strategy shows one proposed approach to develop and execute projects identified in the Bikeway Network Map. While the City and region should also be opportunistic in capturing potential bikeway improvements as other capital projects emerge, this strategy can be a model for how to think about implementation in terms of developing a connected network.

For each category of projects, planning level cost ranges have been developed to provide an estimate of funding that would be required. It is not necessary that all projects be completed at one time and funding and

Key Recommendation 3.1

Develop packages of short-term bikeway projects that can be implemented within existing street right-of-way and seek funding to implement.

Key Recommendation 3.2

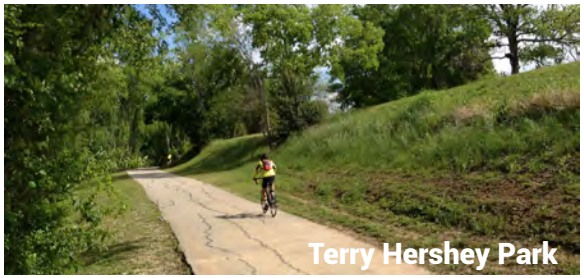
Prepare key connection recommendations as a package of projects detailing benefits and costs. This package should be utilized to recruit funding partners and apply for grants as opportunities become available.

other capacity constraints may dictate that projects are developed in smaller packages for implementation. This approach is meant to be illustrative of how bikeways can be expanded to create a network. Specific funding strategies are discussed in detail in Implementation Strategy 5.

Figures 6.10 through 6.13 demonstrate how a thoughtful implementation approach can connect existing segments of high-comfort bikeways, largely isolated and disconnected in the current network, and transition towards a true network. Figure 6.10 shows three high-comfort bayou trails in three different neighborhoods of Houston: Buffalo Bayou in the Inner West Loop, Terry Hershey Park in west Houston, and Halls Bayou in northeast Houston.

As shown in the pictures below, these are all attractive corridors with well-designed







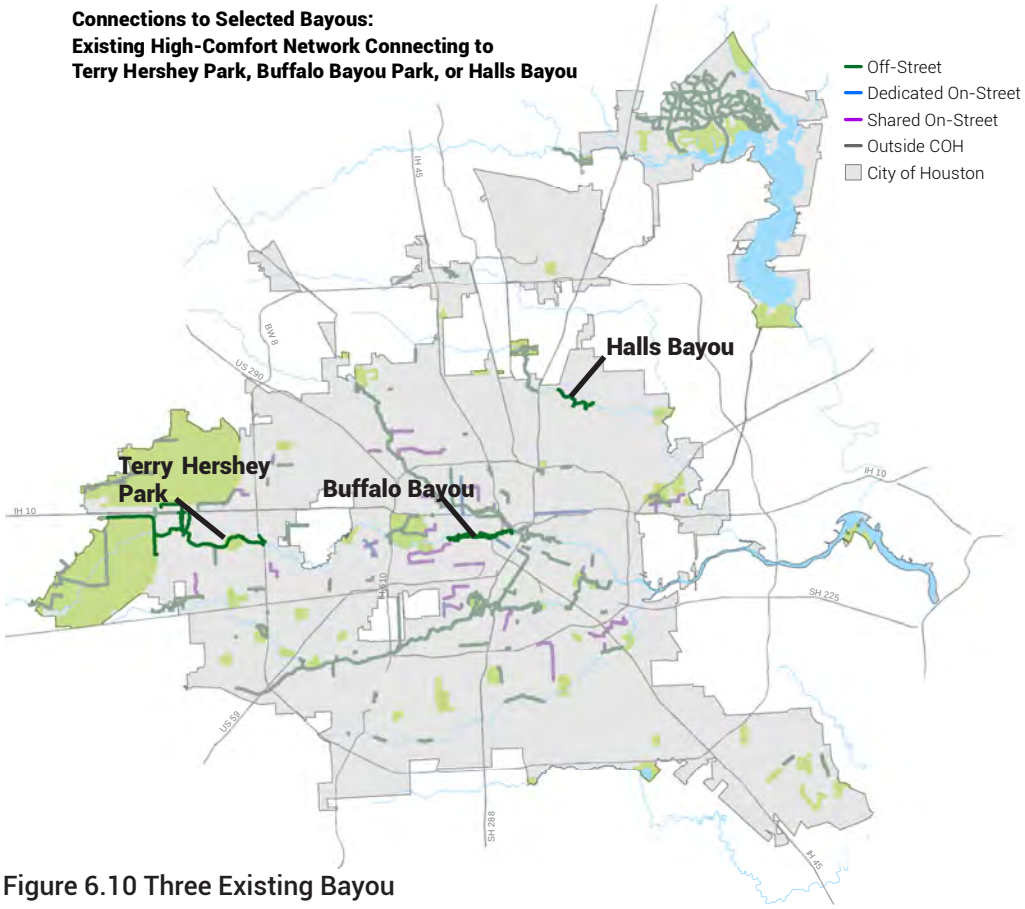


Figure 6.10 Three Existing Bayou Corridors

bikeways but each is disconnected from the rest of the bikeway network. Other high-comfort bikeways in the network that are not directly connected to these trails have been grayed out.

The Programmed Projects Map in Figure 6.11 includes known capital projects from the City of Houston CIP, Bayou Greenways 2020, Management District and TIRZ CIPs, and TxDOT that are funded and planned for completion in the next five years, or roughly by 2021. This includes connections currently in design or construction which will link White Oak Bayou, Lamar Street, Columbia Tap Trail, and parts of Brays Bayou into one high-comfort network. It will also extend the Halls Bayou Trail to Keith-Weiss Park and further east and add street corridor bikeways connecting to Terry Hershey Park.

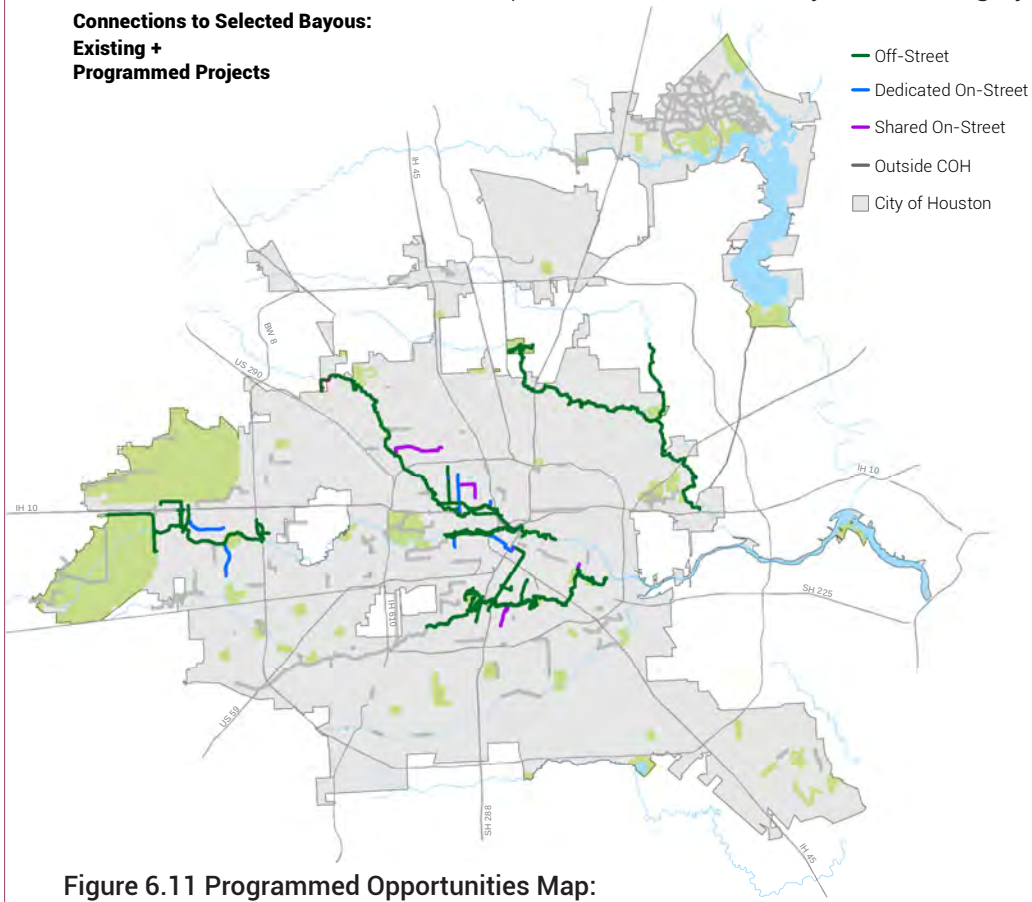


Figure 6.11 Programmed Opportunities Map: Existing + Programmed Project Network

The number of projects already in development shows the momentum underway in the city to extend and expand the bikeway network. This will make these attractive corridors more accessible to more people and begin to better connect major activity centers like Downtown, the Texas Medical Center, and the Energy Corridor. However, the programmed projects don't connect these smaller area networks together in order to create the "connected, city-wide network" set forth as a goal of the Houston Bike Plan. Achieving the beginnings of such a network sooner rather than later will require the completion of a set of the short-term potential projects as well as certain key connections to link these and other areas together.

The highest potential opportunity to expand the high-comfort bikeway network in the relatively near term is to focus on the corridors where improvements can be implemented within the existing street pavement. These typically take the form of signage and pavement marking projects with small capital requirements. Such projects would designate low-volume, low-speed streets as shared on-street routes and allocate pavement space

to dedicated bike lanes on other streets with higher volumes and speeds and available capacity.

While further engineering studies and neighborhood engagement will be required to determine the ultimate feasibility of these potential short-term bikeway projects, corridors that have been preliminarily identified as opportunities and connect to the initial three bayou corridors are shown on the Short-Term Potential Opportunities Map in Figure 6.12. These are just the corridors that connect to these three bayous shown to illustrate the approach. There are many other short-term opportunities that may be implemented in other neighborhoods.

As shown, access to each of the bayous is greatly enhanced by implementing these projects. The Energy Corridor would be connected to Westchase and CityCentre in west Houston, and Halls Bayou would connect to Hunting Bayou in northeast Houston. Due to a more robust, well-connected street grid that distributes traffic across more streets and provides more alternate routes, central Houston has the highest potential for short-term projects that create a strong bikeway network. This also aligns with where the most people are making relatively short trips across all modes, a key indicator of where bicycle use has the greatest potential to grow.

Where gaps exist, this is typically because the roadway network is limited, often with only the major arterials providing meaningful connectivity. This presents several challenges to expanding the bikeway network: first there is a limited or non-existent network of secondary streets that may be more suitable for comfortable bikeways; second, the limited roadway connectivity focuses more traffic on fewer streets, leaving limited space to reallocate towards bikeways; and third, the network makes trip distances longer and less direct making it less attractive for bicycle trips. Typically, to provide a comfortable bikeway network in these areas, capital

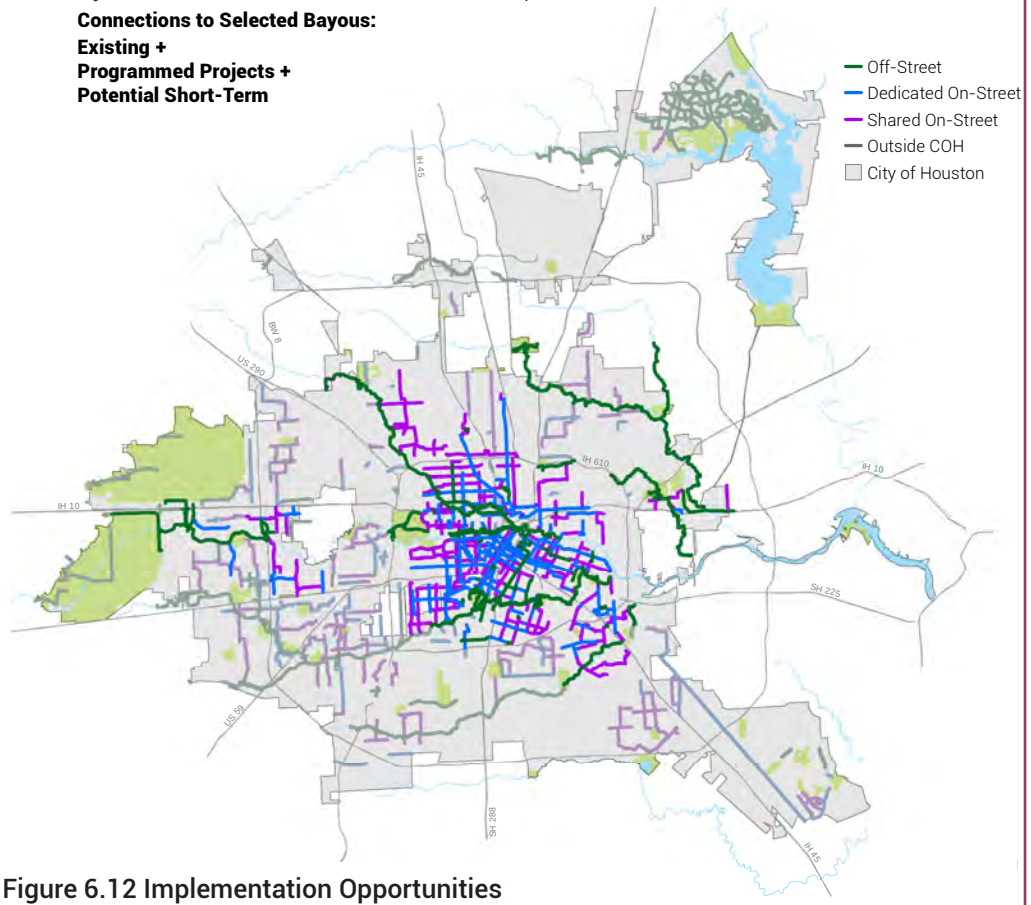


Figure 6.12 Implementation Opportunities Map: Short-Term Potential

projects such as side paths, off-street trails, or street reconstructions are required.

Overall, the short-term retrofit opportunity bucket includes ***138 miles of dedicated in street R.O.W. bikeways*** (typically some type of bike lanes) and ***242 miles of shared on-street bikeways*** (typically bike routes or neighborhood bikeways). Based on estimates presented in the 2014 H-GAC Regional Bikeway Plan, implementing all of these projects is estimated to cost between ***$27 million and $51 million***. The range will depend on the mix of bikeway types ultimately designed for these corridors, which could be anything from simple signed bike routes to buffered bike lanes depending on the context and constraints. All costs in this section are planning-level estimates and will require further engineering study to refine. They typically include restriping of the entire street segment when implementing dedicated bike lanes. Planning-level costs across these implementation buckets are summarized in Figure 6.14.

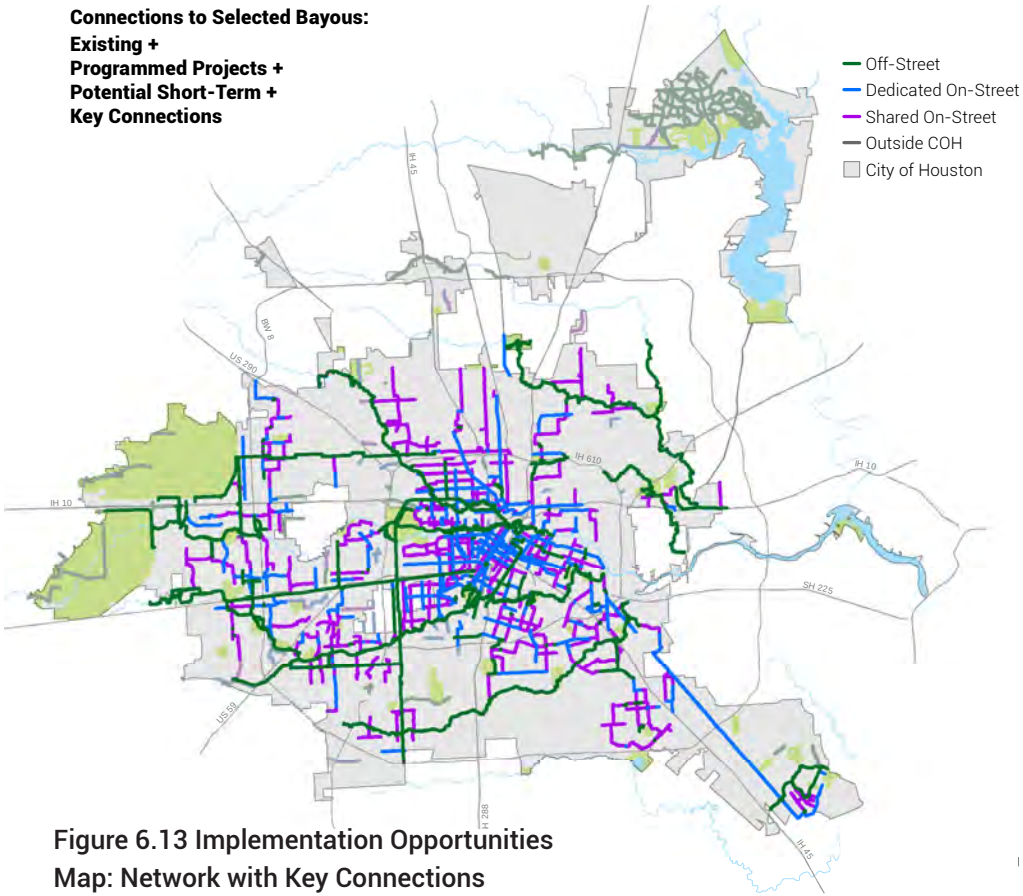


Figure 6.13 Implementation Opportunities Map: Network with Key Connections

One approach to minimize the cost of implementing these projects is to incorporate them into the regular replacement cycle of pavement markings and asphalt overlays. Doing so would add high-comfort bikeway connections while only incurring the incremental cost of the bikeway striping and signage. As maintenance funds are limited, projects could also be implemented by partnering with districts or other agencies, or by packaging projects into grant or other funding applications.

The potential short-term opportunities would create extensive on-street networks within many neighborhoods in the city. It's the Key Connection Projects, however, that tie short-term opportunities from across the city into one network, as shown in Figure 6.13. Until long term projects are completed, Kingwood would not be connected into the rest of the citywide network since the area in between is outside city limits; however, it would be

connected to Townsen Park & Ride and the Spring Creek Greenway.

The Key Connection Projects have a total estimated cost of ***$73 million to $119 million***. Therefore, the total estimated cost to implement the potential Short-Term Opportunities and the Key Connection Projects would be approximately $100 million to $170 million. A list of the Key Connection Projects is shown in Figure 6.15. They include ***75 miles of off-street***, ***8 miles of dedicated in street R.O.W.***, and ***4 miles of shared on-street bikeways***.

Some off street path segments may be fairly straightforward to build, such as those along utility corridors or on drainage easements with well-defined maintenance shelves, while others will require significant drainage work, bridge infrastructure, traffic control, or right-of-way acquisitions that can increase costs substantially. Further engineering study will be required to refine these estimates.

The long-term master plan contains an additional ***269 miles of off-street*** and ***648 miles of in street right-of-way bikeways***. The off-street paths can be estimated at ***$235 million to $382 million*** and would require development as projects. Planning work underway by the Houston Parks Board will further refine the opportunities and cost estimates for potential off-street paths along area greenways.

The on-street components would be implemented as streets are reconstructed, so specific costs and timelines will vary. Individual projects and segments may not provide immediate connectivity or continuity with the wider network, but implementing the plan consistently and methodically over the coming decades will ultimately create the comprehensive network envisioned.

Implementation Category	Miles of Bikeway			Average Cost per Mile* Low-High Range ($Thousands)			Planning Level Cost Range ($Millions)
	Dedicated in Street ROW	On-Street Shared	Off-Street	Dedicated in Street ROW	On-Street Shared	Off-Street	
Existing High-Comfort Bikeway Network	8	30	232	-			-
Programmed Projects	42	1	91	-			-
Short Term Potential	138	242	-	$90-210	$10-140	n/a	$27 - $51
Key Connections	8	4	75	$90-210	$10-140	$600-1,700	$73 - $119
Full Bikeway Network	620	28	269	n/a**	$10-140	$600-1,700	$235 - $382
Total Network	816	305	668				$335 - $552

Figure 6.14 Planning Level Cost Summary for Bikeway Network Implementation

* Cost per mile estimates are based on data from the 2014 H-GAC Regional Bikeway Plan, general planning estimates from comparable projects. Total cost estimates assume a 75%-25% and 25%-75% mix of low and high cost projects to develop range. Cost per mile estimates also include 20% to 40% for contingency, survey, engineering, and project management.

** Dedicated in Street R.O.W. bikeways will have a cost as part of the full network build-out but these would be included in the cost of street reconstruction and therefore are not included here.

#	Project	Type	Miles
1	Centerpoint/Terminal Sub Trail - BW 8 to Memorial Park	Off-Street	12.1
2	Eureka Trail - Memorial Park to White Oak Bayou	Off-Street	2.6
3	Buffalo Bayou connections at IH 610	Off-Street	0.7
4	Riverway-Woodway connection	Off-Street	0.2
5	CenterPoint Spring Branch/Oak Forest Trail - Addicks Reservoir to Shepherd	Off-Street	10.8
6	CenterPoint Wilcrest Trail - Addicks Reservoir to Buffalo Bayou	Off-Street	4.2
7	Westpark Trail - Brays Bayou to Wheeler TC	Off-Street	12.2
8	Brays Bayou Trail - Cennection at BW 8	Off-Street	0.1
9	Centerpoint Willowbend Trail - Keegans Bayou to Terminal Sub	Off-Street	5.3
10	MLK Boulevard - IH 610 Crossing - Southlea to Yellowstone	Dedicated	0.3
11	Donoho Connection - Crestmont to Mykawa	Off-Street & Shared	0.5
12	Buffalo Bayou north bank eastward extension to Bayou St.	Off-Street	0.2
13	Clinton Drive - Hirsch to Schweikhardt	Dedicated	0.3
14	Hunting Bayou Trail - Collingsworth to LBJ Hospital	Off-Street	2.1
15	Kashmere Connection - Sayers to Hunting Bayou	Off Street & Shared	1.5
16	Tidwell - IH 45 Crossing - Werner to Nordling	Dedicated	0.2
17	White Oak Bayou Heights Connections - 18th, 24th, Wynnwood	Off-Street & Dedicated	0.7
18	Tidwell Park Connection - Tidwell & Compton to trail	Off-Street	0.1
19	Hamblin Road - IH 69 to Woodland Hills	Off-Street or Dedicated	2.8
20	Sims Bayou - IH 45 to Milby Park	Off-Street	3.2
21	Berry Bayou and Connections - Sims Bayou to Allendale	Off-Street & Shared	2.2
22	Old Galveston Road - Howaed to Broadway & Connection	Dedicated	2.5
23	Glencrest Drainage Corridor - Sims Bayou to Airport	Off-Street	1.8
24	Airport Boulevard - Telephone to Hansen	Off-Street	1.8
25	Southeast Houston Connections (6)	Off-Street & Dedicated	0.4
26	Clear Lake Bayou Trails	Off-Street	7.5
27	Bay Area Boulevard - Old Galveston to Bay Area P&R	Off-Street or Dedicated	0.4
28	Bering Ditch Trail	Off-Street	2.4
29	Memorial Drive - Memorial Park to Shepherd	Off-Street	1.2
30	Shadowdale Connections	On-Street & Off-Street	2.1
31	Scott, Reed & Red Bud Connections	Off-Street	1.1
32	Brays Bayou Gaps - Buffalo Speedway & Chimney Rock	Off-Street	1.1
33	Fulton - Melbourne/North Lindale Station to Donlen	Off-Street or Dedicated	0.1
34	Hendon at Centerpoint Easement	Off-Street	0.1

Total: 87 Miles

Figure 6.15 Key Connections Priority Projects Connecting Potential Short-Term Bikeways

4. DEVELOP RESOURCE AND STAFFING NEEDS

Implementation of the Houston Bike Plan will require significant resources from the City and presents a staffing resource challenge that will need to be addressed. Staffing resources will be needed for a variety of activities to move policies forward, develop and manage programs, and provide input or review projects being implemented by the City and other entities. Additionally, coordination within multiple city departments, external agencies, developers, and the advocacy community will require a substantial amount of staff time.

Staffing of the Houston Bikeways Program to manage a comprehensive bicycle plan should include, at a minimum, two full-time staff between the Public Works & Engineering and the Planning & Development departments, including the Pedestrian and Bicycle Coordinator (potentially renamed the Active Transportation Coordinator).

Other City departments, particularly Parks & Recreation focused on parks and bayou trails, the Police Department related to enforcement, and the Health Department for education and outreach, will have a variety of roles to play in implementation. Future staffing needs of all departments should be considered comprehensively to ensure best use of resources.

Staffing requirements across all departments should be evaluated regularly, potentially through the annual Bikeways Strategic Report as implementation progresses to ensure adequate capacity to successfully employ recommendations and strategies of the Plan. There should be increased opportunities for training of staff in appropriate departments in the planning, design, engineering, construction, and maintenance of bikeway facilities.

In addition to Houston Bikeway program staff, the development and management of a **Bicycle Advisory Committee** (BAC) can play a key role in implementation. With strong ties to the community, advocacy groups, and public agencies, this committee should be formally established and meet regularly throughout the year. The committee will be vital to implementation through coordination and prioritizing future efforts based on the annual strategic assessment report and new issues or opportunities that develop in the community.

The role of the BAC is recommended to include but not be limited to:

- Working with the City in achieving the ten-year vision and any interim goals and targets
- Development of an annual Houston Bikeways report;
- Working with the City to develop recommendations to address the issue of long-term maintenance of bikeways, both off and on street.

Key Recommendation 4.1

Increase Houston Bikeways Program staff in appropriate departments in the City.

Key Recommendation 4.2

Establish the Bicycle Advisory Committee as a regular standing committee that works with the City staff to implement the Bike Plan.

5. LEVERAGE FUNDING OPPORTUNITIES

For the Houston Bike Plan to be implemented, funding is a key element that must be identified and secured. The City of Houston and its partners have successfully obtained multiple forms of federal and local funding in recent years with TIGER and FHWA grants, as well as a voter-approved bond for the Bayou Greenways Initiative.

However, spending for bicycle facilities and programs has varied greatly over the past several years. For example, from 2011 to 2014, the amount spent on bicycle and pedestrian facilities ranged from $32.3 million and $46 million in 2011 and 2012 respectively, to $15.9 million and $15.1 million in 2013 and 2014 respectively. This funding was allocated from the City's budget and Capital Improvement Program, and included spending from bicycle related projects and programs through the Public Works and Engineering and the Parks and Recreation Departments. (Source: City of Houston data reporting for Alliance for 2014 and 2016 Biking and Walking Benchmarking Report)

Current best practices from cities that have made significant improvements in their bicycle networks, mode share, and overall culture have created funding targets and dedicated funding from their budgets to address Bike Plan implementation. A regular source of funding, with a minimum or target amount within the budget, is needed to not only build the bicycle network, but also provide the required regular maintenance of facilities that ensure that the bikeways remain comfortable and safe.

Funding for bicycle facilities and programs comes from a variety of sources such as local resources, federal funds, and grant programs. While a dedicated funding source within the City is desirable, the key to successful implementation of a bicycle network for the City of Houston is utilizing a variety of funding sources that can complement local funding and best leverage available resources. Below is a description of available funding sources for bicycle planning and implementation.

Local Funding Mechanisms

The City's **General Fund** is responsible for providing core city services such as public safety, facility development and maintenance, and parks and recreation. The Public Works & Engineering (PWE) and Planning & Development (PD) departments are funded through the general fund's development and maintenance services category. The Parks and Recreation Department (HPARD) is funded through the human and cultural services category. Bicycle program resources and non-capital projects would most likely be supported through these categories within the respective department's allocated budget through the general fund.

The City of Houston's **Capital Improvement Program (CIP)** allocates funds for all major capital improvement projects, regardless of the funding source. Many projects implement physical improvements to public facilities and infrastructure. This program

is an important tool for improving bicycle facilities and utilizes funds from a wide variety of sources including bonds, fees, and federal grant sources. The CIP shows a five-year prioritization of infrastructure projects and is revised annually. The City's CIP also provides a long-term planning process for street and drainage systems. Within the CIP, ReBuild Houston provides a specific method for funding street and drainage system infrastructure. Several funding sources are comprised within ReBuild Houston for street projects, which can include bicycle facilities. Those funds come from a drainage utility charge, developer impact fees, ad valorem taxes, and third party funds, such as METRO, TxDOT and federal grants. Incorporating bikeways into the street design of projects as part of the CIP and ReBuild Houston project development processes will aid in the ability to fund implementation of the Bike Plan recommendations. Capital planning and allocation must be consistent with City of Houston processes and approvals, including the CIP and City Council authorization and funding requirements,

The City of Houston has the authority to issue **municipal bonds** for the purpose of financing infrastructure needs. The City has recently utilized bonds to fund the Bayou Greenway Initiative, which develops green corridors with hike and bike trails along the bayous in the Houston area. Voters in the City of Houston could authorize future bonds to be slated for build-out of the bicycle network as identified in the Bike Plan recommendations

Energy Corridor Bikeway

Source: http://energy-corridor.blogspot.com/2015/03/biking-in-energy-corridor.html



as a method to implement the long-range network.

Municipal Management Districts (MMDs) are special districts created by the Texas legislature. These districts are empowered to promote transportation and economic development, along with several other functions within their boundaries. Beyond infrastructure investment, MMDs provide a maintenance activities for transportation facilities, implement bicycle programs, and are a valuable resource. Most MMDs are able to issue bonds and receive funding from ad valorem taxes, assessments, impact fees, or other funds in order to provide improvements and services. MMDs are an important partner for the City of Houston as many are working towards improvements in their bicycle infrastructure already.

Tax Increment Reinvestment Zones (TIRZs) are special zones created by City Council in efforts to attract new investment in an area. Taxes from new improvements are set aside in a fund designed to finance public improvements within the boundaries of the TIRZ. Public improvements can include bicycle facilities and amenities. Many TIRZ boundaries overlap with MMDs as well, providing even greater opportunities to support implementation and maintenance of the Bike Plan. Coordinating and leveraging funding with MMDs and TIRZs is an important strategy that the City of Houston should embrace in order to build out the bicycle network and provide amenities such as bike parking, showers, or promotion of bicycling.

Impact Fees are currently employed in the City of Houston in relation to managing wastewater capacity and demands and drainage through ReBuild Houston. Best practices in other localities include assessing impact fees on new development to pay for transportation projects that are tied to vehicle trip generation rates and traffic impacts of those developments on the transportation network. Developers can reduce these impacts and pay decreased rates by paying for on or off-street bikeway improvements. In-lieu parking fees may also be used to contribute to the construction of new or improved bicycle parking facilities.

Voter Approved Sales Taxes have been utilized in cities to pay for bike facilities. Currently, the City of Houston imposes an 8.25% sales and use tax rate, which is at the maximum allowed by the State of Texas. Bills have been introduced in the last two state legislative sessions for a local-option tax, which would allow cities to impose additional sales taxes above the 8.25% cap to pay for the needs of the locality, including transportation-related infrastructure. If the Texas Legislature creates a local-option sales tax in the future, and voters in the City of Houston approve, it could be a reliable revenue stream to fund implementation of the Bike Plan.

Parking Benefit Districts can serve as a financing tool to support improvements in employment and activity centers. Within

a parking benefit district, public parking spaces (on and off-street) are charged hourly rates designed to keep a particular percentage of parking spaces vacant at all times. Funds collected from parking charges go directly to improvements within the district, such as bike facilities and amenities. According to case studies in Austin, Texas and Washington, D.C., the Federal Highway Administration has found that the application of parking benefit districts has been shown to reduce the need for surface parking and improve traffic congestion while funding local improvements, such as bicycle facilities within the district.

Federal Grant Programs

In 2015, Congress passed the Fixing America's Surface Transportation (FAST) Act, which is a five-year transportation funding bill. The FAST Act provides funding for eligible bicycle projects through multiple funding programs. Utilization of federal funds to grow and improve the City's bicycle network can be most advantageous for large-scale projects or packages of projects. Federal funds typically require a local match of at least 20%. Additionally, projects must meet federal standards. The FAST Act now recognizes NACTO design guidelines in addition to AASHTO and state design standards for bicycle facilities, providing cities with added flexibility for the design of projects. In addition to more flexible design standards, non-profit agencies are also now eligible to receive funding.

The following funding sources are most commonly utilized for bicycle projects and are also shown in Figure 6.16 along with other federal programs that can also support funding for bicycle projects.

Surface Transportation Block Grant Program (STBGP) funds are perhaps the most flexible federal funding available and may be used for nearly all transportation project types, including construction of a wide variety of bicycle facilities and non-construction projects such as maps, data collection and monitoring, bike share, bicycle storage, and public service announcements related to safe bicycle uses, among others. STBGP funds are allocated to states, with 55% suballocated to the local Metropolitan Planning Organization (MPO). The Houston region's MPO is the Houston-Galveston Area Council (H-GAC). H-GAC holds a competitive process for distributing funds and typically holds a call-for-projects every other year, coordinating with approval of the Transportation Improvement Program (TIP).

The Surface Transportation Block Grant Set-aside Program (STBGSP) allocates funding specifically for bicycle and pedestrian projects (previously the Transportation Alternatives Program). Eligible activities include infrastructure facilities, safety and educational activities, and Safe Routes to School programs. These funds are subject to the same competitive process and allocation as the overarching STBGP funds.

Funds from the **Congestion Mitigation and Air Quality (CMAQ) Improvement Program** may be used to construct bicycle facilities or non-construction projects such as maps, brochures, and public service announcements related to safe bicycle use. CMAQ funds are also allocated through a competitive process by the MPO, and typically match the same call-for-projects timing as STBGP funds.

The Highway Safety Improvement Program (HSIP), aims to improve roadway safety for all modes of travel. A highway safety improvement project is any strategy, activity, or project on a public road that is consistent with the State Strategic Highway Safety Plan (SHSP) and corrects or improves a hazardous road location, or addresses a highway safety problem. The program can provide funds for bicycle infrastructure improvements. Based upon analysis from the League of American Bicyclists, this funding source has historically been underutilized for bicycle projects based on analysis of the number and types of bicycle projects that applied for funding, as well as overall funding allocation of the program.

The National Highway Traffic Safety Administration provides funding related to bicycle and pedestrian projects for law enforcement training programs, safety enforcement campaigns, and education and awareness campaigns. This is administered under the **Section 405 National Priority Safety Programs**. These funds are eligible to states where bicycle and pedestrian fatalities exceed 15% of overall traffic fatalities. According to current data, Texas is eligible to receive these funds.

The Recreational Trails Program has been reauthorized under the FAST Act. The program funds trails for recreational modes such as walking, hiking, bicycling, equestrian use, and more. This is a set-aside of the STBGSP funding, administered locally by the Texas Parks and Wildlife Department, and awarded annually.

Other Federal Funding Mechanisms

Transportation Investments Generating Economic Recovery (TIGER) funds are competitive discretionary grants allocated directly by the U.S. Department of Transportation for innovative projects that focus on safety, economic competitiveness, state of good repair, livability, or environmental sustainability. Projects are intended to provide significant impacts to the project area and larger region or metropolitan area. Houston has received three TIGER grants since the program's first allocation in 2010, including one for a package of bicycle access to transit projects. TIGER funds are historically allocated every year through annual appropriations.

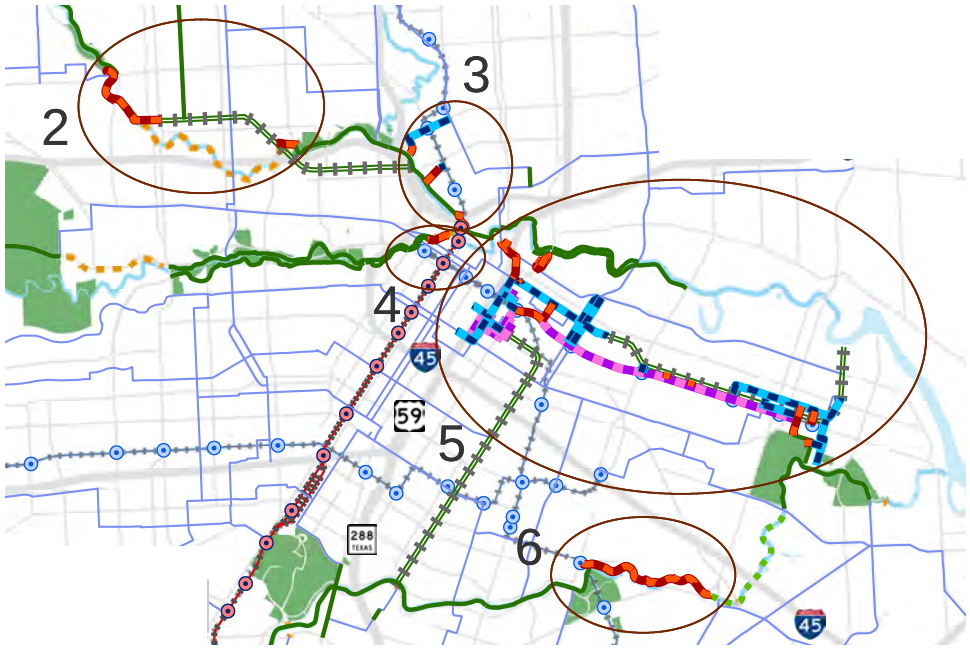
The Transportation Infrastructure Finance and Innovation Act (TIFIA) program provides federal credit assistance through direct loans, loan guarantees, and standby lines of credit to finance surface transportation projects of national and regional significance. TIFIA is helpful tool to advance large-scale projects that may otherwise be delayed due to size, complexity, or timing of revenues. The FAST Act requires a $10 million project threshold.

The **Centers for Disease Control and Prevention (CDC)** recognizes the nexus between active transportation, such a bicycling, and improved community health. The Division of Community Health (DCH) manages multiple grant programs that aim to improve community health, including improving access to and increasing physical activity. Working together with the City of Houston and/or Harris County Health Department may provide opportunities to leverage funding through the DCH for programs that encourage physical activity through bicycling and improve access to physical activity with high-comfort bikeways.

The **Community Development Block Grant (CDBG)** Entitlement Program provides annual grants on a formula basis to cities and counties. These grants are awarded from the U.S. Department of Housing and Urban Development (HUD) to revitalize neighborhoods, improve economic development, and provide improved community facilities and services. Eligible activities include construction of public facilities improvements, including bikeways.

Community Partnerships

Partnerships with other city departments, outside agencies, and others within the community are key to funding bikeways and leveraging resources efficiently. As high-comfort bikeways provide healthy, affordable, and fun transportation options to a community, they also add significant value. As such, bikeway projects can attract investment interest from developers, businesses, hospitals, philanthropic organizations, non-profits, universities, and transit agencies. The following list identifies means to better leverage resources from these entities.



Map of TIGER grant projects awarded in 2012 connecting bikeways to transit

Source: www.houstonparksboard.org

Figure 6.16 Federal Funding Sources and Eligible Bicycle Project Activities

	Eligible Activity	TIGER	FTA	CMAQ	HSIP	NHPP	STBGP	TAP	405	RTP	SRTS	402
Bicycle Project Type	Access enhancements to public transportation	X	X	X			X	X				
	Bicycle lanes on road	o	X	X	X	X	X	X			X	
	Bicycle parking	o	X	X		X	X	X		X	X	
	Bike share	X	X	X		X	X	X				
	Bicycle storage or service centers	o	X	X			X	X				
	Crosswalks (new or retrofit)	X	X	o	X	X	X	X		X	X	
	Data collection and monitoring	o	X			X	X	X		X	X	
	Helmet promotion						X	*			X	X
	Landscaping, streetscaping (bicycle route; transit access)	o	X				X	X				
	Lighting (pedestrian and bicyclist scale associated with bike project)	X	X		X	X	X	X		X	X	
	Maps		X	X			X	X			X	
	Paved shoulders	X		o	X	X	X	X			X	
	Police patrols/ Enforcement Campaign						*	*	X		X	X
	Safety brochures, books						*	*	X		X	X
	Separated bicycle lanes	X	X	X	X	X	X	X			X	
	Shared use paths	X	X	o	X	X	X	X		X	X	
	Signs/signals/signal improvements	X	X	X		X	X	X			X	
	Signed bicycle routes	X	X	X		X	X	X			X	
	Spot improvement program	X	X		X		X	X		X	X	
	Traffic calming	X	X		X	X	X	X			X	
	Training			X			X	X	X	X	X	X

X = eligible o = eligible, only competitive as part of a larger project * = only eligible under srts program

TIGER: Transportation Investment Generating Economic Recovery
FTA: Federal Transit Administration Capital Funding (includes Section 5307 and 5339 programs)
CMAQ: Congestion Mitigation & Air Quality Improvement Program
HSIP: Highway Safety Improvement Program
NHPP: National Highway Performance Program
STBGP: Surface Transportation Block Grant Program
TAP: Transportation Alternatives Program (set-aside of STBGP)
Section 405 National Priority Safety Programs
RTP: Recreational Trails Program (set-aside of STBGP)
SRTS: Safe Routes to School Program (set-aside of STBGP)
402: State & Community Highway Safety Grant Program

- The City can develop policies to require or create incentives for **developers** to enhance their projects with bicycle parking, amenities, or investment in infrastructure on or adjacent to the developer's property. Incentives through the permitting process have successfully been utilized in other cities to help develop bicycle facilities and encourage bicycle amenities.
- **Businesses** designated as "Bicycle Friendly" and others that have a particular interest in bicycling may be interested in partnerships as they already see the benefits of bicycling. Financial assistance in connecting bikeways to their business or providing parking, other bicycle amenities, and promotion of bicycling are just a few ways that businesses may be partners in implementing the Bike Plan.
- **Hospitals and other health service providers** are natural places of concern for community health and can be a partner for improving active transportation facilities. For example, the Seattle Children's Hospital committed to making bicycle and pedestrian improvements in its Major Institution Master Plan. Through that, they are improving nearby connections, including bike lanes, to the hospital and investing $2 million in a Bicycle and Pedestrian Fund to build infrastructure to help employers and visitors access the hospital safely. Working with hospitals in Houston, particularly within areas like the Texas Medical Center, could be an additional strategy to aid in the "last-mile connections" within activity centers and neighborhoods.
- **University and educational campuses** are historically attractive for bicycling by students, faculty, and staff as parking constraints are common. Bicycling eases parking demand and is an attractive option to community members looking for low-cost transportation. Colleges across the country have helped fund bikeways that provide important connections to or across their campuses.
- **Philanthropic entities and non-profits** exist to make improvements to the community. Partnerships with non-profit organizations can demonstrate support for projects and programs beyond the City government, which can be crucial to obtaining federal funds or leveraging new local funding. The Kinder Foundation focuses on the greater Houston area and has supported bicycle infrastructure improvements through the Bayou Greenway Initiative. The National Foundation Center (www.foundationcenter.org) provides a database of grant program information, including guidelines and application

procedures. The Robert Wood Johnson Foundation awards grants for bicycle and pedestrian projects if they can be tied to research or promotion of health and physical activity. The Rails to Trails Conservancy provides grants to turn unused rail corridors into public places.

- As the City's transit provider, the **Metropolitan Transit Authority of Harris County (METRO)** can be an important partner for the City in implementation of the Bike Plan. Federal Transit Authority (FTA) formula funding allocated to METRO is available to be spent on access to transit facilities, providing parking, improving signage, and even maintaining those facilities, provided there is a link to transit. Additionally, the FTA Bus and Bus Facilities program provides eligibility for bicycle routes to transit facilities. Biking and transit have natural linkages and a partnership with the METRO, which would improve opportunities for transit patrons to better access and utilize METRO services and facilities, building upon the METRO Bike & Ride Plan, and could leverage funding that would benefit both agencies.
- As the region's Municipal Planning Organization (MPO) the **Houston-Galveston Area Council (H-GAC)** will be a key partner in the development, coordination and funding of the Bike Plan. Continued engagement and coordination on funding opportunities will be critical to implementation success.

Bike parking at METRO's Kingsland Park & Ride

Source: www.ridemetro.org



Maintenance & Operation Funding

Maintenance of bikeways is an important issue to discuss in relation to funding. When maintenance dollars available to the City are already stretched, the addition of new bikeways, particularly the miles of facilities recommended in the Bike Plan, can be an additional strain on the budget. Many funding sources typically support the construction of new facilities, but often do not address the continued maintenance needs associated with those facilities.

While constrained funding for maintenance should not preclude constructing new bikeways, it does present a need to develop priorities for maintaining bikeways along with other facilities. Other cities have utilized a

variety of strategies including but not limited to partnerships, federal funding through the FTA's State of Good Repair program or the Recreational Trails Program, or local funding through prioritization and inclusion in other routine maintenance programs, or increases in the local sales tax to ensure proper bikeway maintenance.

Development and maintenance of bike facilities has been identified as one of four goals for the Bike Plan. Not all bikeways are maintained by the City; multiple agencies and entities build and maintain infrastructure within the City. As the City implements the Bike Plan it is recommended to use best practices to maintain these facilities within its funding constraints. It is recommended that one of the key roles of the Bicycle Advisory Committee (Strategy 4.2) should include working with the City to develop recommendations to address the issue of long-term maintenance of bikeways, both off and on street.

Key Recommendation 5.1:

Create a spending target with dedicated funds from the City's budget for bikeway projects and programs.

Key Recommendation 5.2:

Identify and pursue funding partnerships and support from other local agencies, City departments, and private entities to leverage funds.

Key Recommendation 5.3:

Pursue funding for short-term and key connection projects.

Key Recommendation 5.4:

Develop bicycle facility maintenance prioritization criteria and incorporate bicycle facility maintenance as part of roadway maintenance when possible.

6. BUILD MOMENTUM THROUGH PILOT PROJECTS

With each new high-comfort bikeway that opens and expands the network, more people will have access to better opportunities. These instances should be wholeheartedly celebrated.

One additional approach for building momentum for implementation of the Bike Plan is the development of pilot projects that showcase how the Bicycle Toolbox can be applied. Often in Houston, people who have not had a chance to view best practices in bikeway design in other cities do not clearly understand what high-comfort bicycle infrastructure can look like with the exception of the great bayou paths expanding across the city. Their experience is typically narrow bike lanes or shared roadways that are not designed to encourage people of a broad range of ages and abilities to ride.

The City of Houston and its partners already have several bikeway projects in development that will start to change this. The Separated Bikeway on Lamar Street in Downtown was a first step to showing what is possible and projects are planned that extend this facility west to connect to Buffalo Bayou and east to St. Emanuel in EaDo.

Additional projects that are coming online soon include:

- Bike Route and Wayfinding on Hutchens Street - EaDo
- Center Point Easement Walk/Bike Path north of Orem Street in southwest Houston
- MKT Trail Crossings
- Bayou Greenway Trails Multiple Bayous

This Implementation Strategy showcases an additional five proposed pilot projects that will provide the City with additional, key near-term improvement opportunities. Through pilot projects, people will be able to see and experience quality bicycle infrastructure, which will in turn provide opportunities for more community feedback and encouragement to the City to implement more high-comfort facilities in more locations.

The proposed pilot projects were selected to show conceptual improvement across various contexts and in different geographic areas of the City. The projects utilize a range of approaches from the Toolbox. These locations have been identified as gaps or barriers to people bicycling. They show how facilities can meet community needs identified through public outreach, provide important links in the bikeway network, improve intersections, and help bicyclists safely navigate neighborhoods.

1. Intersection Improvements – Polk Street at Scott Street

The intersection of Polk Street is one of the longer on-street bikeways in Houston's East End. The corridor connects Downtown, EaDo, and the Columbia Tap Trail with METRORail

Pilot Projects:

Proposed pilot projects are conceptual in nature. Development of pilot implementation should follow the public engagement process as recommended under Section 9 of this chapter. Key Recommendation 9.1 recommends incorporation of public engagement beginning no later than preliminary engineering, i.e. the design phase of the project.

transit and neighborhoods east of Scott Street. The intersection presents a barrier due to the current design and is complicated by the presence of METRO's Purple Line LRT and the transition of Scott Street to the Sampson/York one-way pair north of the intersection. The pilot project develops a design to improve the bike lanes on Polk Street through the intersection.

2. ROW Reallocation – Kelley Street Hirsch to LBJ Hospital

Kelley Street is a six-lane Major Thoroughfare carrying low traffic volumes. The corridor is an important connection to METRO's Kashmere Transit Center and LBJ Hospital. The pilot project develops improved bike lanes along this corridor connecting destinations and linking to a north-south bikeway on Hirsch Road which provides connections to the Bayou trail system.

3. ROW Reallocation – Gemini Avenue– Bay Area Park & Ride to Saturn Lane

This bikeway was recommended in the 2011 Clear Lake Pedestrian and Bicycle Plan as a route to connect Bay Area Park & Ride to Saturn Lane and the Johnson Space Center. These streets are four-lane undivided roadways with an estimated 4,000 to 6,000 vehicle trips per day. This pilot project would develop a four-lane to three-lane conversion approach as well as potential intersection treatments for signalized intersections along the route.

4. Neighborhood Bikeways – Gulfton-Sharpstown neighborhood plan area.

Implementation Strategy 8 is developing a pilot approach to neighborhood planning looking at how to integrate neighborhoods into the citywide bikeway network. This also includes programs and policies to support an increase in bicycling tailored to that neighborhood's needs and starting point. This pilot project details some of the recommendations developed with the community.

5. Bike Station – Downtown Houston

The ThinkBike workshop in Downtown Houston identified the potential to develop a BikeStation in downtown which generates support among the Downtown District, potential developers, and others. This pilot project outlines a potential location to develop a Bike Station and create a plan for how it could be implemented.

Key Recommendation 6.1

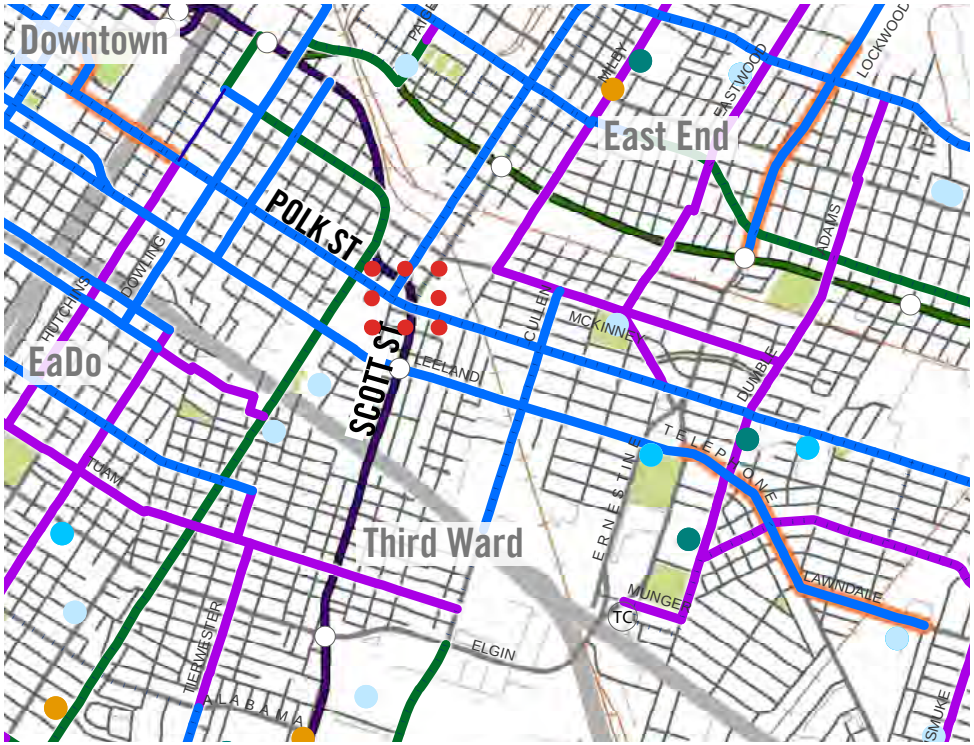
Create conceptual plans for specific bikeway treatments across the city.

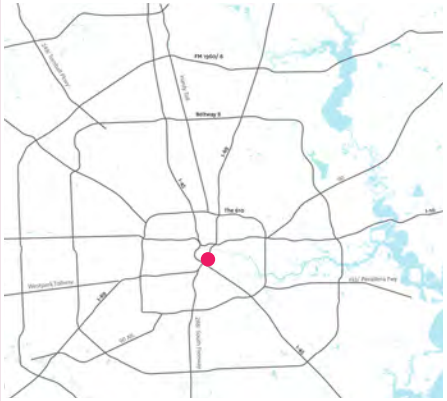
Key Recommendation 6.2

Implement and celebrate bikeway projects to build momentum to implement the Plan.

Pilot Projects

Polk Street at Scott Street





TOOLBOX ITEMS

Bike Lane

Turn Lane Treatment

Intersection Crossing Markings

CONTEXT

A wide intersection of two arterials with bus traffic, a light rail line, and high turn volumes.

SOLUTION

A continuous bike lane through the intersection area separated from cars

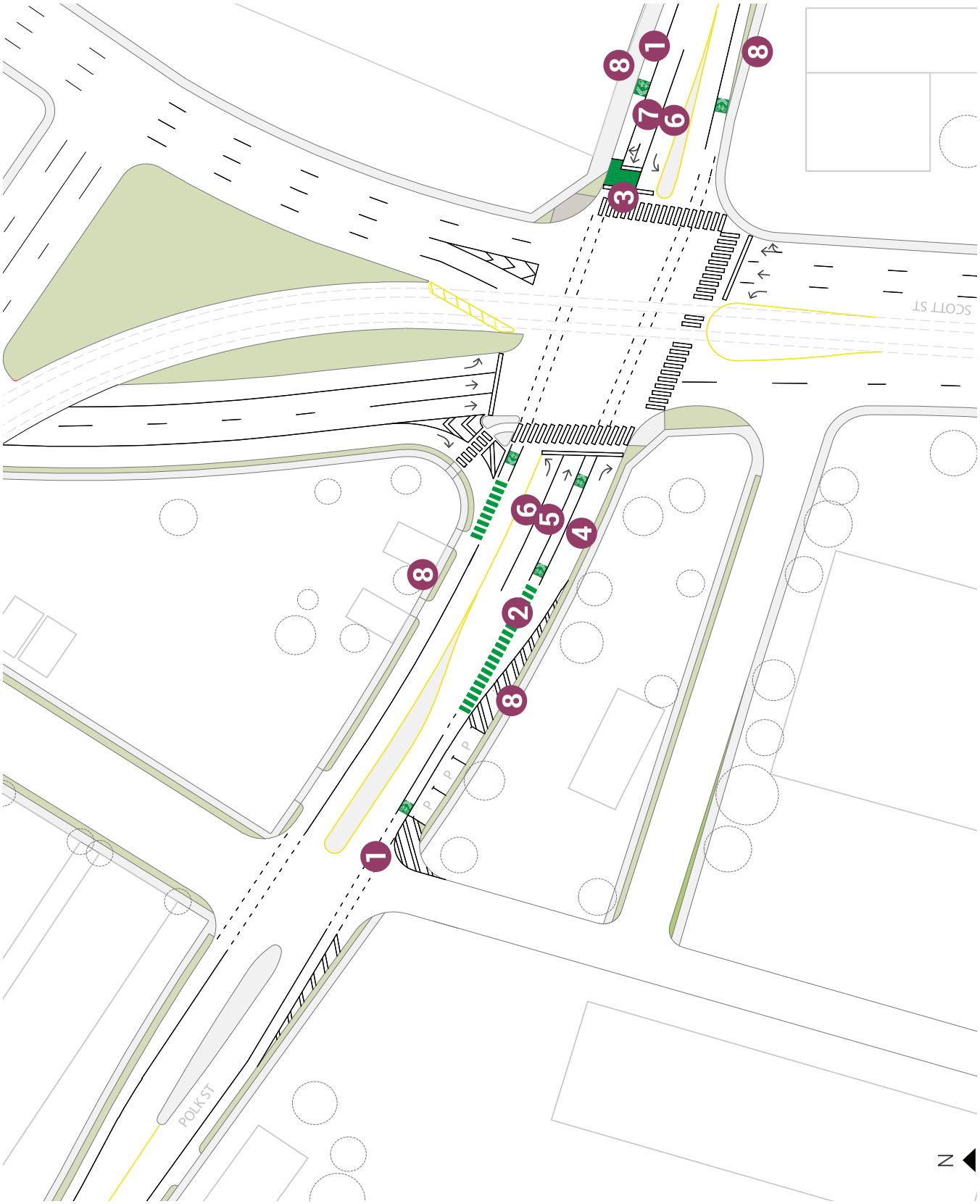
OUTCOME

Creates a more comfortable and safer bike route from the East End and EaDo into Downtown.

1. Bike Lane
2. Merge Zone
3. Bike Box
4. Right Turn Lane
5. Through Lane
6. Left Turn Lane
7. Right Turn Lane / Through Lane
8. Bike Lane and No Parking Signage

DESCRIPTION

Polk Street is a major east-west bike route that creates a link from Downtown through a rapidly developing part of EaDo to dense residential neighborhoods in the East End. It connects to Buffalo Bayou to the west, Brays Bayou to the east, and the Columbia Tap in EaDo. It also meets two light rail lines and several high frequency bus routes. Because of proximity to the Lamar Street separated bike lane into Downtown, Polk Street has potential to be a high quality connection into and Downtown. It is already a well-used bike


SCOTT ST
POLK ST
N

route, and, because it serves neighborhoods with many short trips, it has the potential to increase bike use.

Polk Street has an existing bike lane. The lane is substandard, but the street space exists to make it a high-comfort facility through re-striping, maintenance, and parking restrictions. However, the intersection with Scott Street is a major barrier. Scott has four lanes with a center running light rail line. Polk also widens to provide turn lanes at the intersections. Both streets carry some truck traffic and frequent bus routes, and there are many turning movements. The bike lane on Polk continues to the intersection, but is located between the curb and right turning cars, setting up dangerous conflicts.

The proposed pilot project creates a dedicated right turn lane. This sets up an approach with one left-turn lane, one right-turn lane, and one through lane to match the single receiving traffic lane on the other side of the intersection. Using a recommended turn-lane treatment as shown in the Bicycle Toolbox, the bike lane is placed between the right-turn lane and the through lane, resolving conflicts between bikes and right running cars. Pavement markings continue the bike lane through the intersection.



Polk St @ Scott St Looking East (Existing)

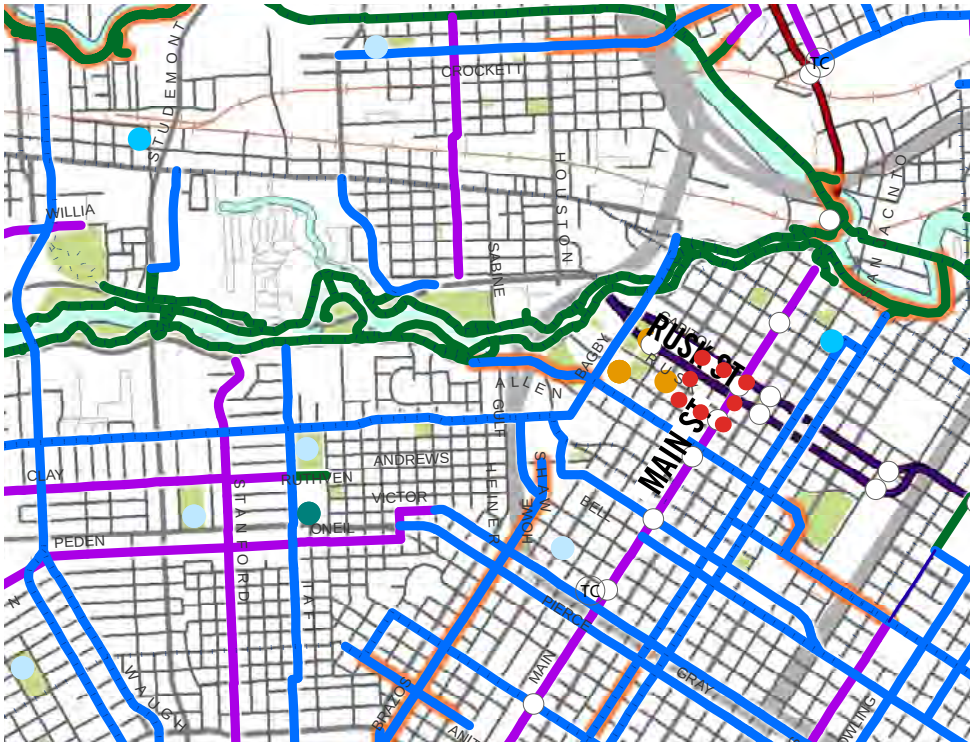


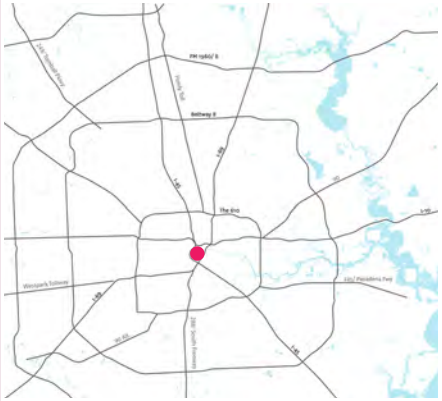


Proposed Pilot Project - Polk St @ Scott St

Pilot Projects

Bike Station at Rusk St and Main St





TOOLBOX ITEMS

Bike Station

CONTEXT

The ground floor of an office building in the center of the Downtown employment core.

SOLUTION

A Bike Station offering bike valet parking, bike repairs, bike supplies and accessories and, information.

OUTCOME

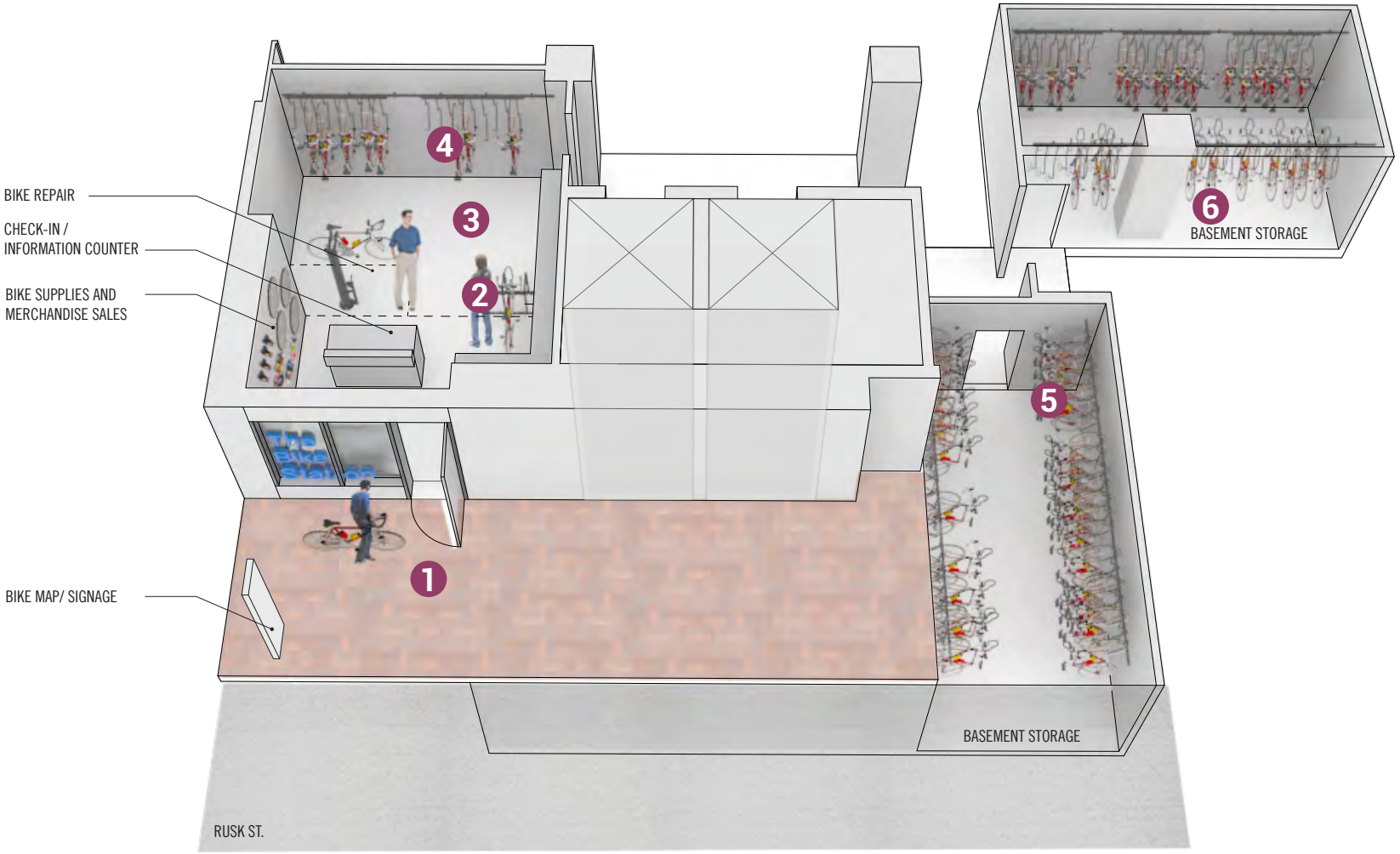
Makes it easier for employees in Downtown office buildings to bike to work.

1. Rider bikes to station
2. Rider parks bike at drop-off rack
3. Rider gets claim slip from attendant
4. Attendant hangs bike
5. Basement storage
6. Additional basement storage may be added

DESCRIPTION

Downtown has a high potential for bike commuting. There are a lot of jobs in a small area, surrounding neighborhoods are dense, and the Bayou Greenways offer high-comfort connections. However, secure bike parking can be a challenge. Only some companies and office buildings offer sheltered, protected parking.

A bike station would address the parking need for a large number of Downtown employees with a single project. Located on the ground floor of a Downtown building, it would offer valet parking: riders would ride up, leave their bike with an attendant, get a claim ticket, and walk out. The station would also be able to offer other services. Bikes could be professionally repaired during the day, and the attendant could also sell bike supplies and accessories.


BIKE REPAIR
CHECK-IN / INFORMATION COUNTER
BIKE SUPPLIES AND MERCHANDISE SALES
BIKE MAP/ SIGNAGE
1
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BASEMENT STORAGE
BASEMENT STORAGE
RUSK ST.
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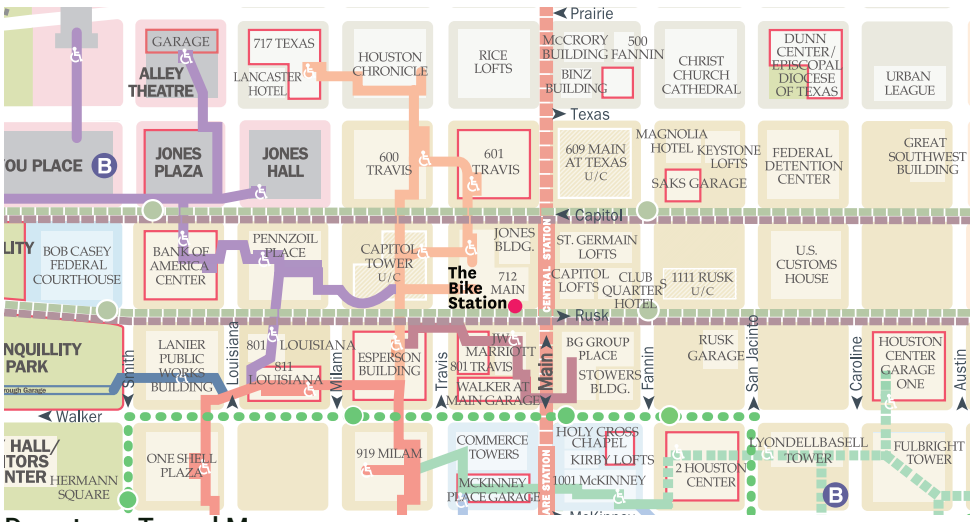
Equally as important, the bike station would be a visible bike presence in Downtown, raising awareness and giving people who are interested in riding the opportunity to walk in and get information and advice.

The site shown here is on the ground floor of 712 Main Street, facing Rusk Street. This is an ideal location within two blocks of over 10 million square feet of office space, adjacent to a light rail station, and close to Main Street, which is designated as a bike corridor in the Bike Plan. The building is currently being renovated by Lionstone Investments and Midway, and space is available for the bike station on the ground floor, in addition to remote storage space in the basement. Since the building will have a gym, it might also be possible to reach an agreement where bike station members could use the showers and lockers in the gym a critical component for some people to ride. The station could be managed by the building owner, a non-profit, or the Downtown Management District. The operator might operate themselves or contract operations to a bike shop. Bike valet rates could support operating costs, or public funds could be used to subsidize the operation.



Downtown Tunnel Map

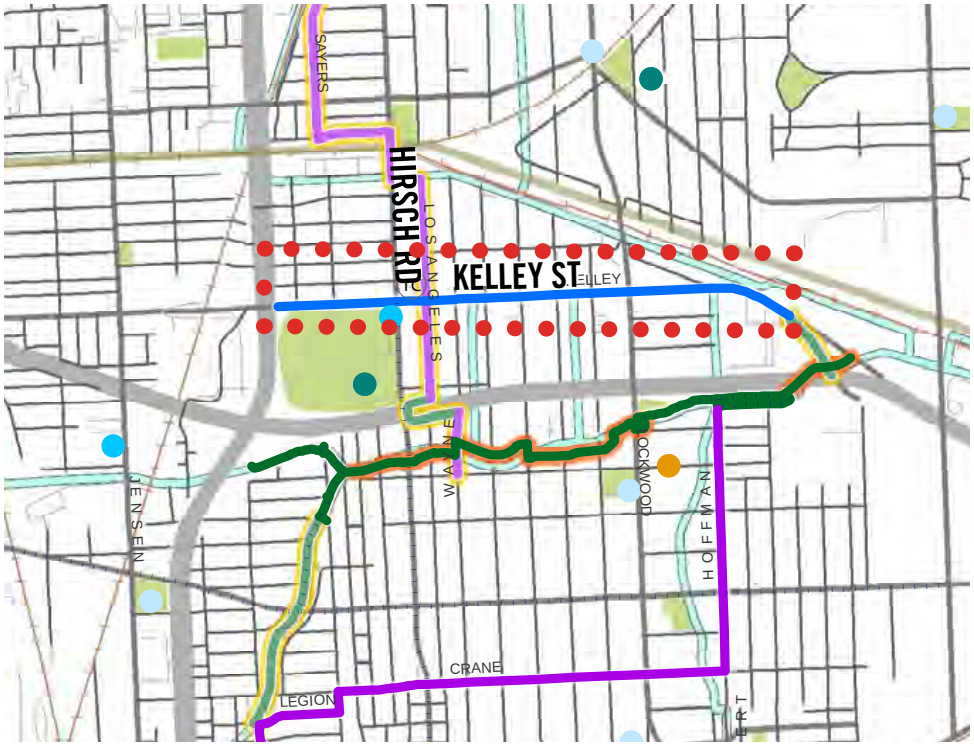


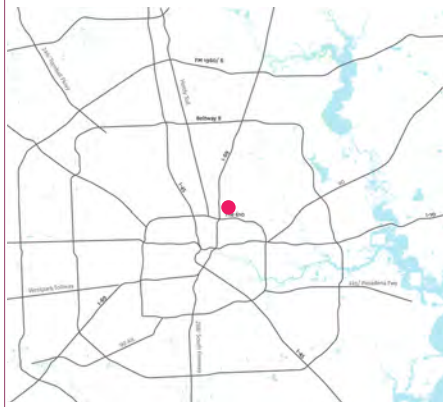


Proposed Pilot Project
Bike Station

Pilot Projects

Kelley Street





TOOLBOX ITEMS

Buffered Bike Lane

CONTEXT

An oversized arterial in a low income neighborhood.

SOLUTION

Restriping of 6 lane street to 4 lane street with buffered bike lanes.

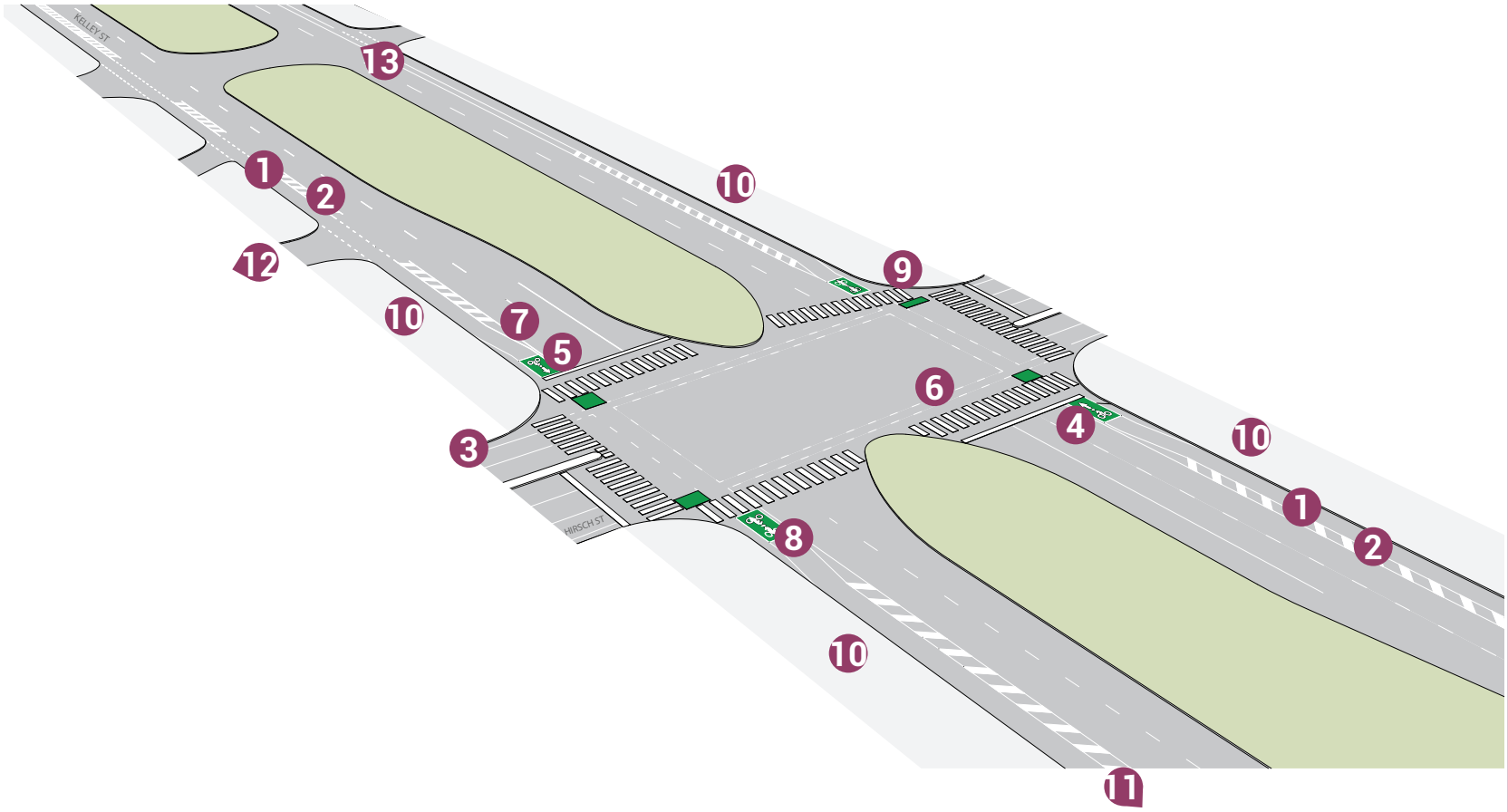
OUTCOME

A new high-comfort bike facility connecting to LBJ Hospital, Barbara Jordan High School, and the Kashmere Transit Center.

1. Existing 11' Travel Lane converted to 7' Bike Lane
2. 4' Buffer
3. Existing Bike Lane on Hirsch Road - future project
4. Bike Box increases visibility for cars turning right
5. Bike Box allows two-stage left turns
6. Dashed Lines increase visibility at intersections
7. Bike Lane shifts towards travel lane to increase visibility
8. Green pavement marking directs bicyclists across intersection
9. Improved curb ramp recommended to align crosswalk
10. Bike Lane and No Parking Signage
11. Access to school
12. Access to transit
13. Access to hospital

DESCRIPTION

Kelley Road once served as a precursor to 610, linking the Houston Ship Channel to the nation. Today, that traffic is on the interstate and Kelley's six lanes are dramatically


KELLEY ST
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underused. This is not just a waste of pavement but a danger to residents. The wide road encourages speeding, endangering people on foot or on bicycles, including people from the surrounding single family neighborhoods headed to local stores, the high school, the large public hospital, and the transit center (which has all-day frequent service to major employment centers). Biking here is a basic means of transportation, but people on bicycles are not given a comfortable place to ride.

The outer lanes could easily be re-purposed as buffered bike lanes through paint and signs. This low-cost project would create a safe, high- comfort bike facility to meet the neighborhood's transportation needs and make the street safer for all users. It could also connect to north-south bikeways linking the neighborhood to Hunting and Buffalo Bayou opening up opportunities to connect across the city.

Additional improvements to medians or curb ramps to allow for easier crossing or the inclusion of a raised barrier separating the bikeway would be potential enhancements to this project as funding allows.



Kelley St @ Hirsch St Looking West (Existing)

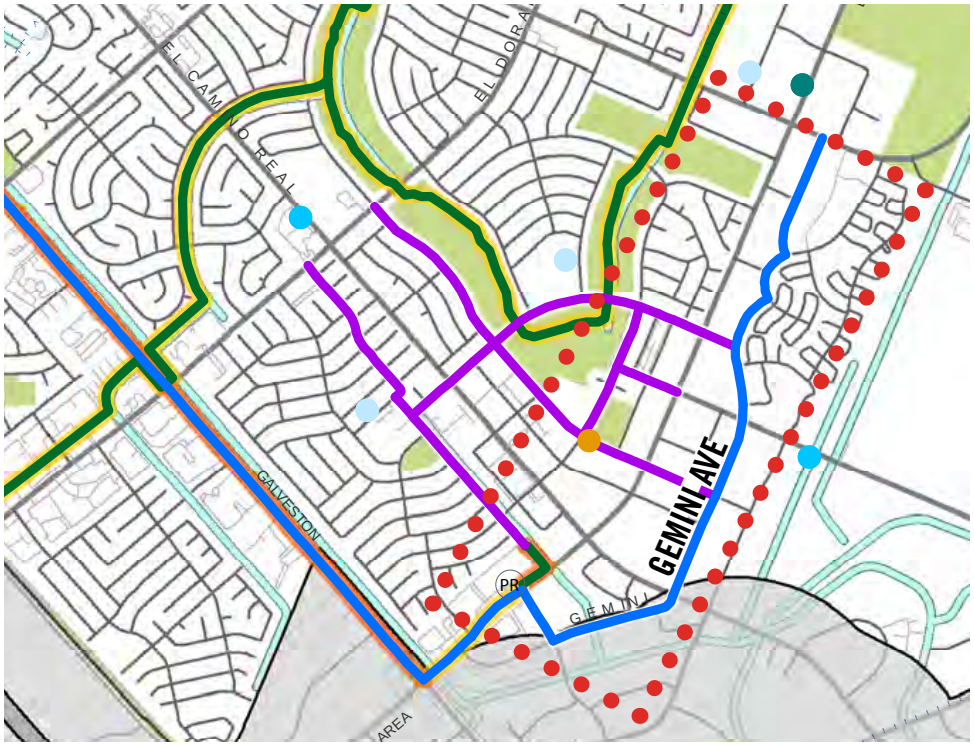


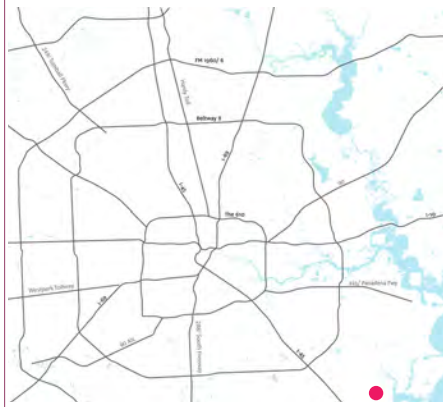


Proposed Pilot Project- Kelley Street

Pilot Projects

Gemini Avenue





TOOLBOX ITEMS

Bike Lane

4 to 3 conversion

Jurisdictional Coordination

CONTEXT

A low traffic commercial street connecting residents to employment in a suburban setting.

SOLUTION

Conversion of a four-lane street to a three-lane street with continuous turn lane and bike lanes. Coordination with the City of Webster would be required.

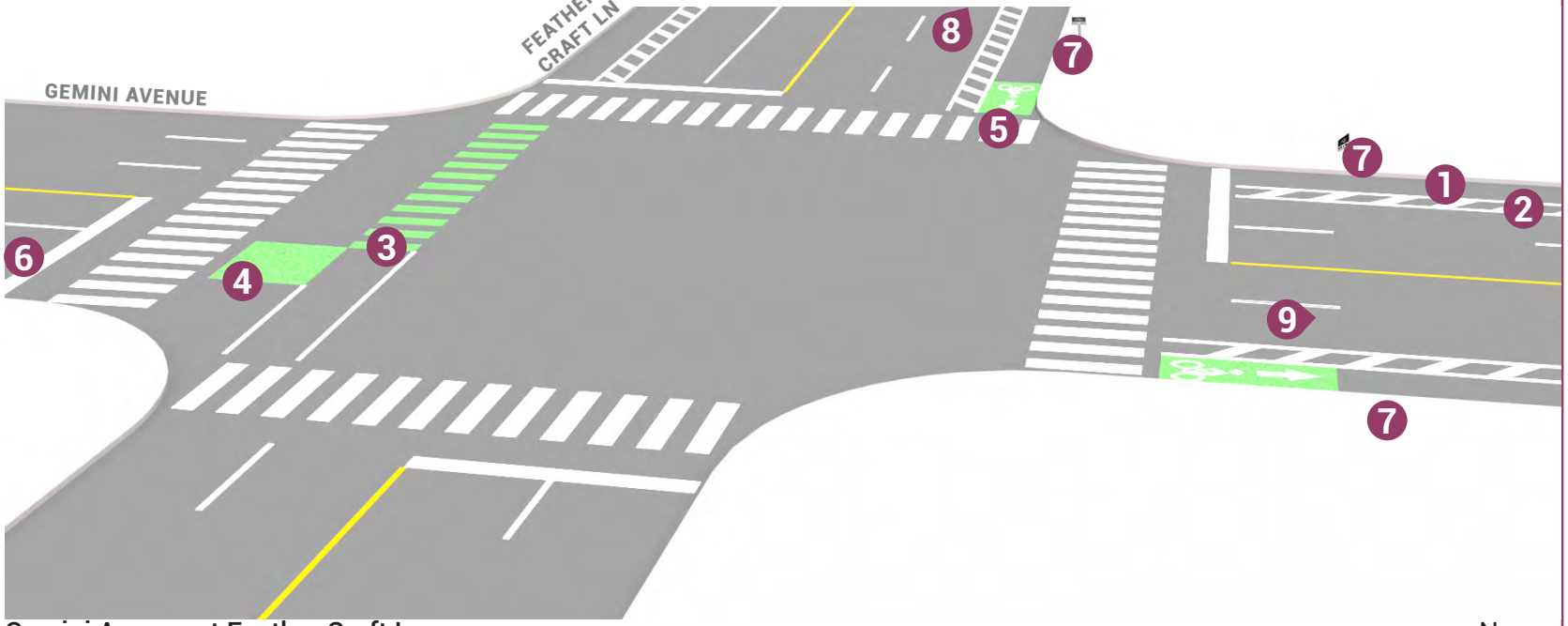
OUTCOME

Links residential areas to office buildings, the Johnson Space Center, and the Bay Area Park and Ride

1. Existing travel lane conversion to 7' Bike Lane
2. 3' Buffer from travel lane
3. Pavement treatment to increase driver awareness of bicycle presence
4. Bike box to accommodate common turning movement from Feather Craft to Gemini
5. Pavement treatments to guide bicyclists as bike route turns
6. Right turn only lane allows bike lane to begin
7. Bike Lane and No Parking Signage
8. Access to Bay Area P&R
9. Access to jobs, housing, and NASA

DESCRIPTION

Bikes can provide a useful alternative to driving and serve as a feeder to the transit system, extending the catchment area of people that can easily access transit.



Gemini Avenue at Feather Craft Lane Intersection

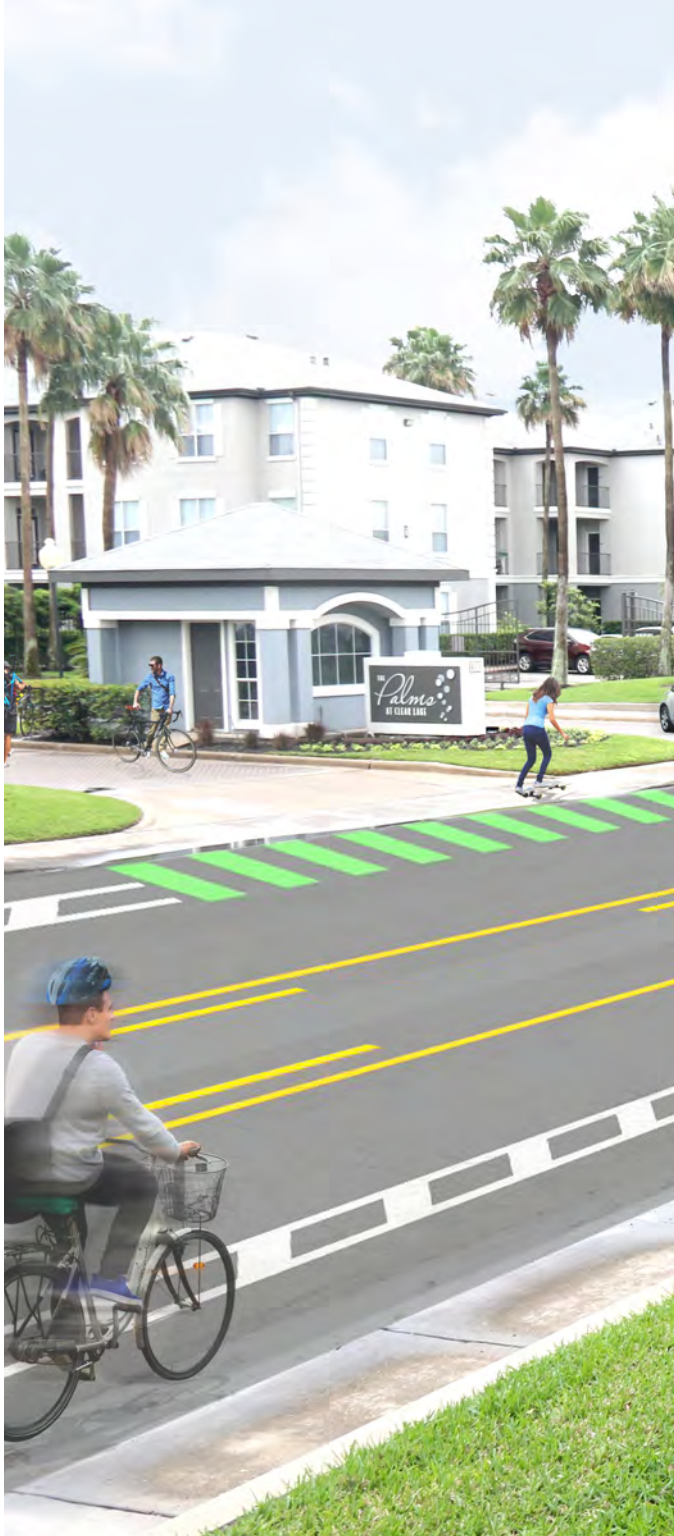
Gemini Avenue runs parallel to the congested Bay Area Boulevard corridor. It carries relatively low traffic volumes but has signalized crossings of major cross streets. At its east end it connects to a single family residential neighborhood. Also at its east end, at Saturn, it connects to a potential bike corridor to the Johnson Space Center. At the west end is the Bay Area Park and Ride, with express bus service to Downtown Houston with connections to the rest of the region. Along the way, Gemini is lined with apartments and office buildings. This corridor includes a large mix of uses in close proximity, making many trips bikable.

Gemini currently has four lanes. Because its primary purpose is local access, the inner lanes often serve as turn lanes. Thus, the street effectively has two through lanes. This is not a problem, since the traffic volumes — 4,000 to 6,000 cars per day — require only two lanes. By converting the center lane to a turn lane, the street can carry the same volume of traffic in three lanes. This frees up space for a buffered bike lane in each direction, potentially with vertical separation such as armadillos, creating a high quality bike facility with no impact on cars.

Gemini is an opportunity to create a high-quality bike facility, and a key connection in the bikeway network, by restriping an existing street with no impact on its currently functionality. One segment of the corridor runs through the City of Webster and would require inter-agency coordination.



Gemini Ave Looking South (Existing)

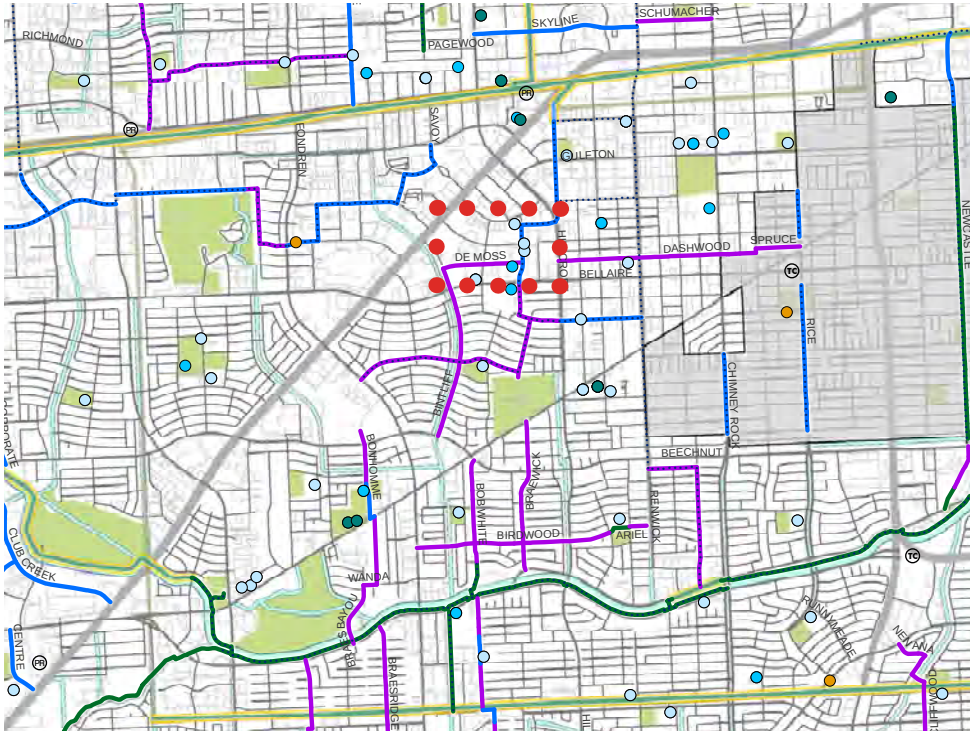


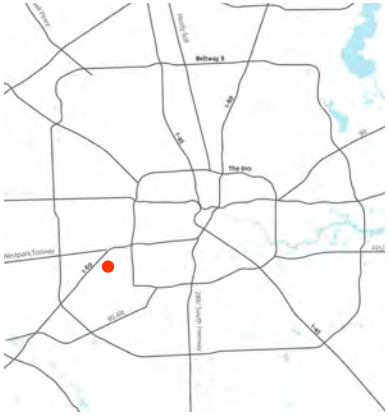


Proposed Pilot Project- Gemini Avenue

Pilot Projects

De Moss Drive at Rookin, Rookin Street, High Star Drive at Hillcroft





TOOLBOX ITEMS

Bike Lane

Two-way bike lane

Intersection Crossing Markings

CONTEXT

Gulfton and Sharpstown, located in southwest Houston, consist of diverse communities who benefit from the concentration of services located in the area. This area was identified as an important location for a pilot project because of the prevalence of residents who currently bike for transportation. The streets are generally perceived as unsafe for cycling because of high traffic corridors like Hillcroft Avenue and Bellaire Boulevard that are barriers to otherwise comfortable bikeway connections along neighborhood streets. Another logical connection is to the trail along Brays Bayou. As seen throughout the region, these bayou trails are attracting people for recreational use, and opening the opportunity for useful transportation trips by bike.

In an effort to better understand the needs of the community, two focus groups were held with community leaders followed by a neighborhood workshop that offered residents an opportunity to refine the city-wide bike plan at a neighborhood level. A more detailed description of this public engagement process and findings can be found in Implementation Strategy 8: Neighborhood Plan, which provides a framework for helping other neighborhoods discover how the Houston Bike Plan Toolbox can be applied in their community.

A priority project identified in this process was De Moss Drive from Bintliff to Rookin and Rookin Street from Bellaire to Hillcroft, where there are several community destinations, including schools, clinics, a community

center, a library, and a mosque. Community members expressed a desire to make this area safer for children. The density of destinations along these corridors promote a walkable neighborhood, however, the street design does not encourage bicycle use.

SOLUTION

A two-way bike lane on the south side of De Moss Drive that is physically protected by a row of on-street parking with appropriate intersection treatments to support turning movments.

A standard bike lane on either side of Rookin Street, where on-street parking alternates on either side of the roadway.

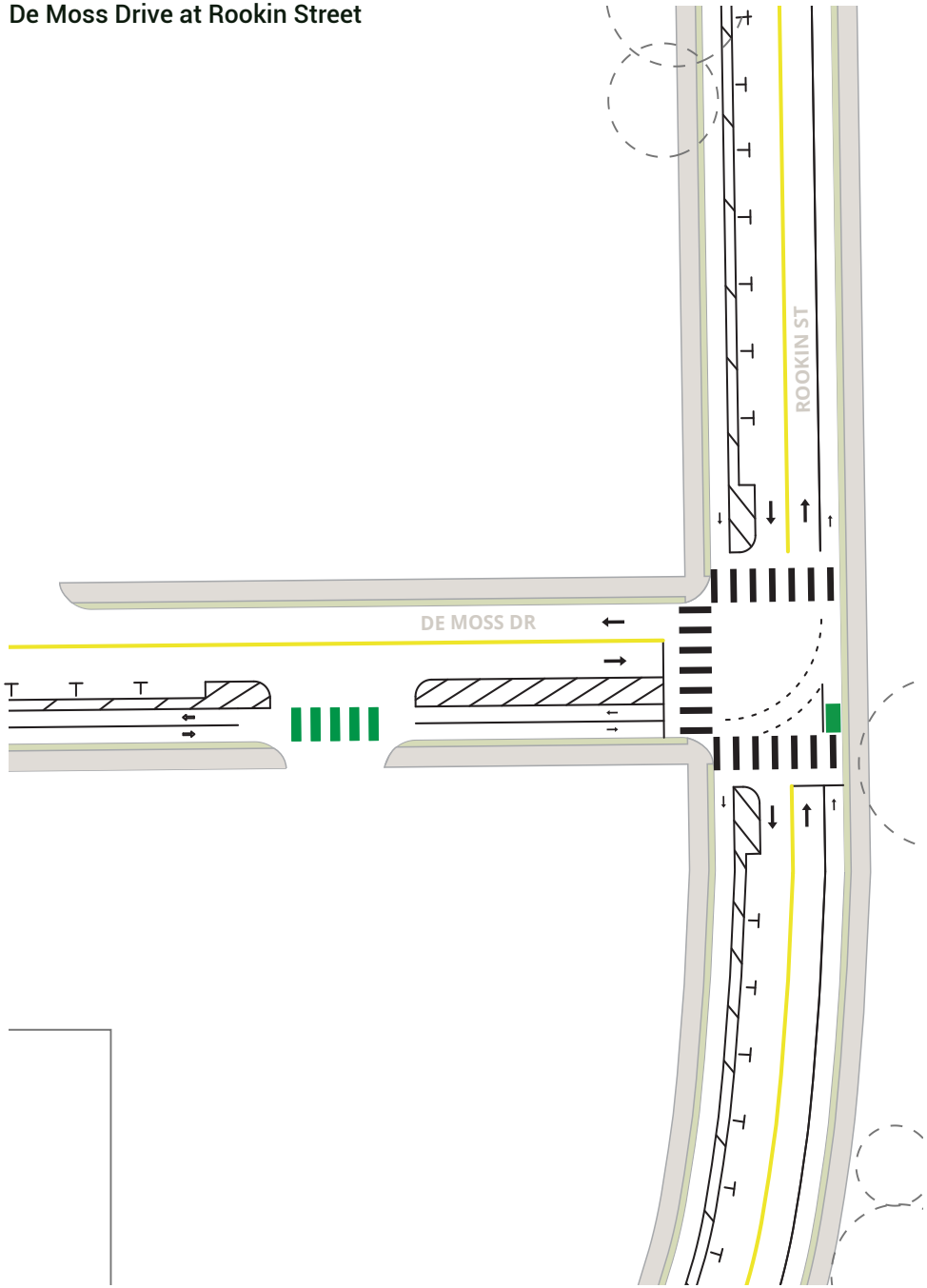
OUTCOME

Safer streets that are more appropriate for all ages and abilities, where automobile traffic is slowed through the reduction of vehicle lane widths, and bikes are separated from moving traffic with parking lanes.

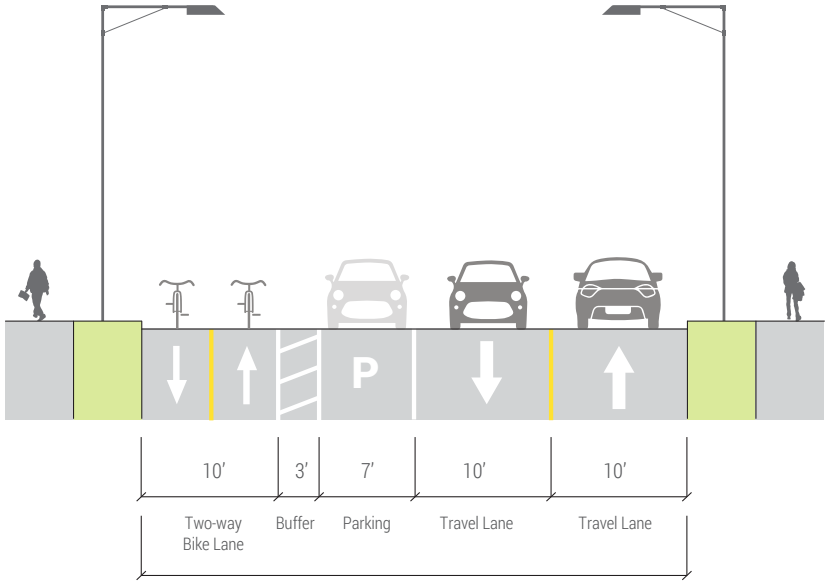
DESCRIPTION

De Moss Drive was originally designated as a ***bike route*** on the draft Bike Plan, which means there could be traffic calming devices put in place, and bikes and cars would share a slow-speed roadway. However, because of the character of De Moss Drive and the destinations that it serves, the community recommended that greater physical protection would make it safer for the children who use it regularly. They preferred a 10-foot two-way bike lane separated from moving automobile traffic by a row of on-street

De Moss Drive at Rookin Street



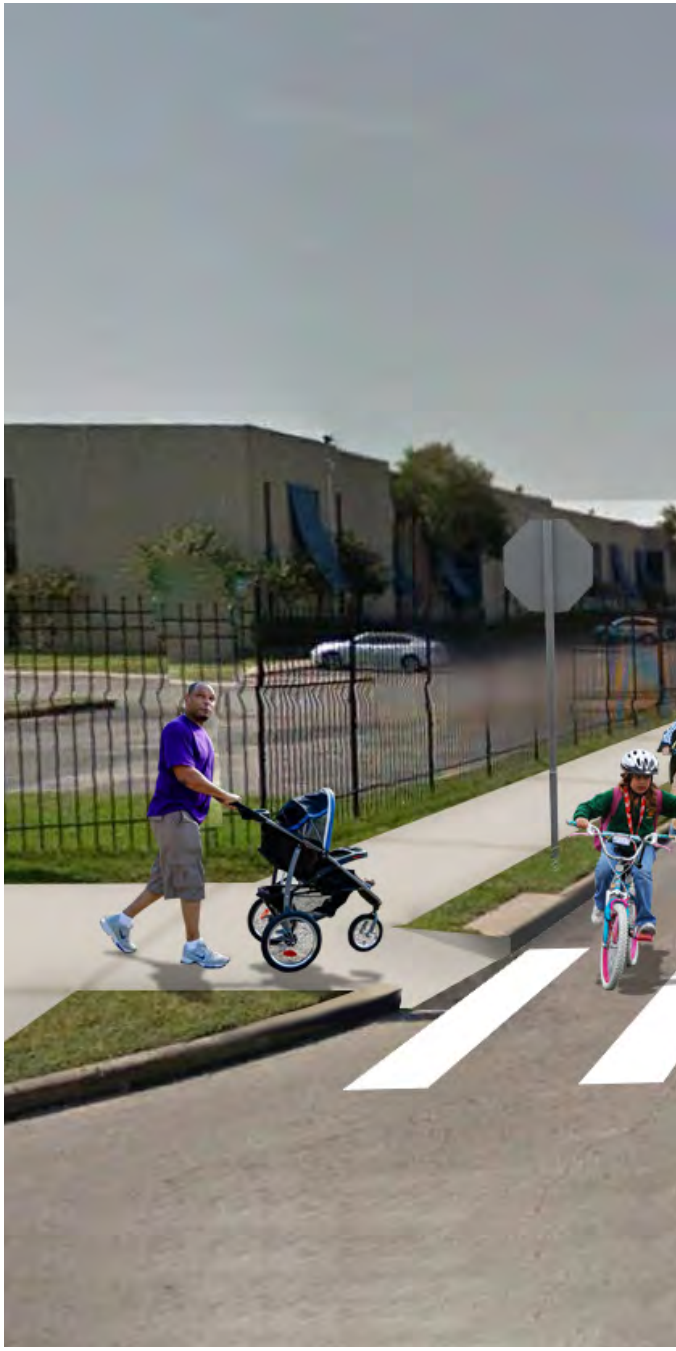
parking that would serve the adjacent properties. Automobile traffic lanes would be reduced from 20-feet to 10 feet, which would require a variance from the Infrastructure Design Manual.



Proposed section: De Moss Drive at Rookin Street facing west



De Moss Drive at Rookin Street facing west (Existing)



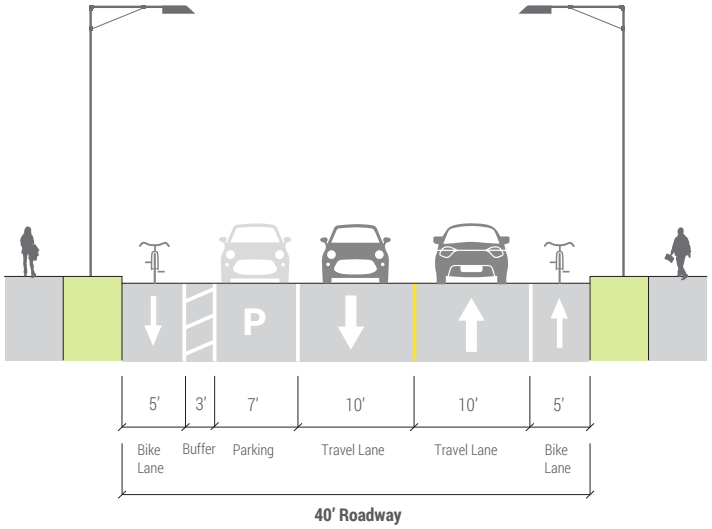


Proposed Pilot Project- Demoss Street

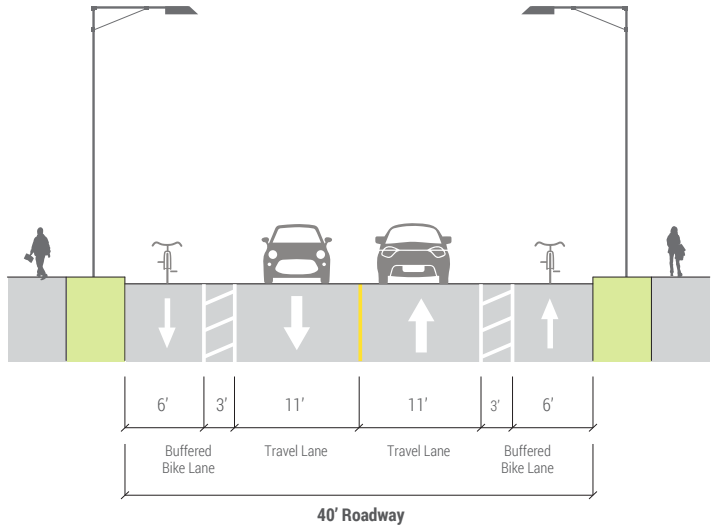
Rookin Street is an important north-south connection between nearby residences and area destinations, which was designated a proposed ***bike lane*** on the draft Bike Plan. In order to improve safety, 5-foot bike lanes would be installed on either side of the street, while on-street parking could alternate on either side, similar to the design on De Moss Drive, would serve as a physical protection between bike and motorist traffic. Automobile traffic lanes would be reduced from 20-feet to 10-feet, which would require a variance from the Infrastructure Design Manual.

For both corridors, the use of intersection crossing markings help alert drivers to look out for bicyclists on the road as they intersect with a bike facility. This is particularly important along a two-way bike lane, where drivers aren't accustomed to looking both ways before making a right-turn.

On-street parking would be restricted for the first 200 feet on High Star Drive, just west of Hillcroft Avenue to provide adequate roadway space for bicyclists crossing Hillcroft Avenue.



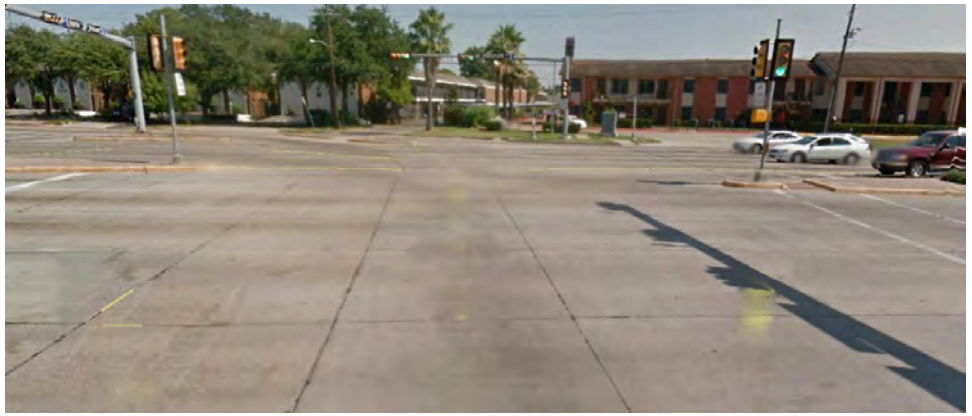
Proposed section: Rookin Street



Proposed section: High Star at Hillcroft

The street section for the gateway into the neighborhood would be 6-foot bike lanes with 3-foot buffers on either side of the street, and 11-foot automobile travel lanes. When on-street parking is integrated back into the street section, the bike lanes will narrow to 5-feet and the buffer will drop. On-street parking may alternate on either side of the roadway.

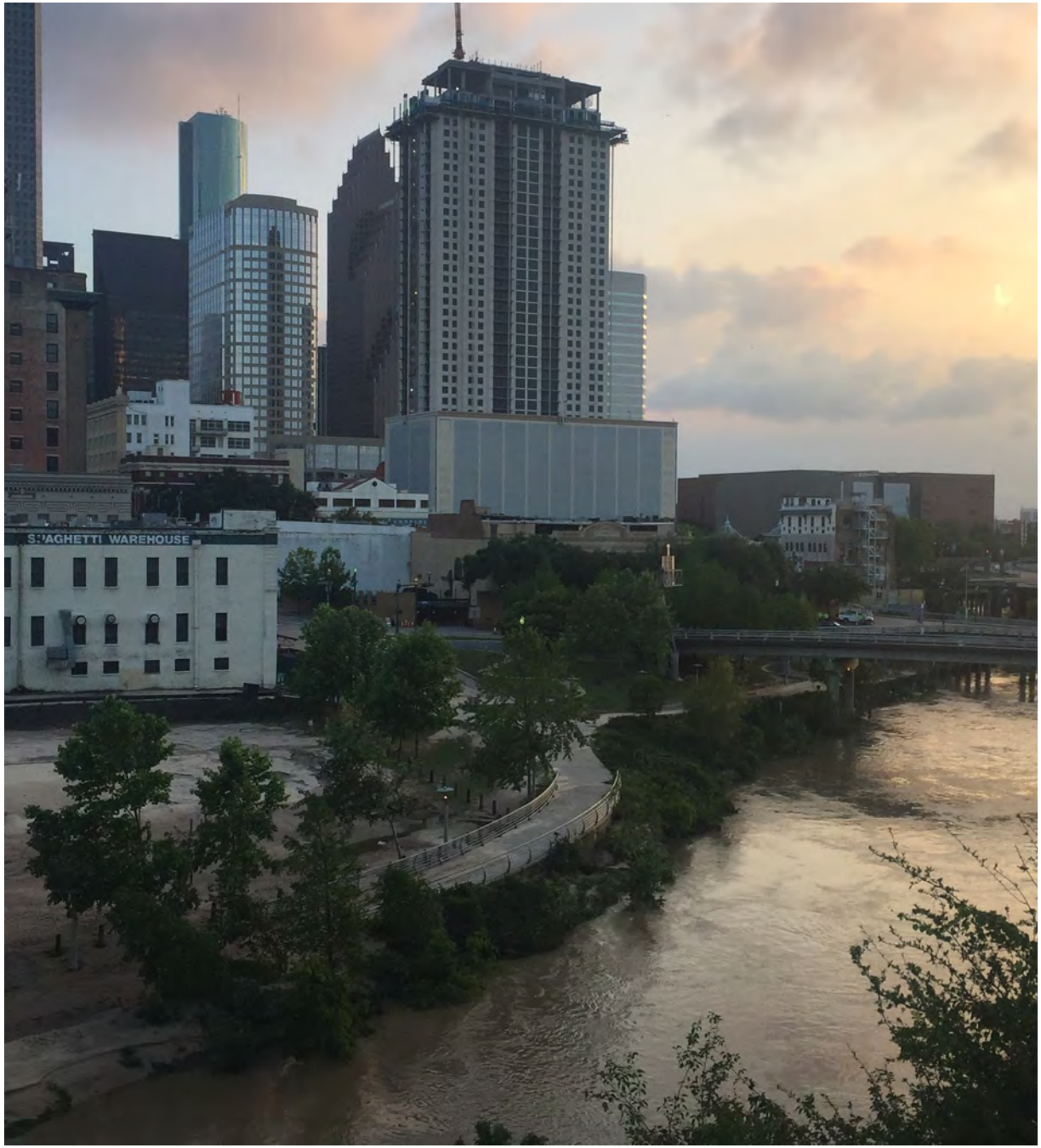
Intersection treatments should be added on Hillcroft Avenue, where green striping alerts drivers of bicyclists presence and informs bicyclists of their safest path in what is currently a large and intimidating intersection design.



Existing: High Star Drive at Hillcroft Avenue facing east



Proposed: High Star Drive at Hillcroft Avenue facing east



Buffalo Bayou Trail from the Main Street Bridge

7. CONNECT TO MAJOR BICYCLE THOROUGHFARES (E.G., BAYOUS AND OTHER GREENWAY TRAILS)

As the Houston bayou and greenway paths and trails are an integral part of the high-comfort bikeway network and provide a backbone to the broader citywide network, special attention was paid to how projects can connect neighborhoods and activity centers to the bayous. Developing a high-comfort network that provides access to bayous and other significant trail corridors is important because these corridors have the potential to be bicycle "highways" that can significantly change the landscape of biking in Houston.

This Implementation Strategy specifically identifies an example of how more detailed planning related to these corridors can be applied. An in-depth look at Sims Bayou looks at access on a detailed level, specifically how that access changes at various implementation stages of the Bike Plan. Recommendations will ensure access works at a detailed level and identify key linkages and new trail heads, available amenities, and gaps that will need to be addressed.





Existing Sims Bayou

Key Recommendation 7.1

Develop specific plans and policies for access to major greenway corridors to ensure safe access to these "bicycle highways" from neighborhoods and activity centers.

Key Recommendation 7.2

Coordinate with adjacent jurisdictions to provide a connected network across city lines.

BAYOU ACCESS PLAN

The Bayou Greenways 2020 project is creating extraordinary bicycle connectivity. Trails along Sims Bayou, Braes Bayou, Buffalo Bayou, White Oak Bayou, Hunting Bayou, Halls Bayou, and Greens Bayou will be continuous high-comfort corridors stretching for miles. These will be the City's "bicycle highways."

Because Bayou Greenways follow natural drainage corridors and have committed to building out the entire lengths of the bayous, it is also a truly equitable project. All neighborhoods along the bayous, regardless of income or race, get trails. In low-income neighborhoods like the Near North Side, Kashmere, Sunnyside, and the East End, this will link residents to jobs and education and provide families with recreational opportunities.

Just being near a bayou trail, though, is not the same as being connected to one.

Because development in Houston historically turned its back on the bayous, and because street networks were laid out with no thought to the bayous being an asset, street connectivity to the bayous is uneven. In some neighborhoods, there are frequent streets crossing the bayou and neighborhood parks alongside the bayous. These create natural connection points, and trails built here are well connected without unusual effort. In other neighborhoods, the bayous are behind residential backyards and industrial parcels and crossing points are widely spaced. Here, there are many neighborhoods (as well as destinations like schools, colleges, transit centers, community centers, and retail) that are within a half mile of the bayou trail directly, or as the crow flies, but miles away along the roadway network.

Thus, truly taking advantage of the greenways requires neighborhood scale links along the length of the bayous. In some cases these can use existing parkland or street right of way; in others they may require agreements with other governmental entities, the use of utility easements, or even acquisition.

This map shows Sims Bayou with the currently designed trail access points (shown as green dots.) The highlighted areas and the dashed white street networks show what is within 1/2 mile travel of those access points. In some areas, this covers all the property and development along the bayou; in others, neighborhood bordering the bayous have no readily available access. Bike facilities included in the short-term bike plan are also shown, along with major destinations.


FONDREN
AIRPORT
CHIMNEY ROCK
GASMER
POST OAK
ALLUM
SAM HOUSTON PKWY
HILLCROFT
ADIBE
TIDEWATER
WUTHERING HEIGHTS
PLAYER
OREM
GRAPEVINE
ROCKWELL
CHASEWOOD
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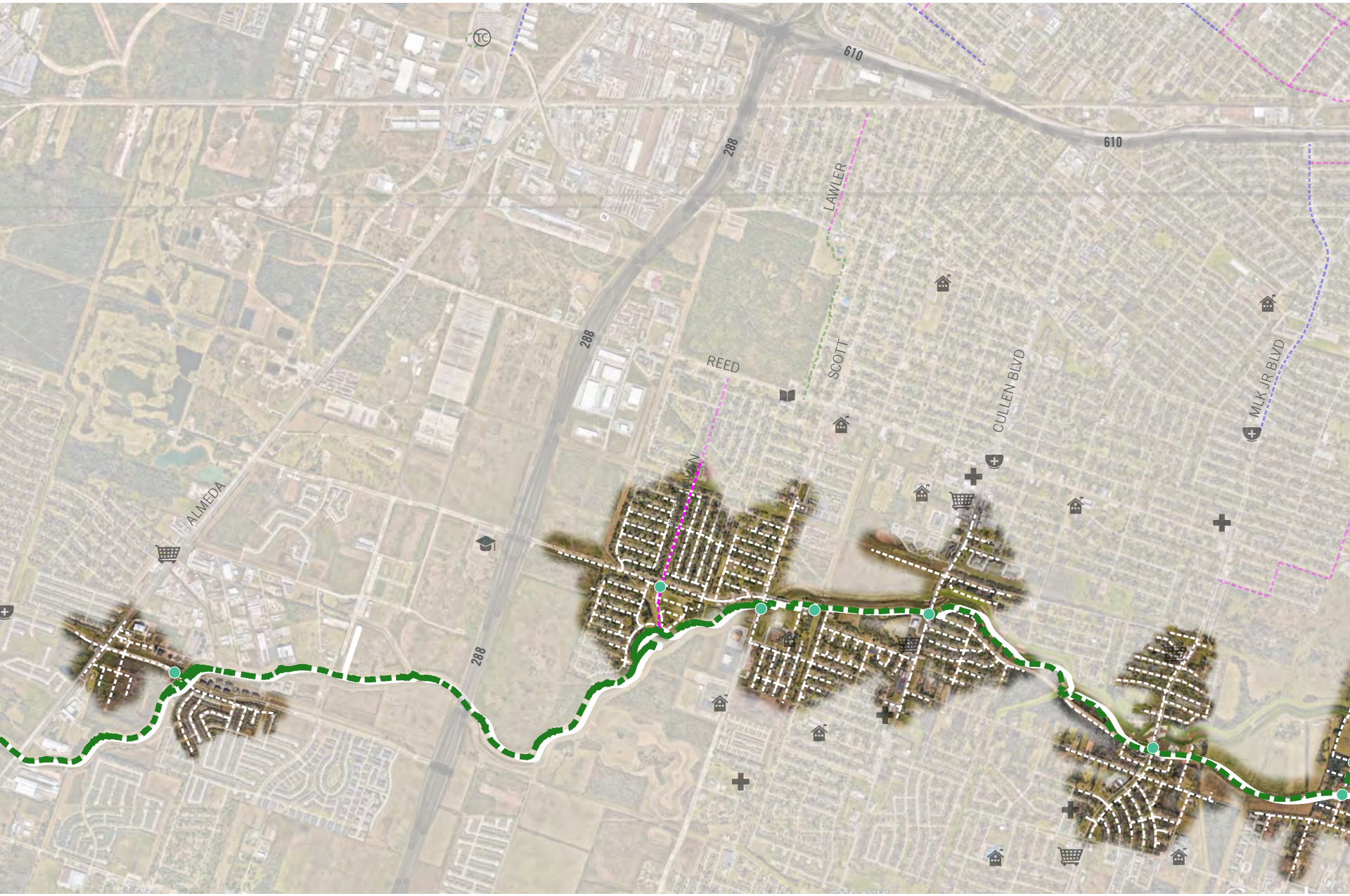
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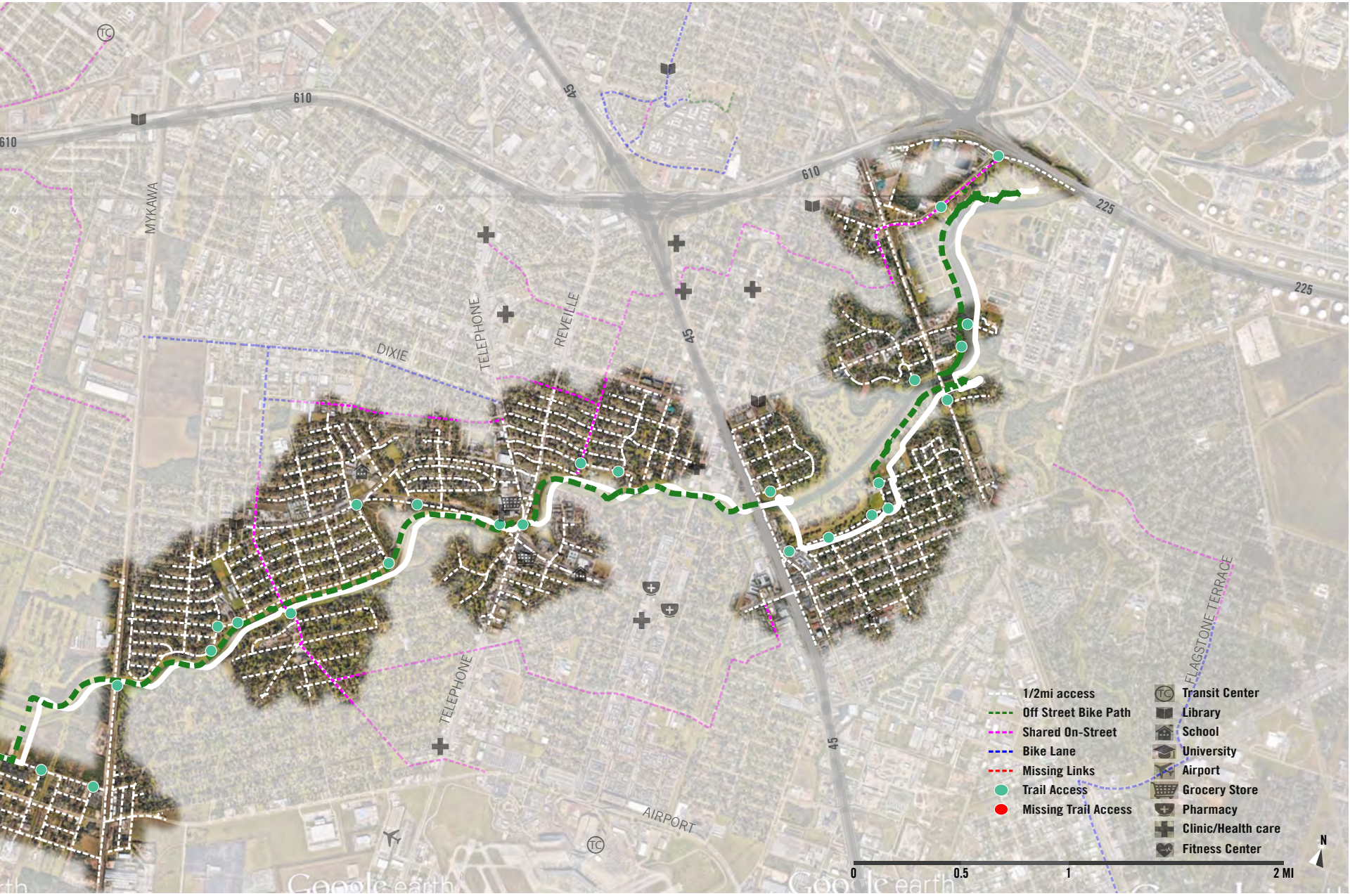
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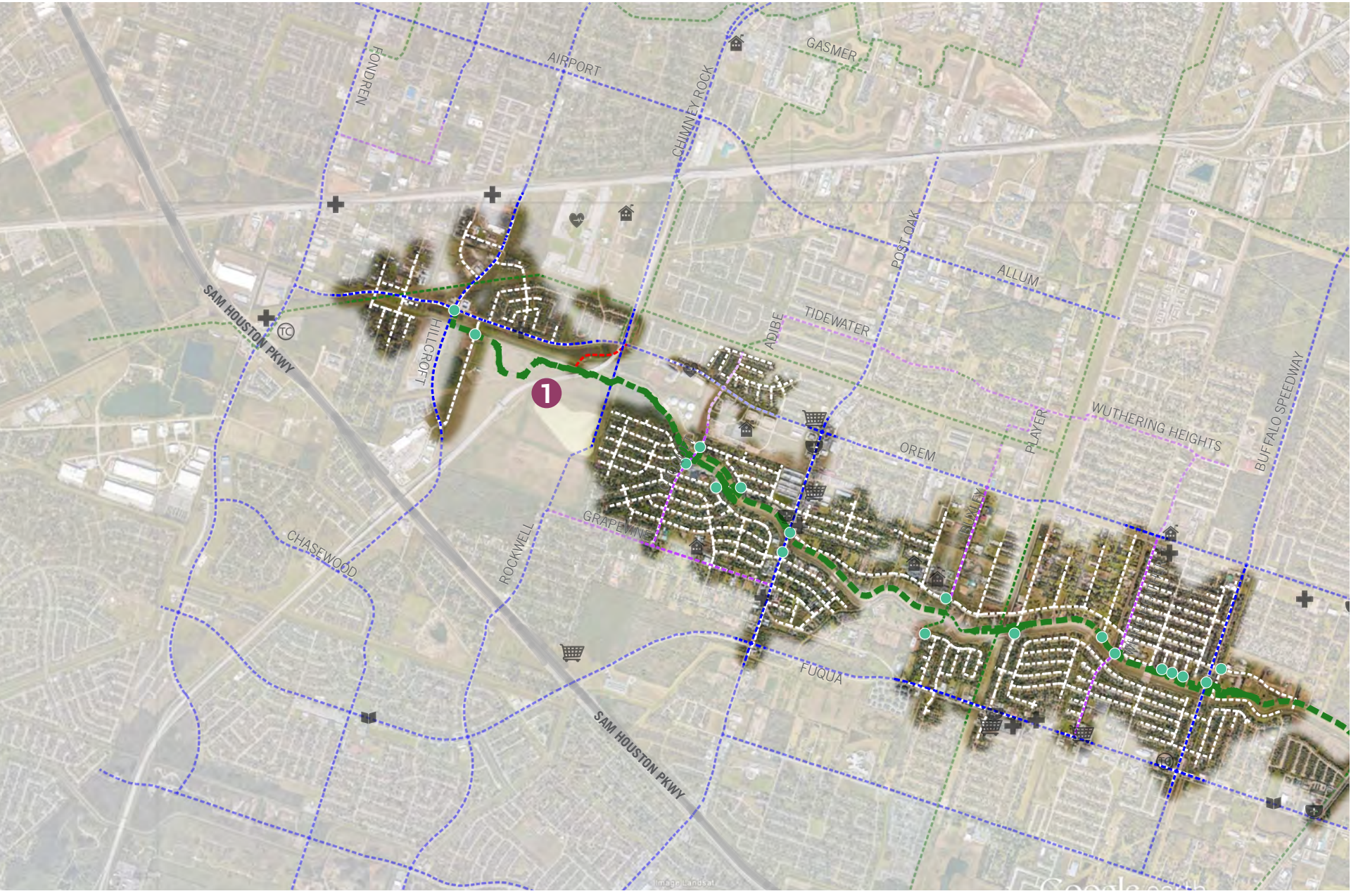
PROPOSED ACCESS IMPROVEMENTS

Looking at the bayou access based on the draft Bike Plan maps allows identification of gaps and improvement opportunities. These short connections greatly expand access to neighborhoods and major destinations as shown in the figures on the following pages.

1. A connection at the Fort Bend Toll Road would connect the bayou to Orem Drive and utility corridor connections that extend up to HISD's Joe Kelley Butler Sports Complex, a charter school, Westbury, and Willow Waterhole.
2. A bike trail along Almeda connects to neighborhoods to the north and south.
3. A drainage easement allows a neighborhood connection to Regal Oaks subdivision.
4. A connection directly to neighborhood streets provides higher comfort access than the route along West Orem.
5. When Kirby is built as shown on the Major Thoroughfare plan, bike connections to the bayou should be provided.
6. A connection along 288 would access the Houston Community College campus.
7. The Flood Control District detention basin on Scott can be a neighborhood amenity and a link to the trail system and Orem Street.
8. A short connection opens up the southern end of the neighborhood to the trail.
9. A drainage canal offers a connection to the nearby utility easement.
10. Neighborhoods south of the bayou can be connected with a new trail along a drainage easement.
11. A bridge would open up neighborhoods north of the bayou.
12. FW Law Park borders the bayou but does not have any trails connecting to it.
13. Neighborhoods south of the bayou could be connected with a bridge.
14. A bridge and connection to Leonora Street would allow residents to avoid the fast traffic on Telephone Road and access to the trail.
15. An access point at Broadway would connect to retail, neighborhoods, and high frequency bus service.
16. The new Houston Botanical Garden should be designed with a "front door" to the bayou trail.
17. Extending the bayou trail north, under SH 225 and railroad lines, would connect the isolated enclave of Manchester to Milby Park and the bayou greenway.

A similar analysis should be conducted along all the other bayous as well as along proposed drainage and utility corridor trails to identify similar improvements.

Where possible policies that supported making these connections should be developed, especially to address existing trails and bikeways like the Columbia Tap or Halls Bayou where connections can be challenging.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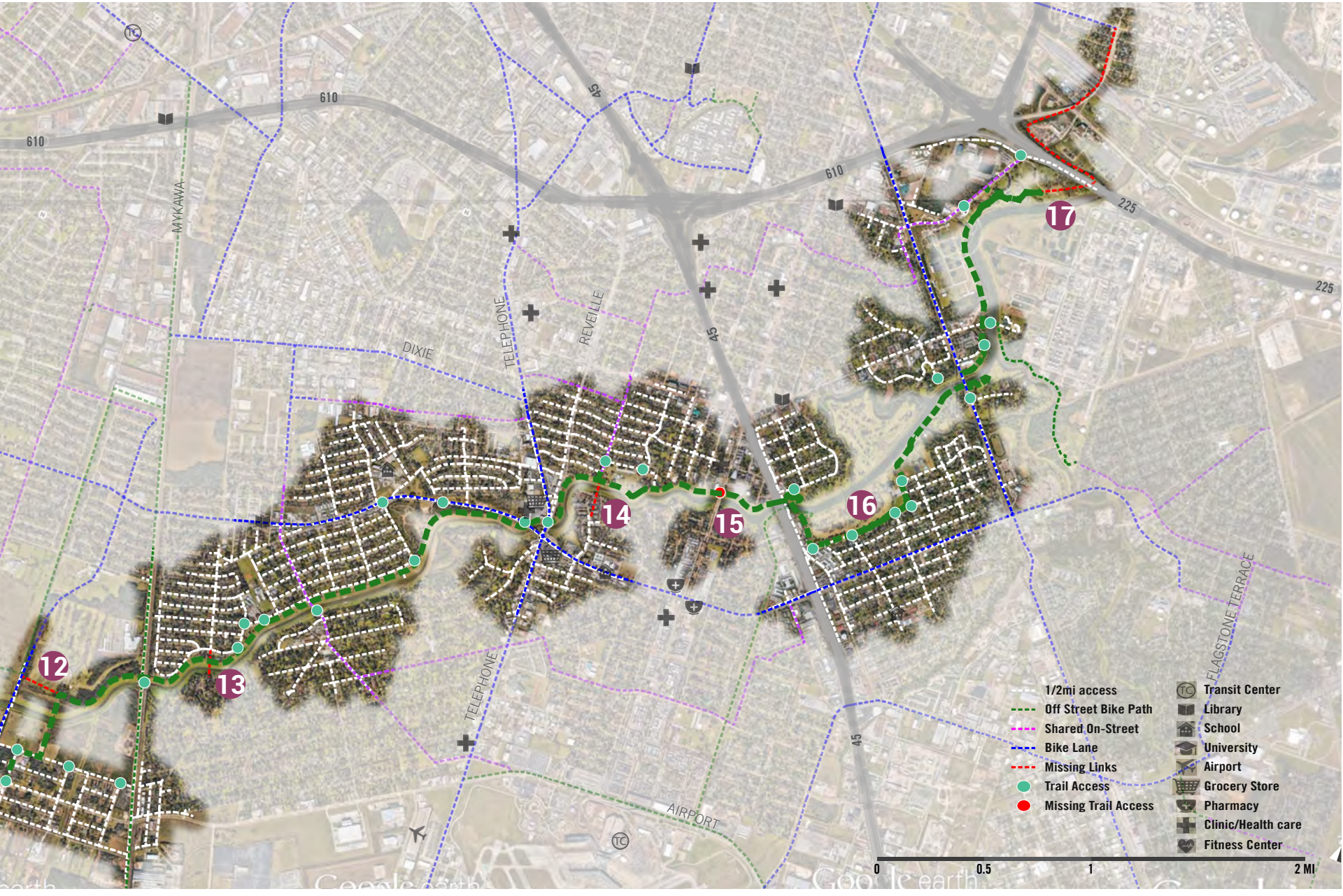
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University
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Existing Sims Bayou
Site for Future Bayou
Greenway Trail

8. ENGAGE NEIGHBORHOODS TO TRANSLATE PLAN TO LOCAL LEVEL

The Houston Bike Plan defines a framework for a citywide bicycle network with policies and programs to help make Houston a safer, healthier, more bicycle friendly city. Every neighborhood in Houston will have a different starting point; some have a significant number of existing people who bicycle and some may not. Attitudes toward biking may be quite different as well. To bring the Bike Plan to a local level, and develop implementation strategies that are most effective for a specific community, the City and others can develop neighborhood plans that link to the citywide bikeway network and prioritize specific programs and policies tailored to a neighborhood context.

This Implementation Strategy outlines the Houston Bike Plan Neighborhood Planning Guide and resulting Neighborhood Bike Plan recommendation for the Gulfton-Sharpston area. It is intended to serve as an example or go-by for future neighborhood planning efforts.



Gulfton-Sharpstown Area Roadways

Key Recommendation 8.1

Incorporate and refine the provided approach and tools for neighborhood level planning to connect to citywide bikeway network, in future planning projects.

Key Recommendation 8.2

Identify opportunities to apply specific policies or programs at the neighborhood level to support the growth of safe, healthy opportunities to bicycle.

Key Recommendation 8.3

Continue proactive outreach to neighborhoods and other civic groups on the Bike Plan.

NEIGHBORHOOD PLANNING GUIDE

The Houston Bike Plan public engagement efforts have been effective in reaching thousands of people, and it is evident that many Houstonians are anticipating a connected bike network in the city. With the planned addition of over 1,000 miles of high-comfort bike facilities, the implementation strategy must be continuously pursued over the years. Additionally, while the Plan provides guidance in creating a city-wide network, it will be necessary for neighborhoods to tie into the larger network at a more granular scale, pursuing specific projects, policies and programs that are appropriate to the area demographics and needs.

This Neighborhood Bike Plan Guide may be used by City departments and community organizations to help guide the incremental implementation of the Houston Bike Plan by continuing to gain input from the community members. Throughout the Houston Bike Plan public engagement process, participants have been invited to share their location, offering valuable data for understanding where community feedback has been strong and where it is lacking. Areas that haven't received significant responses should be targeted for increased engagement as the opportunity for facility implementation arises. It is advised that the City consult with community members in shaping infrastructure that serves their needs.

This guide was developed during the organization, facilitation, and review of a pilot Neighborhood Workshop in the Gulfton and Sharpstown areas of southwest Houston. Materials and responses from this pilot workshop can be reviewed when planning future workshops, and, of course, when pursuing efforts in this area of Houston. The following sections provide a process for organizing and leading meaningful focus groups and a neighborhood workshop to gain useful information and support from the community.

Focus Group Overview

Prior to hosting neighborhood workshops, one or two focus groups should be organized to inform community leaders about the Houston Bike Plan and learn about opportunities and challenges that the community may face regarding cycling, infrastructure, and community organization. The Houston Bike Plan Toolbox is a wealth of information, but its comprehensive nature can be overwhelming. These focus group conversations will be useful in understanding how to best target and narrow down this resource for the Neighborhood Workshop, which the larger community will be invited to attend. The focus group participants should also help disseminate workshop invitations through their networks.

Invitation & Outreach

A focus group is a quick way to gain information about a community, but the range of information will be limited to those that are invited and can attend. Focus Group outreach should be targeted towards specific community leaders when possible. Having individuals' names and direct contact will be important to gaining the attention of busy leaders, and helping them understand the importance of their involvement. Begin with an e-mail that offers clear instructions on how to be involved, allow them to indicate their availability, and offer contact information for questions. If no response is given within a reasonable time frame, follow up with a phone call.

Gulfton - Sharpstown Focus Area



Potential Focus Group Invitation List

Civic association leaders

Neighborhood association leaders

Non-profit and community leaders

School principals

Parent-teacher organization leaders

Local business owners

City Council district representative

Religious group leaders

Police liaison

District State Representative

Management District Representative

Tax-Increment Reinvestment Zone (TIRZ)

Chambers of commerce leaders

University and college representatives

Sample Letter

Dear Community Leader,

In 2015, the City of Houston began the planning process for its update of the City's comprehensive bike plan. The draft network reaches the extents of Houston's over 600 square miles, which varies incredibly in its social and urban fabric. As we look closer at your community, we would greatly appreciate your involvement in understanding the needs, opportunities, and challenges that your neighborhood faces.

We would like to invite you to participate in a focus group with other community leaders to review the proposed bike network. Knowledge of bicycling is not necessary to contribute, as this presents an opportunity to learn about the tools that have been developed and explore how biking can be improved for the community.

We'd be happy to answer any questions you may have about the Houston Bike Plan and the focus group. We look forward to meeting with you soon.

Sincerely,
Houston Bike Plan Team

Focus Group Materials

- Printed copy of bike network map in focus area with points of interest in large format
- Printed copy of questions for focus group facilitator
- Audio recorder (used with participant approval)

Focus Group Questions

Focus group questions may vary based on what is already known about the community. Consider what questions will be helpful in preparing for the Neighborhood Workshop and building a strong community profile to understand partnership and implementation opportunities moving forward. The following questions may be used or built upon, depending on the desired outcome of the focus group:

Connections

1. Where do people currently bike in this area?
2. Where do you see opportunities to make safe and useful connections?
3. What type of cycling do you see the most in the community (e.g. sport, youth, commuter, recreational, casual)?

Barriers

4. What are some of the challenges this community faces for bicycling?
5. What physical barriers prevent people from biking?
6. Who do you think would be most likely to use bikes in the community if they had the opportunity?

Businesses and Community Leaders

7. What organizations are there in the community that are providing important services? Do you know if these or other organizations offer bike-related services?
8. What businesses and organizations might be interested in partnering to improve biking in the area?

Outreach

9. Considering we aim to receive diverse participation in the upcoming workshop, what days of the week and times of day would be most conducive for members of this community?
10. What are the most successful forms of outreach? Are you able to share workshop information or materials in either physical or digital format?

Workshop Overview

The Neighborhood Workshops are an opportunity to hone in on elements of the Houston Bike Plan at a local level and tailor it to communities' needs. Unlike the focus group(s), the Neighborhood Workshop should be advertised to the broader community. It is an opportunity to educate citizens on the progress of the Houston Bike Plan and the resources available in the Toolbox, present realistic expectations about the plan, introduce the timeline for implementation, and gain feedback from the community. Types of feedback will vary in each community, considering the types of funding available and the level of organization that community members are engaged around bike-related issues. Workshop organizers should consider which of the following fit the neighborhood , and how to devote attention and outcomes.

- **The City or partnering agency has funding to pursue project implementation in the community.**
  The community may be involved in identifying priority projects or guiding the design specifics of a proposed project. The Houston Bike Plan Toolkit will be helpful in explaining the options to community members. Consider that people may have a variety of concerns, including the availability of sidewalks or parking, connections to destinations, and the appropriateness of design for potential users.

- **There is a clear gap in previous participation in the Houston Bike Plan from the identified community, however, there isn't funding available to pursue projects.**
  There is still an opportunity to dive into bike-related issues and refine the draft bike network with the community's help. There may be missed opportunities that participants can help identify, such as a useful connection. Documentation of participants' responses will be important to make it easy to revisit at a later date. If revisions can't be made to the draft network directly, there should be a database for comments that help create a living document for the City as future improvements are made.

- **There is a significant segment of the community that is passionate about bicycling, and will want know what types of improvements will be made and when.**
  This situation presents an opportunity to strengthen partnerships to define and pursue funding for an important project. Explore potential programming opportunities that community members can achieve on their own or with other groups. This type of setting may begin with identifying priority projects, then move into a brainstorm on partnerships to advocate and pursue funding.

- **There are consistent design challenges that make it difficult to provide safe bicycling conditions, such as lack of right-of-way and/or a disconnected grid network.**
  Explore design and route alternatives, including unconventional ideas. It would be important that the designers and engineers explore a variety of options to present to participants, and allow them to weigh the pros and cons. Facilitators may need to be prepared to discuss issues of ownership and policy that currently prevent solutions from being achieved. Participants may also come with their alternative routes to share, and an area map will be helpful.



Gulfton-Sharpstown Neighborhood Workshop

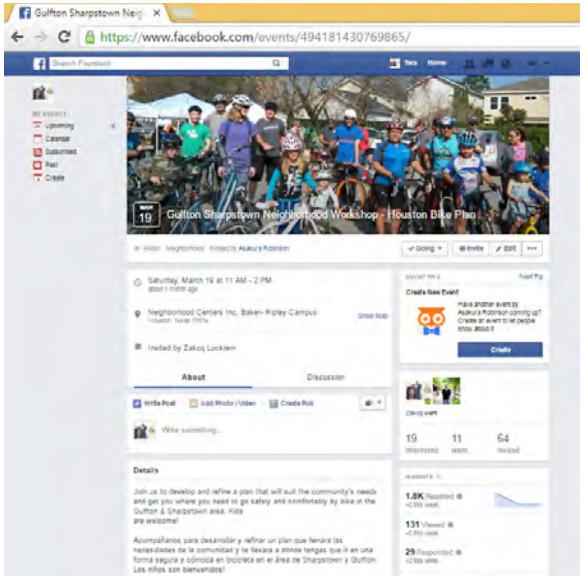
Existing Conditions Analysis

In preparation for the workshop, an existing conditions analysis should be conducted in the focus area; information from the network plan should be expanded upon, and relevant information should be gathered from the Toolbox (Chapter 4). The Toolbox includes a comprehensive list of projects, policies, and programs that may be applied throughout the city. By determining which of these could potentially be applied in the focus area, the workshop may be designed to determine what is most appropriate: street design, programs developed through community partnerships, or support for policies that can address issues in the neighborhood.

- **Projects:** For each proposed route on the draft network, determine the right-of-way widths and which facility types could work.

- **Programs:** Discuss with community leaders in the focus group what bike-related issues need to be addressed, determine what programs could address those, and which community organizations could be potential partners. These potential partners should be invited to the workshop.

- **Policies:** Discuss with community leaders in the focus group what bike-related issues need to be addressed, and determine what policies could address those. City officials and appropriate department representatives should be invited to the workshop so that they may respond to issues that may be brought up at the workshop.



Workshop Facebook Invitation

Workshop Outreach

A multi-faceted approach should be utilized for workshop outreach efforts to ensure that participants reflect diversities within the community, and that people who are not typically involved in civic groups or organized communities still have an opportunity to be informed of the event and are encouraged to provide their input. Outlets for communication include but are not limited to the following:

- Flyers and posters at community centers, schools, libraries, restaurants, shops, and commercial destinations
- Flyers distributed door-to-door
- Emails distributed through community groups such as those on the invitation list
- Notices included in community groups' newsletters
- Posts and announcements sent out through social media outlets (Twitter, Facebook, NextDoor, etc.) that allows audiences to share within their networks
- Radio announcements

Sample 2-Hour Workshop Agenda

15 minutes	Sign-in
30 minutes	Presentation
75 minutes	Station Exercises

Station Instructions

Workshop instructions and station design will vary per community and the desired outcomes of the workshop. Stations should present participants with a chance to learn about elements of the Houston Bike Plan that are relevant to the neighborhood and determine what solutions are most appropriate to their needs.

Facilitator Materials:

- Digital presentation
- Computer
- Projector
- Large writing board

Station Materials:

- Printed copies of presentation
- Printed copies of table instructions
- Printed copies of existing bikeways map
- Large printed copies of draft bike network map in focus area with points of interest
- Markers, pens, or pencils
- Printed copies of the Houston Bike Plan Toolkit or select pages from the Toolkit
- Printed copies of labeled photos of roadway conditions
- Printed copies of typical street section drawings for roadways with proposed bikeways
- Best practice pictures
- Translated materials (if applicable)
- Children's activities

Potential Workshop Invitation List

Civic associations

Neighborhood associations

Community groups

Non-profit organizations

School organizations

Parent-teacher organizations

Local businesses

Religious organizations

District State Representative

Management District

Tax-Increment Reinvestment Zone (TIRZ)

Chambers of commerce

Residents

Area employees

Students

GULFTON-SHARPSTOWN NEIGHBORHOOD PLAN PILOT

Context

The Neighborhood Plan establishes a framework for engaging communities across Houston in bike-related issues, and how to best implement elements of the Houston Bike Plan. The Gulfton and Sharpstown areas were identified for the pilot Neighborhood Plan because of the prevalence of residents who currently bike for transportation on streets that are often unsafe for cycling, and the concentration of services in the area that make this neighborhood well positioned for bikeability.

Focus Groups

The Houston Bike Plan team held two focus groups with community leaders and residents of the area who had previously engaged with planning efforts to date through the online forum or at public meetings held across Houston. The focus groups were intended to inform community leaders and community members about the Houston Bike Plan; and allow the facilitators to learn about opportunities and challenges that the community may face regarding cycling, including infrastructure and community organization. These focus group conversations were also designed to better understand how to best target and narrow down the Houston Bike Plan Toolbox.

This discussion was helpful in adjusting the boundary of the focus area and determining which issues to target. For example, we learned that the most common bicyclists seen in the community are utilitarian or commuter cyclists, who bike for transportation; and that the neighborhood streets are typically easy to travel on, but major corridors are challenging to cross.

Workshop

The Gulfton-Sharpstown Workshop was held on Saturday, March 19, 2016 from 11AM to 2PM at Neighborhood Centers - Baker Ripley Campus. Based on feedback from the focus group, it was believed that hosting a Saturday event would make it easier for people to attend. Similarly, allowing people to drop in at their convenience during this three-hour period would also improve accessibility of the event.

Because of the diversity of the community, flyers and other outreach information were distributed in English, Spanish, Urdu, and Hindi, with the availability of translators at the event.

Outreach for the workshop consisted of a variety of methods. Volunteers from BikeHouston distributed flyers and posters to neighborhood shops, and went door-to-door in multi-family apartment complexes to help spread the word. A Facebook event was created, which reached sixty-four people. Everyone with zip codes adjacent to the focus area, who were previously engaged with the



Workshop flyer



Workshop agenda

Houston Bike Plan, was invited via e-mail. Emails were also sent to various community groups from a list that was created with the help of community leaders that participated in the focus groups. Among these groups was the local Houston City Council Member's contact list. Outreach material indicated that kids were welcome as not to exclude families, and a kids' table at the workshop offered activities. Additionally, a volunteer from the non-profit BikeHouston set up a bike repair station outside the event.

The workshop consisted of a presentation and three stations that people could move through and discuss with Houston Bike Plan team members:

1. Area Bikeways
2. Bikeways Toolbox
3. End-of-Ride Facilities.

Workshop Map: Focus Route

LEGEND

Bicycle Facility Recommendations

- Bike Lane
- Bike Route
- Off Street

Existing Bicycle Facilities

- Low Comfort Bike Lane
- Shared Lane / Signed Bike Route
- Shared-Use Path
- High Comfort Shared-Use Path

- Focus Bike Route

Points of Interest

- University / College
- Library
- hgac_school
- Police Stations
- Fire Stations
- Hospital
- Health
- Community Centers
- METRO Bus Stops

- Bayous, Creeks, Streams
- Water Features
- Parks

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A focus route was identified to hone in on potential implementation projects in the area. The route's southern end was at an existing connection to the Brays Bayou trail, meandered through the neighborhood along proposed bikeways, cut across the popular Bayland Park (currently closed at night for safety reasons), continues north to Rookin Street where several community services are offered, and crosses Hillcroft Avenue to Westward Street where students currently bike to Benavidez Elementary School.

During the focus groups, Hillcroft Avenue was identified as an important bike connection for people, however, the redesign of this major corridor has been identified as a long-term project. The workshop, instead, focused on short-term projects such as neighborhood bikeways, bike lanes, and intersection crossings.



Workshop Board: Area Bikeways

1 Area Bikeways

The area bikeways board included relevant information from the Toolbox that could be considered on proposed bike routes in the area, with a board with a map for reference and mark-ups. The proposed bike routes included segments of Bob White Drive, Birdwood Drive, Braewick Drive, and Scribner Road. Participants explored traffic calming options for these streets such as chicanes, speed humps, and neckdowns.

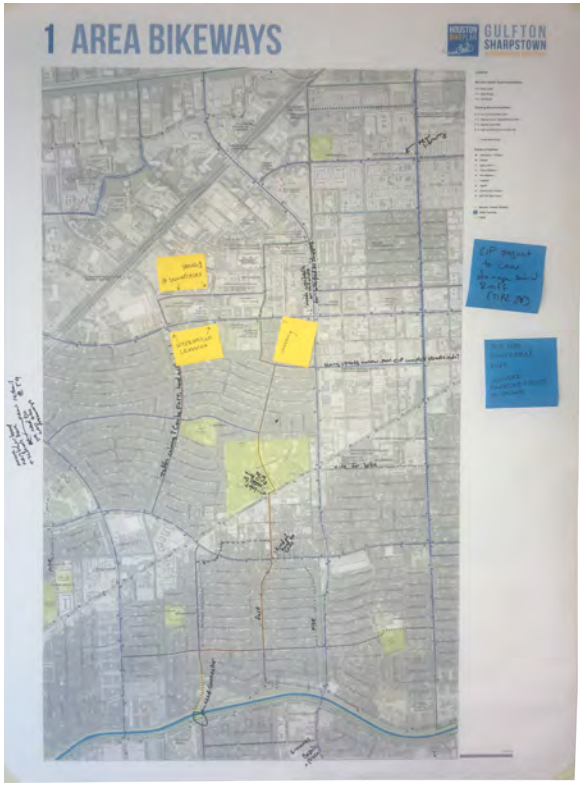
No specific traffic calming projects were identified by participants along the focus routes. However, within the focus area, De Moss was seen as a priority, with proposed neckdowns that delineate street parking and promote slower motorist speeds.

The following are major points identified by community members during the workshop:

- Cars drive fast on Braewick Drive (south of Beechnut Street) — Bob White Drive is a better connection. The focus route

should continue north from the bayou trail on Bob White to Tanger Street and Cypress Street before heading north on Braewick Drive.

- The bike route on Braewick Drive drops off at N. Braeswood Boulevard, and should divert at Birdwood Road instead.
- A bike route should be added on Tanger St/Albacore Dr (from Bob White to Cypress) and Cypress St (Albacore to Braewick).
- The traffic signal at Bissonnet St and Braewick Dr should activate when bikes arrive at the intersection.
- Traffic calming is needed on Bintliff Drive from Beechnut St to Bellaire Blvd. Alternatively, the drainage corridor on the west side of Bintliff may be incorporated into a shared-use trail as a capital improvement project, and through coordination with TIRZ 20. People currently bike on Sandpiper between Hazen and Leader, east of the drainage corridor, which isn't included on the plan. The proposed drainage corridor trail would be a welcome alternative.
- Intersection crossings should be improved for pedestrians and bicyclists on Bellaire Blvd at Bintliff and Tarnef.
- Neckdowns should be added on De Moss Drive at Bintliff and Rookin.



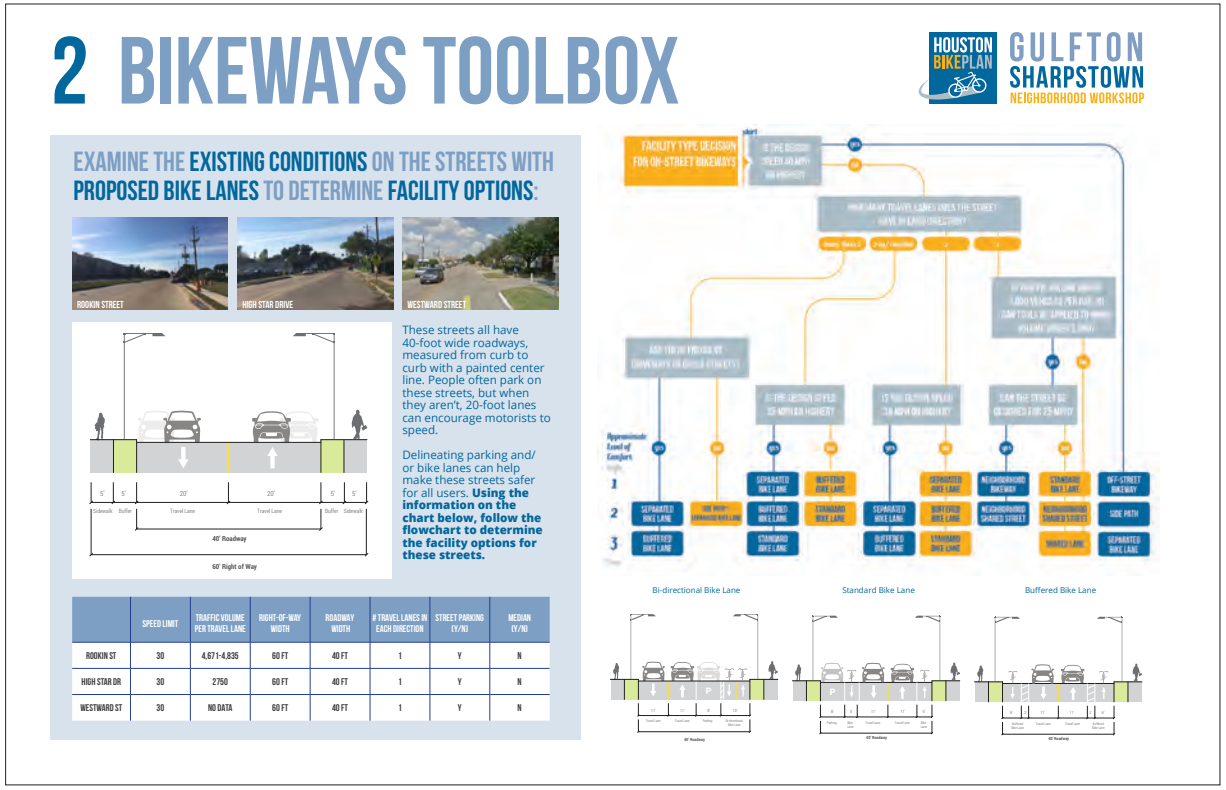
Workshop Map with Notes: Area Bikeways

- Crosswalks are needed on Hillcroft between Bellaire and High Star, which is a popular shopping destination for many people traveling by bike and on foot.
- Bike facilities should connect through the Houston Baptist University campus.



Gulfton-Sharpstown Neighborhood Workshop

The charts provided included the following information about the streets: speed limit, traffic volume per travel lane, right-of-way width, roadway width, number of travel lanes in each direction, street parking (y/n), and median (y/n).



	SPEED LIMIT	TRAFFIC VOLUME PER TRAVEL LANE	RIGHT-OF-WAY WIDTH	ROADWAY WIDTH	# TRAVEL LANES IN EACH DIRECTION	STREET PARKING (Y/N)	MEDIAN (Y/N)
ROOKIN ST	30	4,671-4,835	60 FT	40 FT	1	Y	N
HIGH STAR DR	30	2750	60 FT	40 FT	1	Y	N
WESTWARD ST	30	NO DATA	60 FT	40 FT	1	Y	N

Workshop Board: Bikeways Toolbox

2 Bikeways Toolbox

The bikeways toolbox focused on three streets that were identified along the focus route as proposed bike lanes: Rookin Street, High Star Drive, and Westward Street. These all have 40-foot wide roadways, measured curb to curb with a painted center line. People often park along the sides of the roadways, but when they aren't, these 20-foot wide lanes can encourage motorists to speed, making them potentially unsafe for people biking.

Participants were invited to use data about these streets, indicated on a provided chart, to use a ***Facility Type Decision Flow Chart*** for Bikeways to determine what the appropriate facility types are for these corridors. Using the data provided in the chart, the flow chart path for Rookin Street is as follows:

- Is the design speed 40 MPH or higher? The speed limit is 30 — No.
- How many travel lanes does the street have in each direction? —1.



Workshop Board: Bikeways Toolbox

- Is traffic volume under 3,000 per day, or can tools be applied to bring volume under 3,000? The traffic volume is 4,671 - 4,835 —No.
- Options include standard bike lane, neighborhood shared street or shared lane.

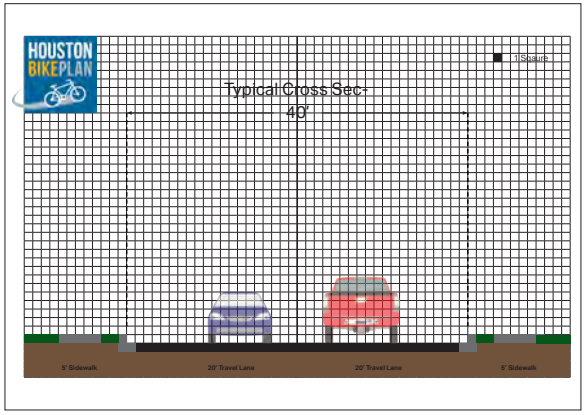
Rookin Street is proposed as a bike lane. Workshop participants were able to explore different roadway configurations through a street section exercise that included paper cut-out components of a potential street section that could be arranged within the 40-foot roadway. This exercise is helpful for participants to understand the trade-offs of roadway design. They may want a protected bike lane, but it could come at the expense of existing street parking.

It's important to recognize that the flow chart does not determine the only feasible facility types. Rather, it is a useful exercise for understanding standards and their

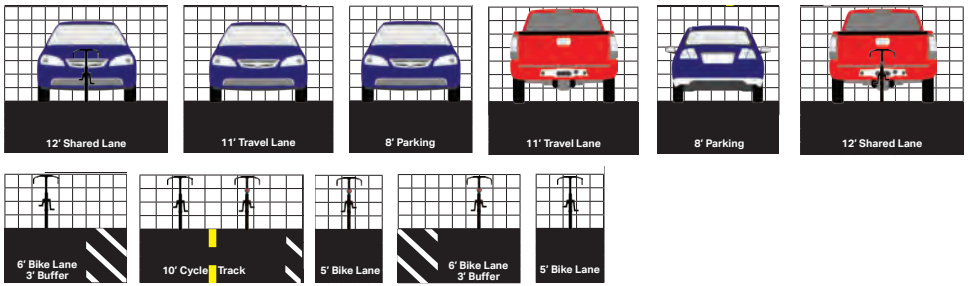


Workshop Board: End-of-Ride Facilities

- CVS at Houston Baptist University
- Sugar Grove Elementary
- Fiesta on Hillcroft Ave
- Walgreens of Hillcroft Ave
- Destinations in the social services area between Bellaire and US-59, Bintliff and Hillcroft
- Apartment complexes east of Hillcroft Avenue
- SER Ninos
- Along Harwin Drive at shopping destinations



Bikeways Street Section Exercise: Game Board



Bikeways Street Section Exercise: Game Pieces

relationship to roadway comfort such as speed and lane width. While the three options determined for these three roadways using the flow chart were standard bike lane, neighborhood shared street, and shared lane, the context of these streets may warrant deviation from those types.

Participants weighed in on the design of these streets, and the prevalence of children was considered an important justification for a separated bike lane on Rookin Street where a parking lane separates people biking from motorist traffic.

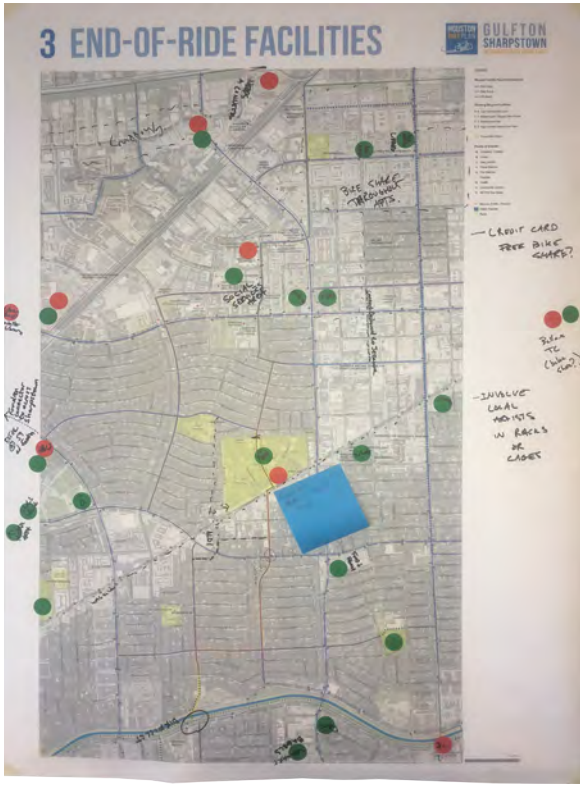
Including representative images on board materials helps participants understand what the possibilities are, and to visualize the character and level of comfort these facilities could offer. Since many of these types have not yet been implemented in Houston, participants may not be aware of what facility types look like.

3 End-of-Ride Facilities

During the focus groups, participants indicated that shops often lack bike racks and it's common to see bikes locked to METRO bus stop posts. During the workshop, the End-of-Ride Facilities station offered a description of various types of amenities and their purpose, and allowed people to indicate on a map where these might be most useful to people.

Participants indicated that bike racks are needed at the following locations:

- Walmart south of Brays Bayou
- Shopping area on Hillcroft Avenue at Brays Bayou
- Herod Elementary and adjacent park
- Foodarama at Hillcroft and Beechnut
- Energized For Excellence Middle School and Early Childhood
- Bayland Park



Workshop Map with Notes: End-of-Ride Facilities

The following were identified by participants as potential bike share station locations:

- Jewish Community Center
- Bayland Park
- Houston Baptist University
- Neighborhood Centers Baker-Ripley Campus
- At Hillcroft Ave and Harwin Dr
- Hillcroft Transit Center

Conclusion

There were many noteworthy ideas shared during the focus groups and workshop which helped inform recommendations for project implementation in the Gulfton and Sharpstown areas. To date, funding is limited, but should be pursued as available to build on the momentum. Recommendations from the community helped refine the draft recommendations for the Houston Bike Plan and a potential pilot project was developed that would make the neighborhood more bike-friendly.

This Neighborhood Planning approach should serve as a framework for engaging with communities as the City or partners have funding or resources to improve biking conditions through either physical projects, programs in the community, or policy changes. It will help build momentum and tailor the approach to a neighborhood's specific challenges and opportunities. Where needed, this approach can help translate the higher level City Bikeway network to local plans and programs tailored to a neighborhoods specific needs.

9. CONTINUE TO ENGAGE THE PUBLIC IN THE DEVELOPMENT OF BICYCLE FACILITIES

The City should develop a process(es) for continued public engagement for the implementation of bikeway projects. Building on the significant public input on the Bike Plan the City should work with stakeholders and communities as it develops final decisions on the design and location of bicycle facilities. Implementation of final designs will happen after additional analysis and public engagement which should begin no later than the preliminary engineering phase of project development. Mobility plans/studies should be referenced to determine the vision for streets within the study area.

Bikeway improvements as a part of City of Houston Projects:

All Houston 5+5 CIP Projects take bicycle facilities into consideration based on the City's Complete Streets Executive Order. If a bicycle facility exists or is proposed on the Bike Plan, the Public Works and Engineering (PWE) Department evaluates design alternatives prior to the project design and engineering phase to determine if a high-comfort bicycle facility is feasible in the project scope. If a bicycle facility is feasible, design options are evaluated and may be recommended. If a high-comfort bicycle facility is not feasible; the report identifies options for bicycle facilities in the near term or long term and may identify alternate routes to serve desired connections. Examples of options for implementation might include a wide shared sidewalk or side path where feasible, or a parallel corridor for a bikeway facility. City of Houston CIP projects typically include public engagement at three stages of the CIP process:

1. The public has an opportunity to provide input on projects during annual CIP town hall meeting.
2. Public input is solicited on the conceptual design in preliminary engineering before the project moves forward to final design and engineering. Public meeting format allows the public to provide input via online public comments and the design is updated and released to the public.
3. A final public meeting is held prior to construction of the project.

Key Recommendation 9.1
Incorporate public engagement on bikeway projects beginning no later than preliminary engineering i.e. the design phase of the project.

Bikeway corridor implementation projects, not associated with the City's CIP process, along public streets that warrant pavement reconfiguration, should include these public engagement steps or a similar process:

- Coordination with key stakeholders such as District Council Member(s), Management Districts, public agencies, large institutions, etc. and conduct initial community engagement.
- A stakeholder/community public meeting in the neighborhood near the corridor to discuss plans.
- Notification of stakeholders and the community on the final implementation plans and project schedule.

The project development and community engagement process for these two types of projects are graphically represented In Figure 6.17 below:

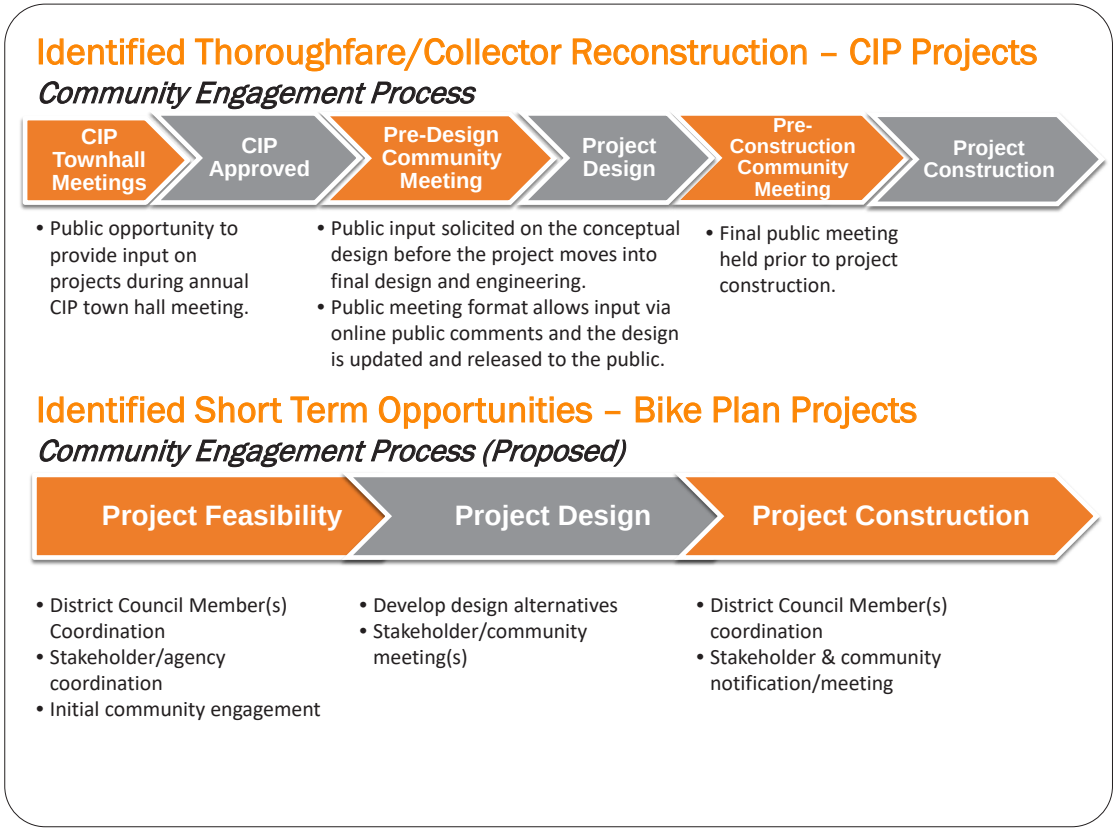


Figure 6.17 Recommended Engagement Process for City of Houston CIP and Non-CIP Projects