



BikeStripe: Designating Bikeways within the Existing Roadway Footprint

Guidance and Recommendations

Public Transportation Division

May 2016

Table of Contents

Introduction	2
Background	2
Getting Started	2
Stakeholders	4
Creating the Project	5
Crafting the Program’s Purpose and Objectives	5
Analyzing Data	5
Prioritizing Projects	9
Implementation	10
Funding	10
Design/Construction	10
Information	10
Measuring Success	10
Additional Resources	11

Introduction

This document is intended to assist individuals and organizations looking to stripe bike lanes within an existing roadway footprint. This document focuses on on-street bikeways and the best use of existing infrastructure. This document is not a stand-alone resource; it provides basic information and guidance to organize concepts and viewpoints into a common planning effort. Additional resources and expertise will be needed.

Background

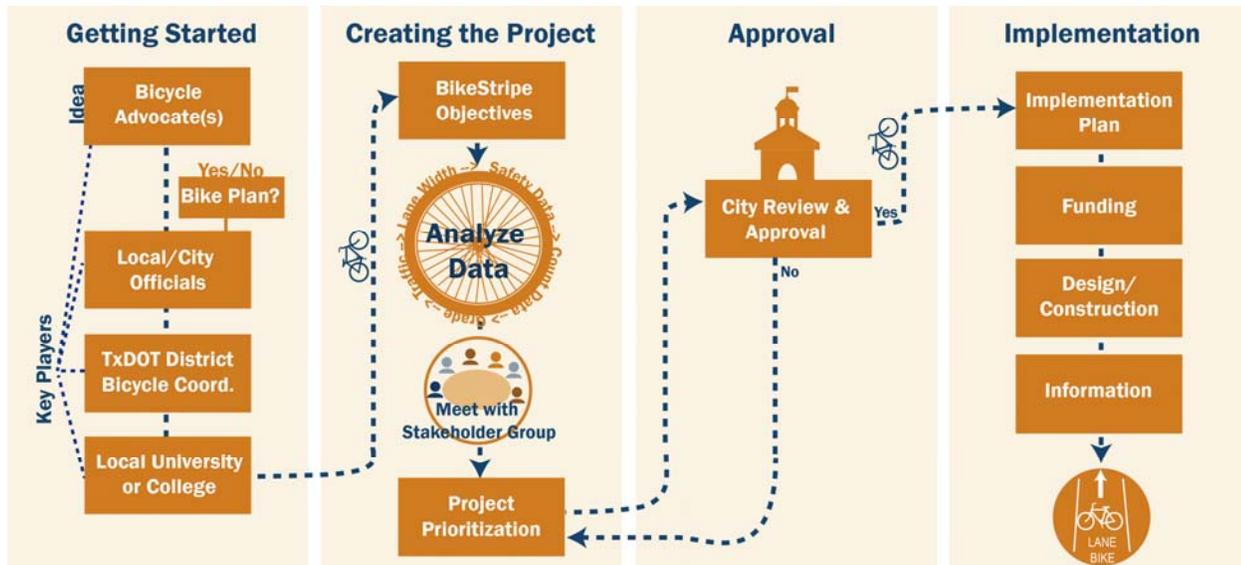
In 2015, a group of civil engineering students from the University of Texas at Tyler (UT Tyler), in coordination with the TxDOT's Bicycle Advisory Committee's (BAC) Chair, worked to identify roadways in the city of Tyler, Texas to be designated as part of the city's bicycle network. The initial intent of the project was to "put paint on the ground" to add bike lanes on existing roadways. The project, referred to as "BikeStripe," used available roadway data, low-cost technical resources and a logical approach to prioritizing roadways to add designated bike lanes. Since the initial BikeStripe effort in Tyler, the city has identified several roadways where bike lanes could be added to provide access to Tyler Junior College, UT Tyler and downtown Tyler.

The BikeStripe prioritization effort piqued the TxDOT BAC's interest in recommending resources to local governments to help them identify roadways for striping designated bike routes. This document lists the basic steps, and identifies potential resources for advocates, planners, engineers and elected officials who are looking to "put paint on the ground" and establish bikeways.

Getting Started

You can get in quite a bit of trouble if you head to the streets with a can of paint looking to paint bike lanes without any planning. It is imperative that you involve the right people at the right time, review current conditions, analyze bicyclists' needs, and develop a thoughtful plan for designating bikeways. Figure 1 provides a flow chart for what this process might look like, although the actual process you employ may vary greatly based on the needs and resources available in your community.

Figure 1 – Example flow chart for designating bikeways within an existing roadway footprint



Consider the following as you begin to pull together key people you will need to work with to designate bikeways:

1. Does the locality have a bike plan? Are bike routes designated in the area?

A bicycle plan usually includes goals and objectives that are then used to prioritize bikeway corridors and improvements.

Additional questions to consider:

- Has the plan been adopted by the local jurisdiction?
- When was the plan adopted? Is the plan relevant?
- Has the plan been updated to show what has been implemented?
- Who was involved in the development of the plan?
- Where are bike routes currently designated?
- Do bike maps exist for current and planned bikeways? Who maintains those maps?

You will want to incorporate previous planning efforts and the people who are currently responsible for bicycle planning.

2. Who has jurisdiction over roadway maintenance (state, county, or city)? Who currently manages bicycle designations and facilities in the area (ex: trails, public works, parks and recreation, etc.)? Does the local jurisdiction have a process in place to request having a roadway designated as a bike route?

It is likely that this project will include a number of entities. Those that may be impacted by designation should be involved in the planning process.

3. What local officials should be involved?

It is important to have a local champion for the project. Who that local champion is will vary greatly based on the community and the interest of local officials. At minimum, you will need to have support from the local jurisdiction responsible for roadway maintenance.

4. Are there local technical resources or staff that can assist with analysing data and prioritizing projects?

Technical assistance may be needed to analyze corridors, data and prioritize projects. In the Tyler “BikeStripe” effort, students from UT Tyler helped gather and analyze data.

5. What roadway and bikeway design standards does your community use?

You will want to become familiar with roadway design standards for various roadways and use of the Manual on Uniform Traffic Control Devices (MUTCD).

Buy-in from local government and other responsible entities (TxDOT) is imperative if you want to see your plan implemented. Work with appropriate transportation personnel.

You will need to discuss the concept of designating bicycle facilities in your area with the appropriate individuals and get buy-in from the transportation officials responsible for roadway maintenance. Meet early with these individuals to present your ideas. This will help lay the groundwork to garner support for your plan.

Stakeholders

It is beneficial to use a group of stakeholders to develop your objectives, review data and prioritize projects. You must work with local officials (ex: public works and city council) to develop recommendations. Establish a group of stakeholders and work with existing transportation and citizen committees. This will create buy-in for your planning process. Make sure you can explain how stakeholders were chosen. Be completely transparent in your planning process. If possible, talk to local officials about the importance of getting public feedback on your plan and process as you move forward. It is important that you include appropriate people and avoid uninformed, unilateral decisions.

Table 1 - Sample Stakeholder Representation

<i>Local advocates</i>	<i>City engineering/public works</i>	<i>TxDOT district bicycle coordinator</i>
<i>School district</i>	<i>County roadway maintenance</i>	<i>City council member(s)</i>
<i>County commissioner(s)</i>	<i>Local transit agency</i>	<i>Downtown business association</i>
<i>Local university or college</i>	<i>Bicyclists</i>	<i>Chamber of commerce</i>
<i>Economic development corp.</i>	<i>Parks and recreation</i>	

Creating the Project

Once you have identified and met with the appropriate key people to establish a planning strategy, you should be ready to start creating the plan.

Crafting the Program's Purpose and Objectives

Your bikeway designation plan should be developed to meet the needs of the community. It is important to work with your stakeholder group to determine your program's purpose and objectives. Your program purpose should be broad, aim for one or two well-developed sentences. Your objectives help you achieve the program purpose and can be more detailed. Your program purpose and objectives will help drive what analysis may be needed and assist with project prioritization.

Table 2 - Sample Program Purpose and Objective Statements

Provide bicycle access across the community	Connect employment centers with residential areas
	Provide safe routes to schools
	Integrate existing trails into roadway system
	Provide east-west connectivity for bicyclists
	Provide "last-mile" connections

Analyzing Data

Once you have established your program purpose and objectives, it is time to begin identifying potential bicycle routes. What should you consider when designating bicycle routes? In many instances you will begin by drawing lines on a map. Next you will want to identify easily accessible data to make your process more thoughtful. Using existing data will be helpful to measure whether different alternatives meet your needs. For example, if you have two route options to get from downtown to a university by bicycle, using crash data, traffic volumes and posted speed will help to prioritize the safer route for bicyclists.

Your stakeholder group will need to determine how to prioritize bicycle routes. For example, you may want to start by identifying nodes in the community that you want to connect; these could include places of employment, transit or shopping centers, institutional buildings, residential areas, schools, recreational facilities, etc. Or perhaps you would like to create a bicycle route grid across the community. Based on available right-of-way and traffic data, you may want to recommend a buffered bike lane along a particular corridor. Your prioritization process will depend on existing conditions and the needs of your community.

The Federal Highway Administration (FHWA) in *Case Studies in Delivering Safe, Comfortable, and Connected Pedestrian and Bicycle Networks*, identified the following principles of exemplary pedestrian and bicycle networks:

- **Cohesion** – How connected is the network in terms of its concentration of destinations and routes?
- **Directness** – Does the network provide direct and convenient access to destinations?
- **Accessibility** – How well does the network accommodate travel for all users, regardless of age or ability?
- **Alternatives** – Are there a number of different route choices available within the network?
- **Safety and Security** – Does the network provide routes that minimize risk and injury, danger and crime?
- **Comfort** – Does the network appeal to a broad range of age and ability levels and is consideration given to user amenities?

A lot has been written about what to consider when designating bicycle routes. This guide does not provide a literature review, but the following national resources may be helpful and should be considered as part of your roadway suitability analysis.

- **Bicycle Level of Service (BLOS)** is used in a number of resources and publications perhaps most notably in the *Highway Capacity Manual*. It has been refined over the years and is a statistically-derived method of evaluating bicycling conditions in a shared roadway environment. A suitability score or “compatibility” score is applied based on factors such as roadway width, bike lane width, traffic volume, pavement conditions, motor vehicle speed and the presence of on-street parking. The BLOS produces an output that is similar to Level of Service (LOS) evaluations for on-road vehicular traffic.
- The **Bicycle Compatibility Index (BCI)** was developed by FHWA and is a type of BLOS; it allows practitioners to evaluate potential roadways for accommodating both motorists and bicyclists using geometric and operational characteristics such as lane width, speed and volume. The BCI is heavily critiqued by transportation practitioners. The BCI can be cumbersome to calculate and has limited usefulness, but some of the considerations used in the calculation may be helpful.

Table 3 on the following page compares the ranges from the BLOS and BCI.

Table 3 - Bicycle Level of Service Comparison

LOS	BLOS Range	BCI Range	Compatibility Level
A	Less than 1.50	Less than 1.50	Extremely High
B	1.51 – 2.5	1.51 – 2.30	Very High
C	2.51 – 3.5	2.31 – 3.40	Moderately High
D	3.51 – 4.5	3.41 – 4.40	Moderately Low
E	4.51 – 5.5	4.41 – 5.30	Very Low
F	Greater than 5.5	Greater than 5.30	Extremely Low

Source: US Department of Transportation, 1998, The Bicycle Compatibility Index

- **Levels of Traffic Stress (LTS)** has been developed as another method of assessing the desirability of a roadway for use by bicyclists. LTS data is used to assign numerical measures to roadway segments and produce stress maps. Roadways with the lowest LTS are the most comfortable for bicycle users. This can also be conveyed as a “comfort level.”

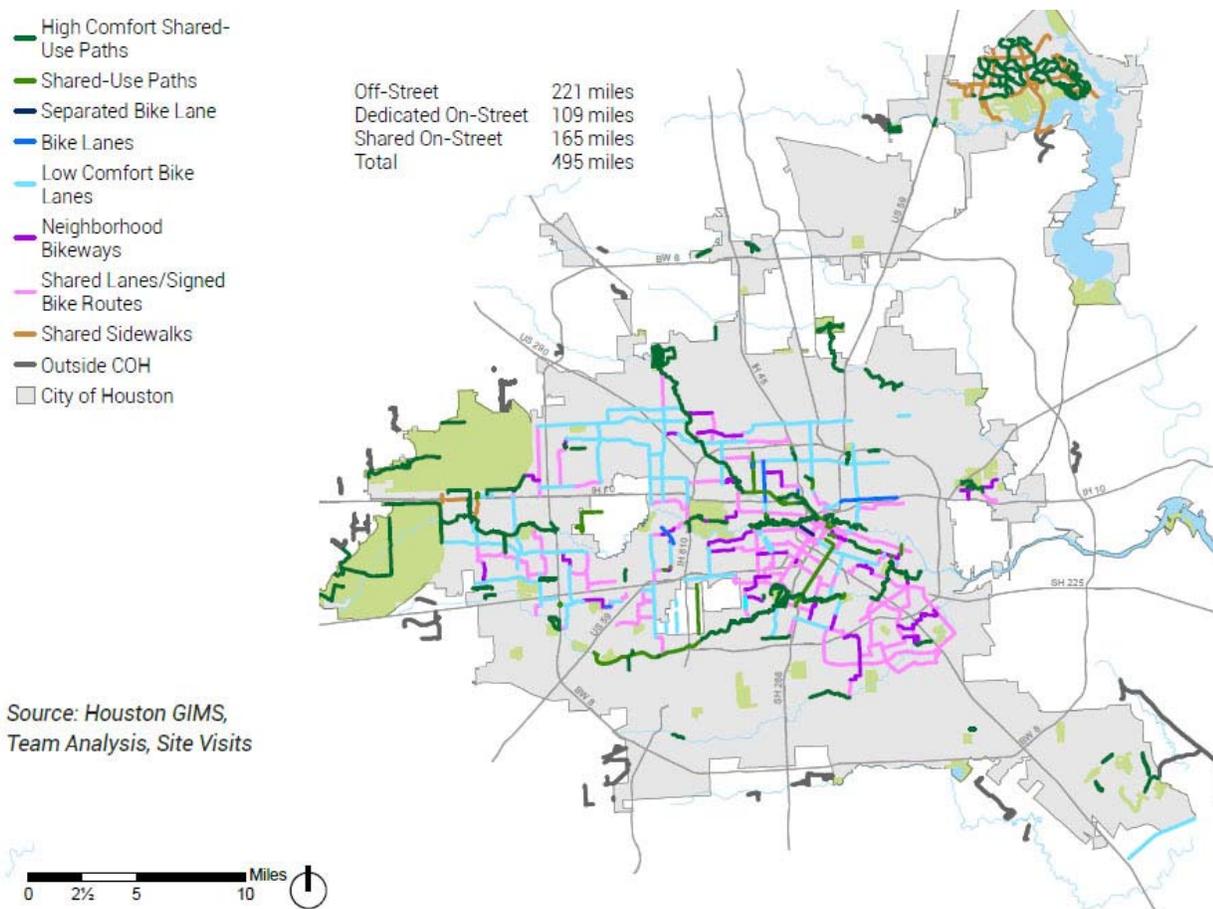
Table 4 - Standards of Levels of Traffic Stress

Level of Traffic Stress			
1	2	3	4
<ul style="list-style-type: none"> • Physically separated from traffic or low-volume, mixed-flow traffic at 25 mph or less • Bike lanes 6 ft. wide or more • Intersections easy to approach and cross • Comfortable for children 	<ul style="list-style-type: none"> • Bike lanes 5.5 ft wide or less, next to 30 mph auto traffic • Unsignalized crossings of up to 5 lanes at 30 mph • Comfortable for most adults • Typical of bicycle facilities in the Netherlands 	<ul style="list-style-type: none"> • Bicycle lanes next to 35 mph auto traffic, or mixed-flow traffic at 30 mph or less • Comfortable for most current US riders • Typical of bicycle facilities in the US 	<ul style="list-style-type: none"> • No dedicated bicycle facilities • Traffic speeds 40 mph or more • Comfortable for “strong and fearless” riders (vehicular cyclists)

Source: Low Stress Cycling and Network Connectivity, 2012

See Figure 2. Level of Stress Example: Houston’s Existing Bikeway Network.

Figure 2 – Level of Stress Example: Houston's Existing Bikeway Network



Houston Bike Plan, Network Plan and Maps, 2015

- **Road Diet Suitability Analysis** identifies which roadways would experience limited impact to traffic if a vehicular travel lane was converted into a bikeway (or other use). This type of analysis generally looks at Average Daily Traffic (ADT), turn-lanes, lane width, traffic dispersion, curb-cuts, bus stops and intersection operations.

It is important to incorporate qualitative and quantitative information when prioritizing routes. For the examples above (BLOS, BCI and LTS), a value is assigned to a segment of roadway which can then be displayed on a map. Talk to you stakeholder group about what data they are interested in and what data is easily available. What information would be useful to make design decisions and garner support? Table 5 provides a list of information you should consider.

Table 5 - Information to Consider and Review

<i>Crash data</i>	<i>Perceived user safety</i>	<i>Traffic counts</i>
<i>Lane width</i>	<i>Grade</i>	<i>Proximity to desired locations</i>
<i>Existing bike routes</i>	<i>Number of traffic lanes</i>	<i>Parking along the roadway</i>
<i>Street lighting</i>	<i>Presence of a shoulder</i>	<i>Adjacent land use</i>
<i>Speed limit</i>	<i>Available bike lane footprint</i>	<i>Intersections</i>
<i>Ease of access</i>	<i>Current bicycle usage</i>	<i>Road surface type and condition</i>
<i>Bicycle amenities</i>	<i>Type of users</i>	<i>Number of heavy vehicles</i>

The stakeholder group should determine which information is most important for consideration. Additional questions to ask include: Who will be using the bikeway? Is there a possibility that this bikeway will become a designed route for children? In some instances, there may be only one viable option. A large amount of data is available through Geographic Information Systems (GIS) or free mapping tools available online. Additional information may be available from city, county and state agencies. In all cases, a visual inspection of the roadway will be necessary. It is recommended to ride the proposed route on a bicycle, if possible. Take photographs of existing conditions, especially where pedestrian and bicycle traffic exists.

Prioritizing Projects

Once the stakeholder group has reviewed all available data in conjunction with the program purpose and objectives, the group can begin to prioritize corridors and projects. Work with local government to gather input on proposed routes and projects. Use maps and other visual tools to showcase the projected projects. It will be necessary and beneficial to get feedback on proposed projects from potential users, including motorists and bicyclists. Feedback can be acquired a number of ways: through meetings, focus groups, social media and/or comment forms.

Approval

The process of getting routes actually designated and “paint on the ground” will vary greatly based on community support and local jurisdiction approval and funding. In some cases, the local jurisdiction may be able to simply add route designation(s) as part of roadway maintenance. In other cases, a more detailed analysis and engineering evaluation may be required. Approval may be ad hoc or it may have to go through an approval process at the city, county, regional planning commission or TxDOT. Involving all the right people early in the planning process will foster greater support and increase your opportunity for success.

Implementation

Implementation will be done in coordination with the jurisdiction responsible for maintaining the roadway, which could be the state, city, county, etc. Work with your local entities to create an implementation plan. An implementation plan would outline *who* is responsible for *what*.

One of the most cost effective ways to add bike lanes to an existing roadway is during a resurfacing project. The Federal Highway Administration (FHWA) published *Incorporating On-Road Bicycle Networks into Resurfacing Projects* in March 2016, this workbook highlights existing guidance, justifications and best practices for providing bikeways during resurfacing projects.

Funding

Begin by discussing potential funding options locally. Local funds may be available or could be used to match federal or state program funding.

Design/Construction

All on-road bikeways in Texas should conform to the MUTCD and on state-maintained roadways the bikeways should conform to the Texas MUTCD. The local government and/or transportation agency responsible for roadway maintenance may have additional roadway design requirements.

Information

Once the bikeways have been put in place, it's time to get the word out! Route signage and maps are will be helpful. Make sure bicycling information is available at employment, transit and shopping centers, residential areas, schools, recreational facilities, etc. Consider involving the media, organizing local bike rides or even having an opening ceremony to attract interest.

Measuring Success

There are a number of ways to measure a successful bikeway designation program. Consider using any or all of the following to measure your success:

- **Bicycle counts** – This can be done using electronic counters or by manually counting bicyclists before and after a route designation.
- **Surveys** – Consider surveying users or potential users before and after project implementation.
- **Crash data** – Bicycle crash data is available from TxDOT and in some cases from your city or county.
- **Input from users** – Comments and suggestions from users can be very telling.

Additional Resources

There are a number of additional resources available

- [Texas Manual on Uniform Traffic Control Devices \(TMUTCD\)](http://www.txdot.gov/government/enforcement/signage/tmutcd.html)
http://www.txdot.gov/government/enforcement/signage/tmutcd.html
- [AASHTO Guide for the Development of Bicycle Facilities](https://bookstore.transportation.org/item_details.aspx?ID=1943)
https://bookstore.transportation.org/item_details.aspx?ID=1943
- [NACTO Urban Bikeway Design Guide](http://nacto.org/publication/urban-bikeway-design-guide/)
http://nacto.org/publication/urban-bikeway-design-guide/
- [FHWA Bicycle and Pedestrian Design Publications](https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/)
https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/
- [ADA Best Practices Tool Kit for State and Local Government](http://www.ada.gov/pcatoolkit/toolkitmain.htm)
http://www.ada.gov/pcatoolkit/toolkitmain.htm
- [Safe Routes to Schools](http://www.saferoutesinfo.org/)
http://www.saferoutesinfo.org/