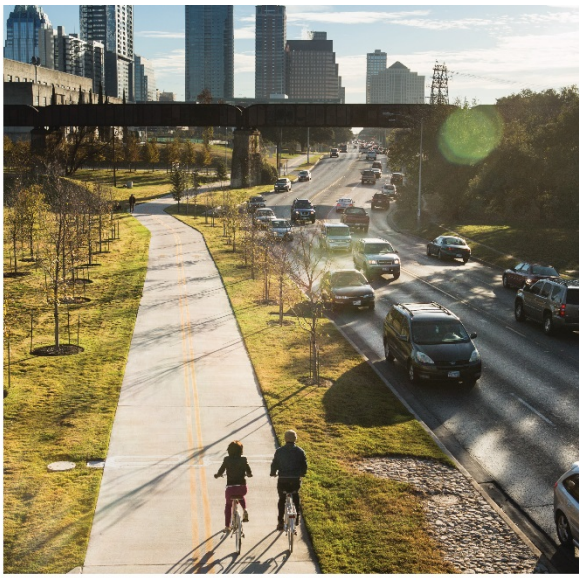

Texas Bicycle Tourism Trails Study

Final Report

Public Transportation Division

July 2018

Acknowledgements

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Acronyms and Abbreviations

%	percent
AASHTO	American Association of State Highway Transportation Officials
ACA	Adventure Cycling Association
BAC	Bicycle Advisory Committee
BTTS	Bicycle Tourism Trails Study
CDC	Center for Disease Control
CH2M	CH2M HILL Engineers, Inc. (now Jacobs)
COG	Councils of Governments
DES	TxDOT's Design Division
DOT	Department of Transportation
EDT	Economic Development and Tourism Division
FHWA	Federal Highway Administration
GIS	Geographic Information System
mph	mile per hour
MPO	metropolitan planning organization
MUTCD	*Manual on Uniform Traffic Control Devices*
NACTO	National Association of City Transportation Officials
NHTSA	National Highway Traffic Safety Administration
NOx	nitrogen oxides
NPS	National Park Service
O&M	operations and maintenance
project team	TxDOT-PTN and Jacobs staff
PS&E	Plans, Specifications, and Engineering
PTN	Public Transportation Division
SDR	*Strategic Direction Report for TxDOT's Bicycle Program*
SUP	Shared Use Path
TA	Transportation Alternative
TARC	Texas Association of Regional Councils
TCA	Texas Commission on the Arts

TEMPO	Association of Texas Metropolitan Planning Organizations
THC	Texas Historical Commission
TPP	Transportation Planning and Programming
TMUTCD	*Texas Manual on Uniform Traffic Control Devices*
TPWD	Texas Parks and Wildlife Department
TRF	TxDOT's Traffic Operations Division
TRV	TxDOT's Travel Information Division
TSATC	Texas State Agency Tourism Council
TxDOT	Texas Department of Transportation's
US	United States
USBR	U.S. Bicycle Route System
USDOT	U.S. Department of Transportation
WHO	World Health Organization

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1. Introduction

The purpose of the Bicycle Tourism Trails Study (BTTS) was to investigate the development of a statewide bicycle tourism trail network. The study was initiated in January 2017 by the Texas Department of Transportation's (TxDOT's) Public Transportation Division (PTN) Bicycle and Pedestrian Program in response to the 2005 Texas Bicycle Tourism Trails Act (Texas Transportation Code § 201.9025 Texas Bicycle Tourism Trails[1]).

TxDOT-PTN staff and its consultant, CH2M (now Jacobs), worked with TxDOT's Bicycle Advisory Committee (BAC) to propose recommendations for the development of bicycle tourism trails in Texas. This study applied BAC and TxDOT-developed quantitative and qualitative routing criteria to provide an example vision of a statewide network of tourism bikeways. The products resulting from this study will serve as an initial high-level network analysis for statewide bicycle tourism consideration and future development.

What is Bicycle Tourism?

Bicycle tourism can be defined as any travel or tourism-related activity that incorporates a bicycle. Bicycle tourism activities include, but are not limited to, long-distance bicycle touring, bike-packing, local day rides, urban cycling, and bicycle events that include races and/or adventure destinations. Bicycle tourism activities occur in urban, suburban and rural locations on a variety of different on-road and off-road facilities.

A network of bicycle tourism trails across Texas would highlight the natural, historic and exceptional landscapes across the many unique regions of the state. These tourism trails have the potential to attract bicyclists from around the world, showcase communities across the state, and boost economic development. The bicycle tourism trail network could also provide recreational and travel opportunities for local Texans craving a Monday-night ride, an alternative route to work, or perhaps a family weekend adventure.

This final report summarizes the deliverables created as a result of the study and outlines the methodology used. The final report documents the following:

- The stakeholder engagement process used to inform, guide, and validate study products.
- The economic, health, environmental, and transportation benefits of bikeways in Texas and the benefits related to bicycle tourism
- The process used to develop the BTTS Example Network
- The bikeway types proposed for inclusion into an Example Network, providing both bikeway design recommendations and estimated costs per mile.

This final report incorporates the content from four interim technical memoranda that provide focused descriptions of specific study areas and function as stand-alone documents.

2. Study Background

Over the past decade, TxDOT funded more bikeways making bicycling safer throughout Texas. This work is supported by TxDOT-PTN's Bicycle and Pedestrian Program and TxDOT's Bicycle Advisory Committee (BAC). In 2015, TxDOT-PTN, in coordination with TxDOT's BAC, developed the *Strategic Direction Report: Opportunities for TxDOT's Bicycle Program* (SDR)[2]. The SDR identified seven focus areas for TxDOT's Bicycle Program to advance. TxDOT's Bicycle Tourism Trails Study builds upon several focus area activities identified in the SDR and recommendations from TxDOT's BAC. Members of the BAC volunteered to participate in a Working Group that met monthly to review planning data and make recommendations as part of this study.

2.1 Vision, Goals, and Objectives

Early on, TxDOT-PTN and Jacobs staff (hereafter "the project team") collaborated with the BAC Working Group and BAC to draft and refine the vision, goals, and objectives for the study. The vision, goals, and objectives guided the project team's work and coordination efforts. These elements were carried through into all products, including Example Network routes, the development of bikeway types, and bikeway design criteria recommendations.

Bicycle Tourism Trails Study Vision Statement

A network of bicycle tourism routes collaboratively developed to provide safe, non-motorized access to and connectivity between statewide/regional destinations and support economic development across Texas.

Goal 1: Identify tourism trail routes

Objectives:

1.1 Establish criteria for route locations
1.2 Promote connections with existing bicycle, transit, rail, vehicle, and pedestrian networks
1.3 Identify statewide/regional destinations and bicycling events
1.4 Identify routes
1.5 Map routes

Goal 2: Foster the development of safer bicycle tourism trails

Objectives:

2.1 Establish design criteria for various bikeway accommodations
2.2 Provide estimated costs associated with development of various bikeway accommodations
2.3 Establish procedures for considering state-maintained roadways for inclusion in USBRS
2.4 Provide leadership for coordinated bikeway connections statewide

Goal 3: Identify benefits of bicycle tourism trails

Objectives:

3.1 Identify economic benefits

3.2 Identify health benefits

3.3 Identify environmental benefits

Goal 4: Engage stakeholders

Objectives:

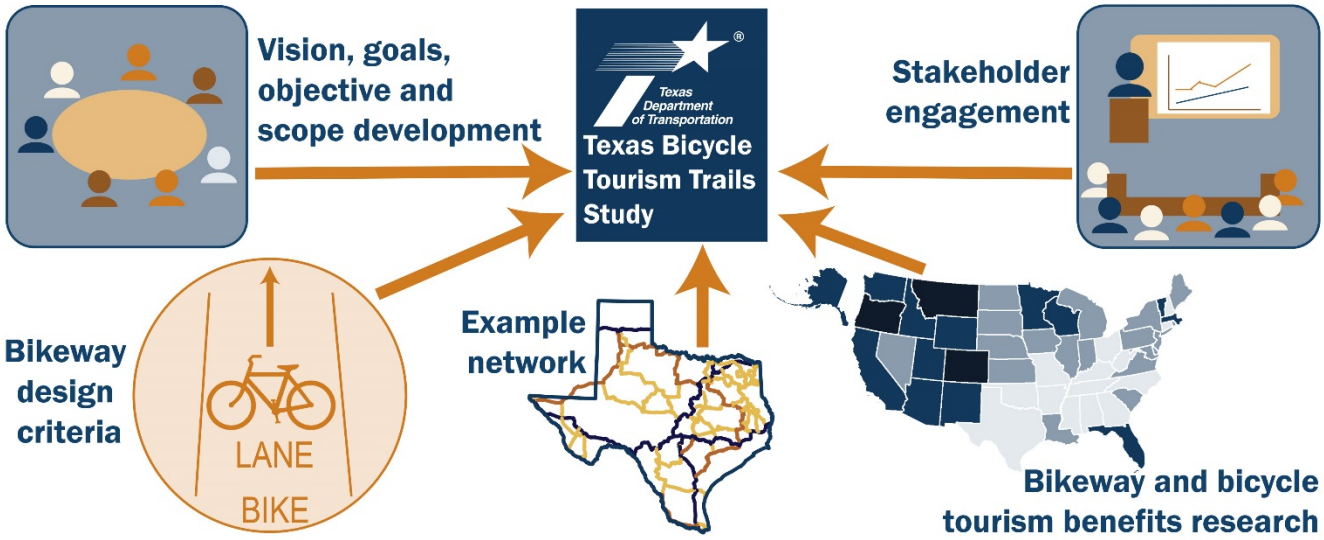
4.1 Coordinate and consult with state agencies (including Texas Economic Development and Tourism Office and the Texas Parks and Wildlife Department)

4.2 Coordinate with other government entities

4.3 Engage statewide bicycle interest groups

Figure 1 below depicts the overall planning process.

Figure 1: Texas Bicycle Tourism Trails Study Planning Process



3. Stakeholder Engagement

At the earliest stages, TxDOT-PTN determined that the stakeholder engagement approach should match both the scale and depth of analysis for a statewide planning-level study. More specifically, stakeholder engagement methods would need to complement the depth of detail anticipated for this statewide, high-level analysis. The stakeholder engagement approach used for this study involved guidance from the BAC Working Group and input and validation from regional stakeholders. As such, the project team used TxDOT's BAC to confirm needs and priorities, and staff at regional entities (metropolitan planning organizations [MPO], councils of government [COG], and TxDOT Districts) for critical local knowledge of bikeway plans, projects, and existing/planned infrastructure.

Additionally, TxDOT-PTN acknowledges that a more thorough analysis of local conditions and extensive stakeholder engagement is necessary to advance the study's resulting Example Network routes. Indeed, the Example Network was so named because it represents one broad application of the qualitative and quantitative criteria established as part of the study.

TxDOT's BAC and the BAC Working Group played a critical role to steer the BTTS. The project team's interaction with the Working Group was essential to the development of a transparent, data-driven process for identifying proposed bicycle route locations. Using an iterative, consensus-driven approach, the project team sought monthly approval and/or direction from the BAC Working Group on various interim products throughout project development (see Figures 2 and 3). Meanwhile, project team members presented and led discussions about progress to BAC members quarterly. Ultimately, a unanimous BAC endorsement of the study products was received and concluded the work of the study.

Figure 2: Simplified BTTS Stakeholder Engagement Schedule

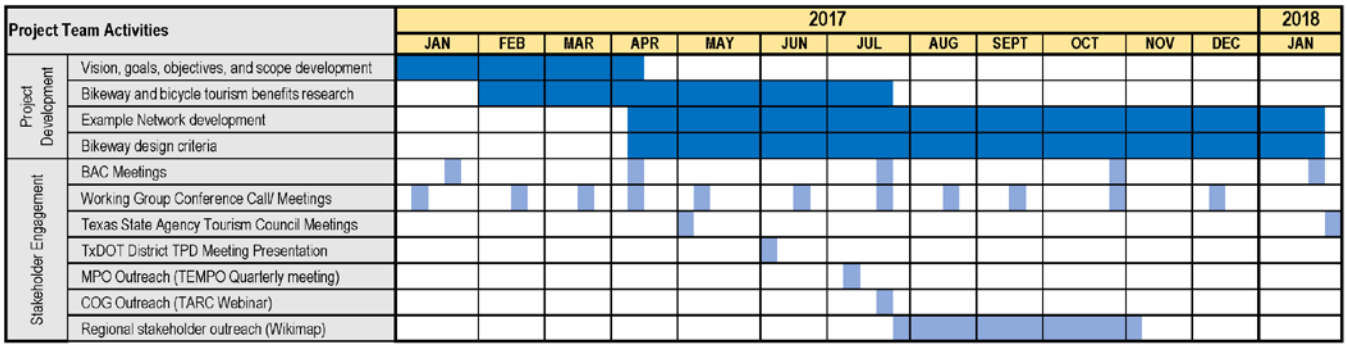
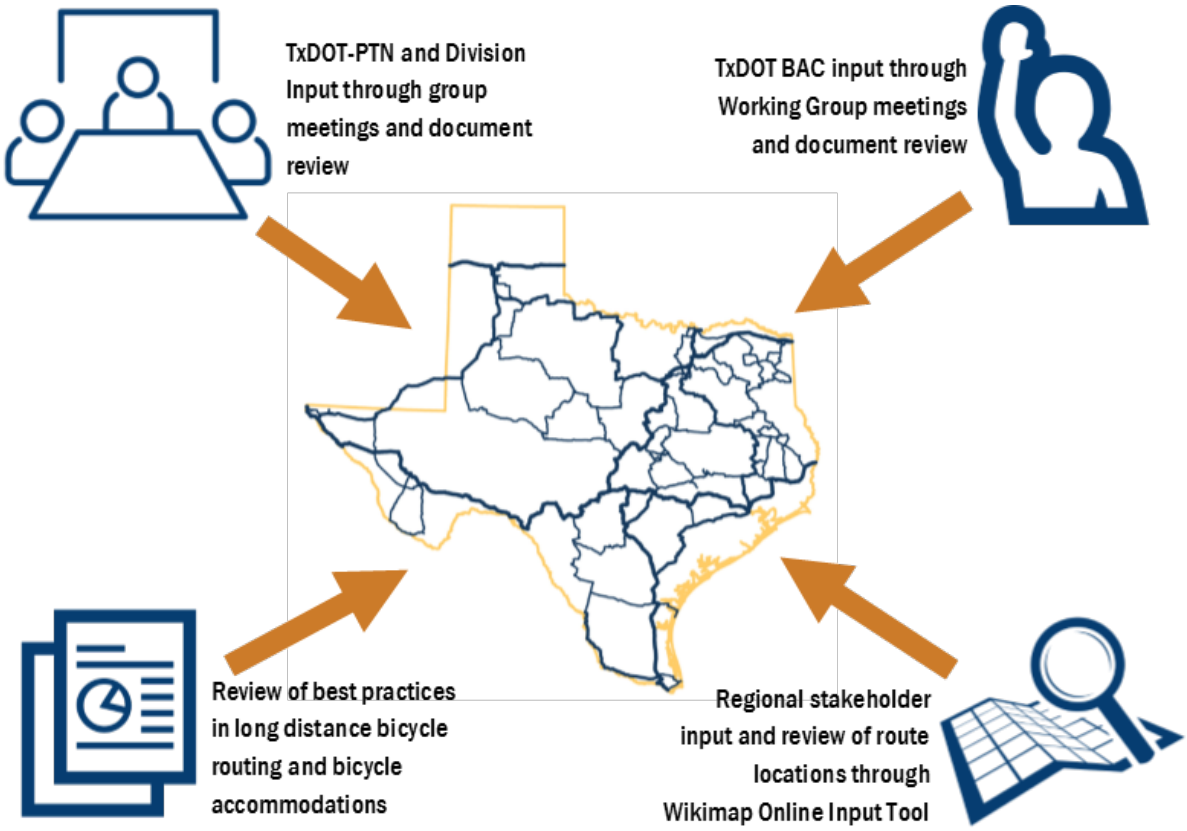


Figure 3: BTTS Stakeholder Involvement



3.1 TxDOT's Bicycle Advisory Committee (BAC)

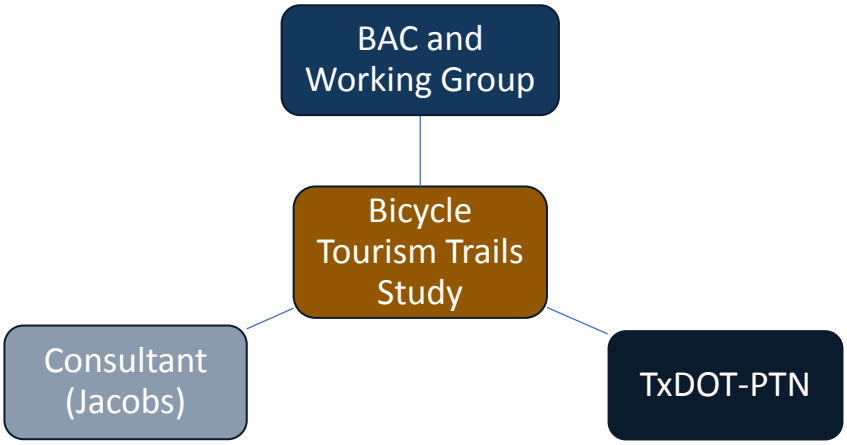
The TxDOT BAC's 11 members are selected from all areas of Texas and represent a cross section of people with various backgrounds. Membership is not limited to any particular profession and generally includes representation from the private sector, local government, non-profit, engineering/planning firms, advocacy organizations, metropolitan planning organizations, etc. Approved by the Texas Transportation Commission, the members serve 3-year terms, volunteering their time and travel expenses. The main objective of the committee is to advance the consideration of bicycling as part of transportation planning and development. The BAC has quarterly in-person meetings at TxDOT's Austin headquarters to advise TxDOT on bicycle issues. TxDOT's BAC helps to incorporate a bicyclist's perspective into departmental policies affecting bicycle use, including the design, construction, and maintenance of roads.

3.2 BAC Working Group

A subset of BAC members volunteered to be a part of this study's Working Group to help guide the efforts of the project team as the study progressed.

The Working Group was charged with advising and advancing the work of the study between quarterly BAC meetings. Meanwhile, the BAC provided confirmation/general guidance to the project team at quarterly meetings.

Figure 4: BTTS Project Partners Diagram



During monthly in-person meetings or WebEx-style video and audio conference calls, the Working Group reviewed interim products and made suggestions/recommendations for improvement. Figure 4 (above) illustrates the study's project partners. Table 1 (below) lists the names of the BAC and Working Group members.

Table 1: BAC and Working Members

BAC Cohort	BAC Members	Working Group Member
2017 BAC Members	Allison Fink	
	Robert Gonzales	☑
	Ramiro Gonzalez	☑
	Billy Hibbs	☑
	George Mendes	
	Joseph Pitchford	☑
	DawnElla Rust	☑
	David Steiner	
	Shawn Twing	☑
	Karla Weaver	☑
	Anne-Marie Williamson	

Table 1: BAC and Working Members

BAC Cohort	BAC Members	Working Group Member
New BAC Members appointed in October 2017	David Ham	
	Margaret O'Brien-Nelson	
	Jeffrey Pollack	
	Cristian Sandoval	

The 12 BAC Working Group meeting presentations can be found in *Technical Memorandum 4: Stakeholder Engagement*. Table 2 provides a summary of BAC and Working Group meeting activities over the duration of this study.

Table 2: TxDOT BAC and Working Group Meeting Activities

Group	Date	Activities
Working Group	1/12/2017	• Introduction to Bicycle Tourism Trails Study
BAC	1/20/2017	• Introduction to Bicycle Tourism Trails Study
Working Group	2/21/2017	• Develop vision, goals, and objectives (Part 1)
Working Group	3/20/2017	• Develop vision, goals, and objectives (Part 2) • Define stakeholders • Review national/regional examples of tourism trails • Discuss statewide approaches to bicycle tourism
BAC	4/10/2017	• Approve vision, goals, and objectives • Review national/regional examples of tourism trails • Discuss statewide approaches to bicycle tourism
Working Group	4/10/2017	• Initial routes exercise • Prioritizing route location criteria exercise
Working Group	5/15/2017	• Review Working Group drawn routes (April exercise results) • Review route location criteria (April exercise results) • Review Preliminary Routes based on exercise results

Table 2: TxDOT BAC and Working Group Meeting Activities

Group	Date	Activities
Working Group	6/20/2017	• Review Preliminary Route updates • Discuss process for applying quantitative route location criteria metrics • Introduce Wikimap Online Input Tool for regional stakeholders input
BAC	7/17/2017	• Review Preliminary Route updates • Discuss stakeholder outreach
Working Group	7/17/2017	• Review Preliminary Route updates • Application of quantitative route location criteria • Discuss benefits of bicycle tourism and bikeways research
Working Group	8/22/2017	• Present Conceptual Routes • Discuss bikeway types and design criteria (Part 1) • Present Wikimap Online Input Tool interface for regional stakeholders input
Working Group	9/29/2017	• Review Wikimap (regional stakeholder) feedback (Part 1) • Review bikeway types and design criteria (Part 2)
BAC	10/27/2017	• Review Wikimap (regional stakeholder) feedback (Part 2) • Discuss bikeway types and design criteria • Stakeholder outreach update
Working Group	10/27/2017	• Review Conceptual Route changes in response to Wikimap feedback • Discuss bikeway types and design criteria (Part 3) • Review U.S. Bicycle Route System Route Designation process
Working Group	12/12/2017	• Present Example Network • Discuss cost estimates for BTTS bikeway types
Working Group	1/19/2017	• Review all draft final products • Discuss next steps
BAC	1/22/2018	• Seek BAC endorsement for all products • Discuss next steps

TxDOT's Bicycle Advisory Committee (BAC) was heavily involved in the work of the Bicycle Tourism Trails Study (BTTS) from start to finish. The eleven members of the BAC represent a diverse cross-section of cycling advocates from around the state. This became extremely useful when various routes, parks, and places of interest were under consideration. We believe that the BTTS will help revive the economies of hundreds of small towns, while firmly placing Texas at the top of all cycling tourism destinations. We strongly, and unanimously, endorse its results.

- Billy Hibbs, Chairman, TxDOT's Bicycle Advisory Committee

3.2.1 Defining Stakeholders

In the beginning stages of the study, the project team and Working Group identified critical stakeholders. The project team suggested that stakeholder qualities may include one or more of the following:

- Knowledge of regional bikeways in Texas
- Expertise in bicycle tourism
- Responsibilities related to development, promotion, and/or implementation of Texas bicycle tourism trails

Additionally, stakeholders may be asked to do the following:

- Identify potential routes
- Review route location criteria
- Review bikeway design details
- Identify issues or concerns
- Review draft bicycle tourism route locations

Table 3 presents the BTTS stakeholders as identified by the BAC, Working Group, and project team.

Table 3: BTTS Stakeholders

Stakeholder	Attributes
TxDOT Division and District staff	• Knowledge of project development (including cost estimates, safety concerns, design guidance, etc.) • Expertise and access to Geographic Information System (GIS) data • Experience constructing bikeways on state-maintained roadways • Knowledge of planned, funded, and let projects across Texas
Texas Parks and Wildlife Department (TPWD)	• Knowledge of recreational trails and other long-distance bicyclist destinations across Texas • Experience constructing recreational trails and bicycle/pedestrian facilities
Governor's Office of Economic Development and Tourism (EDT)	• Practical knowledge of tourism spending models and economic benefits • Potential partner during future promotional phases
Texas Historical Commission (THC)	• Knowledge of long-distance bicyclist destinations • Texas Heritage Trails program and Texas Main Street program
Metropolitan Planning Organizations (MPOs)	• Knowledge of local bicycle infrastructure, planning efforts, bicycle project development, and local GIS data
Councils of Governments (COGs)	• Knowledge of regional destinations, economic development, local transportation infrastructure, planning efforts, and local GIS data
BikeTexas	• Knowledge of previously considered bicycle tourism trail routes • Valuable partner for future support and promotion of BTTS Routes
Texas Department of State Health Services	• Knowledge of public health issues and potential partner during future promotional phases
Texas Commission on the Arts (TCA)	• Knowledge of arts and tourism destinations and potential partner during future promotional phases

3.3 TxDOT Divisions and Districts

TxDOT's 33 Divisions are responsible for a diverse range of services for the agency ranging from procurement and occupational safety to maritime and strategic planning. Division staff with skills and abilities in areas related to planning, data management, and project development (including design, construction, and maintenance) were particularly important to the project team. The TxDOT Divisions engaged during the study included:

- Design (DES)
- Transportation Planning and Programming (TPP)
- Traffic Operations (TRF)
- Travel Information (TRV)

The Divisions listed above would be involved as implementation occurs. It was important to inform and engage Division leaders on the activities and importance of the study. Division staff assisted the project team in several ways:

- Reviewed BTTS bikeway design criteria and suggested changes according to their knowledge of TxDOT and FHWA guidance and procedures
- Provided guidance on the usage of TxDOT GIS data during quantitative criteria application and route development
- Provided insights into long-range planning and development of the Texas Transportation Plan at TxDOT
- Facilitated engagement with external agencies

There are 25 TxDOT Districts across the state, through which District staff oversee the planning, design, construction, and maintenance of state roadways. As a result, TxDOT District staff are not only knowledgeable about state-maintained roadways within their District, but also about municipal and regional transportation plans, trends, and issues. TxDOT District Bicycle Coordinators and Transportation Alternative (TA) Program Coordinators were directly solicited for feedback regarding the Conceptual Routes via the Wikimap Online Input Tool. For more information regarding Wikimap feedback from TxDOT District, MPO, and COG staff, please see the Wikimap Online Input Tool section below and refer to T*echnical Memorandum 2: Routing Criteria and Example Network Development*.

3.4 Consultation with Texas State Agencies

The 2005 Texas Bicycle Tourism Trails Act (codified in Texas Transportation Code § 201.9025) states that TxDOT's BAC "shall advise and make recommendations to the commission on the development of bicycle tourism trails in this state." Additionally, recommendations "shall be made in consultation with the Parks and Wildlife Commission and the Texas Economic Development and Tourism Office." The study team worked with these and other agency officials during the study. The

recommendations of the study will be shared with agencies as they will be valuable partners in developing a bicycle tourism trail network. As listed in Table 3, additional state agencies have knowledge and responsibilities directly related to the products developed during this study and would be involved in future implementation decisions.

Representatives from the Governor's Office of Economic Development and Tourism, THC, TPWD, and the Texas Commission on the Arts (TCA) regularly meet to discuss Texas tourism concerns under the designation of the Texas State Agency Tourism Council (TSATC). Project team representatives attended two TSATC meetings to discuss the study and the resulting deliverables.

The listed state agencies are discussed in greater detail as follows.

3.4.1 Office of the Governor, Economic Development and Tourism Division (EDT)

According to their website, the EDT supports the Governor's efforts to position Texas as the world's premier business location and travel destination. EDT coordinates the promotion of Texas tourism for the state and works in concert with local/regional partners (convention and visitors bureaus, local chambers of commerce, private travel-related organizations and associations) to promote economic opportunity through domestic and international tourism marketing[3].

EDT would play a critical role in successfully marketing a future bicycle tourism trail network and could help ensure a higher return on future bikeway investments. EDT's Travel Research staff provide and analyze information about domestic and international travel behavior and trends, which will assist future bicycle tourism trail route/network planning efforts. Additionally, EDT's Research and Economic Analysis Department could assist in targeting strategic bikeway investments within appropriate Texas geographies and markets. EDT's Director of Tourism has been an active member of the TSATC and was an active collaborator during TSATC meetings with the project team.

3.4.2 Texas Historical Commission (THC)

THC works to preserve the history of Texas and quantify the impacts that historic preservation and tourism have on the Texas economy. Within the THC, the Community Heritage Development Division partners with communities and regions to revitalize historic areas, stimulate tourism, and encourage economic development using historic preservation strategies. This division administers the Texas Main Street and Texas Heritage Trails programs, while separately evaluating the economic impact of historic preservation and heritage tourism in Texas.

The project team engaged THC to gain insights into Texas Heritage Trails networks and small town/main street communities. Texas Heritage Trails is a tourism and economic development initiative which promotes Texas' historic and cultural resources through 10 Texas Heritage Trail Regions and historic sites. Through this and other programs, THC has developed stakeholders and partners in small towns across Texas. Future collaborative efforts between these small town economic development/revitalization efforts and any future bicycle tourism trails should be encouraged. THC provided data describing locations of Main Street programs and heritage trails.

3.4.3 Texas Parks and Wildlife Department (TPWD)

According to the TPWD website, this state agency works:

> *"to manage and conserve the natural and cultural resources of Texas and to provide hunting, fishing and outdoor recreation opportunities for the use and enjoyment of present and future generations."*[4]

The project team engaged TPWD to gain insight into previous and continuing investments in recreational trails around the state. TPWD operates the Texas Recreation and Parks Account grant program and the Recreational Trail Fund Program (funded through the Federal Highway Administration's [FHWA's] Transportation Alternatives Program). In communicating with the project team, TPWD staff shared their experiences creating different types of thematic recreational trails. TPWD has developed paddling, birding, and other wildlife trails to encourage nature tourism and visitation of state parks. Future collaborative marketing efforts between these recreational trails and any future bicycle tourism routes/networks should be encouraged.

Additionally, TPWD provided valuable GIS data representing the locations of trails and boundaries of state and national parks, wildlife areas, and similar preserved public lands. These protected natural and scenic areas could act as bicycle tourism destinations and lodging sites; their location was important to the route development process.

If TxDOT or another state agency champions the development of bicycle tourism trails or a bicycle tourism network, TPWD partnership will be critical. TPWD has a history of constructing a variety of paved and unpaved bicycle and pedestrian facilities in state parks including some long distance trailways. Future bicycle tourism infrastructure investments should be coordinated and communicated with TPWD involving both the State Parks Trails Coordinator and Marketing Director.

3.4.4 Texas Commission on the Arts (TCA)

TCA's mission is to "advance Texas economically and culturally by investing in a creative Texas"[5]. TCA invests public funds in the form of grants to cultural, educational, artistic, and civic organizations.

TCA is a member of the TSATC and as such encourages arts and cultural tourism activities and designates Texas cultural districts. Bicycle destinations may be enhanced by the diverse and innovative arts promoted by TCA; future collaboration between arts/cultural investments and bicycle tourism investments should be encouraged.

3.5 Regional Planning Entities

The BTTS is an initial statewide investigation into the development of a bicycle tourism trail network in Texas. Given the preliminary nature of this inquiry, regional stakeholders were engaged to gain a better understanding of local-level bikeway infrastructure and planning efforts at a high level. Development of the BTTS into a statewide Bicycle Tourism Trails Plan would require engagement of local jurisdictions (cities, towns, counties, etc.) across Texas. Indeed, a more thorough analysis of local conditions and extensive stakeholder engagement is needed to advance any routes.

3.5.1 Metropolitan Planning Organizations

MPOs are federally mandated and designated to carry out the transportation planning processes of urbanized areas. As such, the federal government allocates funding to MPOs to program and plan transportation infrastructure and mitigate regional transportation concerns, such as air pollution and congestion. MPOs are required in urban areas with a population of 50,000 or more. Decisions are governed by a policy board of the MPO. The MPO provides an ongoing, cooperative, regional transportation planning process that results in plans and programs which consider all transportation modes. Because of these responsibilities, MPO staff are generally knowledgeable about current and planned bikeways within their MPO jurisdictions.

The Association of Texas Metropolitan Planning Organizations (TEMPO) is a membership association for the 25 Texas MPOs. To disseminate information about the BTTS to MPO staff across Texas, project team staff coordinated with TEMPO staff and TxDOT MPO Coordinators and presented study information at one of TEMPO's quarterly meetings.

3.5.2 Regional Councils

Regional councils or COGs are voluntary organizations of local governmental entities that coordinate programs and services to address needs across jurisdictional boundaries. Texas is divided into 24 regional councils. Unlike MPOs, regional councils are not required to have transportation planning or funding responsibilities and routinely represent rural rather than urbanized areas. Regional council responsibilities range from emergency preparedness strategies and services for the elderly to community and economic development. Regional councils provide

planning, education, and support for rural and small population areas of Texas that do not have MPO representation.

The Texas Association of Regional Councils (TARC) is a statewide association of regional councils which assists local governments across Texas by sharing best practices and education, as well as acting as a representative of regional councils to state elected officials and agencies. Project team staff coordinated with TARC staff to disseminate information about the study to regional council staff across Texas including providing an online presentation on the study. As regional councils do not necessarily have transportation planning staff, TARC assisted in determining the most appropriate staff member(s) to receive solicitations for input.

3.5.3 Wikimap Online Input Tool

The Wikimap Online Input Tool is a customizable, interactive, online map product used to collect geographically specific point and line comments/feedback from regional stakeholders across Texas. From September 5 to 29, 2017, TxDOT District, MPO, and regional council staff were solicited to review and comment on BTTS Conceptual Routes through the Wikimap tool. Specifically, the regional stakeholders were asked to place comment pins or draw routes related to their knowledge of local and regional bicycle infrastructure, transportation plans, transportation needs, and economic development.

Detailed information about regional stakeholder engagement process and the Wikimap Online Input Tool can be found in Section 5 below. Additionally, documentation of all Wikimap comments and project team responses can be found in *Appendix B*.

3.6 BikeTexas and Users

BikeTexas, a statewide non-profit bicycle advocacy organization, promotes and advances bicycle safety, access, and education. BikeTexas membership includes many bicycle shop owners, bicycle advocates, and bicycle groups around Texas. BikeTexas, which has supported bicycle tourism for many years, was among the voices advocating for the 2005 Texas Bicycle Tourism Trails Act (Texas Transportation Code § 201.9025).

In July 2016, BikeTexas reminded the BAC of the 2005 Texas Bicycle Tourism Trails Act in a presentation titled, “Developing Texas Connections to the U.S. Bicycle Route System.” BikeTexas had previously identified cross-state bicycle route recommendations. The project team accepted BikeTexas route recommendations as initial inputs in the route location development process (see Section 5 for additional initial inputs and a detailed process description).

BikeTexas remained active throughout the course of the study, attending all five quarterly BAC meetings, and two meetings with the project team to review their previous efforts and gain a thorough understanding of the behind-the-scenes work occurring over their many years of advocacy. BikeTexas reviewed all study deliverables and fully endorsed them.

BikeTexas is very pleased with the products resulting from TxDOT's Bicycle Tourism Trails Study. Future investments in bicycle infrastructure will encourage economic development in towns and cities across Texas. We look forward to partnering with state and regional partners as we all endeavor to build a future network of bicycle tourism trails across Texas.

- Robin Stallings, Executive Director, BikeTexas

BikeTexas would play a critical role in the promotion and marketing of a future bicycle tourism trail network. This important partnership should be leveraged to communicate with bicyclists, bicycle entrepreneurs, and bicycle groups around Texas.

3.7 Collaborative Approaches to Bicycle Tourism

An investigation of states around the country reveals differing approaches to promoting bikeways and bicycle networks. Some states have begun some level of statewide promotion/marketing of long-distance bicycle tourism.

- One group of states has chosen to focus marketing and infrastructure investments on long-distance or touring bicyclists. These users are routed onto low-volume roadways with limited accommodations and signage. This approach requires little infrastructure investment but aims to attract a narrow spectrum of highly experienced road cyclists.
- Other states focus their marketing and investment on short-distance recreational or weekend bicyclists. Many of the investments may be off-road in state parks or recreational areas and attract mountain bikers, gravel riders, and/or long-distance bicyclists, who don't need facilities.
- A final group of states are not marketing or focusing infrastructure investments on any one type of bicyclist, but instead adopt a multiple user focus. Multiple levels of government (state, regional, and local) aim to promote and invest in bicycling in general. These states offer a variety of accommodations depending on the geographic area and market their facilities based on seasonal or regionally-specific attributes.

3.7.1 Leadership

This study provides an example vision of a statewide network of tourism bikeways and recommendations for the bikeway accommodation types. However, a statewide champion or leader is needed to guide interagency coordination and ultimately designate statewide bicycle tourism trail routes. Other states have had different champions leading the bicycle tourism cause, including:

- Department of Transportation
- Tourism department
- Parks and wildlife department

- Local government/MPO
- Bicycle advocacy groups

TxDOT is poised to be a valuable collaborator in bicycle tourism route promotion and marketing. Tourism departments and statewide bicycle advocacy groups in other states perform central roles in long-distance bicycle tourism promotion. In Texas, a synchronized approach by state agencies will be required to advance bicycle tourism trails. Additionally, a focused marketing effort involving a variety of digital and printed products available from a variety of digital platforms and physical locations is recommended to maximize route promotion. A common practice used in other states is to highlight bicycle amenities/businesses as well as bicycle and cultural events along promoted routes to channel bicycle tourism dollars into rural and small-town economic development.

Engaging state-level stakeholders during this study built trust and developed partners for potential future stages of bicycle tourism trail implementation. Future development of bicycle tourism trails will require further state agency coordination and extensive local stakeholder engagement.

4. Benefits of Bikeways and Trails

Communities across Texas have realized the importance of constructing dedicated bikeways to provide safer means to bicycle, walk, and exercise. The U.S. Department of Transportation (USDOT) supports bikeways and their many benefits. As stated in the USDOT Policy Statement on Bicycle and Pedestrian Accommodation Regulations and Recommendations, "*walking and bicycling foster safer, more livable, family-friendly communities; promote physical activity and health; and reduce vehicle emissions and fuel use.*"[6] Well designed and constructed bikeways benefit the health and safety of users, provide additional transportation options, and support the local economy. Local governments, state Departments of Transportation and bicycle advocates are promoting bicycling as an activity with economic, societal, health, and environmental benefits that contribute to an overall enhanced quality of life.

This section will focus on the general trends and benefits of bicycling infrastructure and bicycle tourism as related to the economic, health, environmental, and transportation benefits of bicycling infrastructure and bicycle tourism identified in academic literature. Quantifying these benefits would be an involved process, requiring data collection, analyses, and detailed modeling which is beyond the scope of this study.

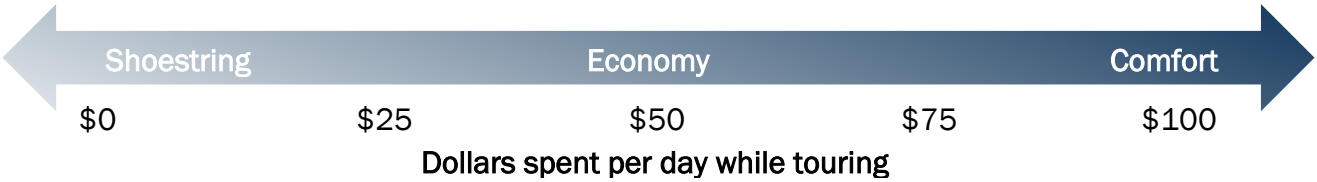
4.1 Economic Benefits

Spending associated with constructing bikeways (which may one day comprise a future Texas Bicycle Tourism Trails network) produces a local economic benefit. Bikeway design, right-of-way acquisition, purchasing materials, and hiring workers to build the bikeways will fuel the local economy. These construction activities along with maintenance activities (for example, sweeping, mowing, repairing cracks, and maintaining light fixtures) make up the project costs and will provide an economic benefit. This section will focus on literature associated with community benefits of existing bicycle tourism trails, including tourism-related spending, bicycle retail and manufacture, and property value impacts.

4.1.1 Bicycle Tourist Spending

The dollars spent by bicyclists can vary depending on the type of trip, trip length, destination, household income, type of accommodations, and whether the trip is guided or non-guided. Bicycle tourist expenditures for multiple day trips might include: sleeping accommodations, meals, gasoline, trail fees, gear purchases, bicycle rental fees, etc. Figure 5 shows how some researchers classify bicycle tourism spending into typologies, which are based on tourists' perceived needs and willingness to spend.[7]

Figure 5: Bicycle Tourism Typology Spectrum



The variability in bicycle tourism-related spending is described herein and summarized in Table 4:

- In Arizona, a survey of bicycle tourists found that the average bicyclist spent as much as $260.01 per day or $638.28 per trip (2012 dollars).8 The Arizona survey amount is nearly double what other research has estimated, but the surveyed bicycle tourists tended to be more affluent and spent much more than the average tourist in Arizona.
- In Canada, a 2014 study by Université du Québec à Montréal's Transat Chair in Tourism in Quebec Province found that bicycle tourists spent an average of $214 per day (US $163) while cycling La Route Verte network. Accommodations and restaurants account for the majority of this amount.9
- In Missouri, bicyclists using the Katy Trail spent an average of $45 per day on trip-related expenses and $56.82 per day on trail-related expenses, for a total average of $101.82 in 2011.[10]
- In Wisconsin, research shows the average bicyclist's expenditure varied dramatically depending on the type of trip. For example, a Wisconsin resident bicyclist using a trail spends $17.99 per day, whereas a bicyclist embarking on a multiday bicycling tour spends $80.84 per day on average.[11] This data is consistent with a 2014 survey of Great Allegheny Passage users (Pittsburgh, Pennsylvania to Cumberland, Maryland) which found that day users spent an average of $18 per day, while overnight bicyclists spent $124.58 per day.[12]

Table 4: Summary of Research: Daily Expenditures by Bicycle Tourists

Average Daily Expenditure 2017 USD[a]	Type of User	Study Area (b)
$90	Multiday bicycle tourists	Wisconsin [13]
$94	Out of state visitors who rode bicycles	Colorado [14]
$78 – 107	Multiday bicycle tourists	Montana [15]
$109	In-state bicyclists	Georgia – Silver Comet Trail [16]
$101	Bicycle tourists, mostly in-state	Missouri – Katy Trail [17]
$124	Out of state bicycle event participants	Minnesota [18]
$127	Cyclists with overnight stay	Pennsylvania, Great Allegheny Passage Trail [19]
$152	Independent bicycle tourists	Oregon [20]
$158	Multiday bicycle tourists on guided tour	Maine [21]
$167	Bicycle tourists	Canada, La Route Verte [22]
$275	Out-of-state bicycle tourists	Arizona: Northern, Central & Phoenix, Tucson and Southern Areas [23]

[a] Daily expenditures were converted to February 2017 dollars using the US Bureau of Labor Statistics CPI Calculator [https://www.bls.gov/data/inflation_calculator.htm].

[b] End notes indicate the specific study reference citation.

*Results from 11 studies reveal that bicycle tourists on average spend **$136 per day** (ranging from $78 to $275 per day).*

4.1.2 Events and Races

Bicycle-related events attract bicyclists, their supporters, and spectators. If and when bikeways are established as part of a future Texas Bicycle Tourism Trail network, additional bicycling events will likely follow. Examples of events and races include the following:

- Events like Tour de Fat, a multicity carnival-like bicycle festival in the U.S. with an organized bicycle ride that attracts thousands of local and regional amateur bicyclists. Races and rides like these can draw people from all over the world. Charitable bicycling events provide an opportunity to combine bicycling, tourism, and fundraising.
- For seven days each summer, bicyclists from all over the world travel to Colorado to Ride the Rockies. The route changes each year to highlight different parts of the state. Bicyclists camp or stay in local hotels along the way.

- Gran Fondo in Europe is an exclusive long-distance, one-day bicycling event that draws a variety of ages and skill levels, and gives prizes for bicyclists from different age groups. Bicycle races include road, mountain, cyclo-cross, track (velodrome), bicycle motocross (BMX), and triathlons.
- The Hotter 'n Hell Hundred, which takes place in Wichita Falls, Texas each summer, regularly brings in over 10,000 registrants.[24]

The amount of money spent by bicycle tourists participating in events or races varies. An online survey of non-local participants in 26 bicycling events in Minnesota found that an average bicycle event visitor spent a total of $121 per day in 2015.[25] In addition to event attendees and race participants, spectators supporting participants also contribute to the local economy.

An online survey of non-local participants in 26 bicycling events in Minnesota found that an average bicycle event visitor spent a total of $121 per day in 2015. [26]

4.1.3 Bicycle-related Manufacturing and Retail Expenditures

Sales of bicycles and accessories support the bicycling industry from small bicycle shops to large national retailers across Texas. Dollars spent on bicycles, apparel, mechanical equipment, and repairs are re-spent in the local economy, which creates a ripple effect, as successive spending occurs.

While there are currently no large bicycle manufacturers in Texas, there are a number of small, craft bicycle manufacturers across Texas that offer a variety of unique and custom bicycles. More detailed economic analysis featuring multiple data sets that describe observed local and regional consumer spending practices across many economic sectors would be necessary to adequately estimate the economic impact of bicycle-related manufacturing and retail expenditures in Texas.

4.1.4 Property Values

Being near or adjacent to a bikeway can be attractive to many home buyers and tenants. Previously, as bikeways were developed, many properties with access to the local bikeway network have realized increased property values. While some sources use the term "multi-use trails" or "trails," TxDOT-PTN generally prefers the term "shared use path" (used by American Association of State Highway Transportation Officials [AASHTO] and the *Manual on Uniform Traffic Control Devices* [MUTCD]).

- The National Association of Realtors & National Association of Home Builders documented in their "Consumer's Survey on Smart Choices for Home Buyers," publication that 36 percent of 2,000 home buyers designated multi-use trails as either an "important" or "very important" community amenity. Having access to a walking and bicycling path outranked 16 other options, including security, parks, and access to shopping or business centers.[27]

- Studies in Denver, Seattle, Minnesota, and other communities across the country have consistently found that proximity to trails increases the value of homes from 1 to 6.5 percent.[28]
- In a study in Bexar County, Texas (where San Antonio is located), homes near or abutting trails saw a 2 percent house price premium.[29]
- A study of property values near multi-use paths in the state of Delaware found that properties within 50 meters of a bicycle path sold for an average of $8,800 more than other similar homes.[30]

Despite much data indicating that bikeways have a positive correlation with increased property values, proper community engagement (including local government, advocates, and residents) is necessary to gain support and successfully implement bikeways.

Studies in Denver, Seattle, Minnesota, and other communities across the country have consistently found that proximity to trails increases the value of homes from 1 to 6.5 percent.[27]

4.1.5 Bike Share/Bike Rental

Description

Bicycle rentals have been popular for decades. Throughout the world, bicycle rental companies have thrived by providing bicycle rental opportunities near popular trails. Bike share programs, a new model of bicycle rentals, offer easy access to bicycles for many types of users. Bike share programs generally use kiosks to dock bicycles in accessible locations that allow users to pay to use a bicycle for a limited period of time and then return it to another kiosk in the system. Some bike share programs no longer use kiosks, but rely on mobile applications to locate and rent a bicycle. Bike share programs have become increasingly popular over the last 10 years. These programs flourish in urban environments where bicycles will be rented by a number of people for short periods of time.

Details

- Most bike share programs are designed for shorter trips, point-to-point transportation, and/or as an extension of the public transit network. On average, bike share trips last 12 minutes for system members and 25 minutes for casual users.
- Typically, bike share programs anticipate frequent turnaround use of bicycles in high-use areas, and the fees for use increase after 30 minutes. This fee structure is not generally beneficial to long-distance bicycle tourists, who would be better served by bicycle rental operators; however, bike share might be a viable option for sightseeing in urban settings, where destinations may be in close proximity.

- Additionally, the bicycles used in most bike share programs have sturdy, hybrid bicycle designs that have adjustable seating, baskets, lighting, and mud guards. This type of bicycle may not be preferable for longer trips due to their size and weight. As a result, bike share systems have become a popular alternative mode of transportation for tourists visiting points of interest in urban areas.[31]

Popularity

According to the National Association of City Transportation Officials (NACTO), bike share programs have grown from 4 systems in 2010 to more than 55 systems in 2016. As of August 2017, there are bike share operations in at least 15 Texas cities. For example, San Antonio's Bcycle program provides bike share access along the Mission Trail and has at least 16 Bcycle stations along the trail. Users can dock their bicycles, access various Spanish colonial missions and transit or parking facilities, then continue exploring.

4.2 Health Benefits

In addition to the economic benefits of developing a bicycle tourism trail network, there are numerous health benefits for those that use the trail. The World Health Organization (WHO) defines health as "a state of complete physical, mental and social well-being and not merely the absence of disease."[32]

4.2.1 General Physical Health Benefits of Bicycling

WHO and the Center for Disease Control (CDC) recommend a minimum of 150 minutes of physical activity like bicycling per week.[33] The National Park Service (NPS) and CDC in the *Parks, Trails and Health Workbook* note[34] that trails and parks can deliver the following health benefits:

- Provide opportunities to practice healthy lifestyles
- Create destinations and venues for physical activity
- Reduce stress and improve mental wellness
- Foster community interaction and social support networks
- Provide beneficial, low impact use of sensitive areas, reducing injury and property loss that could occur if the land was used for other functions
- Reduce air and water pollution
- Mitigate urban heat islands
- Preserve important habitat, environmental and cultural sites

Active transportation also supports and benefits mental health. Spending time exercising in nature has been reported to reduce stress[35], improve attention[36], and positively impact mental restoration and coping with attention deficits.[37] Active commuting is inversely associated with high body mass index (BMI), obesity, triglyceride levels, blood pressure, and insulin levels[38]. Additionally, natural

light is known for its therapeutic effects and research suggests being outdoors can have positive effects on everything from stress to attention disorders, to rates of healing to social cohesion, as well as, lower crime rates.[39] [40]

4.2.2 Physical Health Concerns Associated with Bicycling

As previously mentioned, individuals can realize a variety of physical health benefits from bicycling for physical activity; however, studies have analyzed detrimental impacts to physical health associated with bicycling including the following:

- Some individuals may have concerns over inhaling more air pollutants while bicycling because of the increased breathing rates. Studies have shown that inhalation rates of air-born particulates and elemental carbon are higher for bicyclists; however, this is highly dependent on travel routes, land use density, and trip duration.[41]
- As compared to traveling in a car, the risks of being involved in traffic collisions, and the severity of such collisions, may increase for bicyclists. Indeed, the National Highway Traffic Safety Administration (NHTSA) reported 818 bicyclist fatalities and 45,000 bicyclist injuries in 2015 in the U.S. resulting from motor vehicle-bicycle crashes, accounting for 5 percent and 2.3 percent increases respectively over the previous 10 years.[42]
- After quantifying physical health benefits and costs for urban commuting in a car versus bicycle, researchers writing in *Environmental Health Perspectives* found that on average, the estimated health benefits of cycling were substantially larger than the risks relative to car driving. Researchers measured benefits and costs as mortality impacts in life-years gained or lost. These researchers found that the increased physical activity benefits of bicycling were nine times larger than the risks of bicycling, including exposure to increased air pollutants and increase in traffic collisions.[43]

*Researchers found that the increased physical activity **benefits of bicycling were nine times larger than the risks** of increased air pollutants and increase in traffic collisions.*

4.2.3 Benefits of Living in Proximity to Bicycle and Pedestrian Accommodations

Regular physical activity lowers the risk of chronic diseases and is an important strategy for reversing the obesity epidemic.[44] Meanwhile, physical inactivity leads to negative health outcomes, alarming obesity rates, and other life-threatening diseases.[45] Increasing the likelihood or opportunities for individuals to maintain an active lifestyle can lead to positive public health outcomes. Constructing bikeway infrastructure has been shown to increase bicycling and encourage physical activity.

- People who live near shared use paths are 50 percent more likely to meet physical activity guidelines and 73 to 80 percent more likely to bicycle.[46]

- A national survey of 3,700 U.S. adults found that 43 percent of regularly active adults reported using a shared use path at least once a week, whereas only 22 percent of irregularly active and 4 percent of inactive adults reported using shared use paths as often.[47]

4.2.4 Public Health Benefits and Opportunities

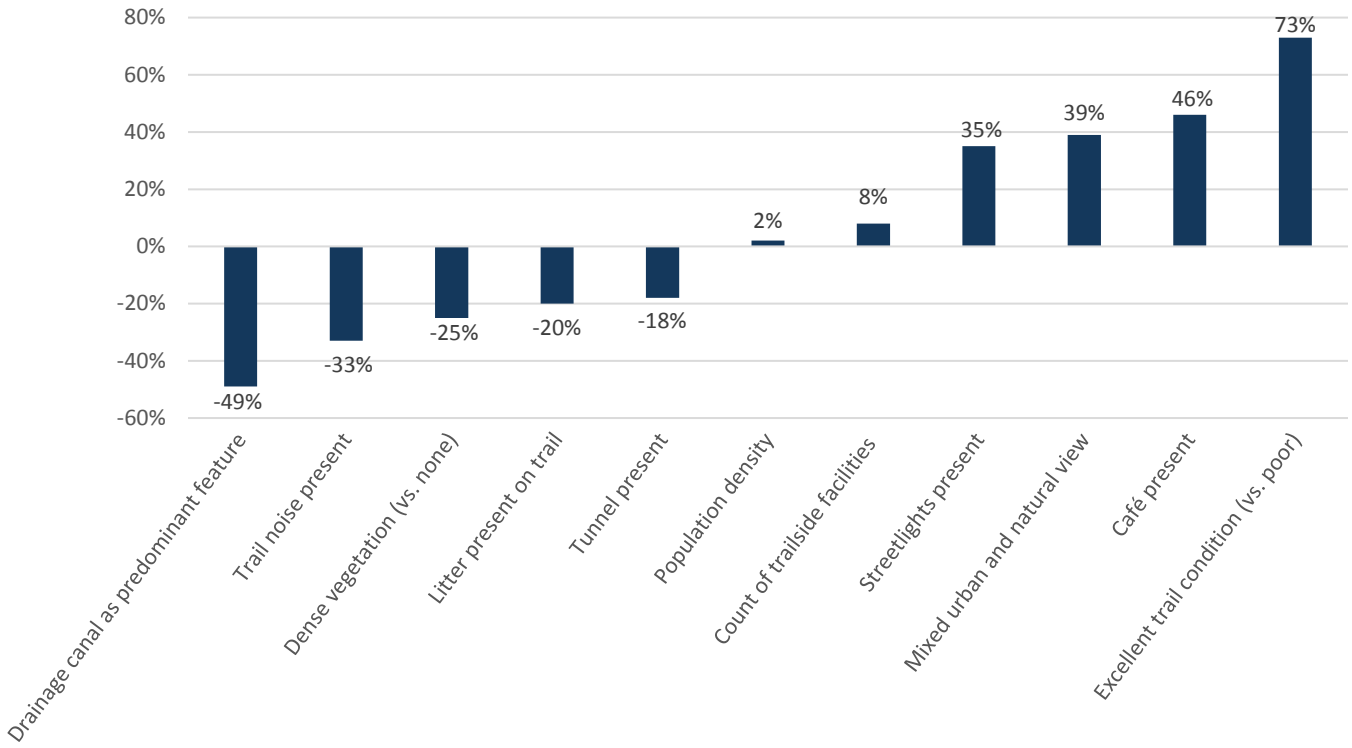
The CDC reports that only 21 percent of American adults get the recommended level of physical activity.[48] From 2011 to 2014, 17 percent of youth and 36.5 percent of adults were classified as obese, which is defined as having a BMI greater than or equal to 30[49]. Collectively, the physical health benefits from bicycling activities can lead to significant societal benefits and contribute to reversing these negative and expensive national trends.

- Using data from the National Medical Expenditure Survey, one study in Nebraska found that for every $1 spent on trails, there was a $2.94 savings in direct medical costs from a societal perspective.[50]
- One of the ways local administrators can measure the health benefits of walking and bicycling in their communities is to start with a community health profile that includes health statistics and demographic data on potential users. Community health profiles can help local communities identify baseline health data, measure benefits, and assist planners with constructing accessible walking and bicycling accommodations. As the Texas Bicycle Tourism Trail network is developed, local project sponsors can use community health profiles to measure the overall benefits of the trail to the community and state, identify more public health benefits of bikeway construction, and make even more compelling arguments for further implementation.

4.2.5 Trail Amenities and Usage

Not all trails are equally desirable to users. In one study examining shared use path usage in Chicago, Los Angeles, and Dallas, researchers found that shared use paths with well-maintained surface condition, mixed and urban views, lighting, and trailside amenities have higher rates of usage (Figure 6). Meanwhile, shared use paths with litter and excess noise were associated with lower rates of use.[51]

Figure 6: Chances in Trail Use Based on Amenities



4.3 Environmental Benefits

The environmental benefits of constructing bikeways or implementing a tourism trail network segment will vary depending on the location, type of bikeway constructed and level of use. Overall, research shows that spending time in nature strengthens interest in environmental stewardship.[52]

Many researchers have claimed that increasing the number of trips made by bicycle can improve air quality and reduce air pollution emissions on local roadways. Motor vehicle emissions currently constitute 27 percent of greenhouse gas emissions in the U.S.[53] If motor vehicle trips are replaced by bicycle trips, there could be air quality benefits (by reductions in motor vehicle emissions). However, significant air quality benefits may only be seen when a substantial proportion of travelers shift from using cars to bicycles. For instance, one such analysis of 11 Midwestern U.S. cities estimated that particulate concentrations would decrease by 1 to 2 percent and levels of nitrogen oxides (NO_x) would decrease by 5 to 12 percent. Particulate concentrations are air pollutants with a diameter of 2.5 micrometers or less, small enough to invade even the smallest airways. In that analysis, these changes would result in 608 fewer deaths annually because of improved air quality across the 11 cities. However, these air quality benefits could result if 50 percent of short trips (under 5 miles in length) during the summer months were taken by bicycle instead of car.[54] Since most Texas cities have less than 1 percent bicycle commuters and a small portion of all trips occur on bicycles, these air quality benefits would be challenging to achieve.

Increasing the number of trips made by bicycle can reduce emissions and improve air quality on local roadways.

With proper planning and design, shared use paths can provide a "buffer" space between the built and natural environments and contribute to reduced pollution run-off and improved water quality. However, without proper planning and design, shared use paths can destroy habitat, create hazards to wildlife, and degrade water and air resources. Thoughtfully designed shared use paths can attract a wide variety of users that would both benefit and enjoy the natural environment and exceptional landscapes in Texas.

4.4 Transportation/Travel Benefits

Expanding the bikeway network can improve transit access and reduce traffic congestion across the state, which would improve overall quality of life for residents and users.

- Congestion Reduction: Although bicycles have a lower top speed than motor vehicles, the capacity for bicycle accommodations to move people is far higher than motor vehicle lanes. Their small size makes bicycles efficient users of space. Additionally, bicycles require about one tenth of the storage space at either end of a journey, which frees land for other uses besides vehicle storage. Indeed, one study, in Washington DC, showed a causal relationship between increased bicycle infrastructure (specifically increasing the availability of bike share stations) and reduced traffic congestion.[55] Another study, in New York City, that investigated the traffic effects resulting from construction of a variety of protected bicycle lanes along several heavily trafficked corridors found that average motor vehicle travel times throughout the day were either unchanged or fell as much as 35 percent at parts of the day. Additionally, travel speeds remained steady throughout the project area.[56]
- Bicycles Complement Transit Access: In many cases, well-integrated bikeways will become valuable transportation assets for local residents to access their communities. The expansion of bicycle networks will likely encourage additional trips by both bicycle and public transportation. A bicycle user can cover around 4 times the distance of a pedestrian in the same time. This mobility advantage can lead to significant efficiencies when paired with transit. The accessible distance of a train station is doubled, which significantly increases the number of people who can comfortably access transit without a car. In this way, effectively integrating bicycling and walking with public transportation can lead to reducing the necessity of parking and feeder bus services and increase use of public transportation in general.[57] For congested bus and train transit networks, bike share programs and construction of bikeway infrastructure have the potential to alleviate transit congestion by increasing bicycle mode share.[58]
- Bikeways for All Ages and Abilities: Bikeways that provide additional horizontal space or vertical barriers between motor vehicle travel lanes and bicycle travel lanes increase

bicyclist safety. One Montreal study found that cycle tracks[1], as compared to bicycling in the street, attract a larger number of bicyclists and significantly lessen injury and collision rates.[59] Another study analysed collisions involving bicycles with motor vehicles in two cities (Toronto and Vancouver, Canada) over the course of one year and the study revealed that a variety of dedicated bicycle infrastructure reduced bicyclist injury risk. As compared to bicycling with motor vehicle traffic, the researchers found that incidence of injury to bicyclist on cycle tracks was 90 percent lower, on bicycle lanes was 40 to 50 percent lower, and on paved shared use paths was 20 percent lower.[60] Off-street shared use path conflict points and visibility concerns may explain the relatively lower percentage associated with that bikeway type. See more about shared use path bikeway design criteria in Section 8 below.

- Usage Increases Visibility and Investment: If bikeways are well integrated within a community's existing network and attract additional bicyclists, then the bikeway receives positive attention and greater visibility. Increased attention can help improve safety by creating a more compelling case for regular maintenance and can stimulate investment in supporting amenities (such as bathrooms, benches, lighting, and parking).

4.5 Preservation of Historic and Cultural Features

Throughout Texas, bicycle tourism trails can help highlight and provide access to historic and cultural resources. Some trails, such as those in historic rail corridors, have helped to preserve historically significant elements along transportation corridors. For example, the Katy Trail in Missouri follows a portion of Captain Meriwether Lewis and William Clark's expedition across the U.S. Visitors to the Katy Trail can trace the steps of these early American explorers while taking in scenic views.

One of the best ways to explore the San Antonio Missions is by accessing the shared use paths that follow the river between the missions. Users can walk, run, or bicycle on the shared use paths that run between the missions and provide a unique view of the area that cannot be seen from the road. When bicyclists take the shared use path to explore the river they get a better sense of what it was like for early settlers and Native Americans that lived in the area. Shared use paths can link bicyclists to a shared past which helps to enhance cultural awareness and establish a community's identity.[61]

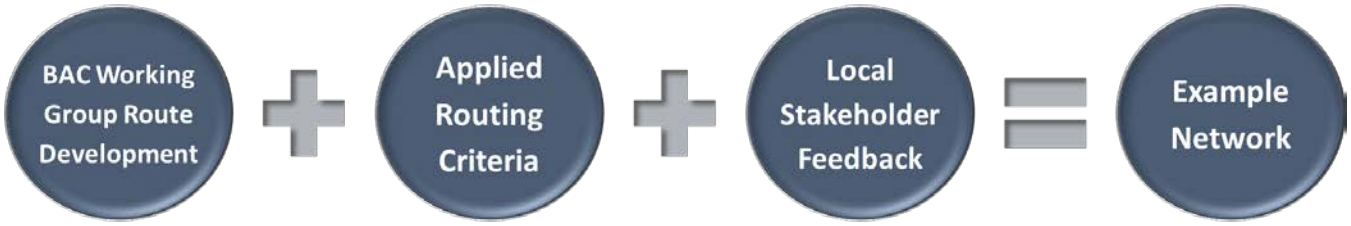
Trails can link bicyclists to a shared past which helps to enhance cultural awareness and establish a community's identity

[1] Cycle tracks are on-street bike lanes physically separated from traffic that feature either one-way or two-way traffic.

5. Development of the Example Network Routes

The following section documents the process used to develop the Example Network and focuses on the critical role played by TxDOT's BAC members and the BAC Working Group created to help steer TxDOT's Bicycle Tourism Trails Study. Interaction with the Working Group was critical to the development of a transparent, data-driven process for identifying proposed route locations. Using an iterative process, the project team sought monthly approval and/or direction from the Working Group on various interim products throughout project development. Figure 7 provides a simplified diagram of the route development process.

Figure 7: Route Development Methodology Diagram



5.1 Preliminary Route Development

Once the BAC and project team agreed on the goals and objectives of the BTTS, the project team started the route location development process. At the April 10, 2017 Working Group meeting, the project team asked the Working Group members to draw their ideal route locations on statewide and regional maps of Texas. The maps featured the following data layers:

- National and state parks, forests, grasslands, etc.
- Cities
- National, state, and local roadways
- Railways
- Existing, funded, and planned bikeway infrastructure (known at that point in the study)
- State park trails
- Potential U.S. Bicycle Route System (USBRS) corridors through Texas
- U.S. Fish and Wildlife Service, National Park Service, and historic trails
- Previously proposed bicycle tourism trail routes from BikeTexas (including "Railtrails," Rail with Trail, off-street, and on-street accommodations)

Trails Reviewed as Part of Study

- Camino Real
- Chisholm Trail
- Conceptual USBRS 55, 66, 84, and 90
- Mission Trail
- MS 150 Route
- Northeast Texas Trail
- Old Texas 20
- Palo Alto Battlefield
- Route 66
- Texas Heritage Trails

During the April 2017 BAC Working Group meeting, members marked cultural and recreational bicycling destinations, drew connections between urban areas, and identified known bicycle routes on statewide and regional Texas maps. Figures 8, 9, and 10 represent routes drawn by Working Group members. Members provided perspectives on existing conditions and popular recreational routes in their home regions. The Working Group recommended a “spine and spur” network type, featuring a few cross-state spine routes forming the backbone of a potential future Texas bicycle tourism network with routes connecting key destinations around the state.

Figure 8: Working Group Feedback Drawn on a Texas Statewide Map

The project team transferred the lines drawn by the Working Group into a digital Geographic Information Systems (GIS) format (Figure 11). This initial GIS linework was adjusted to follow existing and funded bikeways in urban areas around Texas. Meanwhile, in rural areas between urbanized portions of the state, this initial GIS linework followed state-maintained and local roadways. After the April 2017 meeting, the project team requested GIS data from several major urban areas around the state and began collecting municipal and regional bicycle and transportation plans from around Texas

.

Figure 9: Working Group Feedback Drawn on an East Texas Regional Map

Figure 10: Working Group Feedback Drawn on a Dallas/Fort Worth Regional Map

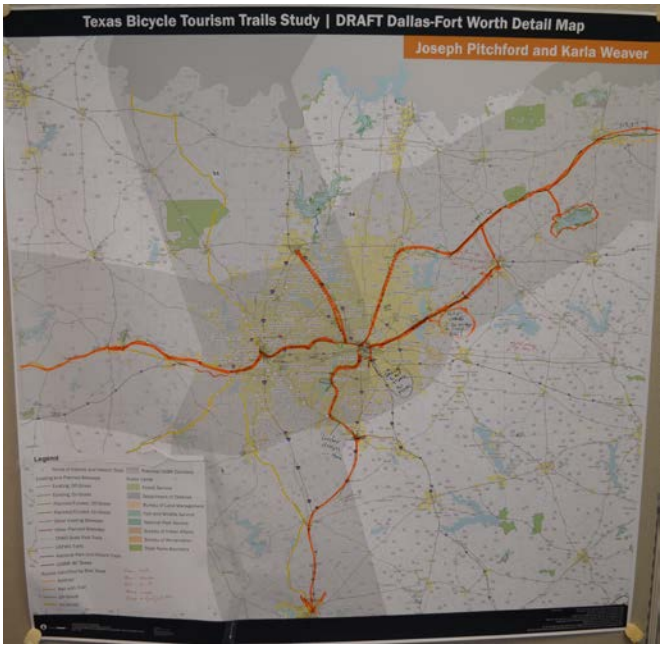
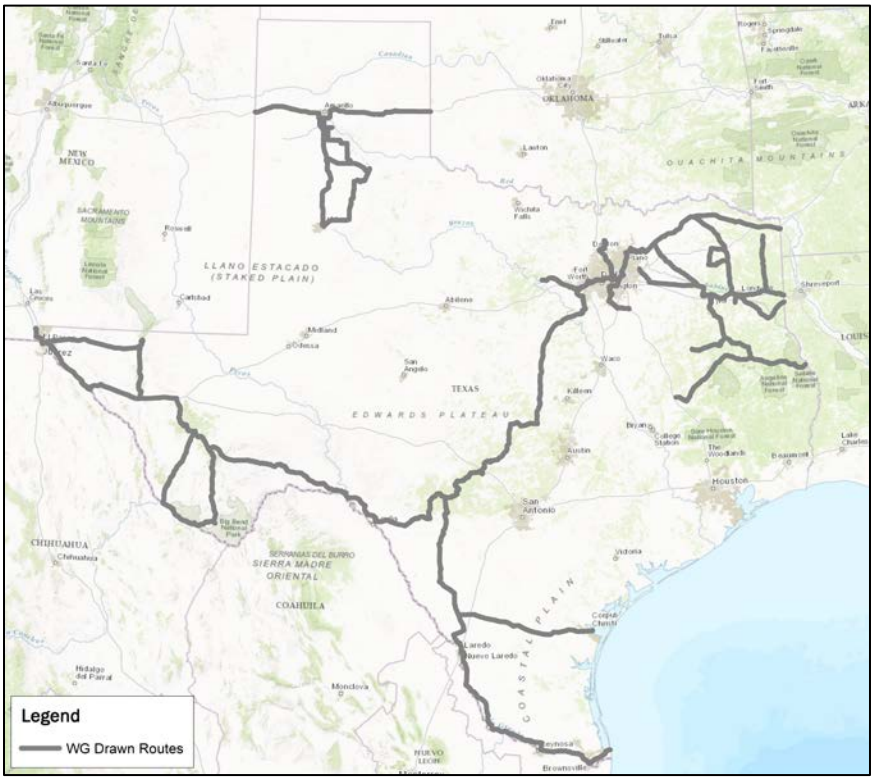


Figure 11: Routes Drawn by Working Group – April 10, 2017



Also during the April 10, 2017 BAC Working Group meeting, the project team asked members to prioritize bikeway routing criteria tailored to the Texas local context. Each of the members were given 10 dots to place next to their preferred routing criteria. Afterwards, the dots were totaled. Table 5 summarizes the results of this routing criteria prioritization exercise.

Table 5: Working Group's Criteria Prioritization Exercise Results

The routes for Bicycle Tourism Trails should...		
Criteria Group	Dots	Routing Criteria
A	9	Use existing and proposed off-road shared use paths (including rails to trails and greenways where available)
	8	Connect to national and state parks
B	5	Focus on two or three cross-state "spine" routes and anticipate complementary "spoke" routes
	4	Use rural area roads with low vehicle volume (preferably carrying fewer than 2,000 vehicles per day)
	4	Use rural area roads with shoulders minimum 8 feet wide
	4	Use available rights-of-way within transmission line corridors, where possible
	4	Establish regional loops of interest focused on culture/geography/points of interest
C	3	Use available rights-of-way within rail corridors, where possible
	3	Use corridors that highlight natural geography, unique scenery, and/or distinctive terrain
	3	Have cell phone reception availability
	2	Avoid truck routes
	2	Use TxDOT's road network (U.S. and state highways, FM roads, etc.)
	2	Be rural in nature. Where convenient, the route should pass near, but generally not through, large centers of population.
	2	Have bicycle services (food, water, shelter, etc.) every 40 to 60 miles
	1	Use corridors that highlight cultural or historic paths and points of interest
	1	Be more or less evenly distributed north-south and east-west
	1	Establish long-distance pathways focused on connecting destinations

Table 5: Working Group's Criteria Prioritization Exercise Results

The routes for Bicycle Tourism Trails should...		
Criteria Group	Dots	Routing Criteria
D		Use rural area roads with shoulders minimum 6 feet wide
		Use rural area roads with shoulders minimum 4 feet wide
		Avoid roads with steep or sustained sloping grades on hills
		Connect top 10 most populous metro areas in Texas
		Follow reasonably direct paths in rural areas to connect major cities and/or attractions
		Connect to annual bicycle events
		Connect to small town "Main Street programs"
		Connect to Texas Heritage Trails signed vehicular routes

Criteria Group Definitions:
A = Full Agreement
B = At least half agree
C = Minority agrees
D =Not a priority

5.1.1 Qualitative Routing Criteria

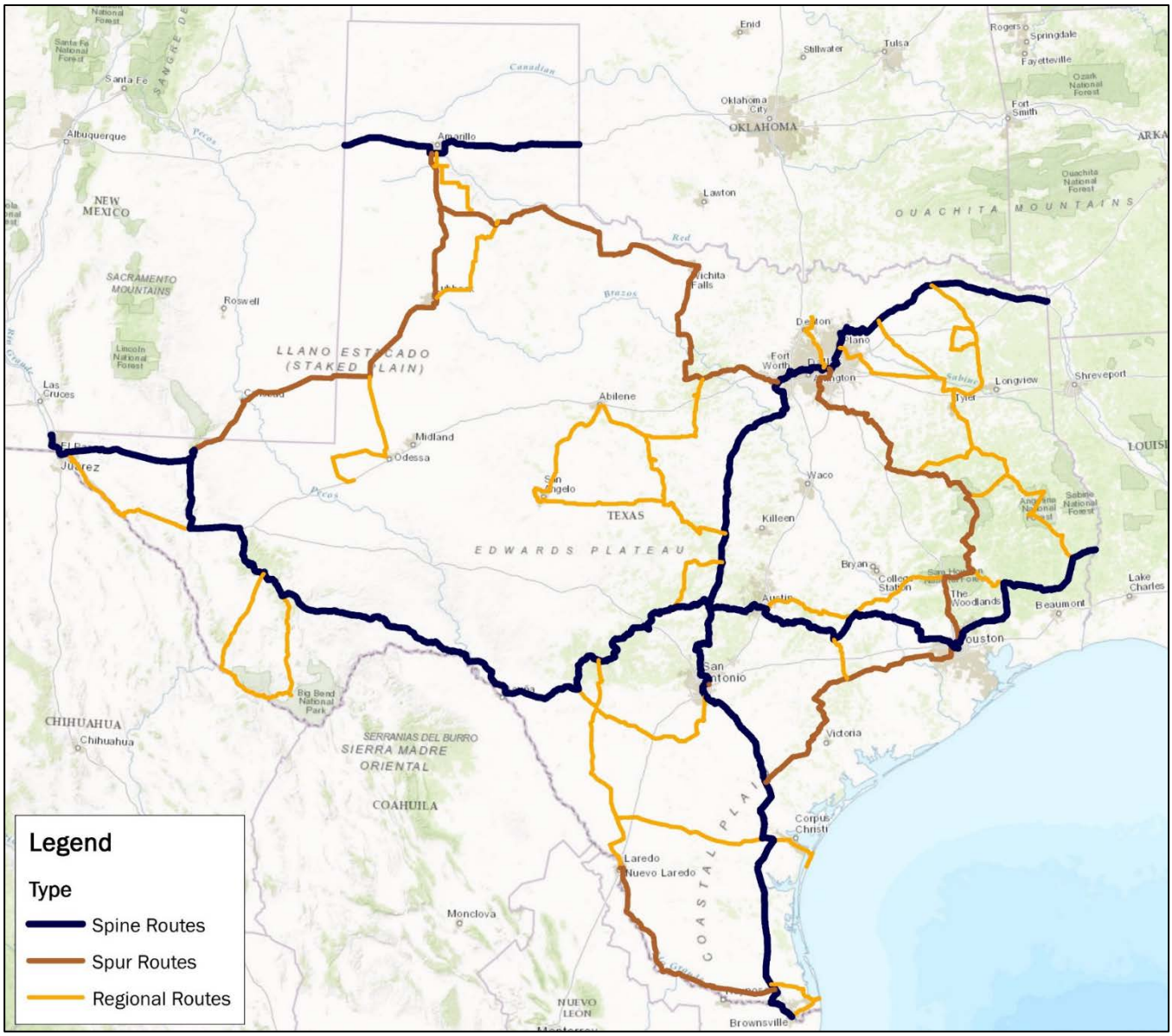
The project team began investigating route decision-making by assembling a list of routing criteria from long distance bikeway/trail planning efforts in other states/regions as well as best practices for national bicycle routes. These sources for corridor identification and routing criteria included:

- Corridor and Route Criteria for the United States Bicycle Route System (USBRS), created by the AASHTO Task Force for Numbered Bicycle Routes[62]
- Adventure Cycling Association Route Selection Philosophy[63]
- East Coast Greenway Route Selection Guidelines[64]
- Criteria for Establishment of U.S. Bicycle Routes in Florida[65]

The project team began to locate bicycle tourism trails based on the priorities identified during the routing criteria prioritization exercise. As additional bicycle plans and GIS data were provided or identified by local jurisdictions and Metropolitan Planning Organizations (MPOs), the project team

expanded the network. Between April and July, Working Group members provided feedback and enhancements to the routing locations during monthly meetings. By the time of the July 17, 2017 BAC meeting, route locations were identified as Preliminary Routes to reflect these Working Group and project team refinements (Figure 12).

Figure 12: BTTS Preliminary Routes – July 17, 2017



5.1.2 Quantitative Routing Criteria

While the Preliminary Routes proposed a statewide network of trails connecting state/national parks, existing shared use paths, and other bicycle destinations, a question remained: Do *Preliminary Routes* match preferences of bicycle tourists? After the Working Group prioritized route location criteria during the April 2017 meeting, the project team began to identify potential metrics associated with location criteria and any available GIS data that could help quantify those criteria. Establishing metrics allowed the project team members to more confidently select routes that reflect bicycle tourist routing preferences. Specifically, the project team could apply data-driven modifications to Preliminary Routes as described below.

TxDOT's Transportation Planning and Programming Division (TPP) maintains GIS datasets that represent the most current and broadest geographic expanse of data available for TxDOT-maintained roadways. The project team used TxDOT's Roadway Inventory (RHINO) GIS file[66], which includes roadway dimensions (such as shoulder widths, number of lanes, divided or undivided) and usage information (speed, motor vehicle volume, truck volume). For more information on the data sources used during the routing process, please see *Appendix A.*

Table 6 identifies the qualitative and quantitative criteria identified by the Working Group and project team. This table also lists the metric, where available, which was identified to guide routing decisions. Several qualitative metrics identified as "subjective routing guidance" were used to expand Preliminary Routes across Texas. Meanwhile, the remaining metrics identified in Table 6 helped the project team modify the Preliminary Routes to better approach bicycle tourist routing preferences.

Table 6: Route Location Criteria and Metrics

Criteria Category	Criteria	Metric
Quantitative Criteria (data-driven route location guidance)	Use roads with wide shoulders, where possible	Outside shoulder width
	Use low volume roads, where possible	Daily vehicles per outside lane
	Avoid truck routes, where possible	Daily trucks per outside lane
	Use lower speed roadways, where possible	Speed limit
Qualitative Criteria (largely subjective, case-by-case route location guidance)	Connect to national and state parks	Subjective routing guidance
	Use existing and proposed off-road shared use paths	"Facility length"/"distance-away" ratio is greater than 1
	Have bicycle services and amenities (food, water, shelter, cell phone reception, etc.) every 40 to 60 miles	Route through towns with populations at least 500 persons every 40 miles
	"Spine and spur" network	Subjective routing guidance
	Use corridors that highlight natural geography, unique scenery, and/or distinctive terrain	Subjective routing guidance
	Establish regional loops/routes of interest	Subjective routing guidance
	Be rural/scenic in nature	Subjective routing guidance
	Use corridors that highlight cultural or historic paths and points of interest	Subjective routing guidance
	Use available rights-of-way within rail corridors, where possible	Subjective routing guidance
	Use available rights-of-way within transmission line corridors, where possible	Subjective routing guidance

The roadway dimension and usage data available in TxDOT-TPP's RHINO GIS file were used to rank all the Texas roads according to the metrics listed in Table 7. However, only the roadways with the available quantitative data (shoulder width, average daily traffic volume, speed limit, and percent heavy trucks) were analyzed and ranked. Roadways with the available quantitative data were largely TxDOT-maintained and totaled 59,537 miles, or 19 percent, of all roadway miles in Texas. More detailed route location identification processes in the future may require additional roadway dimension and usage data from local or regional partners. While these additional datasets may be available from municipalities and MPOs across Texas, the TxDOT-TPP RHINO GIS data were determined to provide the most appropriate data for the scope of this initial statewide study.

For the initial roadway analysis, metric groups were determined based on the following:

- Research of bicycle facility selection and routing practices in other U.S. states and cities.

- AASHTO's Guide for the Development of Bicycle Facilities (2012)[67]
- Federal Highway Administration's Small Town and Rural Multimodal Networks (2016)[68]

Table 7: Detailed Quantitative Criteria Metrics

Routing Criteria Name	Metrics		Score	Measure	Weight
	Data Grouping	Metric			
Lower speed roadways	Poor	55+ mph	2	Speed Limit	5
	Acceptable	35–55 mph	4		
	Good	<35 mph	8		
Lower volume roadways	Poor	5,000+ vehicles/lane	2	$\frac{Volume\ of\ daily\ vehicles}{Number\ of\ lanes}$	2.5
	Acceptable	1,000–5,000 vehicles/lane	4		
	Good	< 5,000 vehicles/lane	8		
Avoidance of truck routes	Poor	1,000+ trucks/lane	2	$\frac{Volume\ of\ daily\ heavy\ vehicles}{Number\ of\ lanes}$	2.5
	Acceptable	100–1,000 trucks/lane	4		
	Good	<100 trucks/lane	8		
Roadways with wider shoulders	Poor	0–5 feet wide	2	Outside Shoulder Width	2.5
	Acceptable	6–7 feet wide	4		
	Good	8 feet wide or wider	8		

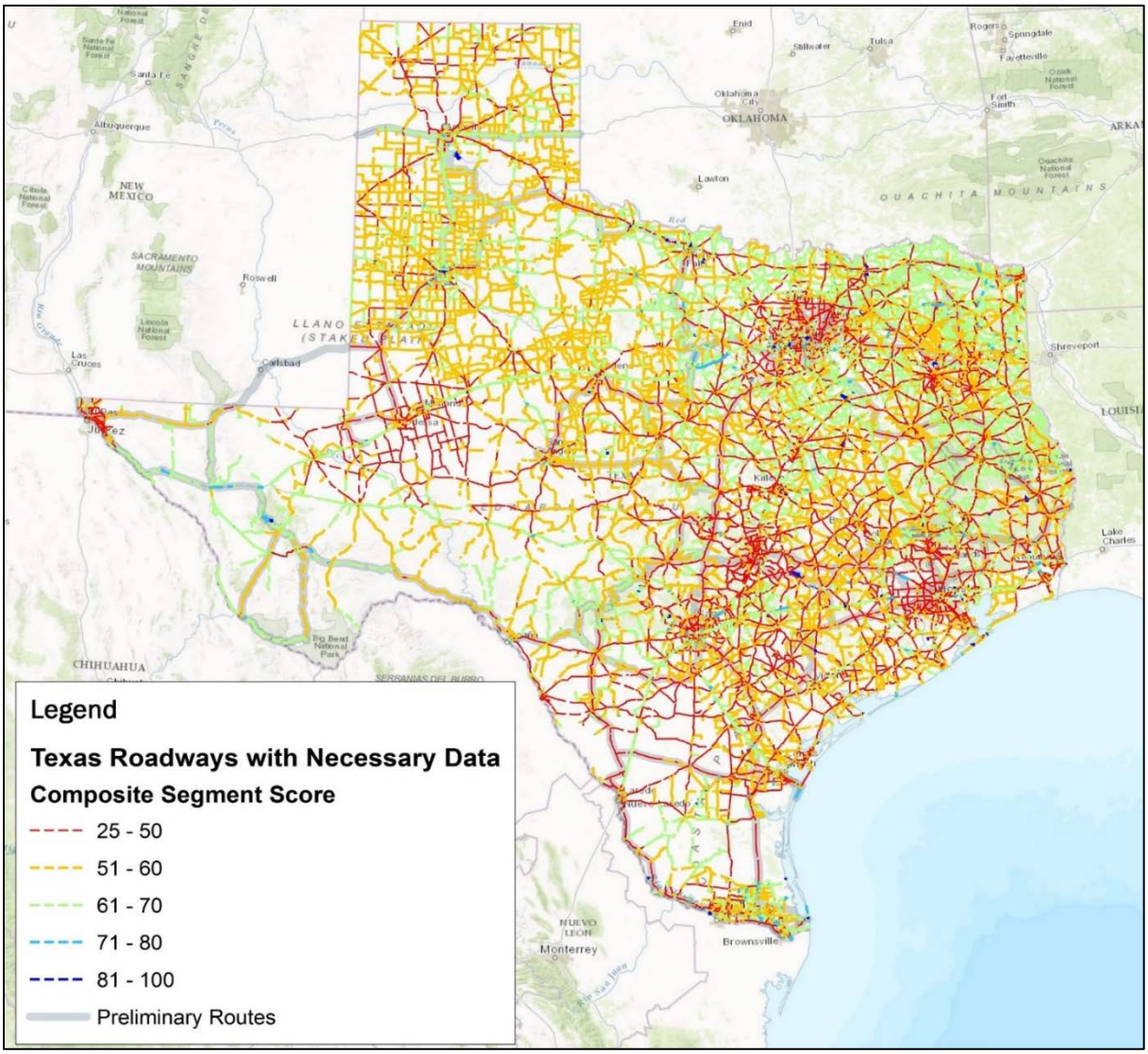
Table 8 provides an example composite score calculation for a 2-lane, 2.5-mile-long segment of SH 70 in the Childress District (SH0070, Control Section 0310-01).

Table 8: Example Calculation for Composite Segment Score

Routing Criteria Name	Measure	Example Roadway Data	Score	Weight	Weighted Score
Lower speed roadways	Speed Limit	75	2	5	10
Lower volume roadways	$\frac{Volume\ of\ daily\ vehicles}{Number\ of\ lanes}$	395	8	2.5	20
Avoidance of truck routes	$\frac{Volume\ of\ daily\ heavy\ vehicles}{Number\ of\ lanes}$	75	8	2.5	20
Roadways with wider shoulders	Outside Shoulder Width	8	8	2.5	20
				Composite Segment Score	**70**

GIS Python coding was developed to calculate a composite segment score for each of the 85,000-plus roadway segments with the quantitative data necessary to complete composite segment score calculations. This Python coding automated the segment scoring process by assigning scores and weights based on the measure as seen in the example segment in Table 8. The relevant data for each segment was grouped and scored. Subsequently, each criterion score was multiplied by the weight, then all weighted scores were added together to obtain a composite score. The result of this process created a score similar to a Bicycle Level of Service score for the segments analyzed. Figure 13 represents the results of this analysis geographically with the composite segment scores grouped into five color-coded categories. Figure 14 presents the statistical distribution of these composite segment scores.

Figure 13: Composite Segment Scores Applied Statewide



The project team used the established study criteria metrics to modify the Preliminary Routes. Specifically, the project team considered modifying a Preliminary Route under the following conditions:

- An existing or planned shared use path was near a Preliminary Route
- A composite segment score for an adjacent, parallel, or nearby (within 10 miles) segment was higher than the Preliminary Route segment
- A higher scoring route allowed routing nearer to a national/state park
- A higher scoring route provided a distance between bicycle services and amenities (food, water, shelter, cell phone reception, etc.) that was less than 40 miles. The project team approximated these services and amenities by assuming these would be available in towns with populations of at least 500 people for every 40 miles.

Figure 14: Composite Segment Score Distributions

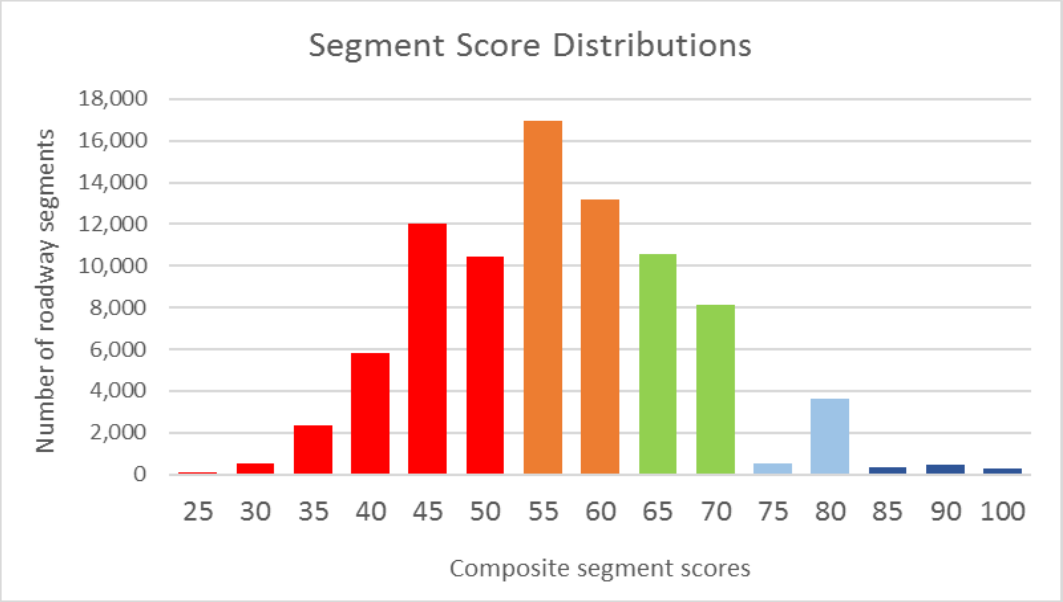
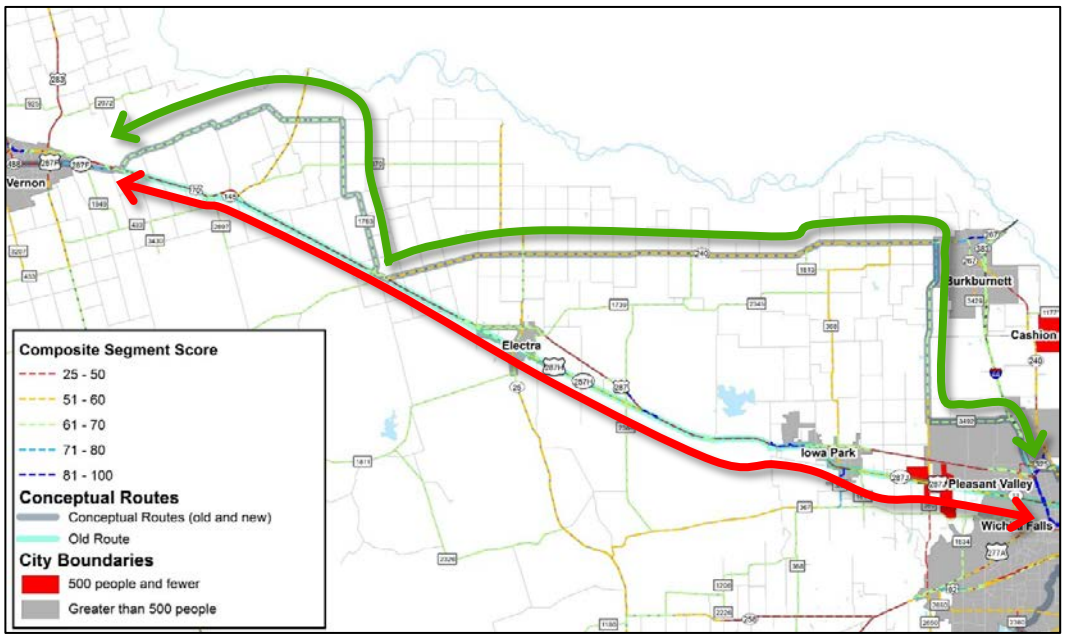


Figure 15 below provides an example of modifications to the Preliminary Routes. In this section of US 287 between Vernon and Wichita Falls, a Preliminary Route was originally drawn along US 287 (red), but composite segment scores on nearby roadways generally paralleling US 287 indicated adjacent, lower volume, lower speed state-maintained roadways that would be more bicycle-tourist-friendly (green).

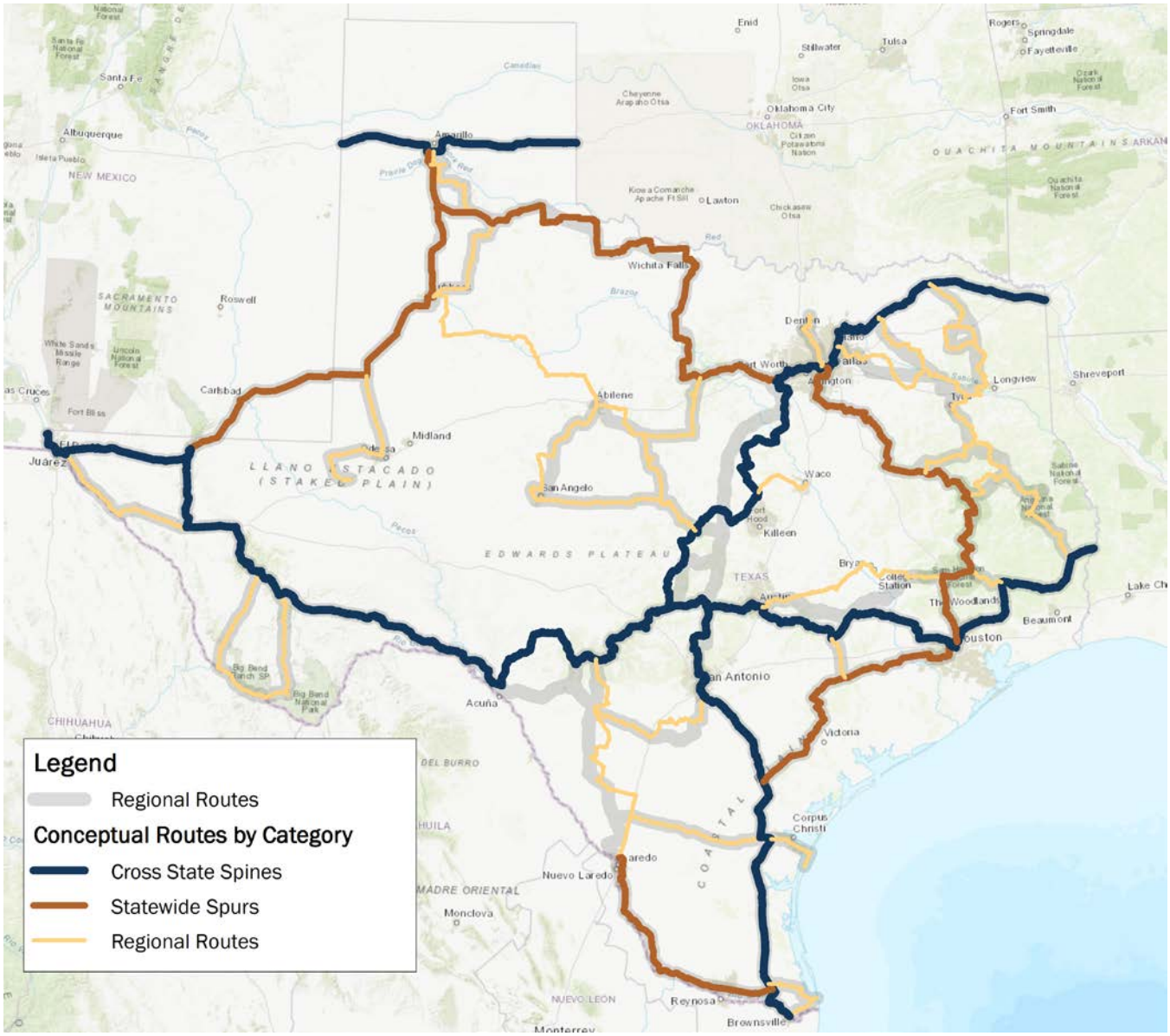
Figure 15: Example of a Preliminary Route Modification



This exemplifies a common Preliminary Route modification throughout the state – where available, lower speed and lower volume roadways which tend to be circuitous were identified for bicycle routing instead of higher speed, higher volume, truck-heavy routes, which tend to be more direct.

Once these Preliminary Route modifications were completed statewide, the modified route network was renamed Conceptual Routes. Figure 16 compares the Preliminary Routes (grey) with the Conceptual Routes (blue, brown, and orange). After the Working Group approved the Conceptual Routes, the project team sought feedback from regional stakeholders.

Figure 16: Preliminary and Conceptual Routes Compared



5.2 Conceptual Route Network and Regional Stakeholder Input

During Summer 2017, the project team presented an overview of the BTTS to regional stakeholders including TxDOT District, MPO, and regional council representatives. Following these overview presentations to regional stakeholders, the project team contacted representatives of the 25 TxDOT Districts, the 25 MPOs, and the 24 regional councils across Texas to solicit feedback on the Conceptual Route Network through a Wikimap Online Input Tool. The Wikimap tool was available to stakeholders to provide feedback from September 5 to 29, 2017.

5.2.1 Wikimap Online Input Tool

The Wikimap Online Input Tool was a customizable, interactive, online map product used to collect geographic specific point and/or line feedback from regional stakeholders across Texas. Upon clicking on the specific weblink in the solicitation email, the user was brought to an online map which featured the Conceptual Routes as seen in Figure 16. An introduction screen (Figure 17) identified the requested feedback, the map legend, and navigation tools. To navigate the map, the user could pan, zoom, and even "drive" a street in Google Streetview in any area across Texas. Specifically, regional stakeholders were asked to place comment pins or draw additional routes related to their knowledge of local and regional bicycle and roadway infrastructure, transportation plans, transportation needs, and related economic development considerations.

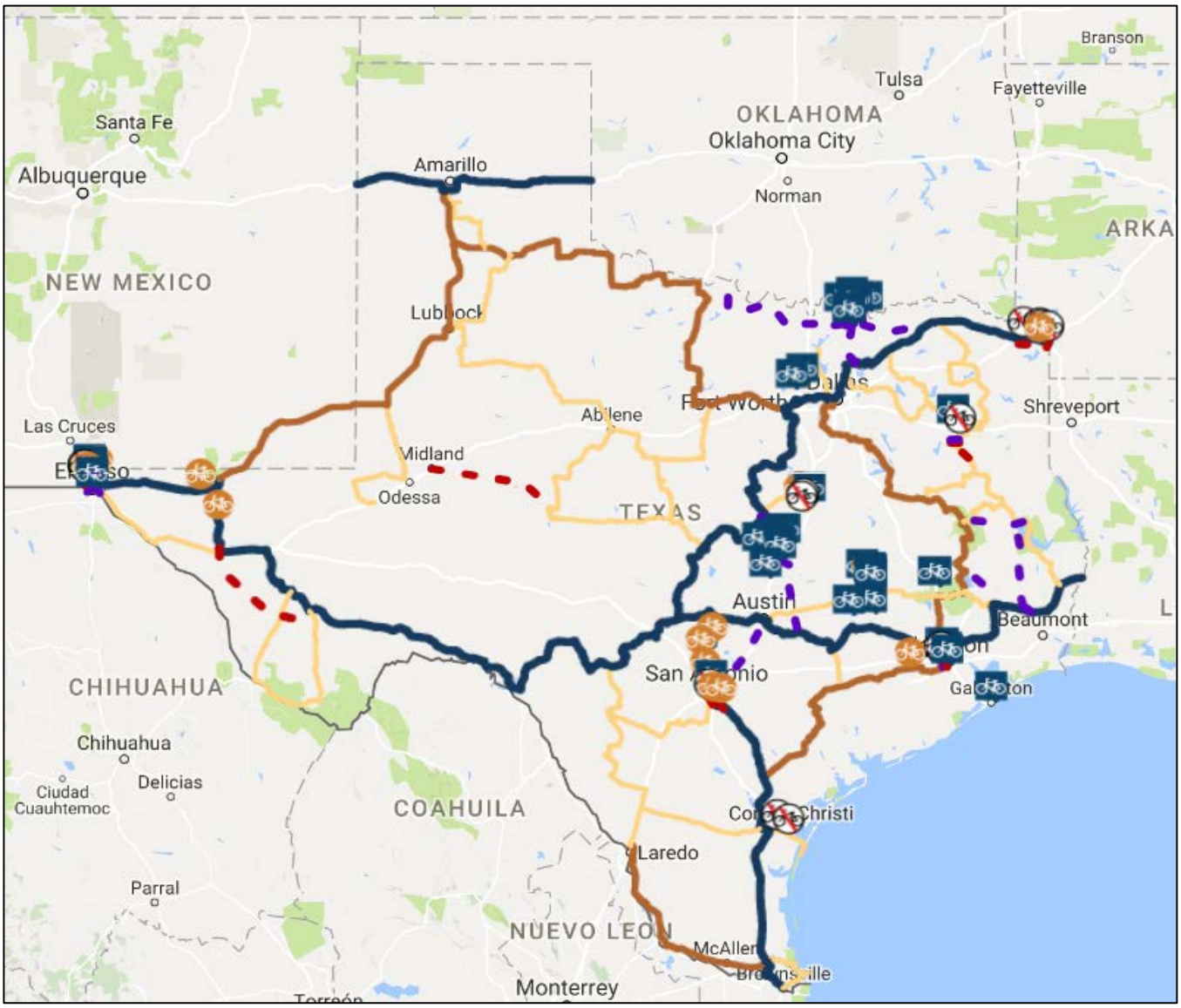
Figure 17: Wikimap Introduction Screen and Legend

After a 1-month comment period, the project team received more than 200 point or line comments from 58 users in 13 urban areas of Texas. Additionally, the regional stakeholder outreach process started conversations with several MPOs in Texas, which led to MPOs sharing local bike plans and GIS bikeway data with the project team. Table 9 and Figure 18 summarize the Wikimap feedback received statewide.

Table 9: Wikimap Online Input Tool: Written comments summary

Comment Type	Comment Category	Number	Totals
Point	New bicycle destination	66	99
	Route not suitable for bicycle use	17	
	Route only for fearless cyclists	16	
Line	Recommended route change	27	107
	Significant route connection	80	

Figure 18: Wikimap Online Input Tool: Feedback Map



5.2.2 Conceptual Route Modifications in response to Wikimap feedback

Some point comments, like “Bicycle Destination” comments, were more informational in nature, indicating locations of local bike shops, mountain biking courses, wildflower blooming locations, etc. Other comments had no written text attached, but instead were points identifying roadways as “Only for fearless cyclists” or “Not suitable for bicycle use.” Most of the point and line comments contained valuable additional knowledge of local roadway conditions, planning efforts, well-traveled bicycle routes, and local cyclist interests.

In general, the project team adopted the suggestions of regional stakeholders unless the suggestion conflicted with a higher scored routing option or the suggestion recommended a routing away from existing/planned infrastructure. Specific responses to Wikimap feedback were categorized and documented. Documentation of all Wikimap comments and project team responses can be found in *Appendix B*.

Figures 19 and 20 show a Houston-area example of Wikimap feedback and the modifications made to the Conceptual Routes in response.

Figure 19: Houston-area Wikimap Feedback/Comments

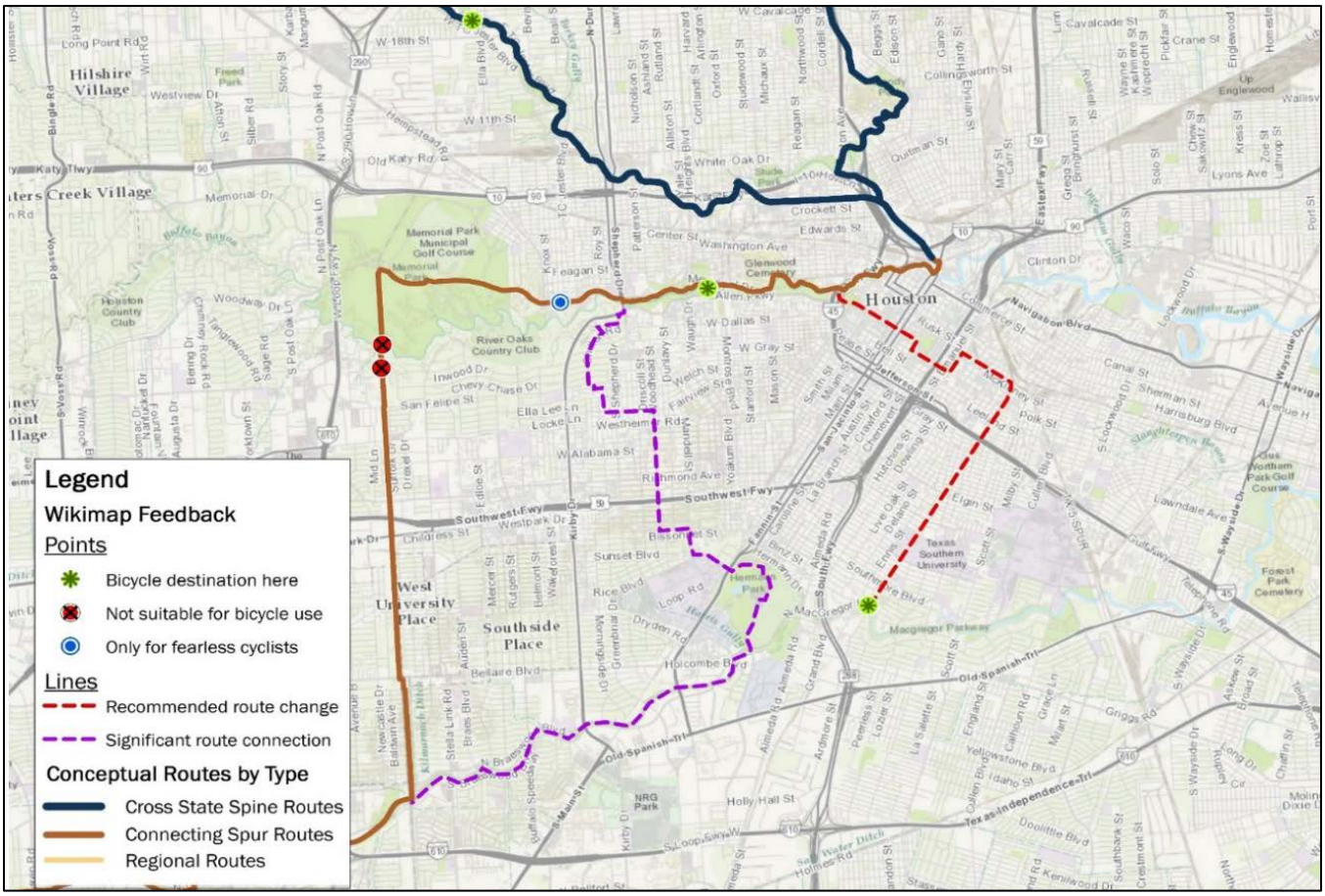
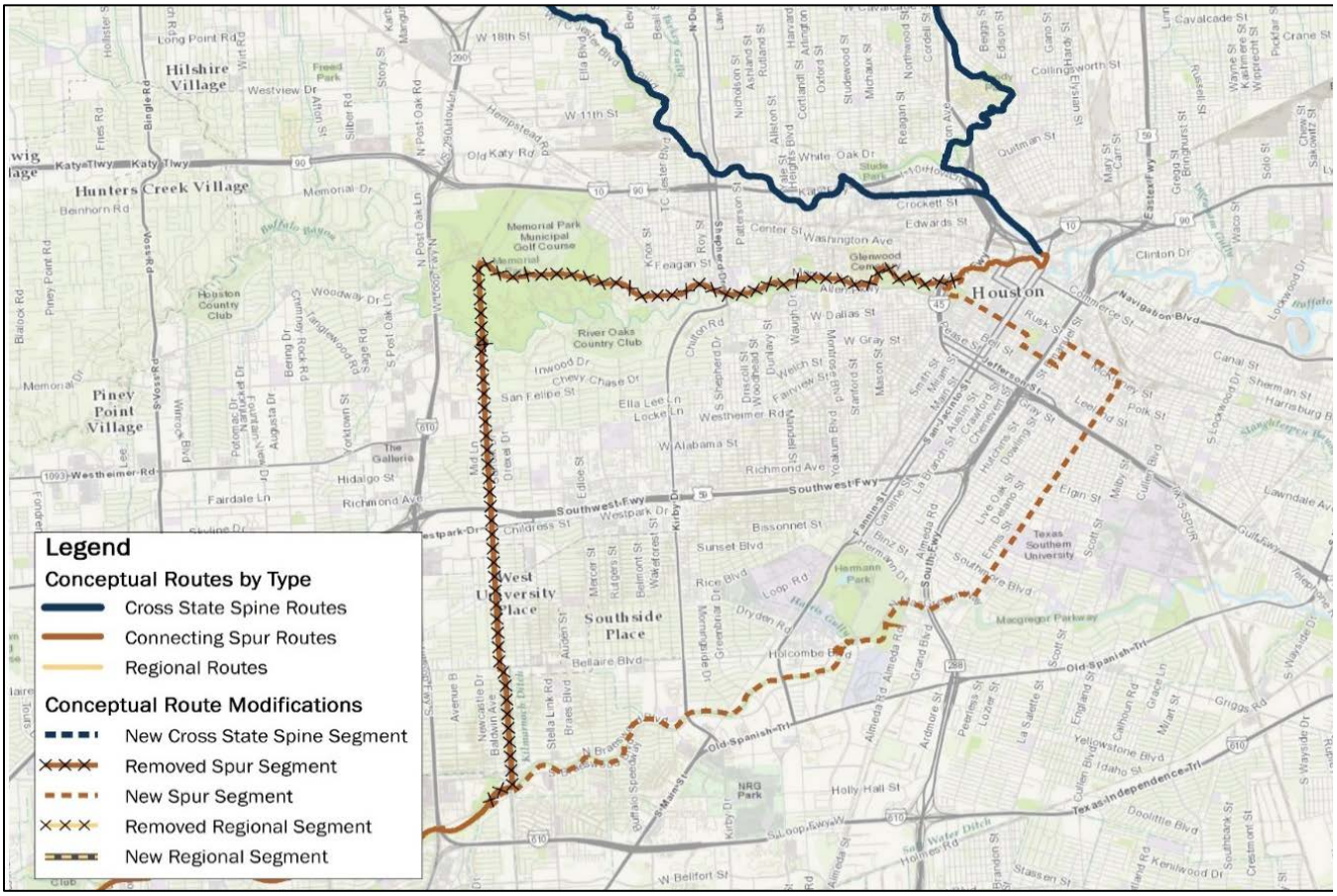


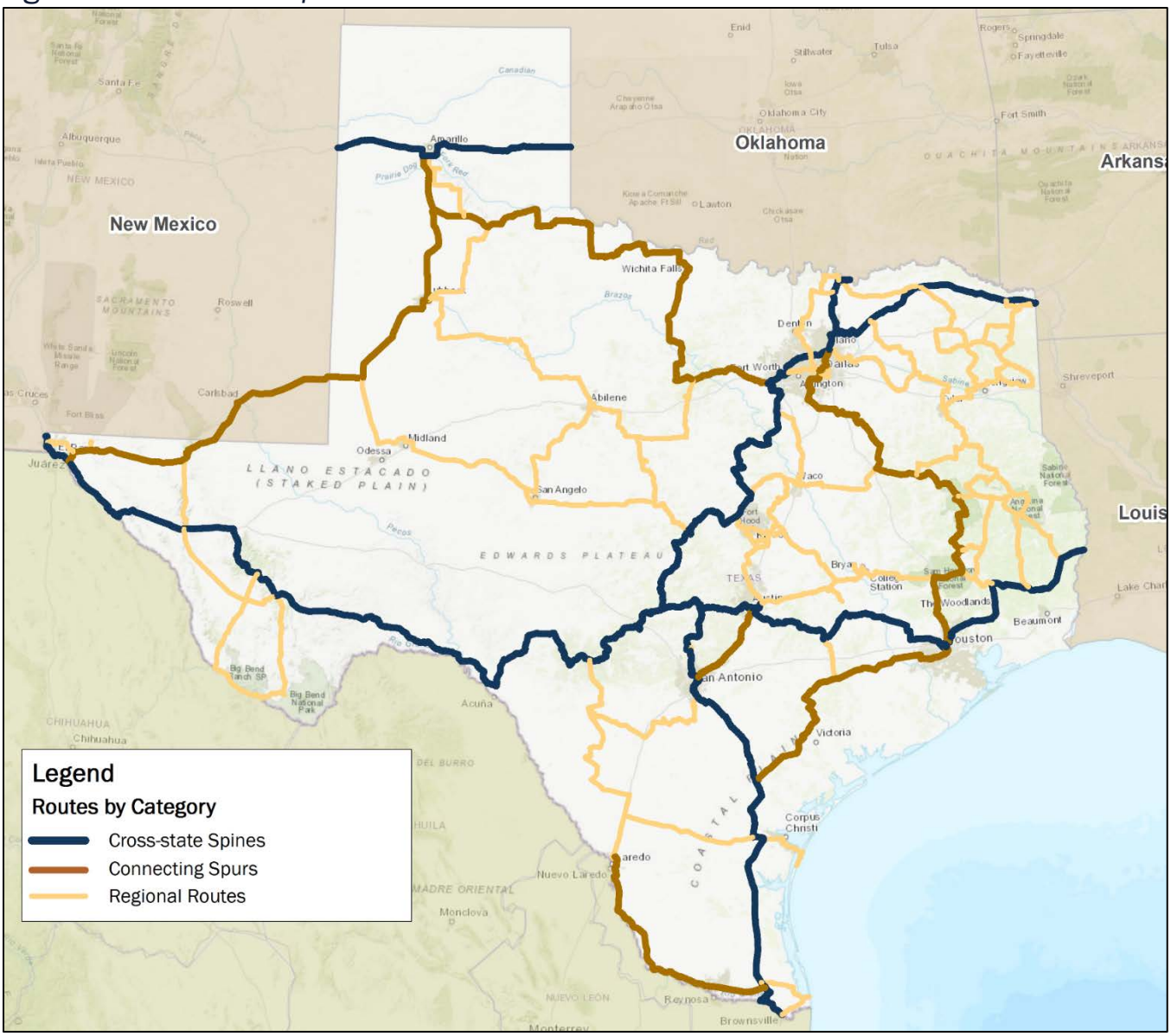
Figure 20: Houston-area Conceptual Route Modifications



6. Bicycle Tourism Trails: Example Network

After modifying the *Conceptual Routes* in response to regional stakeholder feedback, the project team renamed the *Conceptual Routes* map to *Example Network* to more accurately reflect the study scope. The bicycle tourism routes that have been identified as part of TxDOT's Bicycle Tourism Trails Study do not reflect an extensive statewide local-level stakeholder engagement process, nor do the results include analysis of local environmental or site conditions. **Example Network routes represent an application of the qualitative and quantitative criteria established as part of the study. A more thorough analysis of local conditions and extensive stakeholder engagement is needed for all routes.** Figure 21 displays the BTTS Example Network alignments symbolized by route category.

Figure 21: BTTS Example Network



6.1 Example Network Analysis

Table 10 provides analysis of the Example Network by route category. The project team defined three route categories as follows:

- Cross-state Spines
  - Routes of statewide significance which connect to other states and link major urban areas.
  - Due to interstate connections, these routes may be candidates for USBRS designation.
- Connecting Spurs
  - Routes of statewide significance which connect major urban areas, state/national parks, and other bicycle destinations.
  - Routes that provide important links between cross-state spines, with end points within the state boundary.
- Regional Routes
  - Routes of regional significance which connect to natural/scenic areas and frequently form loops nearby or between mid-sized or smaller population centers.

Table 10: Example Network by Route Type

Route Category	Miles	Percent of Total Network
Cross-state Spines	2,346	28%
Connecting Spurs	1,809	22%
Regional Routes	4,163	50%
Total	8,318	

TxDOT's BAC emphasized the importance of locating tourism trail routes across Texas to connect to bicycle tourism destinations and through urban areas with existing infrastructure. Perhaps more importantly, tourism trail routes have the potential to affect the local economies of small towns. *Technical Memorandum 1: Benefits of Bikeways and Trails* provides more information on the community benefits of bikeways. Analysis shows that Example Network alignments cross directly through 254 small towns (fewer than 5,000 people). Table 11 shows the extent to which the *Example Network* routes are located near other economic development and tourism-related destinations around Texas.

Table 11: Example Network Geographic Analysis

Economic Development and Tourism-related Destinations	Within 10 Miles of BTTS Example Network	
	Number	Percent
National Parks/Forests/Historic Sites	18	69%
State Parks/Forests/Historic Sites	110	68%
Historical Markers	6,705	62%
Texas Main Street Communities	65	75%
Small Towns (under 5,000 ppl)	540	62%
Medium Cities (5,000 to 200,000 ppl)	243	75%
Large Urban Areas (over 200,000 ppl)	13	100%

6.2 Example Network Bikeway Types Analysis

While route locations were being identified, the project team and Working Group engaged in a parallel effort to identify the recommended bikeway types for TxDOT's Bicycle Tourism Trail Study. The project team and BAC agreed that the built-out network should be usable for all ages and all abilities, generally referred to as ages 8 to 80. The recommended bikeways include off-road and on-road accommodations identified as follows:

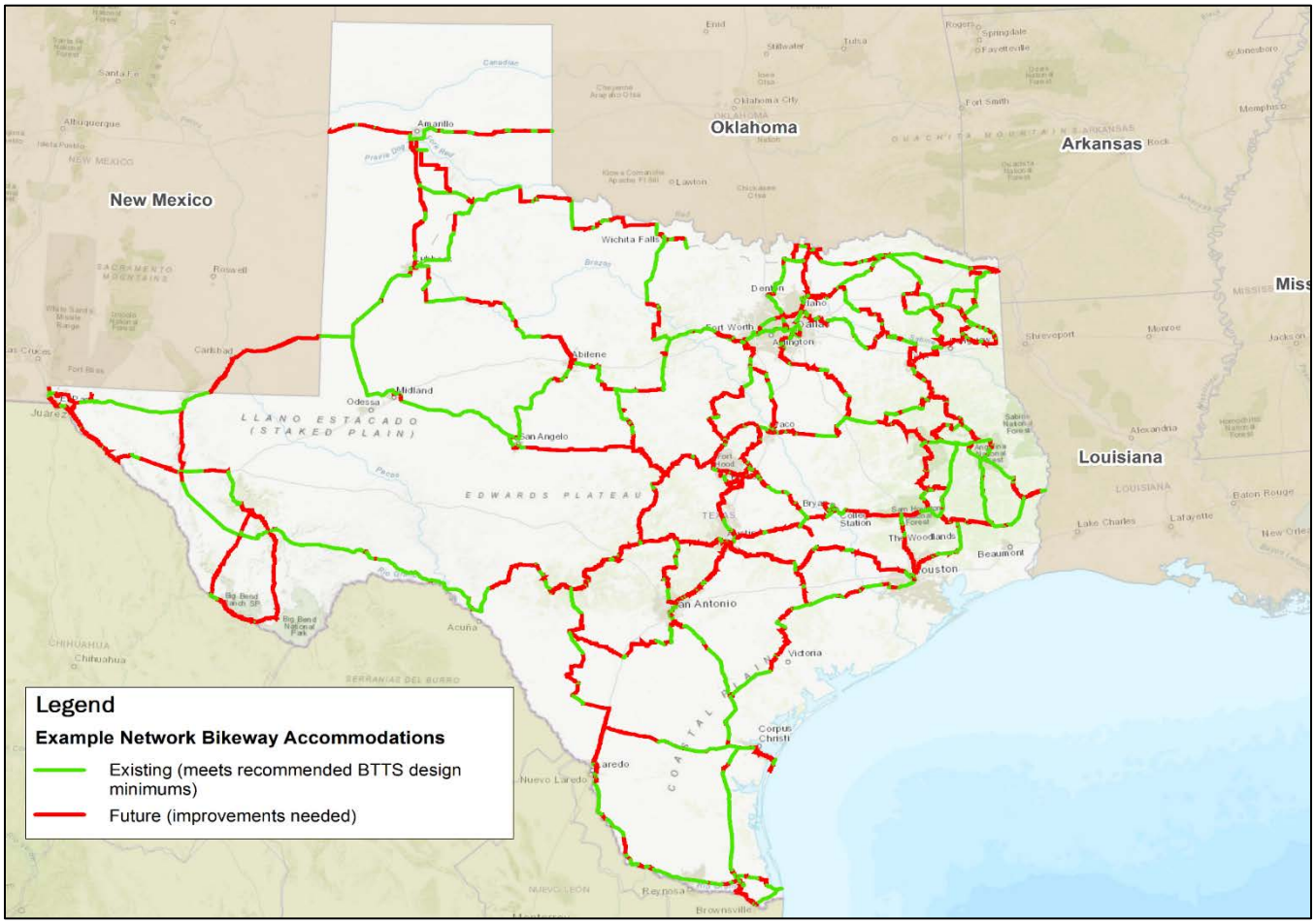
1. Shared Use Path/Sidepath
2. Buffered Bicycle Lane
3. Bicycle Lane
4. Wide Shoulder

The most appropriate bikeway accommodation for an all-ages and all-abilities network is a 12-foot-wide paved, off-road, shared use path. However, existing investments in bicycle lanes and buffered bicycle lanes should be leveraged where available. Additionally, where a roadway has an outside shoulder width of 8 feet wide or wider, shoulders provide a safer riding environment for many bicyclists. Therefore, where existing or planned shared use paths, buffered bicycle lanes, or bicycle lanes are available, (based on local and/or regional bicycle/transportation plans) the project team routed on these facilities. Where these three bikeway types did not exist in local and regional

transportation plans, the project team routed along wide-outside shoulders, where available, and according to the highest composite segment scores.

Using the quantitative criteria application process, 42 percent of the Example Network is routed on a combination of on- and off-road bikeways that meet the recommended BTTS design minimums (Figure 22). Approximately 58 percent of the Example Network will need improvements to accommodate bicyclists of all ages and all abilities. See Figure 22 and Table 12 for map and tabular comparisons of existing and future bikeway accommodations on the Example Network. For additional details on recommended BTTS Bikeway Types see the relevant section below or *Technical Memorandum #3: Bikeway Design Criteria*.

Figure 22: Example Network Bikeway Accommodations: Existing vs. Future Map



While the project team located routes on existing/planned bikeways and wide shoulders, 58 percent of the BTTS Example Network consists of roadways that do not meet recommended BTTS design minimums. The project team believes that an off-road, shared use path is ideal to fill these gaps in the network; however, analysis of local conditions and stakeholder engagement is necessary to further refine the route and determine the most appropriate facility type. See

Figure 23 and Table 13 for map and tabular analysis of the bikeway types that are recommended to comprise the Example Network.

Table 12: Example Network Bikeway Accommodations: Existing vs. Future

Description	Miles	Percent of Total Network
Existing *(meets recommended BTTS bikeway design minimums)*	3,518	42%
Future *(improvements needed)*	4,800	58%
Total	8,318	

Table 13: Example Network by Bikeway Type

Bikeway Accommodation*	Shared Use Path (SUP)/ Sidepath	Buffered Bicycle Lane	Bicycle Lane	Wide Shoulder	To Be Determined
Meets BTTS Bikeway Recommendations	6%	0.0%	0.3%	36%	-
Recommended Improvements *(Local Plans)*	6%	1%	1%	-	-
Improvements Needed *(Either SUP or Shoulder Improvements)*	-	-	-	-	50%
Total Mileage	931	90	111	3,024	4,162

*See *Technical Memorandum 3: Bikeway Design Criteria* for additional details regarding bikeway types, design criteria, and cost estimates.
NOTE: '-' indicates not applicable.

Figure 23: Example Network by Bikeway Type Map

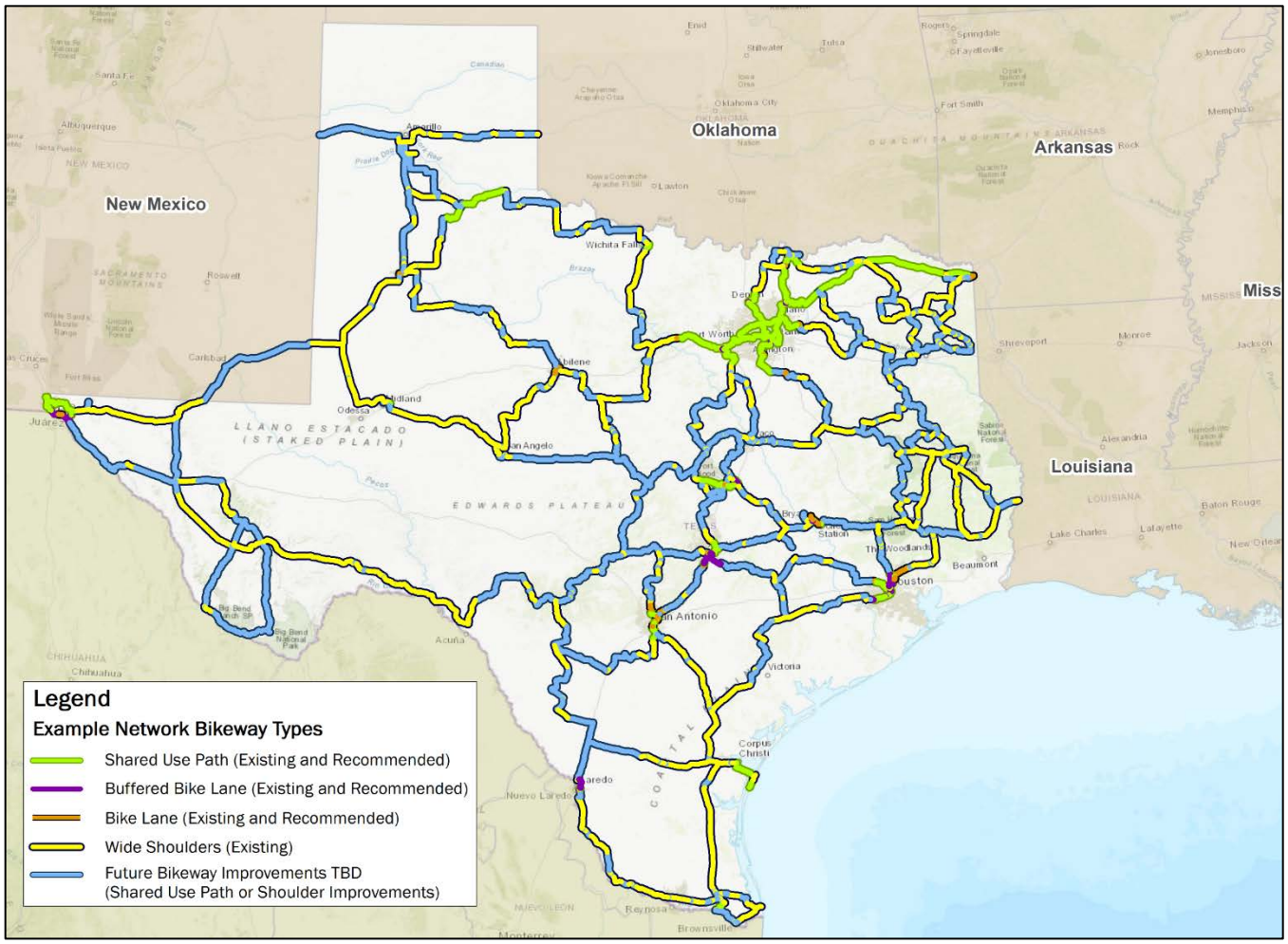
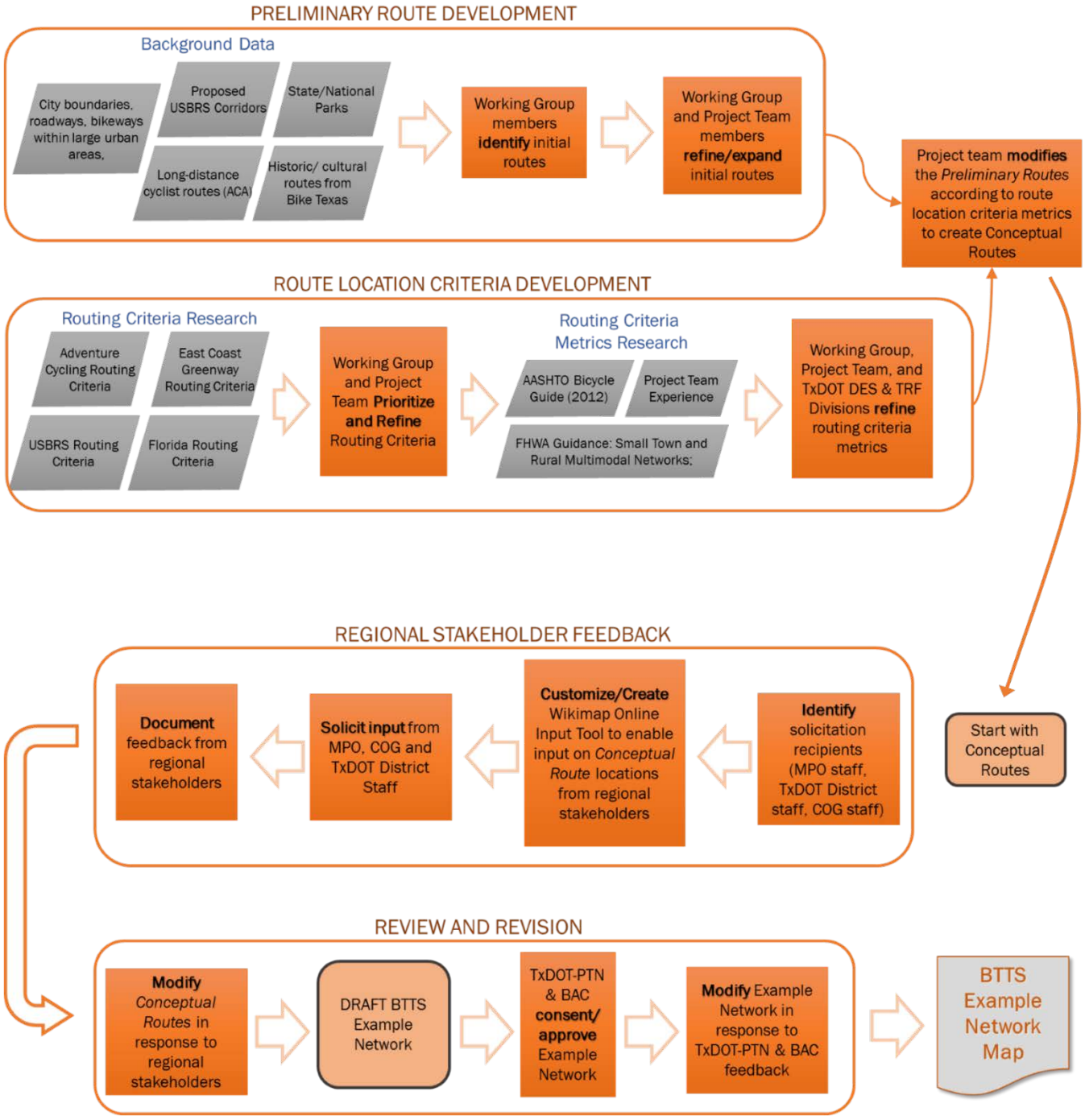


Figure 24 provides a detailed overview of the BTTS Route Development process.

Figure 24: BTTS Route Development: Detailed Process Overview



7. United States Bicycle Route System (USBRS)

In the national context of long-distance bicycle tourism routes, the USBRS represents a proposed nationwide network of bikeways with similar bicycle tourism routing goals as those developed as part of the Example Network. Any successful Texas bicycle tourism network should not only connect between Texas cities and bicycle destinations, but also to adjacent states and to other existing or proposed national-scale bikeway infrastructure. Several Example Network routes link to adjacent states, connect to planned corridors, or follow well-travelled routes.

7.1 USBRS Overview

In 2003, AASHTO formed a Task Force on U.S. Bicycle Routes comprised of various public-sector entities and bicycling advocacy organizations. One bicycling organization, Adventure Cycling Association (ACA), was tasked with developing a map of potential corridors called the National Corridor Plan. The Task Force then assigned numbered designations for signing and marking the routes, allowing for future growth and expansion beyond the proposed corridors. Since 2009, the AASHTO Task Force and ACA have been implementing the proposed corridors into on-the-ground long-distance bicycling routes.

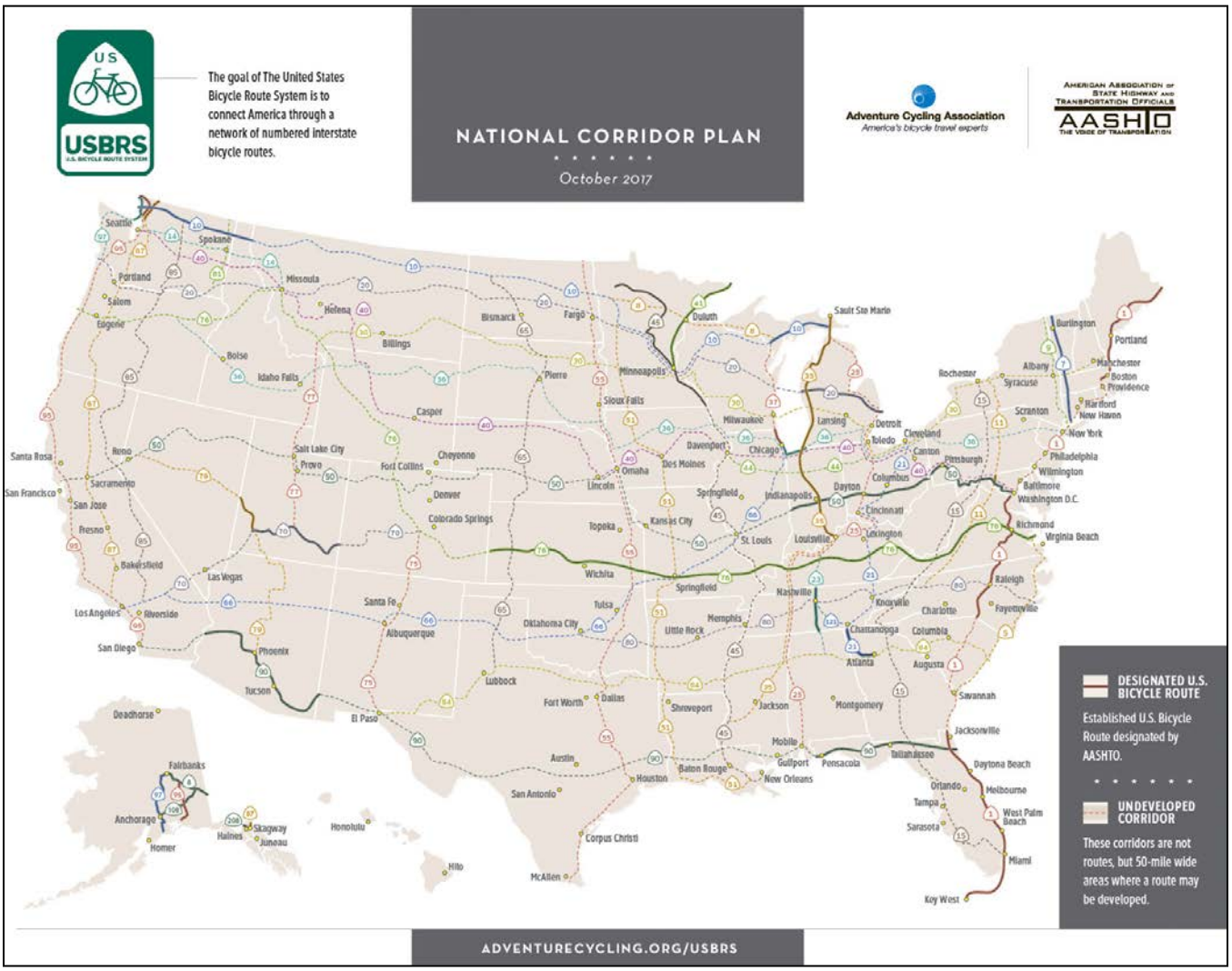
Undeveloped Corridors vs. Designated Routes

It is important to understand the differences between two elements identified as part of the USBRS National Corridor Plan (Figure 25):

1. Undeveloped corridors (dashed lines) – These 50-mile-wide alignments where a route **could be** developed were identified by ACA in their role to provide technical assistance to the AASHTO Task Force. No state or local-level engagement with public sector staff or bicyclists was completed to create these wide corridors which could possibly contain a bicycle route one day.
2. Designated routes (solid, thick lines) – These AASHTO approved and numbered routes have the support of local jurisdictions and bikeway facility owners. These routes are defined with turn-by-turn instructions and were developed with the assistance of state and local level collaboration. These designated routes are officially approved by the state department of transportation through which they traverse. In general, a designated USBRS route must either connect: two or more states, another USBRS route, or to an international border. Additional details regarding the designation process can be found below.

As of May 2018, over 13,100 miles of USBRS routes in 26 states have been officially designated and numbered. Around 37,000 miles of proposed, undeveloped corridors have not been designated (Figure 25).

Figure 25: USBRS National Corridor Plan



7.2 AASHTO Designation Process

The ACA has suggested steps to formalize route designation. These steps are documented below to inform future efforts to implement the results of this study. Figure 26 provides an overview of the route designation process.

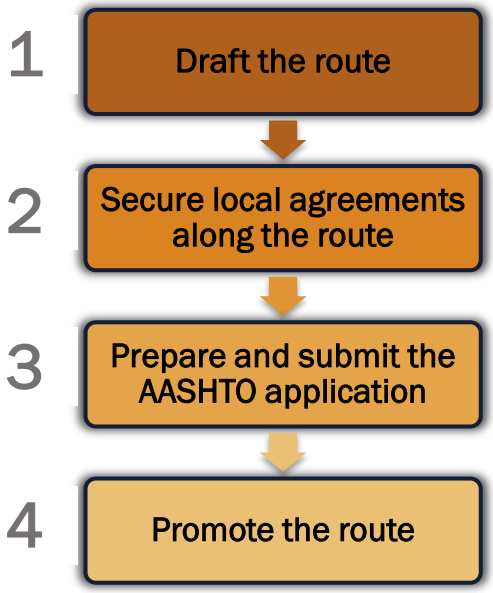
While anyone can lead or champion a USBRS route designation, including the state DOT, a local-level public sector entity, or bicycle tourism advocates, a completed AASHTO application requires signatures from the state DOT.

Step 1: Draft the route

The process begins with determination of the appropriate route, turn-by-turn. The Adventure Cycling Association (ACA) suggests the following process:

- Local, regional, and touring bicycle club routes/maps along with municipal or regional transportation/bicycle plans may be good foundational elements of a proposed USBRS route.
- In addition, a thorough understanding of potential necessary infrastructure improvements along proposed routes will be valuable.
- Regional and roadway characteristics of importance may include: the surface treatment quality/maintenance schedule, traffic volumes, roadside amenities, bicycle destinations, and scenic/recreational/historic features. ACA recommends the consideration of alternative routes begin at this stage.
- Additionally, the appropriate level of stakeholder engagement for the length and scope of the proposed route would be advisable at this point in the process. Allowing stakeholders to provide feedback on the draft route can save time and effort in the long-term.

Figure 26: USBRS Route Designation Process



The qualitative and quantitative routing criteria used as part of the TxDOT's Example Network development process included many of the inputs described in Step 1. Indeed, with additional local engagement and route refinement, the Example Network development process may serve as the basis for USBRS Route designation.

While the Example Network may provide a basis for USBR Route designation, considerations that should be anticipated during this step include:

- Competition between jurisdictions over the route location
- Local preferences on route alignments inside a jurisdiction
- Early concern and discussions about maintenance funding responsibilities

Step 2: Secure local agreements along the route

Following the preparation of a draft route, targeted outreach to jurisdictions along the route begins. This step includes the following:

- Research and documentation of the federal, state, and local agencies (like road authorities, federal land agencies, etc.) with jurisdiction over the roadways where draft routes are proposed. It is important to document everything throughout the process which will serve as a basis for AASHTO application.
- Contacting roadway owners for USBR Memoranda of Understanding (MOUs) or interagency support agreements. TxDOT will work with route designation champions to determine appropriate agreements required for the AASHTO application.
  - Depending on draft route length this step may require volunteer assistance.
  - Having strong arguments for the benefits of bikeways and bicycle tourism may help to gain local stakeholder agreements. See *Technical Memorandum 1: Benefits of Bikeways and Trails*.
  - Conversations with roadway owners should include funding discussions for any anticipated bikeway maintenance and operation costs.
- Contacting trail organizations, bike clubs, and cyclists along the draft route to document their support can create long-term advocates who will help with promotion and development of USBRS routes and/or Texas bicycle tourism trails later.
- Draft route review by TxDOT.

Step 3: Prepare and submit the AASHTO application.
The AASHTO application includes:

- Turn-by-turn instructions
- Map(s) detailing the route in electronic format
- Agreements from:
  - Neighboring states. TxDOT would be responsible for negotiating or obtaining this agreement.
  - State/local road owners
- A signature from a TxDOT official

For additional details see:
https://www.adventurecycling.org/default/assets/File/USBRS/USBRSApplicationInstructions2017.pdf

Step 4: Route promotion and operation
Following AASHTO route designation, on-going route marketing/promotion is the critical final step.
Promotion partners:

- Successful marketing/promotion of USBRS routes may involve several state agencies responsible for transportation, health, tourism, parks/recreation, and/or cultural resources.

- Additionally, extensive engagement of local businesses, bicycle advocates, and municipal/county stakeholders will be crucial to widespread usage of USBRS routes.

Marketing, maintenance, and funding:

- While USBRS route signage is encouraged (not required), funding responsibilities for signage and any other bikeway maintenance and operation costs should be clearly identified.
- Route marketing and promotion may involve outreach events to spread the word. Disseminating route details will likely involve social media, and an online presence. Additional informational/marketing media may include brochures, maps, flyers, stickers, patches, etc.

8. BTTS Bikeway Design Guidance

8.1 Bikeway Design Criteria Development

The bikeway types and design elements described in the following section resulted from an iterative refinement process among TxDOT-PTN, Jacobs, the BAC, and TxDOT's Design (DES) and the Traffic Operations (TRF) Divisions. Bikeway design elements were based on *TxDOT's Roadway Design Manual,*[69] the *AASHTO Guide for the Development of Bicycle Facilities*[70], and the *Texas Manual on Uniform Traffic Control Devices* (TMUTCD)[71]. At the time of this report, AASHTO was in the process of updating its *Guide for the Development of Bicycle Facilities* with an unknown completion timeframe.

8.1.1 TxDOT Bicycle Advisory Committee Review

The BAC Working Group members provided input on aspects of the bikeway design criteria, including:

- Anecdotes about bikeway conditions
- Personal experiences from short-and long-distance bicycle trips
- Recommendations to increase bikeway dimensions to accommodate recreational riders 8 to 80 years of age; and
- Improvements to graphics and cost estimates.

The BAC and Working Group advocated for safer, lower-stress accommodations for long-distance bicycling.

As a result of an iterative review and refinement process involving the BAC and TxDOT's Design and Traffic Operation Divisions, the following bikeway designs are recommended for development of Texas bicycle tourism trails:

- Shared use path/Sidepath
- Buffered bicycle lane
- Bicycle lane
- Paved shoulders

The following bikeway design criteria are recommended for consideration in the development of bicycle tourism trails in Texas. Any design criteria would be subject to current guidance adopted by TxDOT and professional engineering judgement. The recommendations, challenges, and design considerations included with each bikeway type provide important details. This content is intentionally repetitive as this section may be used as reference by future readers.

8.2 Shared Use Path/Sidepath

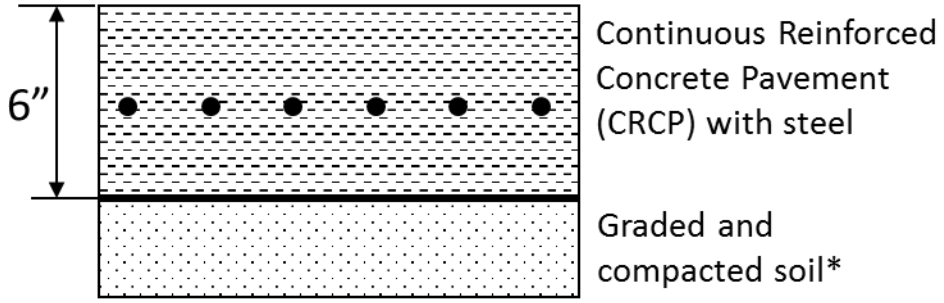
Shared use paths (SUPs) are two-way accommodations for bicyclists, pedestrians, runners, and other users of all ages and abilities. A SUP offers physical separation from vehicular traffic either by an open space or physical barrier. While sometimes referred to as "trails," the term "trail(s)" is frequently associated with recreational hike and/or bike accommodations with unpaved surfaces. Meanwhile, the term "sidepath" is used to describe an SUP located adjacent to the roadway.

Whether located in a park or open space, along a river, seashore, or limited access freeway, SUPs provide a lower-stress experience for bicyclists. In addition, SUPs provide recreational benefits and extend/complement the on-road bikeway network. SUPs may provide safer bicyclist and pedestrian accommodations on high-speed/high-volume roadways[72].

8.2.1 Recommendations

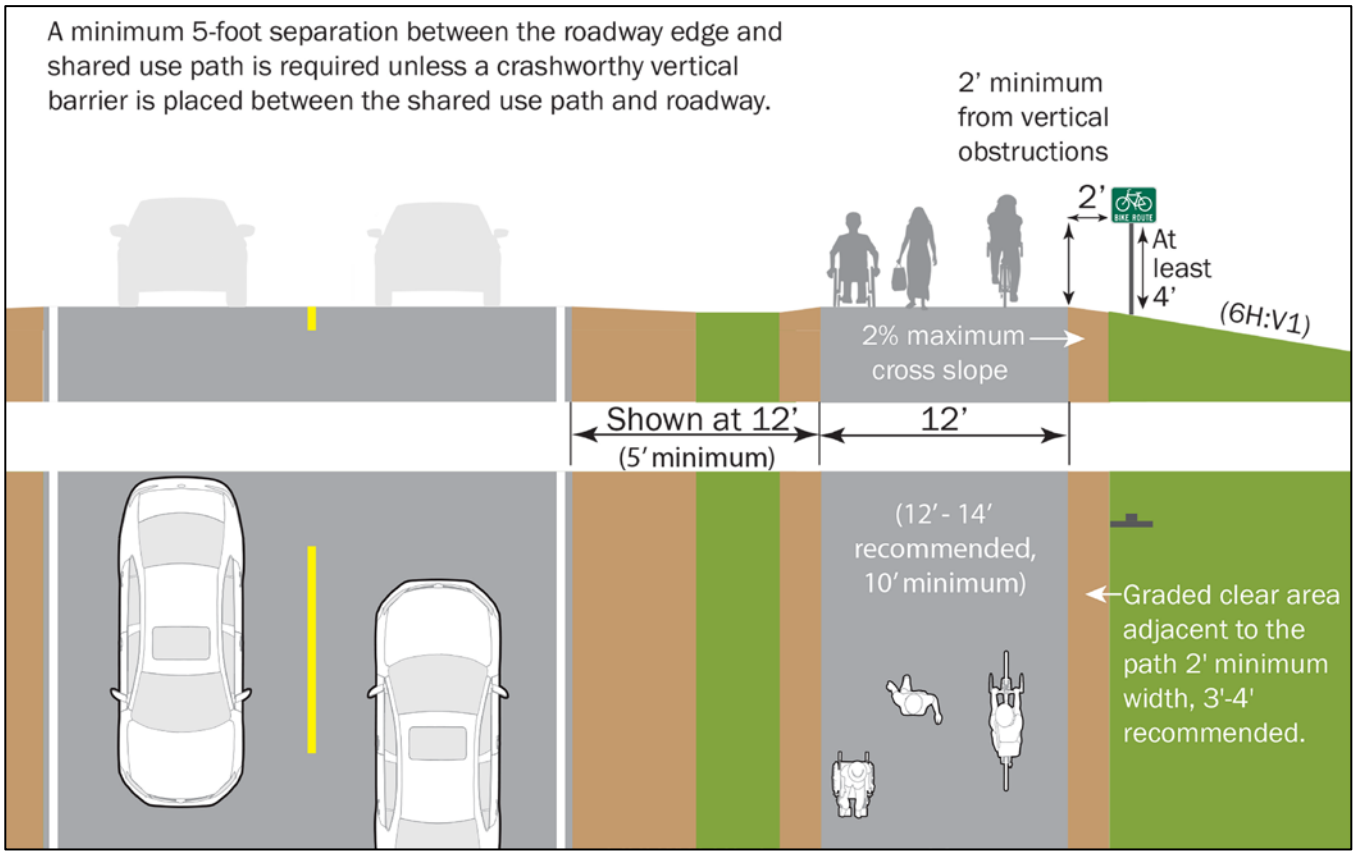
- Based on AASHTO guidance, SUPs should be a minimum of 10 feet wide. For bicycle tourism trail paths, TxDOT recommends SUPs be 12 to 14 feet wide. See Figure 28 for a graphic representation of SUP/sidepath design recommendations.
- A 3- to 4-foot-wide graded shoulder area is recommended (minimum 2-foot-wide). A maximum cross-slope of 1V:6H should be maintained on each side of the SUP. If this cross-slope cannot be provided, then additional protection may be needed.
- A minimum 2-foot horizontal clearance should exist between the edge of the pavement to lateral obstructions (pole-mounted signs, bushes, large rocks, and bridge piers).
- A minimum 10-foot vertical clearance from obstructions to pavement is recommended.
- A 1 percent (maximum 2 percent) pathway cross slope is recommended.
- A 6-inch reinforced concrete pavement surface is recommended in most locations. See Figure 27 for typical pavement structure.
- Due to the potential for pavement damage, signage and/or bollards should be installed adjacent to SUPs to deter motorists (including mopeds, motorcycles, and all-terrain vehicles) from driving on SUPs. Signage and/or bollards should be located at entry points along the SUP to limit access for non-motorized users. Additionally, horses are not recommended on paved SUPs.
- Permanent bicycle and pedestrian count equipment should be installed at logical intervals along newly constructed bikeways to collect usage data.
- If the distance from the edge of the paved roadway to the edge of the pathway pavement is less than 5 feet, a crashworthy barrier that does not impair sight distance is required.

Figure 27: Typical Shared Use Path Pavement Structure



**Additional substructure may be necessary depending on local soil conditions*

Figure 28: Typical Section, Shared Use Path



8.2.2 Challenges

- For SUPs independent of roadway right-of-way:
  - Maintenance and emergency vehicle access must be ensured despite distance from roadway. Thicker pavement sections reduce likelihood of pavement damage from these motor vehicles.
  - While SUPs adjacent to roadways may be maintained concurrently with the roadway, non-roadway adjacent SUP maintenance responsibilities must be clearly identified and funded.
- For SUPs adjacent/parallel to roadway right-of-way:
  - Driveway or roadway crossings of SUPs may result in safety, operational, or design issues.
  - Attention to intersection treatments is necessary to allow bicyclists and pedestrians using SUPs to safely cross roadways at intersections.

8.2.3 Design Considerations

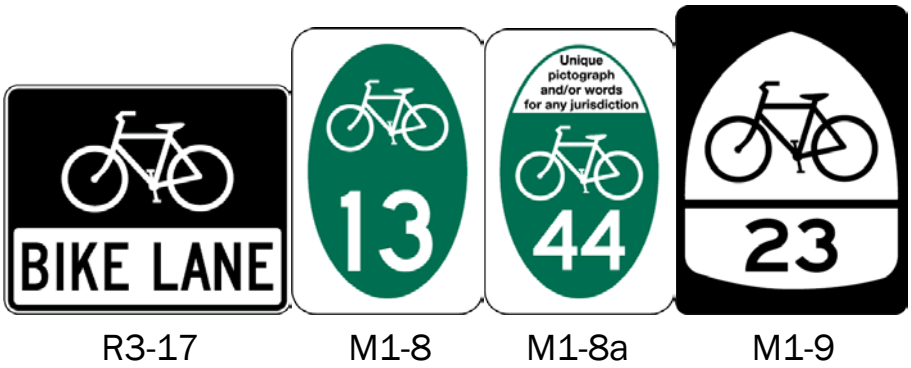
- Design Speeds: While recommended design speeds should be determined during project development, for most SUPs in relatively flat areas, a design speed of 18 miles per hour (mph) is generally sufficient. For hilly terrain, design speeds may vary but should not exceed 30 mph. Geometric design and traffic control devices can be used to improve safety.
- Barrier or Railing:
  - Barriers or railings should have a lateral offset of a least 1 foot (2 feet recommended) from the edge of the path.
  - If barriers or railings are intended to separate the pathway from traffic lanes they must be crashworthy (that is, proven acceptable for use through crash-testing or in-service performance).
- High volume areas: On SUPs with heavy peak-hour or seasonal volumes or where sight distance constraints exist, a solid yellow centerline stripe may be used to separate directions of travel. In such instances, increases in pathway width are recommended.
- Lighting: Pedestrian-scale lighting is preferred. If a SUP is adjacent or near-adjacent to a roadway, lighting must be sufficient to illuminate both the travel lanes and the pathway.
- Pavement: While vehicle weights anticipated on SUPs will be substantially less than roadways, paths need to sustain emergency, security, and maintenance vehicles. While unpaved surfaces have been included in the Example Network, the completed bicycle tourism trail network is envisioned with hard, all-weather pavement surfaces.
- Signage:
  - Sign placement frequency should be determined on a case-by-case basis. The density of adjacent development and existing signage should be taken into consideration to avoid

sign pollution and/or confusion. Signs should be placed for both travel directions and be inclusive of pedestrian and bicycle users.

  - Signs should be placed at least 4 feet above grade and provide a minimum 2-foot horizontal clearance from the pathway edge.
  - If a Texas state agency wishes to advance TxDOT's BTTS and develop a more formal bicycle tourism network, then route numbering and themed signage is recommended in coordination with appropriate entities. The Texas MUTCD suggests the use of M1-9, M1-8, or M1-8a. See Figure 29.

- SUP design should address drainage and stormwater management concerns similar to roadway design.
- See the AASHTO Guide for the Development of Bicycle Facilities for additional information on bridges, drainage, and SUP-roadway intersection design.

Figure 29: Relevant Texas MUTCD Bicycle Regulatory and Guidance Signage



8.3 Buffered Bicycle Lane

Buffered bicycle lanes are on-road bikeways designated by pavement markings. As compared to standard bicycle lanes, buffered bicycle lanes provide additional separation from vehicular traffic designated by pavement markings or a vertical barrier (for example, a concrete barrier, a raised median, planters, or bollards). Buffered bicycle lanes with vertical barriers are known as protected bike lanes or separated bicycle lanes and can be one-way or bi-directional.

While buffered bicycle lanes offer perceived protection from adjacent motorists, for bicycle tourism trails along roadways with higher motor vehicle speeds, physical separation or a crashworthy barrier is recommended. Bicyclists experience lower-stress and enjoy greater levels of comfort with additional physical separation and/or protection from motor vehicle travel lanes. Two valuable resources on separated bike lanes include the Federal Highway Administration's (FHWA's) *Separated Bike Lane Planning and Design Guide*[73] and the National Association of City Transportation Officials' (NACTO's) *Design for All Ages & Abilities.*[74]

Where the existing pavement footprint can accommodate two minimum 5-foot-wide bicycle lanes plus buffer space, installation can be accomplished during rehabilitation or resurfacing projects. Installation of bicycle lanes and buffered bicycle lanes during roadway reconfigurations, road diets, and lane diets is detailed in FHWA's *Incorporating On-Road Bicycle Networks into Resurfacing Projects.*[75] See Figures 30 and 31 for typical on-road bikeway pavement structures.

Figure 30: Typical On-Road Bikeway Asphalt Pavement Structure

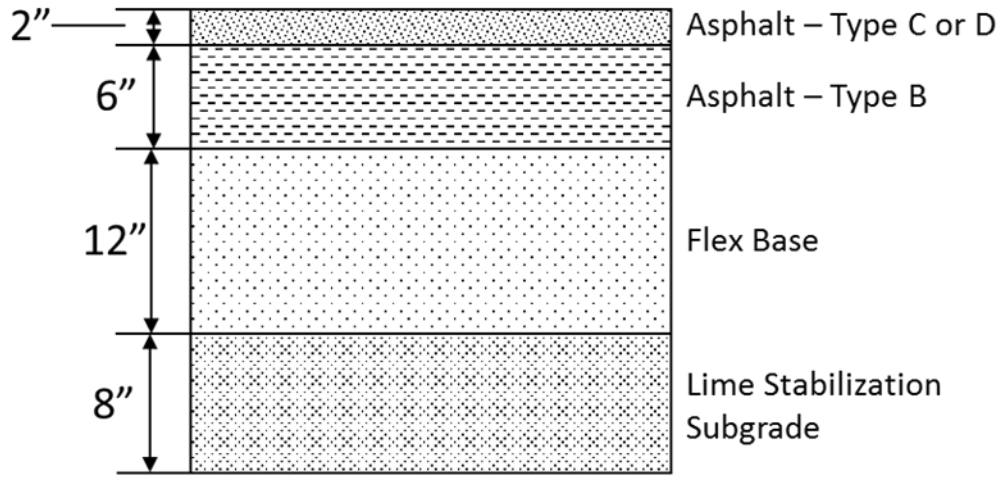
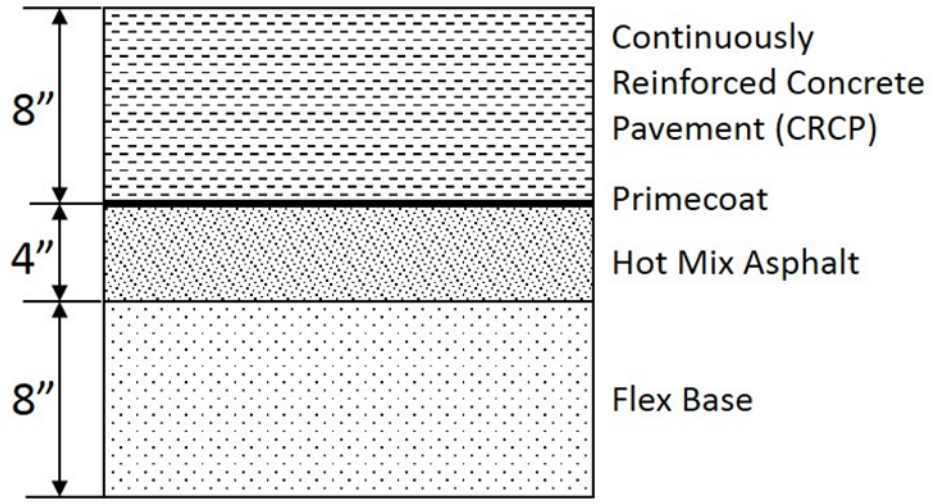


Figure 31: Typical On-Road Bikeway Concrete Pavement Structure



8.3.1 Recommendations:

- One-way buffered bicycle lanes should be 5 feet or wider. See Figure 32 for a graphic representation of buffered bicycle lane design recommendations.
- The bicycle lane buffer should be 2 to 3 feet wide. For additional information, see NACTO's Urban Bikeway Design Guide.[76]
- The combined width of buffer space and bicycle lane should not exceed 9 feet. This measurement will help deter motorists from using the area as a travel lane.
- Drainage grates and gutter seams should generally not be included in the usable width. AASHTO currently measures bicycle accommodations from face of curb because the width of gutter pans generally falls within the shy distance for bicyclists.
- Bicycle route signage should be used.
- Bi-directional buffered bicycle lanes should be a minimum total width of 12 feet wide and include a centerline for separation.
- Vertical separation:
  - Separation type should be based on the presence of on-street parking, street width, cost, aesthetics, maintenance, and motorized traffic volumes and speeds.
  - The total clear width between the curb face and vertical element should allow room for emergency and maintenance vehicles.
- Bicycle pavement markings/symbols should be placed at regular intervals on the paved surface of the bicycle lane to advise motorists of on-street bicycle lanes.
- Permanent bicycle count equipment should be installed at logical intervals along newly constructed bikeways to collect usage data.

8.3.2 Challenges

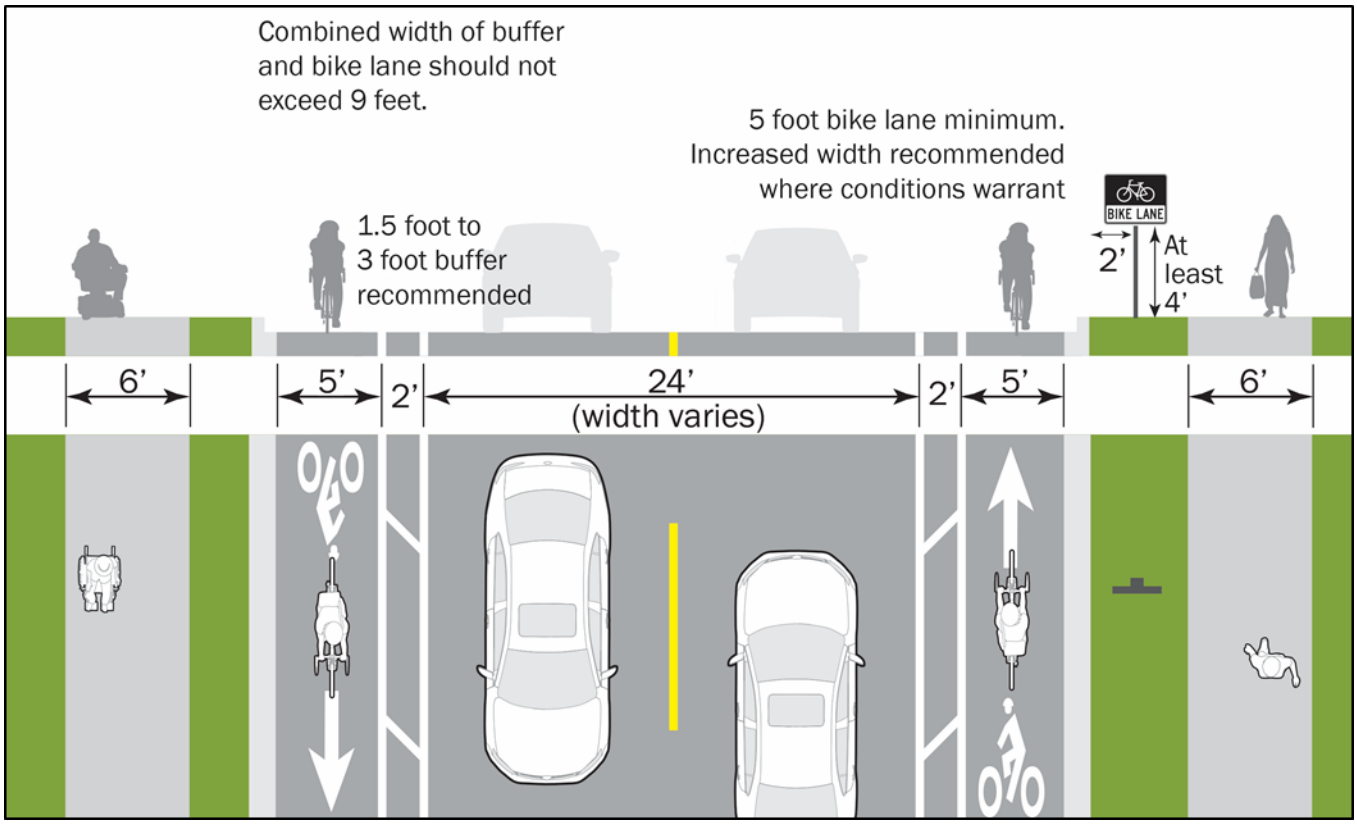
- Relocation and/or adjustments to existing on-street parking may be required to accommodate buffered bicycle lanes.
- Increasing pavement surface area to add bicycle lanes:
  - May be difficult to incorporate into resurfacing projects. Typically, widening can be done effectively during full pavement rehabilitation (that is, complete pavement replacement).
  - May not be possible where right-of-way is constrained.
  - May necessitate costly utility relocations, drainage and/or stormwater management.
  - May encounter natural environment constraints (wetland, wildlife, or parkland encroachment concerns).
  - May be impractical for bridge sections causing bicyclists to share the outside travel lane with motor vehicles across constrained bridge structures.

- May require traffic management control strategies and disruption to motor vehicle travel patterns during construction periods.

8.3.3 Design Considerations

- Intersections and other conflict points represent serious safety issues for bicyclists. Special attention should be paid to bikeway design through intersections and other conflict points.
- Signage:
  - Sign placement frequency should be determined on a case-by-case basis. The density of adjacent development and existing signage should be taken into consideration to avoid sign pollution and/or confusion. Signs should be placed for both travel directions (Per Texas MUTCD, recommended sign is R3-17 with minimum size of 24 inches high by 18 inches wide). See Figure 29.
  - Signs should be placed at least 4 feet above grade and provide a minimum 2-foot horizontal clearance from the pathway edge.
  - If a Texas state agency wishes to advance TxDOT's BTTS and develop a more formal bicycle tourism network, then route numbering and themed signage is recommended in coordination with appropriate entities. The Texas MUTCD suggests the use of M1-9, M1-8, or M1-8a. See Figure 29.

Figure 32: Typical Section, Buffered Bicycle Lane



8.4 Bicycle Lane

Bicycle lanes are on-street, one-way bikeways that typically carry bicycle traffic in the same direction as adjacent motor vehicle traffic. Bicycle lanes exist in both urban and suburban areas. They encourage bicyclists to ride on the roadway in a position where they are more likely to be seen by motorists entering or exiting the roadway. Buffered bicycle lanes and bicycle lanes provide a more comfortable experience for less-skilled bicycle users. Additionally, bicycle lanes buffer pedestrians from motor vehicle traffic, improving pedestrian comfort on adjacent sidewalks. While bicycle lanes offer a perceived separation from motorized traffic, for bicycle tourism trails adjacent to roadways with higher motor vehicle speeds, physical separation between the motorized traffic and bicyclists is recommended. For more information on all-ages and all-abilities bikeways, see NACTO's *Design for All Ages & Abilities.*[77]

Where available rights-of-way can accommodate two minimum 5-foot-wide bicycle lanes (one in each direction), installation can be accomplished during rehabilitation or resurfacing projects. Guidance for installing bicycle lanes and buffered bicycle lanes during roadway rehab or reconstruction, road diets, and lane diets is available in FHWA's *Incorporating On-Road Bicycle Networks into Resurfacing Projects.*[78] Widening the roadway surface to provide bicycle lanes can also be accomplished during complete pavement rehabilitation. See Figures 30 and 31 for typical on-road bikeway pavement structures.

also be accomplished during complete pavement rehabilitation. See Figures 30 and 31 for typical on-road bikeway pavement structures.

It is generally less expensive to install bicycle lanes as part of a resurfacing project than to install the bicycle lanes separately as a retrofit. Cost savings accumulate for several reasons, including the following:

- Marking eradication: The removal of pavement markings would not be necessary when bicycle lanes are added as part of a resurfacing project.
  NOTE: The process of removing existing pavement markings can leave visible grooves on the roadway and lead to confusion during low-light and/or when the pavement is wet.
- Traffic control: Maintaining transportation safety during construction is required. (When bicycle lanes are incorporated into a resurfacing project, the overall cost would not increase significantly enough to cause a funding issue).
- Marking costs: Like traffic control, the cost of adding pavement markings to the budget of a resurfacing project is minor.
- Pavement: To preserve roadway edge and support paved bicycle lanes, additional shoulder preparation work should be completed. When pavement width is added adjacent to an existing pavement section without full-depth pavement replacement, differing pavement sections and uneven wear patterns may result in maintenance issues. A better opportunity to install bicycle lanes occurs during a full-depth replacement of the existing pavement.

8.4.1 Recommendations

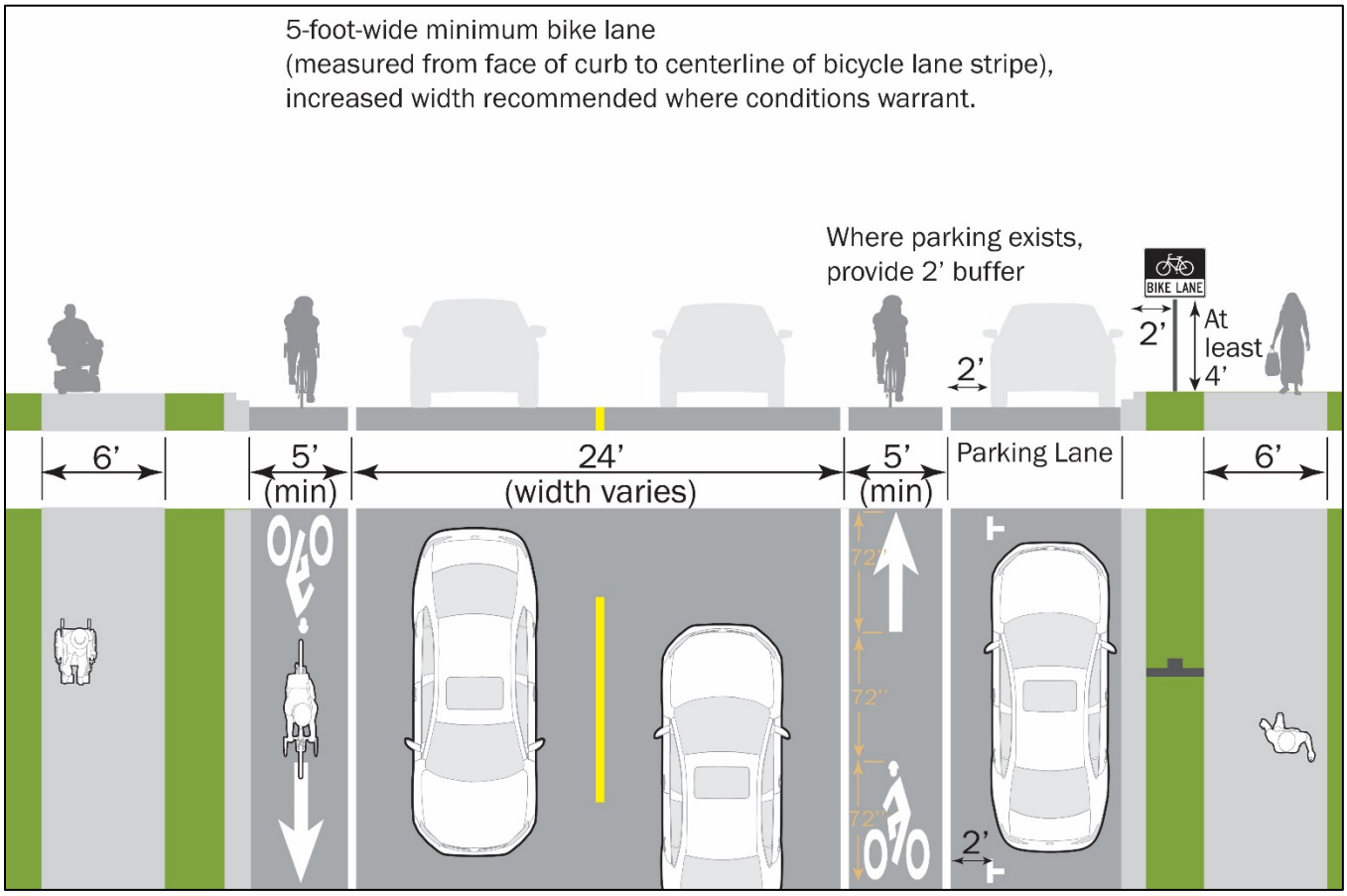
- Bicycle lanes should be a minimum of 5 feet wide when measured from the face of the curb to the centerline of the bicycle lane stripe. Figure 33 provides a graphical representation of bicycle lane design recommendations.
- Drainage grates and gutter seams should not be included in the usable width unless they are bicycle-friendly. AASHTO currently measures bicycle accommodations from face of curb because the width of gutter pans generally falls within with the shy distance for bicyclists.
- Where on-street parking is allowed, a 2-foot wide buffer from the parking stall width should be provided to prevent “dooring”.
- One-way bicycle lanes should be provided on both sides of two-way streets. Bi-directional bicycle lanes may be provided on one side of a one-way street.
- Bicycle route signage and bicycle pavement markings/symbols should be placed logically (evaluated on a case-by-case basis) to advise motorists of the bicycle lanes.
- Bicycle pavement markings/symbols should be placed at regular intervals on the paved surface of the bicycle lane to advise motorists of the on-street bicycle lanes.

- Permanent bicycle count equipment should be installed at logical intervals along newly constructed bikeways to collect usage data.

8.4.2 Challenges

- Intersections and other conflict points represent serious safety issues for bicyclists. Special attention should be given to bikeway design through intersections and other conflict points.
- Relocation and/or adjustments to existing on-street parking may be required to accommodate bicycle lanes
- Increasing pavement surface area to designate bicycle lanes:
  - May be difficult to incorporate into resurfacing projects. Typically widening can be done effectively during full pavement rehabilitation (that is, complete pavement replacement).
  - May not be possible where right-of-way is constrained.
  - May necessitate costly utility relocations, drainage and stormwater management.
  - May encounter natural environment constraints (wetland, wildlife, or parkland encroachment concerns).
  - May be impractical for bridge sections, causing bicyclists to share the outside travel lane with motor vehicles across constrained bridge structures.
  - May require traffic control strategies to avoid disruption to motor vehicle travel during construction.

Figure 33: Typical Section, Bicycle Lane



8.4.3 Design Considerations

- Bikeway design features through intersections and other conflict points should be considered during project development.
- Signage:
  - Sign placement frequency should be determined on a case-by-case basis. The density of adjacent development and existing signage should be taken into consideration to avoid sign pollution and/or confusion. Signs should be placed for both travel directions (Per Texas MUTCD, recommended sign is R3-17 with minimum size of 24 inches high by 18 inches wide). See Figure 29.
  - Signs should be placed at least 4 feet above grade and provide a minimum 2-foot horizontal clearance from the roadway edge.
  - If a Texas state agency wishes to advance TxDOT's BTTS and develop a more formal bicycle tourism network, then route numbering and themed signage is recommended in coordination with appropriate entities. The Texas MUTCD suggests the use of M1-9, M1-8, or M1-8a. See Figure 29.

8.5 Paved Shoulder

Many Texas roadways have wide paved shoulders and may be compatible for bicycling. Paved shoulders offer a cost-effective way to provide bikeway connectivity between destinations. However, riding a bicycle on a paved shoulder can be intimidating for many bicyclists. The speed and traffic volume of adjacent high-speed vehicles, the presence of parked cars, placement of rumble strips, and roadway debris can pose significant hazards to bicyclists. Because of these concerns, only roadways with 8-foot-wide (or wider) paved outside shoulders would be considered for inclusion as a bicycle route in TxDOT's BTTS.

Adding or widening paved shoulders may be best completed during a pavement replacement project, where all the pavement on a roadway is replaced, but the underlying base is maintained. In this situation, a full-depth shoulder may be added along with the width of the roadway travel lanes. Adding or widening paved shoulders during pavement replacement may have the following advantages:

- Cost/efficiencies of scale: In a pavement replacement project, the cost for providing shoulders may be a relatively small portion compared with the cost of the overall project. Having the equipment and materials present would result in a lower material unit cost when compared to a stand-alone shoulder widening project due to the efficiencies of scale.
- Longevity: During a pavement replacement project, there is an opportunity to confirm that the underlying base material beneath the travel lanes and shoulder is uniform. Additionally, if necessary, the pavement depth of shoulders can be increased during a pavement replacement project. Both improvements will lead to longer-lasting shoulders.

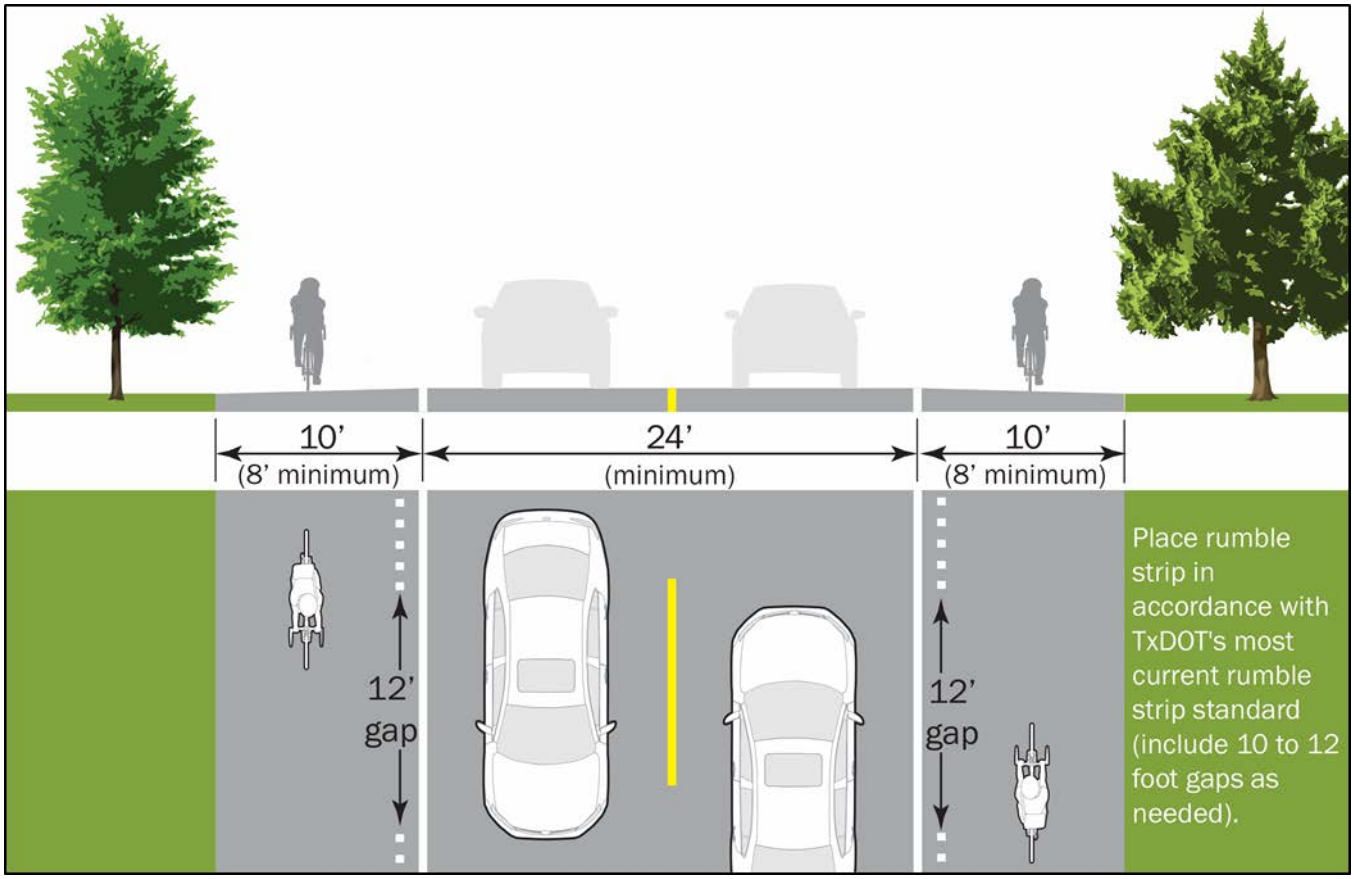
Many road segments with existing 8- to 10-foot-wide outside shoulders have been included as part of the initial BTTS Example Network. See Technical Memorandum 2 for additional details about the route development process.

8.5.1 Recommendations

- To be included as a Texas Tourism Trails route, paved shoulders should be at least 8 feet wide and be provided on both sides of a roadway. See Figure 34 for a graphic representation of paved shoulder design recommendations.
- Where rumble strips/shoulder texturing exists, a clear operating width no less than 4 feet (preferably 6 feet) with a 10- to 12-foot-wide gap in textured treatment every 40 to 60 feet is recommended to provide bicyclists better access.
- Drainage grates and gutter seams should not be included in the usable width unless they are bicycle friendly.
- Bicycle route signage is recommended.

- Permanent bicycle count equipment should be installed at logical intervals along newly constructed bikeways to collect usage data.

Figure 34: Typical Section, Paved Shoulder



8.5.2 Challenges

- Increasing pavement surface area to widen shoulders:
  - May be difficult to incorporate into resurfacing projects. Shoulder widening can be implemented more effectively during full pavement rehabilitation (that is, complete pavement replacement).
  - May not be cost-effective where right-of-way is constrained or in developed areas.
  - May necessitate costly utility relocations, drainage and stormwater management.
  - May encounter natural environment constraints (wetland, wildlife, or parkland encroachment concerns)
  - May not be possible over bridges, causing bicyclists to share the outside travel lane with motor vehicles on bridges.

  - May require traffic control strategies to avoid disruption to motor vehicle travel during construction.
- Roadway debris regularly collects on the shoulder. More frequent maintenance and sweeping is recommended to improve the safety of bicyclists.

8.5.3 Design Considerations

- Rumble strips are a type of shoulder texturing effective at reducing the number of single-vehicle, roadway departure crashes.
  - AASHTO guidance[79] requires at least 4 feet of usable paved shoulder between the rumble strip and outside edge of the paved shoulder. Rumble strips should be placed on the shoulder near the outside lane line. A minimum distance of 6 feet of usable paved shoulder is recommended on BTTS routes.
  - See TxDOT's *Roadway Design Manual*[80] and FHWA's guidance[81] on rumble strips for additional information.
- Intersections and other conflict points represent serious safety issues for bicyclists. Special attention should be paid to bikeway design through intersections and other conflict points.
  - Accommodations should be made for bicyclists traveling through intersections when shoulders have been used to provide for right turn or center turn lanes. Such accommodations could include striping a bicycle lane through the intersection to provide connectivity or adding signage that indicates through-bicyclists are allowed to use the right turn lane.
- Signage:
  - Sign placement frequency should be determined on a case-by-case basis. The density of adjacent development and existing signage should be taken into consideration to avoid sign pollution and confusion. Signs should be placed for both travel directions (Per Texas MUTCD, recommended sign is R3-17 with minimum size of 24 inches high by 18 inches wide). See Figure 29.
  - Signs should be placed at least 4 feet above grade and provide a minimum 2-foot horizontal clearance from the roadway edge.
  - If a Texas state agency wishes to advance TxDOT's BTTS and develop a more formal bicycle tourism network, then route numbering and themed signage is recommended in coordination with appropriate entities. The Texas MUTCD suggests the use of M1-9, M1-8, or M1-8a. See Figure 29.

9. Bikeway Cost Estimates

9.1.1 Bikeway Construction Costs

Per mile bikeway cost estimates were developed based on TxDOT's December 2017 Average Low Bid Prices to provide a range of estimated costs for various bikeway improvements. The estimated

costs include materials and labor. As the BTTS statewide planning-level cost estimates intend to estimate the construction cost for each of the four bikeway types, devoid of a proposed project location, 20 percent was added to cover anticipated project costs including:

- Plans, specifications, and engineering (PS&E) costs
- Regional soil/environmental conditions
- Regional material and labor cost differences
- Intersection/conflict point design alterations
- Construction mobilization

Conversely, some project development costs are too variable across the state to estimate at the planning level. Right-of-way acquisition in more densely developed urban areas will constitute a much higher portion of the total project cost when compared with rural areas based on real estate prices. Similarly, a roadway widening project requiring the relocation of utility infrastructure (sewage or water supply pipes, or telecommunications or electrical conduit) will cost more than a similar project without these location-specific utility constraints. At this stage, statewide planning-level cost estimates cannot anticipate these highly variable cost differences. The following costs are unaccounted for in BTTS construction cost estimate ranges:

- Right-of-way acquisition necessity and/or cost
- Utility relocation necessity and/or cost

Table 14 summarizes the per mile construction cost estimates by type of bikeway improvement project. *Appendix C* details costs associated with each type of bikeway improvement project. All bikeway improvement construction costs include the following:

- Pavement
- Pavement markings
- Signage
- Bicycle and pedestrian count equipment (induction loop and infrared beam pair)[82]

Other additional construction costs that vary by bikeway types include the following:

- Rumble strips
- Lighting
- Flexible delineators
- Concrete traffic barriers

Table 14: Bikeway Construction Cost Estimate Ranges (per mile)

Bikeway Improvement Project	Initial Construction Costs[a,b]	
	Low-end	High-end
Construct Shared Use Path	$480,000	$570,000
Restripe roadway for Buffered Bike Lane	$140,000	$160,000
Widen *concrete* roadway for Buffered Bicycle Lane	$1,190,000	$1,430,000
Widen *asphalt* roadway for Buffered Bicycle Lane	$1,080,000	$1,300,000
Restripe roadway for Bicycle Lane	$80,000	$100,000
Widen *concrete* roadway for Bicycle Lane	$1,000,000	$1,200,000
Widen *asphalt* roadway for Bicycle Lane	$980,000	$1,180,000
Widen c*oncrete* Shoulder	$1,040,000	$1,250,000
Widen *asphalt* Shoulder	$950,000	$1,130,000

Notes:

[a] Construction costs per mile include 20 percent (%) to cover additional project costs including: intersection considerations, mobilization, regional differences, and/or PS&E. Construction costs per mile do not include right-of-way acquisition or utility relocation, as these costs will vary vastly depending on location of bikeway improvements. Base construction costs (materials and labor) were derived using TxDOT's Average Low Bid Prices [http://www.dot.state.tx.us/insdtdot/orgchart/cmd/cserve/bidprice/s_0101.htm] where available.

[b] Low-end cost estimates are calculated as labor and materials costs + 20% allowance for PS&E, regional cost differences, and construction mobilization. High-end cost estimates are calculated 20% higher than the low-end estimates. All costs are provided in 2017 dollars.

9.1.2 Bikeway Operation and Maintenance Costs

To better anticipate the lifecycle costs of bikeway infrastructure, the project team evaluated the Operations and Maintenance (O&M) costs for both on-road bikeways (including buffered bike lanes, bike lanes, and wide shoulders) and off-road SUPs using TxDOT's Average Low Bid prices[83]. Table 15 identifies the O&M activities that the project team included in cost estimates.

Table 15: Bikeway Operation and Maintenance Activities

O&M Category	Maintenance Activities (TxDOT bid item#)	Annualized Per Mile Unit/Activity Cost*
Routine Maintenance *Multiple times each year*	Grass mowing (730 6002)	$216
	Cleaning/brushing (738 2006)	$5,600
	Tree trimming (752 6001)	$1,500
	Vandalism repair	$3,000
	Litter control (751 6005)	$672
Periodic Maintenance *Every 1 to 5 years*	Clearance pruning (751 6011)	$1,500
	Major tree trimming (752 6001)	$1,500
	Brush cutback (752 6002)	$1,500
	Roadway edging (751 6007)	$2,112
	Crack sealing (713 6005)	$5,280
	Re-striping (713 6005)	$1,584
	Permanent counter modem, batteries, etc.	$92

* Periodic maintenance activities do not occur every year. To derive annual maintenance costs for these items, routine maintenance costs were divided by 5 to represent an annualized cost.

Appendix C presents bikeway cost estimates, including O&M costs. While all bikeway facilities will require O&M expenditures to ensure the longevity of the bikeway investment, on-road bikeway O&M activities are assumed to be included in regularly scheduled road maintenance. In other words, a roadway incurs grass cutting, sweeping, and crack sealing costs whether a bike lane exists or not, so these costs may not increase existing O&M costs for the roadway. However, O&M costs for shared use paths and sidepaths would be newly incurred, as these bikeways are independent of a roadway. Depending on routine maintenance schedules, it may be advisable to allocate funding for

increased routine maintenance activities on bicycle tourism trail routes. Roadway debris and litter can severely affect the comfort and safety of a bicyclist.

Long-term maintenance activities will vary based upon location-specific attributes such as bikeway usage, soil conditions, and temperature. As mentioned above, it is assumed on-road bikeways (buffered bike lanes, bike lanes, and wide shoulders) would share the same typical pavement section as the roadway itself, and are, therefore, assumed to have the same long-term maintenance and repair needs. It is assumed these roadways would need a standard full-depth repair after 15-years. However, off-road SUPs are assumed to need full-depth repair after 30 years, as the majority of traffic loads and wear will result from bicycle and pedestrian users. Long-term maintenance activities anticipated for both on-road bikeways and SUPs include *crack cleaning and sealing* (TxDOT Bid #713 6005, $3 per linear foot) and *full-depth pavement repair* (TxDOT Bid #361 2001, $180 per square yard)[84]. O&M budgets should anticipate these infrequent costs.

10. Next Steps

At the January 2018 BAC Meeting, TxDOT's BAC unanimously approved the deliverables resulting from TxDOT's 15-month Texas Bicycle Tourism Trails Study. As part of this meeting, BAC members approved the following project team recommended initial next steps:

1. <u>Incorporate the products resulting from the study into TxDOT's Texas Transportation Plan 2045</u>
   The Texas Transportation Plan 2045 (TTP 2045) is the statewide long-range transportation plan for Texas. Produced by TxDOT and updated every 5 years, this plan represents the long-term, 25-year vision for the state's transportation network. While the TTP 2045 does not identify specific projects or their costs, it documents existing infrastructure and projects funding needs for all passenger and freight modes in the state. It details the strategic direction, long-range planning, programming, and implementation approach for Texas' transportation network.

   TxDOT-PTN has begun coordination with TxDOT's Transportation Planning and Programming (TPP) Division staff responsible for the development of the TTP 2045. Incorporating the BTTS Example Network and recommended bikeway types into the long-range plan will help promote planning and collaboration for bikeway development at the local and regional level and lead to broader promotion of long-distance bicycle coordination and development of bikeways for all-ages and abilities.

2. <u>Incorporate the BTTS Example Network into TxDOT's Statewide Planning Map</u>
   TxDOT-TPP staff are also responsible for the interactive statewide project delivery and information sharing map called the Statewide Planning Map. This useful and publicly available tool can overlay numerous data layers of regional and local transportation significance onto the TxDOT-maintained roadway network map. It can be used by TxDOT District staff to inform the transportation project development process and to better understand interconnected and geographically-specific concerns. An important next step would be to add a Geographic Information System (GIS) layer to the Statewide Planning Map reflecting the TxDOT's Example Network. This GIS data layer must be accompanied with a disclaimer indicating the need for further local-level project development investigation because the Example Network routes only represent an application of the qualitative and quantitative criteria established as part of the study.

3. <u>Identify, fund, and develop segments from the BTTS Example Network as pilot projects</u>
   Pilot projects are a great way to test large-scale implementation of an idea. A well-selected and constructed pilot project can demonstrate the effect of bicycle tourism trail bikeways on local communities. It is recommended that a few pilot projects be competitively selected from TxDOT's Example Network segments. When creating a pilot project prioritization or selection procedure, the following criteria may be included for consideration:

   - Proximity to existing bikeways, bicycle events, and/or potential users
   - Proximity to natural, scenic, or historic views and/or cultural sites

- Accessibility to other transportation modes (near transit or airports, and offers motor vehicle parking)
- Proximity to particular assets or destinations may be important (i.e. state/national parks [TPWD], historic sites or Main Street communities [THC]) if partnering with other state agencies,

Federal or state funded programs with local matches offer local entities the opportunity to partner in bikeway construction. Local partnerships will be crucial to long-term bikeway maintenance promotion and the best possible ridership. In coordination with other agency partners, TxDOT could identify potential funding sources to implement project development activities for segments of the Example Network through a pilot program.

11. Conclusion

Bicycling is an important mode of transportation for many Texans, as it provides a low-cost mode of travel, and is a desirable recreational activity. Bicycling contributes to the quality of life of Texans because it benefits the economy, public and physical health, and the overall transportation network. Literature reveals that simply providing bikeways can lead to greater public use and can lead to increases in physical activity and reductions in sedentary behavior for entire communities. From an economic standpoint, bicycle tourism spending can significantly contribute to local economies. Dollars spent on bicycle repair, manufacturing, and retail sales contribute to local, regional, and state economic prosperity.

TxDOT's Bicycle Tourism Trails Study investigated the development of bicycle tourism trail routes around Texas. The project team established a methodology for route development and provided an Example Network. This final report documents the iterative, collaborative route development process undertaken by the TxDOT's BAC, BAC Working Group, and project team to create TxDOT's Example Network. Data-driven and stakeholder informed, the route development process relied on available existing condition data as well as local/regional transportation plans and knowledge. Example Network routes represent an application of the qualitative and quantitative criteria established as part of the study. A more thorough analysis of local conditions and extensive stakeholder engagement is needed for all routes.

Additionally, this final report documents TxDOT's recommended bikeway accommodations and design criteria, specific to bicycle tourism trails. Newly constructed bikeways planned as bicycle tourism trail routes should follow the recommended design criteria provided in this study. The bikeway design recommendations, challenges, and considerations described under each bikeway type in this report are critical to creating a safer bicycle network for users of all ages and all abilities.

Texans would benefit greatly from more connected bikeways across the state. The provision of bikeways can increase spending in local economies, improve the health of local residents, and improve the quality of life for all Texans.

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Appendix A: Example Network Route Development Data Sources

BTTS Example Network Route Development Data Sources

Data utilized	Data Type	Source
RHINO (2015)	Line shapefile	TxDOT-TPP
City Boundaries	Polygon shapefile	TxDOT-TPP
Railroads	Line shapefile	TxDOT-TPP
BikeTexas Tourism Trail Routes	Line shapefile	CH2M digitized, BikeTexas created
USBRS Proposed Corridors	Line shapefile	CH2M digitized, Adventure Cycling Association originated
Adventure Cycling Routes	Line shapefile	Adventure Cycling Association
Federal and state roadways	Line shapefile	TxDOT-TPP
State Park Trails	Line shapefile	Texas Parks and Wildlife Department
National and State Parks	Polygon shapefile	TxDOT-TPP
Federal lands	Polygon shapefile	TxDOT-TPP
Water (lakes, bays, etc.)	Polygon shapefile	TxDOT-TPP
Water (rivers, streams, etc.)	Line shapefile	TxDOT-TPP
Historic Trails	Line shapefile	National Park Service
Historical markers	Point shapefile	Texas Historical Commission, Texas Heritage Tourism Program
Texas Mainstreet Communities	Polygon shapefile	Texas Historical Commission, Texas Mainstreet Program
Existing bikeway locations	Line shapefile	City of Austin
	Line shapefile	Alama Area MPO
	Line shapefile	Corpus Christi MPO
	Line shapefile	Houston-Galveston Area Council
	Line shapefile	Bryan-College Station MPO
	Line shapefile	Sherman-Denison MPO
	Line shapefile	North Texas Council of Governments
	Line shapefile	Temple-Killeen MPO
	Line shapefile	City of El Paso
Bicycle and Transportation Plans	PDF file/image	Texarkana MPO
	PDF file/image	City of Nacogdoches
	PDF file/image	Capital Area MPO
	PDF file/image	Brownsville Active Plan
	PDF file/image	Dallas Loop
	PDF file/image	City of Abilene
	PDF file/image	City of Laredo
	PDF file/image	Lubbock MPO
	PDF file/image	City of Amarillo
	PDF file/image	Waco MPO
	PDF file/image	City of San Antonio
	PDF file/image	North Texas Council of Governments
	PDF file/image	Northeast Texas Trails Coalition
Regional stakeholder feedback via Wikimap Online Input Tool	Line shapefile	Regional stakeholder feedback
Strava heat map linework	Tiled internet raster layer	Strava Metro
Satellite imagery	Tiled internet raster layer	Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
World street map	Tiled internet raster layer	Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Appendix B: Wikimap Online Input Tool

1) All Stakeholder Comments (4 pages)
2) Wikimap Online Input Tool Feedback and Project Team Responses (2 pages)

Comment ID	Type	Category ID	Category	Initial Comment	Creator ID	Create Date
252986	point	10157	Only for fearless cyclists	The section of Memorial from Buffalo Bayou Park to Memorial Park is pretty speedy and has no shoulders. Cyclists often ride on the sidewalks here.	166717	6-Sep-17
252987	point	10155	Bicycle destination here	Buffalo Bayou Park is a phenomenal place for cyclists to both pass through and stop.	166717	6-Sep-17
252988	point	10155	Bicycle destination here	Really easy ride	166717	6-Sep-17
252989	point	10155	Bicycle destination here	The Columbia Tap Trail, Hermann Park, and Brays Bayou are all great spots. The route should connect to those places as well.	166717	6-Sep-17
252990	point	10156	Not suitable for bicycle use	If I'm reading the map correctly, this is not a bike trail. There's a functional rail line that runs through here and it has no infrastructure for bike use. It would be amazing if there were. Instead, I would take a different route to get back to Brays Bayou. I'll indicate it on the map.	166717	6-Sep-17
252991	point	10156	Not suitable for bicycle use	It is not possible to cross the bayou here. That would be great though!	166717	6-Sep-17
252992	point	10157	Only for fearless cyclists		166717	6-Sep-17
252993	point	10155	Bicycle destination here	It would be great to dream up a route that takes folks to Galveston.	166717	6-Sep-17
253077	point	10156	Not suitable for bicycle use	SH 358 is a divided highway without any accommodations for cyclists. While the greater Corpus Christi region is well suited for developmetn of bike-based tourism, the selected roadways (SH44 and SH358) are not suitable for this purpose. Please see Bicycle Mobility Network defined in the Corpus Christi MPO's Strategic Plan for Active Mobility for alternative routes. Plan includes detailed methodology about data basis for route selection and infrastructure prescriptions. MPO staff would be happy to provide any shapefiles from the plan that may be of use.	167055	7-Sep-17
253078	point	10156	Not suitable for bicycle use	SH 44 is a highway without any accommodations for cyclists. While the greater Corpus Christi region is well suited for development of bike-based tourism, the selected roadways (SH44 and SH358) are limited in ROW and thus may not be preferred for this purpose. Please see Bicycle Mobility Network defined in the Corpus Christi MPO's Strategic Plan for Active Mobility for alternative routes. The Plan includes detailed methodology about data basis for route selection and infrastructure prescriptions. MPO staff would be happy to provide any shapefiles from the plan that may be of use.	167055	7-Sep-17
253128	point	10157	Only for fearless cyclists	No shoulders on Sandy Point Road. Narrow Lanes 70 MPH Speed Limit. Trucks. Drunk Drivers from Lake. Strong and Fearless at best!	167215	8-Sep-17
253134	point	10155	Bicycle destination here	Lake Bryan. Mountain Bike Trails, camping etc.	167215	8-Sep-17
253173	point	10155	Bicycle destination here	Sam Houston State Park. Beautiful recreational bike trails!	167215	8-Sep-17
253174	point	10155	Bicycle destination here	Scenic 390 between Burton and Independence. Spring Wildflowers. Lots of bicyclists. Narrow windy sections however and some traffic. Not 8-80 without some enhancement.	167215	8-Sep-17
253177	point	10155	Bicycle destination here	Long distance riders need places to stay overnight at regular intervals. Routes need to incorporate camping locations!	167215	8-Sep-17
253344	point	10155	Bicycle destination here	City of Sherman Mountain Bike Course	167720	12-Sep-17
253345	point	10155	Bicycle destination here	City of Sherman Bike Course	167720	12-Sep-17
253346	point	10155	Bicycle destination here	City of Denison Waterloo Lake Park; Has a concrete trail around park.	167720	12-Sep-17
253347	point	10155	Bicycle destination here	Loy Lake Park has a number of trails.	167720	12-Sep-17
253348	point	10155	Bicycle destination here	Eisenhower Birthplace State Historic Site	167720	12-Sep-17
253349	point	10155	Bicycle destination here	Eisenhower State Park has a number of trails.	167720	12-Sep-17
253350	point	10155	Bicycle destination here	City of Sherman Bike Course	167720	12-Sep-17
253351	point	10155	Bicycle destination here	Hagerman National Wildlife Refuge has a number of trails.	167720	12-Sep-17
253393	point	10155	Bicycle destination here	Downtown Bryan hosts regular events including Third Thursday Art Step, First Friday, and Brazos Valley Farmers Market on Saturdays. There are occasional street festivals including Texas Reds Steak & Grape Festival, Christmas parade, etc. https://www.downtownbryan.com/	167861	12-Sep-17
253394	point	10155	Bicycle destination here	Blinn College - destination for students living in Bryan, College Station, and/or co-enrolled at Texas A&M University.	167861	12-Sep-17
253395	point	10155	Bicycle destination here	Texas A&M University - destination for students and faculty living off-campus in Bryan and College Station.	167861	12-Sep-17
253424	point	10155	Bicycle destination here	Mountain Biking, Camping and Equestrian Facilities	168016	13-Sep-17
253425	point	10155	Bicycle destination here	Camping, Mountain Biking, Equestrian and Running Trails	168016	13-Sep-17
253426	point	10155	Bicycle destination here	Camping and Mountain Bike Trails Equestrian Camping / Riding is possible with advanced coordination	168016	13-Sep-17
253427	point	10155	Bicycle destination here	Bicycle Repair Station, common Start Point for Endurance Cyclist and Runners	168016	13-Sep-17
253503	point	10155	Bicycle destination here	12 miles of area-best singletrack. A worthy destination.	168215	14-Sep-17
253504	point	10155	Bicycle destination here	Bike trails need to be developed here. Can TXDOT enhance Army Corps of Engineers relations to facilitate trail development? This would be a wonderful attraction for Salado bike tourism, and mountain bikers north and south on Interstate 35.	168215	14-Sep-17
253505	point	10155	Bicycle destination here	Bike trails are developed here. Can TXDOT enhance Army Corps of Engineers relations to facilitate trail development? This would be a wonderful attraction for Temple-Belton bike tourism, and mountain bikers north and south on Interstate 35.	168215	14-Sep-17
253536	point	10155	Bicycle destination here	Historic City (Tourism), e bikes available and popular bike friendly businesses. Gathering start point for endurance road riders.	168016	15-Sep-17
253636	point	10155	Bicycle destination here	Several other local trails are available for shorter trips or excursions. Could be included as a lower-level network. e.g. Salado Creek Greenway Trail, Leon Creek Greenway Trail, Westside Creeks Trails.	168316	19-Sep-17
253638	point	10157	Only for fearless cyclists	Blanco Road is a wide, high speed road and is rated as "Strong" in our bicycle level of traffic stress network. That being said, there aren't any alternate continuous northbound bike routes that would be more comfortable.	168316	19-Sep-17
253644	point	10157	Only for fearless cyclists		168316	19-Sep-17
253645	point	10157	Only for fearless cyclists		168316	19-Sep-17
253646	point	10156	Not suitable for bicycle use	There is no access to Loop 410 from Villamain Road.	168316	19-Sep-17
253647	point	10157	Only for fearless cyclists		168316	19-Sep-17
253648	point	10157	Only for fearless cyclists		168316	19-Sep-17
253846	point	10155	Bicycle destination here	Carpenter's Bluff Bridge is a historic bridge that has been converted to pedestrian access only by the State of Oklahoma.	169381	21-Sep-17
253915	point	10155	Bicycle destination here	Sun City has a very active cycling club, especially involving those over 50 years old.	169507	21-Sep-17
254112	point	10156	Not suitable for bicycle use	I debated between for "fearless cyclists" and not suitable for bicycle use concerning US 82. The stretch of US 82 between Texarkana and New Boston has heavy traffic due to industry. There is not a wide shoulder for use, and there are deep ditches on the north side of the road and a railroad track on the south side of the road. Cyclists have no escape route in my opinion.	169996	25-Sep-17
254113	point	10156	Not suitable for bicycle use	I debated between for "fearless cyclists" and not suitable for bicycle use concerning US 82. The stretch of US 82 between Texarkana and New Boston has heavy traffic due to industry. There is not a wide shoulder for use, and there are deep ditches on the north side of the road and a railroad track on the south side of the road. Cyclists have no escape route in my opinion.	169996	25-Sep-17
254116	point	10156	Not suitable for bicycle use	There are no wide shoulders for riding comfort and heavy traffic during different times of the day due to people going to work at Red River.	169996	25-Sep-17
254117	point	10156	Not suitable for bicycle use	Once you left Lelia Street, you are traveling along a railroad track which, to my knowledge, is still active. Not suitable for bike use!!	169996	25-Sep-17
254118	point	10156	Not suitable for bicycle use	Satellite image has train on the tracks. Not for bike use.	169996	25-Sep-17
254223	point	10155	Bicycle destination here	Tyler State Park	167251	26-Sep-17
254224	point	10156	Not suitable for bicycle use	Narrow lanes with no shoulder and high volume of bulky vehicles accessing the landfill along the route.	167251	26-Sep-17
254242	point	10156	Not suitable for bicycle use	The section after the Rio Grande trail ends is not currently connected to the US 20	170205	26-Sep-17
254253	point	10155	Bicycle destination here	More bicycle facilities are needed in the Northwest quadrant of Fort Worth and the suburbs. This is a rapidly growing area.	166771	26-Sep-17
254254	point	10155	Bicycle destination here	A bicycle facility is needed along Golden Triangle/FM 1709.	166771	26-Sep-17
254260	point	10157	Only for fearless cyclists		170205	26-Sep-17
254263	point	10157	Only for fearless cyclists	This county road hits US 67 at a very busy point, and there is a bit of a sprint to get to the section of US 67 that widens out to have larger shoulders. One could take Presley Road (1225) to FM 2148 S, but that FM road has heavy traffic and maybe 1-2 foot shoulders. It would put a cyclist past the intersections of FM 2148 N and FM 991 when it ties back in to US 67.	169996	26-Sep-17
254272	point	10157	Only for fearless cyclists	This 55-mile HW-54 segment is not adequate with bicycle facilities such as water access, accommodations in case of an emergency, sanitary facilities, limited cell phone coverage, and virtually no rural communities along the road.	170205	26-Sep-17

Comment ID	Type	Category ID	Category	Initial Comment	Creator ID	Create Date
254334	point	10156	Not suitable for bicycle use	Bicycles are prohibited on SH 6 bridges over Lake Waco Freeway class facility	170417	27-Sep-17
254336	point	10155	Bicycle destination here	Cameron Park - Extensive bike trails	170417	27-Sep-17
254337	point	10157	Only for fearless cyclists	Long bridge with no shoulders and 55mph speed limit No plans to widen / retrofit bridge	170417	27-Sep-17
254338	point	10156	Not suitable for bicycle use	Trail on private property No public access - prior permission from property owners required	170417	27-Sep-17
254366	point	10155	Bicycle destination here	San Jacinto Plaza (Downtown El Paso) Bicycle Friendly Zone, Bicycle facilities, and Touristic (historic) Destination	170205	27-Sep-17
254367	point	10157	Only for fearless cyclists	For fearless cyclists. Segment between US-54 and Railroad Dr.	170205	27-Sep-17
254368	point	10155	Bicycle destination here	Franklin Mountains State Park	170205	27-Sep-17
254369	point	10155	Bicycle destination here	Mammoths Trunk Trail Parking. Typically used by mountain bikers to ride some of the Franklin Mountain trails	170205	27-Sep-17
254370	point	10155	Bicycle destination here	Transmountain View	170205	27-Sep-17
254371	point	10157	Only for fearless cyclists	Typically limited cell phone connectivity (low to zero phone signal). Long segments (30-50 miles) without water/food supply. No lodging facilities around (120 miles without hotels)	170205	27-Sep-17
254393	point	10156	Not suitable for bicycle use	Current conditions are not safe for cyclists (I-10 crossing)	170205	28-Sep-17
254405	point	10155	Bicycle destination here	Access to the Franklin Mountains mountain bike trails	170205	28-Sep-17
254411	point	10155	Bicycle destination here	Hueco Tanks State Park	170205	28-Sep-17
254412	point	10155	Bicycle destination here	U.S. Border Patrol Checkpoint. Cyclist must show proper identification and/or travel documents. Cell phone signal/service become limited after this point (eastbound). After this point (eastbound) cyclists will not find water/food/services supply for about 25 miles or more.	170205	28-Sep-17
254413	point	10155	Bicycle destination here	One of the few food/water provisions for cyclists along the El Paso-Guadalupe Mountains route. This place is not open every day. Cyclist must plan in advance.	170205	28-Sep-17
254414	point	10157	Only for fearless cyclists		170205	28-Sep-17
254415	point	10155	Bicycle destination here	Access to a rustic adobe hotel	170205	28-Sep-17
254416	point	10155	Bicycle destination here	Access to the Fort David National Historic Site	170205	28-Sep-17
254417	point	10155	Bicycle destination here	Access to the McDonald Observatory Visitors Center	170205	28-Sep-17
254418	point	10157	Only for fearless cyclists		170205	28-Sep-17
254453	point	10156	Not suitable for bicycle use	Hwy 6 is not recommended as a spur into the City of Waco. Alternate route via State Hwy 1637 is proposed.	170417	29-Sep-17
254454	point	10155	Bicycle destination here	It's important to connect the two largest metro areas in the state. Please consider re-classifying this corridor as a "cross-state spine route". This corridor is also consistent with US Bicycle Route 55 identified in the National USBRS Corridor Plan adopted by AASHTO.	169298	29-Sep-17
254456	point	10155	Bicycle destination here	Please consider re-classifying this corridor as a "cross-state spine route". This corridor is consistent with US Bicycle Route 84 identified in the National USBRS Corridor Plan adopted by AASHTO.	169298	29-Sep-17
254457	point	10155	Bicycle destination here	NCTCOG agrees with the conceptual corridor connecting McKinney to Sherman and Denison. This corridor is also consistent with US Bicycle Route 55 identified in the National USBRS Corridor Plan adopted by AASHTO.	169298	29-Sep-17
254459	point	10157	Only for fearless cyclists	The NCTCOG Metropolitan Transportation Plan identifies SH 34 as a rural route, but in need of being upgraded with shoulders. US 69 to Greenville could be an alternative route.	169298	29-Sep-17
254473	point	10155	Bicycle destination here	This route connects to several DART transit stations.	169298	29-Sep-17
254474	point	10155	Bicycle destination here	Cedar Hill State Park	169298	29-Sep-17
254475	point	10155	Bicycle destination here	Katy Trail is extremely popular among bicyclists and is near downtown Dallas.	169298	29-Sep-17
254476	point	10155	Bicycle destination here	Downtown Fort Worth, Cultural District, and Fort Worth Zoo are popular destinations close to this route.	169298	29-Sep-17
254477	point	10155	Bicycle destination here	Mineral Wells State Trailway.	169298	29-Sep-17
254478	point	10155	Bicycle destination here	Lake Mineral Wells State Park	169298	29-Sep-17
254479	point	10155	Bicycle destination here	Ray Roberts Lake State Park	169298	29-Sep-17
254480	point	10155	Bicycle destination here	Several DCTA and DART transit stations are accessible along this corridor.	169298	29-Sep-17
254481	point	10155	Bicycle destination here	Several TRE transit stations are accessible along this corridor.	169298	29-Sep-17
254493	point	10155	Bicycle destination here	San Angelo State Park. Several trails for cyclists and hikers	170758	29-Sep-17
254590	point	10155	Bicycle destination here	Caddo Lake State Park	164797	2-Oct-17
254591	point	10155	Bicycle destination here	Overlook Point, Lake o the Pines Dam - Lake o the Pines consists of seven parks and four campgrounds with activities such as camping, fishing, and boating.	164797	2-Oct-17
254592	point	10155	Bicycle destination here	Daingerfield State Park	164797	2-Oct-17
254593	point	10155	Bicycle destination here	Wright Patman Lake - 10 surrounding parks	164797	2-Oct-17
254594	point	10155	Bicycle destination here	Enoch's Stomp Vineyard & Winery	164797	2-Oct-17
254595	point	10155	Bicycle destination here	This extension is being proposed to continue along FM 2275/George Richey Rd., which includes four (4) miles of existing bicycle lane between SH 300/Gilmer Rd. and US 259. An additional two (2) miles of bicycle lanes are planned when FM 2275/George Richey is widened from 2 to 4 lanes in 2021, for a total of 6 miles of bicycle lanes.	164797	2-Oct-17
254596	point	10155	Bicycle destination here	Jefferson, Texas is a historic riverport town with attractions and overnight lodging. The city has over 70 historic landmarks, over 25 bed and breakfast locations, restored buildings, museums, dining, lodging, and well-preserved homes. Jefferson is a hot spot for tourists.	164797	2-Oct-17
254696	point	10155	Bicycle destination here	Bike & Fitness Shop - Great stop for supplies or rest between long stretches of riding.	164797	4-Oct-17
1139229	line	10154	Recommended route change		166717	6-Sep-17
1139321	line	10154	Recommended route change	This is a pretty popular bicycle route. See the heat map compared to SH 21 on Strava. It is far lower ADT on all portions and far fewer trucks. Some of the smaller FM sections do not have shoulders however. The FM 60 section has shoulders and new bicycle facilities and enhancements are currently being added between campus to west of FM 2818. -MJ	167215	8-Sep-17
1139323	line	10154	Recommended route change	Bicycle route shifting from South College to Cavitt Street for a section. Enhancements are currently under construction. Enhancements include a new SUP along Spur 308 South College Ave. from Brookside to Inlow. This is not shown because it does not yet connect. Will become main route once an additional project is designed and constructed from Inlow to FM 60 University Drive.	167215	8-Sep-17
1139332	line	10154	Recommended route change	Railroad ROW purchased by Northeast Texas Regional Mobility Authority for multi-use trail	167251	8-Sep-17
1139338	line	10154	Recommended route change	Reroute to match current plans for bicycle routes around University of Texas at Tyler campus.	167251	8-Sep-17
1139419	line	10154	Recommended route change	Hwy 158 from Midland to Hwy 87 to San Angelo. Since the hwy has been rebuilt the shoulders are wide and flat, with places to stop, small communities, a public rest stop on 87 and San Angelo has numerous bike trails and facilities and a state park. It is a beautiful ride.	167826	12-Sep-17
1139432	line	10154	Recommended route change	Existing shared use path along Boonville Road (FM 158) from Earl Rudder Freeway (SH 6) to University Drive (FM 60).	167861	12-Sep-17
1139550	line	10154	Recommended route change	Lake to Lake Route, small stretch of FM 439 and Sparta need shoulder work.	168016	15-Sep-17
1139551	line	10154	Recommended route change	Very low traffic access road leading to scenic outlook of the lake. Popular Hill Challenge at the beginning.	168016	15-Sep-17
1139678	line	10154	Recommended route change	There is no access to Loop 410 from Villamain Road. Shane Road is a low-stress route and would be a good alternative to a high-stress access road.	168316	19-Sep-17
1139679	line	10154	Recommended route change	Need to take access road to get on US 181 S.	168316	19-Sep-17
1139969	line	10154	Recommended route change	Starting at the East Gate of Fort Hood (the Great Place) along Rancier Ave (which the City Mayor is trying to revitalize with sidewalks and landscaping) to the City's largest park, Long Branch Park. Then continuing East along FM-439 to the Belton Lake Park areas (near Dead Fish Grill). Then continuing further East along FM-439 to 317, head North into Temple and South into Downtown Belton. This route would connect Fort Hood, Killeen, Nolanville, Belton and Temple. Plus the scenery/terrain along this route is the most pleasant and safest as compared to I-14.	169515	21-Sep-17
1139970	line	10154	Recommended route change	Makes more sense to continue the FM-439 trail to 317 rather than 121. Because 121 you will have to cross over the dam which has no room for widening and/or it would be too costly. Plus extending to 317 allows for it to break off into two, North towards Temple and South into Downtown Belton.	169515	21-Sep-17
1139971	line	10154	Recommended route change	Extend the trail from the connection of FM-439 and 317 into Downtown near the Gin development or Nolan Creek.	169515	21-Sep-17
1139973	line	10154	Recommended route change	Perfect route from Fort Hood to Central Texas College which provides numerous classes for our troops. Plus it would also connect some Fort Hood Family Housing units to the college.	169515	21-Sep-17
1139974	line	10154	Recommended route change	Extension connecting not only Fort Hood to CTC but CTC to TAMU-CT! This will serve a growing academic population in anticipation of future growth at TAMU-CT.	169515	21-Sep-17

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1139975	line	10154	Recommended route change	This piece would help connect the Fort Hood soldier barracks to the extensive trail along Rancier and FM-439 and provide seamless connectivity from Fort Hood to Temple/Belton/Salado.	169515	21-Sep-17
1139977	line	10154	Recommended route change	This addition would connect the existing Andy K Wells Hike and Bike Trail along Avenue G in Killeen to another significant and widely utilized park, Conder Park. This also connects Central Fire Station to their training facility at Conder Park.	169515	21-Sep-17
1140263	line	10154	Recommended route change	Alternative route connecting Van Horn-Valentine-Quebec-Ryan-Marfa-Alpine areas using the State Highway US 90/US 67 instead of the I-10 Vanhorn-Kent section	170205	26-Sep-17
1140265	line	10154	Recommended route change	Alternative route connecting Van Horn-Valentine-Quebec-Ryan-Marfa-Alpine areas using the State Highway US 90/US 67 instead of the I-10 Vanhorn-Kent section	170205	26-Sep-17
1140302	line	10154	Recommended route change	This route is a suggestion to circumvent US 82 from Texarkana to New Boston. It is not perfect by any means. I have NO idea why US 82 keeps showing up on bike travel websites as a suggested route from New Boston to Texarkana. There have been bike tourists that have followed the route and have been very upset about the amount of traffic and hazards. They may have been riding during a shift change at Red River Army Depot. I don't know of anyone riding FM 2149 from US 67 to SH 8, but knew SH 8 has a bit of heavy truck traffic and not much of a shoulder. Riders should always use caution.	169996	26-Sep-17
1140338	line	10154	Recommended route change	Alternative route connecting El Paso West Side area with El Paso downtown	170205	27-Sep-17
1140463	line	10154	Recommended route change	recommended spur into Waco city limits, instead of Hwy 6.	170417	29-Sep-17
1140473	line	10154	Recommended route change	potential future connection or alternate route from State Hwy 6. Current conditions aren't ideal, but there are future projects to improve the 84/Speegleville interchange (TxDOT project) and a County project to improve a portion of Speegleville road.	170417	29-Sep-17
1140486	line	10154	Recommended route change	This route follows the historic Bankhead Highway, which could serve as an on-street alternative to the planned off-street corridor submitted between Mineral Wells State Trailway and Trinity Trails in Benbrook. Information obtained from the Texas Historical Commission: http://www.thc.texas.gov/content/bankhead-highway	169298	29-Sep-17
1140487	line	10154	Recommended route change	US 69 has shoulders and may want to be considered as an alternative to SH 34.	169298	29-Sep-17
1140633	line	10154	Recommended route change	FM384-Old Longview Hwy can be utilized as an alternative to FM2767-Old Kilgore Hwy. This route has low traffic volumes and picturesque routes through the pines.	164797	3-Oct-17
1139228	line	10153	Significant route connection	This might be another option to getting around the lack of a North-South connection. There are many variations, especially on the urban streets.	166717	6-Sep-17
1139322	line	10153	Significant route connection	This route provides connection to Lake Bryan avoiding Sandy Point Road. It has a strong Strava heat signature as the most used route. Lake Bryan is a popular local/regional bicycle destination.	167215	8-Sep-17
1139352	line	10153	Significant route connection	Proposed reroute will connect to Tiger Creek Wildlife Refuge, Tyler State Park, a multimodal transit hub and downtown.	167251	8-Sep-17
1139400	line	10153	Significant route connection	This trail, which is shown on the 2040 MTP for the Sherman-Denison MPO, would utilize floodplain from the East Fork Trinity River, run along SH 56 (this portion was constructed using TAP funds about four years ago) to downtown Sherman, run up an abandoned railroad line to downtown Denison, run up the floodplain of Duck Creek to a powerline, follow the powerline to an existing road that connects to Eisenhower State Park. Within Eisenhower State Park, there are a series of trails and other amenities for users to enjoy! The Sherman-Denison MPO is excited about the opportunity to add this to the statewide plan.	167720	11-Sep-17
1139401	line	10153	Significant route connection	This trail, which is shown on the Sherman-Denison MPO's 2040 MTP, connects downtown Denison with downtown Bells. We would have like to have continued it and tied it back into the trail to Paris, TX, but did not have the resources to determine the optimal route. Perhaps as part of this study, this is a trail that could be examined.	167720	11-Sep-17
1139407	line	10153	Significant route connection	Connects the proposed trail in downtown Denison to Oklahoma and the historic Carpenters Bluff Bridge.	167720	12-Sep-17
1139408	line	10153	Significant route connection	Has a high Strava count.	167720	12-Sep-17
1139409	line	10153	Significant route connection	Connects downtown Sherman with Hagerman National Wildlife Refuge. There are a number of trails in this area.	167720	12-Sep-17
1139412	line	10153	Significant route connection	This trail connects Eisenhower State Park with Hagerman National Wildlife Refuge.	167720	12-Sep-17
1139414	line	10153	Significant route connection	Connection to Oklahoma.	167720	12-Sep-17
1139415	line	10153	Significant route connection	This rail line appears to be abandoned. If it is not being utilized, this is an excellent opportunity to make a significant connection.	167720	12-Sep-17
1139420	line	10153	Significant route connection	This route, the majority of which is an abandoned rail line, would be an excellent connector to the north Texas region. It would connect a number of small towns across north Texas.	167720	12-Sep-17
1139433	line	10153	Significant route connection	Alternative route to downtown Bryan. Also, commuter route for students and faculty to west campus of Texas A&M.	167861	12-Sep-17
1139695	line	10153	Significant route connection	A direct connection between San Antonio and Austin is recommended. These two regions are increasingly growing towards eachother, and efforts have already been initiated to provide a continuous bike route between them. The Alamo Area MPO and Capital Area MPO held a joint public workshop in February 2017 to identify potential routes, and CAMPO has included regional connections in its draft Active Transportation Plan. Local groups, including the National MS Society, also host bike rides along this corridor.	168316	19-Sep-17
1139968	line	10153	Significant route connection	A Great connecting, scenic route from Gatesville through Belton, scenic Salado and great communities south to suggested regional routes.	169507	21-Sep-17
1139968	line	10153	Significant route connection	A Great connecting, scenic route from Gatesville through Belton, scenic Salado and great communities south to suggested regional routes.	169507	21-Sep-17
1139976	line	10153	Significant route connection	This small extension would allow the existing Andy K Wells Hike and Bike Trail (currently runs from Downtown Killeen to 38th St) to connect to the proposed trail along Rancier/FM-439. And the land owner, which owns all of the land along the northside of Water St in Killeen (James Gaffney and Laurie Leach) have already committed to donating (no cost) all of the land along that section of Nolan Creek and Water Street to the City of Killeen if an extension of the Andy K Wells Hike and Bike Trail was ever to be constructed.	169515	21-Sep-17
1139978	line	10153	Significant route connection	This route would connect the National Mounted Warfare Museum to the other proposed trail along Rancier/FM-439.	169515	21-Sep-17
1140300	line	10153	Significant route connection	Significant Route in Beaumont District	170223	26-Sep-17
1140303	line	10153	Significant route connection	Proposed Bicycle Route	170223	26-Sep-17
1140312	line	10153	Significant route connection	Proposed Bike Route	170223	26-Sep-17
1140314	line	10153	Significant route connection	Proposed Bike Route	170223	26-Sep-17
1140364	line	10153	Significant route connection	Alternative route connecting downtown El Paso and North Loop	170205	27-Sep-17
1140365	line	10153	Significant route connection	Ongoing project: Trail proposal by the Institute of Healthy Living, connecting Azcarate Park with Riverside Park.	170205	27-Sep-17
1140366	line	10153	Significant route connection	Martin Luther King Jr. Blvd (FM 3255) connecting with Stateline/Chaparral (NM-213). Shoulder starts after Loma Real Ave (North bound)	170205	27-Sep-17
1140367	line	10153	Significant route connection	Potential connection using gateways on Woodrow Bean Transmountain Dr.	170205	27-Sep-17
1140397	line	10153	Significant route connection	This route connects downtown El Paso with US-62 route (to Hueco Tanks and Guadalupe Mountains)	170205	28-Sep-17
1140404	line	10153	Significant route connection	TX-2775 Hueco Tanks Rd	170205	28-Sep-17
1140426	line	10153	Significant route connection	Connection to TX-118	170205	28-Sep-17
1140430	line	10153	Significant route connection	Connection to TX-17 (Fort Davis)	170205	28-Sep-17
1140440	line	10153	Significant route connection	Based on KTMPO 2011 Regional Thoroughfare and Pedestrian/Bicycle Plan.	170705	29-Sep-17
1140446	line	10153	Significant route connection	Based on KTMPO 2011 Regional Thoroughfare and Pedestrian/Bicycle Plan.	170705	29-Sep-17
1140447	line	10153	Significant route connection	Based on KTMPO 2011 Regional Thoroughfare and Pedestrian/Bicycle Plan.	170705	29-Sep-17
1140449	line	10153	Significant route connection	Based on KTMPO 2011 Regional Thoroughfare and Pedestrian/Bicycle Plan.	170705	29-Sep-17
1140454	line	10153	Significant route connection	Possible route to connect KTMPO region to proposed network.	170705	29-Sep-17
1140459	line	10153	Significant route connection	Based on KTMPO 2011 Regional Thoroughfare and Pedestrian/Bicycle Plan.	170705	29-Sep-17
1140461	line	10153	Significant route connection	Proposed route to connect KTMPO region to proposed network.	170705	29-Sep-17
1140464	line	10153	Significant route connection	connect from FM 1637 to Lake Waco Dam Trail	170417	29-Sep-17
1140465	line	10153	Significant route connection	recommended connection from Lake Waco Dam Trail (off-street) to on-street bike lanes along Park Lake Dr.	170417	29-Sep-17
1140466	line	10153	Significant route connection	Connection from Park Lake Dr bike lanes to downtown Waco (and downtown Waco bike lanes).	170417	29-Sep-17
1140467	line	10153	Significant route connection	Connection (NW bound)	170417	29-Sep-17
1140468	line	10153	Significant route connection	E-W route out of Waco metro area	170417	29-Sep-17
1140469	line	10153	Significant route connection	Route connection to downtown West. Good tourist stop.	170417	29-Sep-17
1140470	line	10153	Significant route connection	Connection from West and Leory to Axtell via FM 2311.	170417	29-Sep-17

Comment ID	Type	Category ID	Category	Initial Comment	Creator ID	Create Date
1140471	line	10153	Significant route connection	Connection from Axtell to State Hwy 84 via FM 1330.	170417	29-Sep-17
1140472	line	10153	Significant route connection	Potential regional connection from eastern McLennan County to main route in Fairfield, TX, via State Highway 84 and through Mexia and Teague.	170417	29-Sep-17
1140475	line	10153	Significant route connection	potential connection from regional route on FM 317 to potential Speegleville Rd connectivity	170417	29-Sep-17
1140476	line	10153	Significant route connection	recommended connection route from Cotton Belt Trail to downtown McGregor.	170417	29-Sep-17
1140479	line	10153	Significant route connection	From Waco metro area, take Old Dallas Hwy north to West	170417	29-Sep-17
1140480	line	10153	Significant route connection	The cross-state spine routes need to be connected. The City of Benbrook's plan identifies planned bikeways along this segment of FM 2871/Chapin School Road.	169298	29-Sep-17
1140481	line	10153	Significant route connection	connection to Hillsboro via WIllie Nelson Hwy. At I-35 and SH 81, northbound only (because of frontage road). Southbound route will be different.	170417	29-Sep-17
1140482	line	10153	Significant route connection	southbound connection from downtown Hillsboro to FM 3102	170417	29-Sep-17
1140483	line	10153	Significant route connection	potential connection from Hillsboro to main route in Cleburne	170417	29-Sep-17
1140484	line	10153	Significant route connection	This corridor is the Cotton Belt Trail, existing in the Mid-Cities region and planned to parallel the TexRail Commuter Rail Line and Cotton Belt Commuter Rail Lines.	169298	29-Sep-17
1140485	line	10153	Significant route connection	Extending the Cotton Belt Trail to connect with the Fort Worth - Dallas Regional Bikeway Corridor.	169298	29-Sep-17
1140488	line	10153	Significant route connection	An on-street extension from Ray Roberts Lake State Park would connect to the route through Whitesboro proposed by the Sherman-Denison MPO.	169298	29-Sep-17
1140491	line	10153	Significant route connection		169298	29-Sep-17
1140491	line	10153	Significant route connection		169298	29-Sep-17
1140492	line	10153	Significant route connection		169298	29-Sep-17
1140493	line	10153	Significant route connection		169298	29-Sep-17
1140494	line	10153	Significant route connection		169298	29-Sep-17
1140495	line	10153	Significant route connection	LP 375 is an alternative route that passes through Franklin Mountains State Park	170205	29-Sep-17
1140496	line	10153	Significant route connection	River Park trail connection to New Mexico	170205	29-Sep-17
1140499	line	10153	Significant route connection	Connection to the El Paso Mission Trail in Ysleta, Socorro and San Elizario.	170205	29-Sep-17
1140552	line	10153	Significant route connection		164797	2-Oct-17
1140555	line	10153	Significant route connection	Beautiful route north to Harleton with easy access to Enoch's Stomp Vineyard & Winery. Several miles of new construction on FM 450 with wide shoulders.	164797	2-Oct-17
1140556	line	10153	Significant route connection		164797	2-Oct-17
1140557	line	10153	Significant route connection	FM 726 is a preferred route by local and regional bicyclists to visit Lake o the Pines and enjoy Overlook Point for a rest stop and photo op.	164797	2-Oct-17
1140558	line	10153	Significant route connection		164797	2-Oct-17
1140571	line	10153	Significant route connection	SH 49 provides a picturesque route from Jefferson, Texas to Daingerfield, Texas. Daingerfield is home to Daingerfield State Park and is often visited by locals and tourists alike for picnicking, camping, boating, fishing, swimming, hiking, and nature study.	164797	2-Oct-17
1140576	line	10153	Significant route connection	SH-154 commonly selected route for local and regional bicyclists. Low traffic route.	164797	2-Oct-17
1140580	line	10153	Significant route connection		164797	2-Oct-17
1140581	line	10153	Significant route connection		164797	2-Oct-17
1140582	line	10153	Significant route connection		164797	2-Oct-17
1140629	line	10153	Significant route connection		164797	3-Oct-17
1140630	line	10153	Significant route connection		164797	3-Oct-17
1140631	line	10153	Significant route connection	FM 134 is often traveled by local and regional bicyclists. This route allows for access to Caddo Lake State Park. Caddo Lake is the largest natural lake in the south and the only natural lake in Texas.	164797	3-Oct-17
1140632	line	10153	Significant route connection	SH 49 provides a picturesque route from Jefferson, Texas to Daingerfield, Texas. Daingerfield is home to Daingerfield State Park and is often visited by locals and tourists alike for picnicking, camping, boating, fishing, swimming, hiking, and nature study.	164797	3-Oct-17
1140651	line	10153	Significant route connection	Route commonly utilized by local bicyclists due to low traffic and access to FM 449.	164797	4-Oct-17
1140654	line	10153	Significant route connection	FM 449 & FM 2208 commonly traveled by local and regional bicyclists for nice views and low traffic.	164797	4-Oct-17

Users(*): 58
Lines: 105 **Line comments: 6**
Points: 99 **Point comments: 3**

Note: * when allow anonymous users, the data won't be precise as multiple users may use the same computer to input

Area Location	ConceptualRte	ProposedRte	Comment/Issue	Point Comment IDs (25xxxx)	Line Comment IDs (11xxxxx)	Resolution	Response
Texarkana	Cross-state Spine	Rail Corridor Alternative	Rte on active railway	4117-8		Mark as Rail Corridor Alternative	Retained on network. 1) listed in local bike plan as regional route, 2) Currently active railway, but unknown future usage.
	Cross-state Spine	Modified Location	Currently US 82 Not suitable for riders	4112, 4113, 4116, 4263	40302	Keep US82 and add alternative	US 82 retained on network. Local alternative adopted as Regional Route. US82 improvements can make this a good route. SUP on rail can be built as well.
	n/a	n/a	Bicycle Destination	4593		Bicycle Destination	Adopted local recommendation to connect to bicycle destination.
Sherman-Denison	n/a	Cross-state Spine	No coverage of this MPO	4457	39400, 39407	Utilized local plans to add routes	Locally preferred routes were adopted into the network as a cross-state spine.
	n/a	Regional Route	No coverage of this MPO		39409, 39412	Utilized local plans to add routes	Locally preferred routes were adopted into the network as a regional route
	n/a	Rail Corridor Alternative	East-West connection requested		39401, 39415, 39420	Added routes along railway alternatives	E-W connection follows USBRS 'corridor'. Locally preferred routes were added, but identified as on active, unknown, or inactive railways.
	n/a	Spur	East-West connection requested		39401, 39415, 39420	Also added an on-road parallel feature	Between Bells and Paris (East of Denison), On-road parallel facility was added because locally preferred RR was identified as active.
	n/a	n/a	Bicycle Destination	3344-3351, 3846, 4457,4479		Noted on project record	Local bicycle destinations were noted to project record. Routes nearby/adjacent to these destinations were added where suggested.
	n/a	n/a	Bicycle Destination		39408	Noted on project record	Large recreational ridership as indicated by Strava counts. Route not added to network because bypasses Sherman-Denison.
	n/a	Regional Route	Connect Ray Roberts SP to Sherman-Denison		40488	Utilized locally preferred to add route	Locally preferred routes were adopted into the network as an on-street regional route. US 377 mostly has 9 foot shoulders with 55-60 mph during this segment.
	n/a	n/a	Bicycle Destination		39414	Noted on project record	Connection to Oklahoma. Locally significant, but not as safe in comparison to the Carpenters Bluff Bridge connection to Oklahoma.
Bryan-College Station	Regional Route	Modified Location	Local rtes recommended instead		39323, 39433	Modified slightly	Locally preferred route used, utilizes existing on-street bicycle infrastructure. Alternative route not used.
	n/a	Regional Route	Local rtes recommended instead	3128	39322	Added locally preferred rte	Locally preferred route to Lake Bryan added. Current route removed for more direct route
	Regional Route	Modified Location	Local rtes recommended instead		39321	Change Rtes to locallly preferred	Popular local route added to the network as a regional route connection to Caldwell.
	n/a	Regional Route	Utilize existing SUP		39432	DID NOT MODIFY.	Suggested SUP did not connect to other routes.
	n/a	n/a	Bicycle Destination	3134, 3173, 3393-5, 3177		Noted on project record	Local bicycle destinations (Lake Bryan, Sam Houston SP, Blinn College and Texas A&M Univ were noted to project record.
	n/a	n/a	Bicycle Infrastructure	3174		Added regional route to nearby SP	Added new regional route to nearby SP and Lake
Longview/ East Texas	n/a	Regional Route	Local rtes addition recommended		40552, 40555-8, 40571, 40576, 40581-2, 40629-32, 40651, 40654	Added all locally preferred rtes	Locally preferred routes were adopted into the network as regional routes
	n/a	n/a	Bicycle Destination	4590-2, 4594, 4596, 4696		Noted on project record	Local parks, lakes, historic and scenic towns were noted to project record as bicycle destinations
	n/a	n/a	Bicycle Infrastructure	4595		Noted on project record	Local bicycle lane infrastructure noted on project record. Also routes adopted along infrastructure corridor.
	n/a	Regional Route	Local rtes addition recommended		40580	Added locally preferred rte with modifications	Adopted local recommended route with a small modification b/c a low volume road with limited shoulders provided a better detour around low-scoring, high-speed, narrow shoulder segments.
Beaumont/ East Texas	n/a	Regional Route	Local rtes addition recommended		40300, 40303	Added locally preferred rte	Locally preferred US 69 Route added. Not suitable for bicycles now but connects Lufkin to Kountze and areas east.
	n/a	Regional Route	Local rtes addition recommended		40312	Added locally preferred rte	Connects Lufkin to two regional routes
	n/a	Regional Route	Local rtes addition recommended		40314	Added modified version of locally preferred rte	Better scoring route between US59 and Onalaska was found and utilized.
	n/a	Spur	DFW to Houston Spur/Spine route		40492-3	Added locally preferred rte	Locally preferred US 59 Route added. Not suitable for bicycles now but connects Lufkin to Sam Houston Nat'l Forest, Shepard and other cities.
Tyler	Regional Route	Modified Location	Local rtes recommended instead	4224	40633	Change Rtes to locallly preferred	Route location modified away from route not as suitable for cyclists.
	Regional Route	Modified Location	Local rtes recommended instead		39352	Change Rtes to locallly preferred	Locally preferred route modification was adopted.
	Regional Route	Modified Location	Local rtes recommended instead		39338	Change Rtes to locallly preferred	Locally preferred route modification was adopted.
	n/a	n/a	Bicycle Destination	4223		Noted on project record	Local park noted to project record as bicycle destinations
	Regional Route	Rail Corridor Alternative	RR ROW already purchased for SUP		39332	Add rail ROW alternative	Added local rail corridor alternative between Whitehouse and Troupe. Rail ROW is still listed as Active by TxDOT data. Local comment indicates ROW was purchased for SUP.
Dallas-Fort Worth	n/a+B32:H42	Regional Route	Cotton Belt Trail Recommended		40484-5	Added new local Rail Trail	Existing, funded, and planned segments of the Cotton Belt trail were included as a regional route.
	n/a	Regional Route	Extend Regional Rte to connect with Sherman Denison area Rte		40488	DID NOT MODIFY.	Additional N-S RegionalRte a few miles away just added.
	n/a	Spur Route	Consider US 175 as spur Rte btwn Dallas and Houston		40491-94	DID NOT MODIFY	Did not add route. Currently proposed spur and regional routes have lower traffic speeds, volumes and fewer trucks. Wider shoulders may come in time.
	Spur	Spur Route Alternative	Add on-st alternative to Mineral Wells Trail		40486	Added new local on-street alternative	Adoped locally preferred on-street historic Bankhead Hwy. This alternative features many local roads with unknown quantitative scores (data) and many of the segments with data score poorly.
	n/a	Spine Route	Add missing Segment in Benbrook		40480	Segment added.	Segment was missing. Corrected based on stakeholder input.
	n/a	Regional Route	Include Dallas LOOP project	n/a	n/a	Added major local bicycle destination	Local off-road shared use path, Dallas LOOP, is largely funded and/or built. Northwest portion was already a part of N-S Spine through Dallas, but the remainder of the loop was added.
	n/a	Modified Location	US 69 suggested as alternative rte	4459	40487	DID NOT MODIFY	Stakeholder suggests routing on US69 instead of SH34. The shoulders are wider, volumes lower, and speeds lower on SH34 and other local road.
	n/a	n/a	Bicycle Destination	4473, 4474-8, 4480-1		Noted on project record	Local transit stations, downtown areas, parks, and trails noted to project record as bicycle destinations.
	n/a	n/a	Bicycle Infrastructure	4253-4		Noted on project record	Two areas where bicycle infrastructure is needed. Noted in project record.
	Spur	Spine Route	Recommendation	4456		Noted on project record	Stakeholder suggests changing spur route to Cross-state spine. USBRS 84 conceptual corridor does not align with the route suggested by stakeholder. USBRS 84 'corridor' is a 50-mile wide suggestion and actually is located north of DFW closer to the US 82 or US 380 corridor.
	Spur	Spine Route	Recommendation	4454		Noted on project record	Stakeholder suggests changing spur route to Cross-state spine. USBRS corridors are suggestions, which must be refined by state and regional stakeholders. USBRS corridors are just 50-mile wide suggestions developed without analysis or Texas input.
Waco	Regional Route	Modified Location	Local rtes addition recommended	4453	40463	Change Rtes to locallly preferred	Adoped locally preferred alternative.
	n/a	Regional Route	Local rtes addition recommended		40469-72	Suggestion taken, but better route chosen	E-W connection suggested. Instead of US84, a combination of SH164 and other routes were selected due to lower volumes and fairly consistent 8'+ wide shoulders.
	n/a	Regional Route	Local rtes addition recommended		40473, 40476	Partially utilized in reroute	Created new regional rte south from Waco to Mother Neff SP and on into Temple.
	n/a	Regional Route	Significant Route Connection		40475	DID NOT MODIFY	As a new Rte into McGregor was created, this rte is unnecessary
	n/a	n/a	Bicycle Destination	4336, 4338		Noted on project record	Local park and private trail noted on project record
		n/a	Bicycle Infrastructure	4334, 4337		Rerouted and avoided lack of bicycle infrastructure.	Rerouted and avoided lack of bicycle infrastructure.
	n/a	Regional Route	Local rtes addition recommended		40464	DID NOT MODIFY	Locally preferred route was short, on local roads and only connected to Waco Dam Trail, which seems to be a local destination with no connectivity to regional destinations. Other routes near this one were modified to provide regional connectivity
	n/a	Regional Route	Local rtes addition recommended		40465	DID NOT MODIFY	Locally preferred route was short and disconnected.
	n/a	Regional Route	Local rtes addition recommended		40466	Partially utilized in reroute	Partially utilized this route suggestion.
	n/a	Regional Route	Local rtes addition recommended		40467	DID NOT MODIFY	Locally preferred route was short and disconnected because formerly preferred route was rerouted.
	n/a	Regional Route	Local rtes addition recommended		40468	Partially utilized in reroute	Added new N-S connection with DFW along IH35. Utilized this locally preferred route to connect to Downtown Waco.
	n/a	Regional Route	Local rtes addition recommended		40479, 40481-3	Partially utilized in reroute	Added new N-S connection with DFW along IH35. Utilized these locally preferred routes entirely.
	n/a	Regional Route	Local rtes addition recommended		40459, 40461	DID NOT MODIFY	Utilized other roadways with better quantitative scores instead of these locally preferred routes
	n/a	Regional Route	Local rtes addition recommended		39550	DID NOT MODIFY	Local, winding route connecting two local lakes at dead ends, no regional or statewide significance. Maybe added at a later point.
	n/a	Regional Route	Local rtes addition recommended		39551	Added route to W-E, Killeen-Temple connecting route	This short route aligns with a planned future Bike-Ped SUP along US190 according to the KTMPO Regional Thoroughfare and Ped/Bike Plan.
	n/a	Regional Route	Local rtes addition recommended		39968	Partially utilized in reroute	A portion of this path was used btwn McGregor and Salado. Alternate route between Salado and Austin was found using Austin area Bike Plan

Area Location	ConceptualRte	ProposedRte	Comment/Issue	Point Comment IDs (25xxxx)	Line Comment IDs (11xxxxx)	Resolution	Response
Temple	n/a	Regional Route	Local rtes addition recommended		39969	DID NOT MODIFY	This route is parallel to the SUP along S Nolan Creek, which was adopted into the network. This on-road facility is valuable, but due to close proximity to the SUP, it was not selected.
	n/a	Regional Route	Local rtes addition recommended		39970, 39971	Partially utilized in new route	This stakeholder adds important information about routing across a local dam. The expense would be prohibitive however the scenic view may be desirable. Future officials may decide to route this dam route as for advanced cyclists only and not make facility improvements.
	n/a	Regional Route	Local rtes addition recommended		39973	DID NOT MODIFY	This short N-S route connects Fort Hood to a local college. This valuable connection is noted to the project record, but it does not provide regional or statewide connectivity. Not noted in KTMPO Regional Thoroughfare and Ped/Bike Plan
	n/a	Regional Route	Local rtes addition recommended		39974	Partially utilized in new route	According to the stakeholder, this on-road route connects Central Texas College and TAMU Central Texas. It has been utilized as a E-W route south of Killeen. Roads utilized are noted for on-road facilities in the KTMPO Regional Thoroughfare and Ped/Bike Plan
	n/a	Regional Route	Local rtes addition recommended		39975	DID NOT MODIFY	This short, 1-mile long route connects two locations within a federal DOD property. This connection is noted to the project record, but it does not provide regional or statewide connectivity.
	n/a	Regional Route	Local rtes addition recommended		39976	Partially utilized in new route	Added portion of this route following S Nolan Creek SUP as identified in the KTMPO Regional Thoroughfare and Ped/Bike Plan. Did not add parallel on-road route along FM439.
	n/a	Regional Route	Local rtes addition recommended		39977	DID NOT MODIFY	This short, 2/3 mile long, route connects a SUP to a city park. This connection is noted to the project record, but it does not provide regional or statewide connectivity. Further investigation locally may identify other connections.
	n/a	Regional Route	Local rtes addition recommended		39978	Partially utilized in new route	Added portion of this route following US 190 as identified in the KTMPO Regional Thoroughfare and Ped/Bike Plan. Did not connect to parallel on-road route along FM439.
	n/a	Regional Route	Local rtes addition recommended		40440	Adopted locally preferred route	Route follows US 190. FM116, & SH9 as identified in the KTMPO Regional Thoroughfare and Ped/Bike Plan. Connects Killeen to Spine Route.
	n/a	Regional Route	Local rtes addition recommended		40446	Partially utilized in new route	This suggested route has been utilized as a E-W route south of Killeen and as part of a N-S route south of Temple. Roads utilized are noted for on-road facilities in the KTMPO Regional Thoroughfare and Ped/Bike Plan
	n/a	Regional Route	Local rtes addition recommended		40447	DID NOT MODIFY	Alternate E-W route out of Temple found using KTMPO Regional Thoroughfare and Ped/Bike Plan
	n/a	Regional Route	Local rtes addition recommended		40449	DID NOT MODIFY	As alternate E-W Route out of Temple was identified, this connection was not utilized.
	n/a	Regional Route	Local rtes addition recommended		40454	Partially utilized in new route	Utilized KTMPO Regional Thoroughfare and Ped/Bike Plan and stakeholder proposed route to connect Temple to College Station area.
	n/a	n/a	Bicycle Destination	3505, 3536		Route additions/modifications connect to these destinations	Route additions/modifications connect to these destinations
	n/a	n/a	Bicycle Destination	3424-7, 3503, 3536, 3915		Noted on project record	Local bicycle destinations, facilities, trails, and amenities noted on project record.
	n/a	n/a	Bicycle Infrastructure	3504-5		Noted on project record	Stakeholder identified that bike trails and infrastructure need to be added at these locations.
San Antonio	n/a	Regional Route	Significant Route Connection		39695	Added Connecting Rte btwn San Antonio and Austin	Generally followed roadways paralleling I35 on west side, following wikimap feedback, conversations with AAMPO staff and using Strava data.
	Spine Route	Modified Location	Local rtes recommended	3646	39678	Modified existing route to local alternative	Lower stress alternative recommended by stakeholders was adopted.
	Spine Route	Modified Location	Local metro connection recommended		39679	Modified existing route to local alternative	Lower stress alternative recommended by stakeholders was adopted.
	n/a	n/a	Bicycle Destination	3636		Noted on project record	Local trips and excursions along with names of local trails will be noted to the project record. SUP's along greenways and trails were previously included as a N-S spine route.
	n/a	n/a	Only for fearless cyclists	3638, 3644-5, 3647-8		Noted on project record	N-S spine route north and south of San Antonio is noted as needing improvement to be closer to all ages and abilities. Currently SA bicycle level of stress scores are high stress.
Austin	n/a	n/a	Bicycle Infrastructure	n/a	n/a	Noted on project record	Austin MPO and TxDOT District staff noted that the improvements to IH35 will include SUP through several counties.
Corpus Christi	Regional Route	Modified Location	Not suitable for bicycle use	3077		DID NOT MODIFY	Either the parallel railroad ROW or the SH 44 Frontage Rd may provide connectivity into central Corpus Christi. Future shoulder widening may also provide a bicycle facility
	Regional Route	Modified Location	Not suitable for bicycle use	3078		Changed Rte to locally preferred alternative	Modified routes according to local active transportation plan as identified in locally provided GIS files.
Houston	Spine Route	Modified Location	Local rtes recommended		39228	DID NOT MODIFY	This line comment is parallel to 1139229, which was accepted
	Spine Route	Modified Location	Local rtes recommended		39229	Changed Rte to locally preferred alternative	Utilized locally prefered routes as identified in wikimap and local GIS files.
	n/a	n/a	Bicycle Destination	2987-9		Noted on project record	Local bicycle destinations (Galveston, rides, parks, and trails) were noted on project record.
	Spur	Modified Location	Not suitable for bicycle use	2986, 2990-1, 2993		Modified route to suggested alternative	Modified spur route to follow locally preferred alternative.
	Spur	Modified Location	Functioning rail line?	2992		Maintained location along rail corridor	This route travels down a rail corridor. Off-road SUP within RR ROW or along highway would be preferred to on-street. TxDOT data indicates this rail section is inactive.
El Paso	Spine Route	n/a	Sharing information	4242		No change	While section doesn't currently connect to US 20, these improvements may be possible in the future
	Spine Route	Modified Location	Local rtes recommended	4393, 4260	40338	Modified Rte to locally preferred alternative	Modified rte follows preferred alternative except for segments that are not planned to be protected bike lanes or shared use paths.
	Spine Route	Modified Location	Rtes modifications recommended		40364, 40499, 40365	DID NOT MODIFY	Parallel rte is too close to other El Paso Rtes. These may be included in future studies.
	n/a	Regional	Rtes modifications recommended		40366	DID NOT MODIFY	Good connectivity into New Mexico, but not to any known bicycle destinations.
	Spine Route	Modified Location	Rtes modifications recommended		40397	Adopted idea, modified route	Better local rte identified following separated bicycle accommodations (FM659 and SH375). Similar to suggestions in 40495 and 40367
	n/a	Regional	Rtes modifications recommended	4368-70, 4405, 4367	40495, 40367	Added locally preferred alternative	Generally followed locally preferred alternative to create a challenging mountain crossing north of El Paso.
	Spine Route	Modified Location	Rtes modifications recommended		40496	DID NOT MODIFY	Additional New Mexico connection which doesn't appear in Local Bike Plan. What does this additional route provide? What does it connect to?
	n/a	Regional	Rtes modifications recommended		40404	Added locally preferred alternative	5 mile road to SP included.
	Spine Route	n/a	Rte issues noted	4371, 4412-14		Changed Rte to Spine Route	Local stakeholder input included Regional Bikeway Plan connecting communities southeast of El Paso. Upon stakeholder request, flipped Far West Alt A & B. Also, made rte between El Paso and Guadelupe SP a Spur Route.
	Various	n/a	Sharing information	4415-18		Purely informative	Purely informative
	Spine Route	Alternative Rte	Alternative Rte proposed		40263, 40265	Alt Rte added as Regional Rte	Locally preferred alternative adopted.
	n/a	n/a	Significant Route Connection		40426, 40430	Noted on project record	Signifant route connections noted. These connecting routes have narrow to no shoulders but have limited vehicle volumes. These may be included in future studies.
	n/a	n/a	Routing concerns	4412-4, 4272, 4371		Noted on project record	Stakeholders identified border patrol checkpoint and area with limited services/amenities.
	n/a	n/a	Bicycle Destination	4366, 4411		Noted on project record, modified some routes to connect de	Local bicycle destinations (Plazas, SPs, trails, lookouts) noted to project record.
	n/a	n/a	Bicycle Destination	4415-7		Noted on project record	West Texas bicycle destinations (Adobe hotel, historic site, and McDonald Observatory) noted on project record.
	n/a	n/a	Only for fearless cyclists	4418		Noted on project record	Stakeholders identified local alternative route and then identified it as only for fearless cyclists. Alternative route created and noted as only for fearless.
San Angelo-Midland	n/a	Regional	Local rtes recommended		39419	Added locally preferred alternative	Locally preferred rte added. It has greater than 8' shoulders along the entire stretch of SH158
	n/a	n/a	Bicycle Destination	4493		Noted on project record	Local bicycle destinations in San Angelo were noted to the project record.

Appendix C: Detailed Cost Estimate Tables

PER MILE COST RANGES BY BIKEWAY TYPE

Contruction Cost Estimates[1]

Bikeway Improvement Project	Ranges[2]	
	Low-end	High-end
Construct Shared Use Path	$480,000	$570,000
Restripe Roadway for Buffered Bicycle Lane	$140,000	$160,000
Widen Concrete Roadway for Buffered Bicycle Lane	$1,190,000	$1,430,000
Widen Asphalt Roadway for Buffered Bicycle Lane	$1,080,000	$1,300,000
Restripe Roadway for Bicycle Lane	$80,000	$100,000
Widen Concrete Roadway for Bicycle Lane	$1,000,000	$1,200,000
Widen Asphalt Roadway for Bicycle Lane	$980,000	$1,180,000
Widen Concrete Outside Shoulder	$1,040,000	$1,250,000
Widen Asphalt Outside Shoulder	$950,000	$1,130,000

Annual Operation and Maintenance Cost Estimates[3]

Bikeway Type	Routine and Periodic O&M Costs Ranges[2]	
	Low-end	High-end
Shared Use Path	$14,000	$17,000
Buffered Bicycle Lane	$1,600	$2,000
Bicycle Lane	$1,600	$2,000
Wide Outside Shoulder	$1,600	$2,000

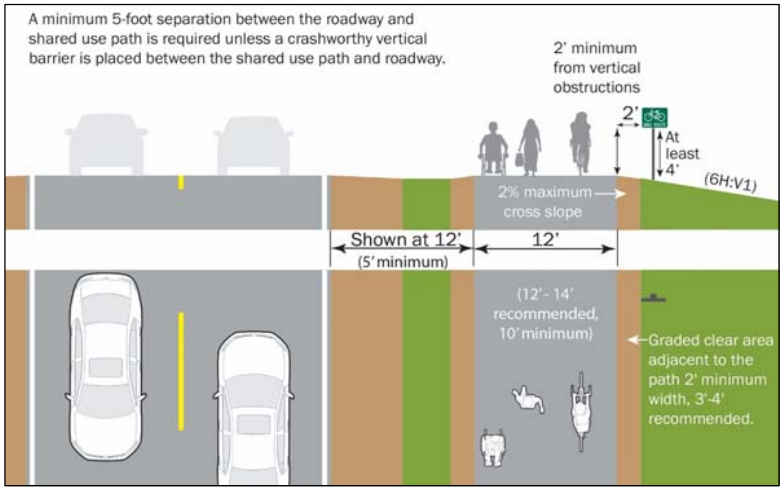
Notes:

[1] Construction costs per mile include 20% to cover additional projects costs including: intersection considerations, mobilization, regional differences, and/or PS&E. Construction costs per mile do not include right-of-way acquisition or utility relocation as these costs will vary prodigiously depending on location of bikeway improvements. Base construction costs (materials and labor) have been derived using TxDOT Average Bid Prices [http://www.dot.state.tx.us/insdtdot/orgchart/cmd/cserve/bidprice/s_0101.htm] where available.

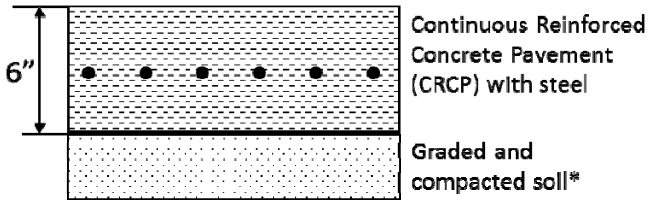
[2] Low-end cost estimates are calculated as labor & materials costs + 20% contingency. High-end cost estimate is 20% higher than the low-end. All costs provided in 2017 dollars.

[3] O&M Costs per year, per mile. While all bikeway facilities will require O&M expenditures to ensure the longevity of the bikeway investment, on-road bikeway (buffered bike lanes, bike lanes, and wide shoulders) O&M activities are assumed to be included in regularly scheduled road maintenance; therefore, these costs are not included in these cost estimates.
Long-Term maintenance includes complete, full-depth pavement replacement. Maintenance costs are listed here as annual portions of necessary total, future investments. For detailed O&M costs, see individual bikeway sheets. All maintenance costs have been derived using TxDOT Average Bid Prices [http://www.dot.state.tx.us/insdtdot/orgchart/cmd/cserve/bidpricm/s_0702.htm] where available.

SHARED USE PATH/SIDEPATH



Typical Pavement Structure



*Additional substructure may be necessary depending on local soil conditions

ESTIMATED CONSTRUCTION COSTS PER MILE

SHARED USE PATH CAPITAL COST DESCRIPTIONS Cost Description	Layman's Terms	Unit	Cost	Rounded Costs	Remarks/Assumptions
6" REINFORCED CONCRETE SUP	6" CONCRETE SHARED USE PATH	Per Mile	$387,200	$387,200	12ft wide SUP with 2' clear area
BICYCLE ROUTE SIGNS	BICYCLE ROUTE SIGNS	Per Mile	$4,798	$4,800	Assumes 10 per mile (case-by-case evaluation)
INDUCTION & INFRARED BIKE/PEDESTRIAN	PERMANENT BIKE/PEDESTRIAN COUNTER	Per Unit	$5,820	$5,800	Count equipment placement and frequency vary (case-by-case evaluation)
	Cost Per Mile (Subtotal)		$397,818		
	Additional miscellaneous project costs	20%	$79,564		
	Total Cost Per Mile		**$477,381**	**$477,400**	

POTENTIAL SIDEPATH ITEMS, CAPITAL COST DESCRIPTIONS Cost Description	Layman's Terms	Unit	Cost	Rounded Costs	Remarks/Assumptions
HIGH PRESSURE SODIUM LIGHT FIXTURE/LED	PEDESTRIAN LIGHTING ASSEMBLIES (100 watt)	Per Mile	$265,000	$265,000	Assumes 53 per mile or every 100 ft

NOTE: Costs have been estimated based upon average installed price (TxDOT Average Bid Prices). See http://www.dot.state.tx.us/insdtdot/orgchart/cmd/cserve/bidprice/s_0306.htm

ESTIMATED OPERATION AND MAINTENANCE COST PER MILE

O&M ACTIVITIES	Annual Rounded Costs	Remarks/Assumptions
ROUTINE MAINTENANCE - MORE THAN ONCE PER YEAR	$5,000	Includes sweeping, mowing, litter control, and vandalism repair
PERIODIC MAINTENANCE - EVERY FIVE YEARS	$9,000	Includes tree trimming, edging, seal cracking, and re-striping
LONG TERM MAINTENANCE COST- EVERY 30 YEARS	$25,167	Includes crack sealing and full depth repair after 30 years
ANNUALIZED LIFECYCLE O&M COST PER MILE AFTER 30 YEARS	**$39,167**	

NOTES:

1. Shared Use Paths are assumed to be independent of roadway right-of-way. All operation & maintenance activities will be independent of roadway operations and maintenance.
2. Costs have been derived using TxDOT Average Bid Prices [http://www.dot.state.tx.us/insdtdot/orgchart/cmd/cserve/bidprice/s_0101.htm]

Assumed Pavement Structure

Continuously Reinforced Concrete Pavement Structure

NEW 10' SHOULDER (ON BOTH SIDES)
COST PER MILE

Item	DESCRIPTION	UNIT	QUANTITY	UNIT COST	SUBTOTAL
360	CONC PVMT (CONT REINF-CRCP)(8")	SY	11,733	42	$492,800.00
310	PRIMECOAT AEP	GAL	3,872	3.3	$12,777.60
341	D-GR HMA TY-B PG64-22 (4")	TON	2,839	67.78	$192,459.05
247	FL BS (CMP IN PLC) (TY A GR 4)(8")	SY	14,080	11.68	$164,454.40
				COST PER MILE	$862,491

Concrete Pavement Surface Area (CRCP) (SF)	105,600
Hot Mix Asphalt Surface Area (SF)	116,160
Flex Base Surface Area (SF)	126,720

Assumptions:
3)PRIMECOAT AEP 0.3 gal/square yard

NEW PAVEMENT FOR 5' BICYCLE LANE (ON BOTH SIDES)
COST PER MILE

Item	DESCRIPTION	UNIT	QUANTITY	UNIT COST	SUBTOTAL
360	CONC PVMT (CONT REINF-CRCP)(8")	SY	5,867	42	$246,400.00
310	PRIMECOAT AEP	GAL	2,112	3.3	$6,969.60
341	D-GR HMA TY-B PG64-22 (4")	TON	1,549	67.78	$104,977.66
247	FL BS (CMP IN PLC) (TY A GR 4)(8")	SY	8,213	11.68	$95,931.73
				COST PER MILE	$454,279

Concrete Pavement Surface Area (CRCP) (SF)	52,800
Hot Mix Asphalt Surface Area (SF)	63,360
Flex Base Surface Area (SF)	73,920

Assumptions:
3)PRIMECOAT AEP 0.3 gal/square yard

NEW PAVEMENT FOR 5' BICYCLE LANE AND 2' BUFFER (ON BOTH SIDES)
COST PER MILE

Item	DESCRIPTION	UNIT	QUANTITY	UNIT COST	SUBTOTAL
360	CONC PVMT (CONT REINF-CRCP)(8")	SY	8,213	42	$344,960.00
310	PRIMECOAT AEP	GAL	2,464	3.3	$8,131.20
341	D-GR HMA TY-B PG64-22 (4")	TON	1,807	67.78	$122,473.94
247	FL BS (CMP IN PLC) (TY A GR 4)(8")	SY	8,213	11.68	$95,931.73
				COST PER MILE	$571,497

Concrete Pavement Surface Area (CRCP) (SF)	73,920
Hot Mix Asphalt Surface Area (SF)	73,920
Flex Base Surface Area (SF)	73,920

Assumptions:
3)PRIMECOAT AEP 0.3 gal/square yard

Asphalt Pavement Structure

NEW 10' SHOULDER (ON BOTH SIDES)
COST PER MILE

Item	DESCRIPTION	UNIT	QUANTITY	UNIT COST	SUBTOTAL
341	D-GR HMA TY-D PG70-22 (2")	TON	1,291	80	$103,300.00
341	D-GR HMA TY-B PG64-22 (6")	TON	4,259	67.78	$288,700.00
310	PRIMECOAT AEP	GAL	4,224	3.3	$14,000.00
247	FL BS (CMP IN PLC) (TY A GR 4)(12")	SY	14,080	18.9	$266,200.00
247	LIME STAB SUBGR (COMP IN PLC)(8")	SY	15,253	4.5	$68,640.00
260	LIME	TON	230	175	$40,240.20
				COST PER MILE	$781,080

Hot Mix Asphalt Surface Area (SF)	105,600
Hot Mix Asphalt Base Area (SF)	116,160
Flex Base Surface Area (SF)	126,720
LSSG Surface Area (SF)	137,280

Assumptions:
3)PRIMECOAT AEP 0.3 gal/square yard

NEW PAVEMENT FOR 5' BICYCLE LANE (ON BOTH SIDES)
COST PER MILE

Item	DESCRIPTION	UNIT	QUANTITY	UNIT COST	SUBTOTAL
341	D-GR HMA TY-D PG70-22 (2")	TON	645	80	$51,700.00
341	D-GR HMA TY-B PG64-22 (6")	TON	2,323	67.78	$157,500.00
310	PRIMECOAT AEP	GAL	2,464	3.3	$8,200.00
247	FL BS (CMP IN PLC) (TY A GR 4)(12")	SY	8,213	18.9	$155,300.00
247	LIME STAB SUBGR (COMP IN PLC)(8")	SY	9,387	4.5	$42,300.00
260	LIME	TON	142	175	$24,800.00
				COST PER MILE	$439,800

Hot Mix Asphalt Surface Area (SF)	52,800
Hot Mix Asphalt Base Area (SF)	63,360
Flex Base Surface Area (SF)	73,920
LSSG Surface Area (SF)	84,480

Assumptions:
3)PRIMECOAT AEP 0.3 gal/square yard

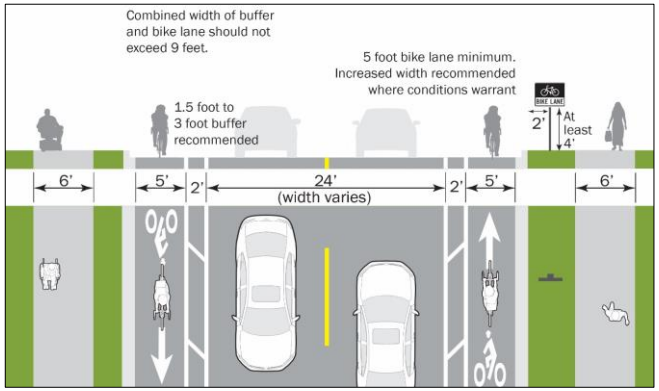
NEW PAVEMENT FOR 5' BICYCLE LANE AND 2' BUFFER (ON BOTH SIDES)
COST PER MILE

Item	DESCRIPTION	UNIT	QUANTITY	UNIT COST	SUBTOTAL
341	D-GR HMA TY-D PG70-22 (2")	TON	903	80	$72,300.00
341	D-GR HMA TY-B PG64-22 (6")	TON	2,710	67.78	$183,800.00
310	PRIMECOAT AEP	GAL	2,464	3.3	$8,200.00
247	FL BS (CMP IN PLC) (TY A GR 4)(8")	SY	8,213	18.9	$155,300.00
247	LIME STAB SUBGR (COMP IN PLC)(8")	SY	8,213	4.5	$37,000.00
260	LIME	TON	124	175	$21,700.00
				COST PER MILE	$478,300

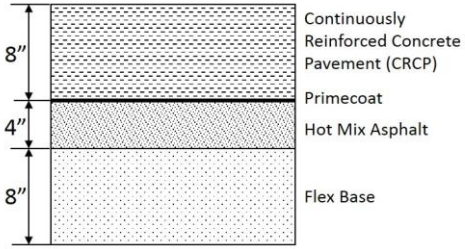
Hot Mix Asphalt Surface Area (SF)	73,920
Hot Mix Asphalt Base Area (SF)	73,920
Flex Base Surface Area (SF)	73,920
LSSG Surface Area (SF)	73,920

Assumptions:
3)PRIMECOAT AEP 0.3 gal/square yard

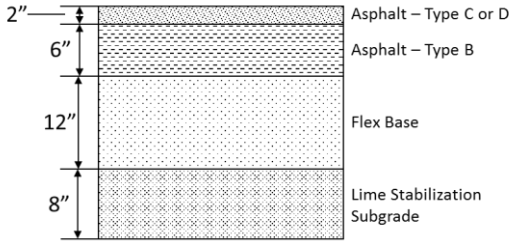
BUFFERED BICYCLE LANE



Concrete Section - Typical Pavement Structure



Asphalt Section - Typical Pavement Structure



ESTIMATED CONSTRUCTION COSTS PER MILE

RESTRIPING TWO-LANE ROADWAY FOR BUFFERED BIKE LANES, CAPITAL COSTS DESCRIPTIONS		Unit	Cost	Rounded Costs	Remarks/Assumptions
Cost Description	**Layman's Terms**				
REMOVE LANE MARKINGS	REMOVE LANE MARKINGS	Per Mile	$23,200	$23,200	
PAV SURF PREP AND PLACEMENT FOR ALL MARKINGS (BIKE ARROW, SYMBOL, AND STRIPES)	SURFACE PREPARATION AND INSTALLATION FOR 6" STRIPES, BIKE ARROW, AND BIKE SYMBOL	Per Mile	$18,964	$19,000	Assumes 4, 6" stripes for one mile; diagonal stripes every 15' on each side; and 40 bike arrows and symbols per mile.
FLEXIBLE DELINEATORS	FLEXIBLE DELINEATORS	Per Mile	$36,960	$37,000	Assumes 530 per mile (1 every 10'). Optional.
BICYCLE ROUTE SIGNS	BICYCLE ROUTE SIGNS	Per Mile	$28,403	$28,400	Assumes signage at start/end of facility and at 2 intersections/mile
INDUCTION & INFRARED BIKE/PEDESTRIAN COUNTER	PERMANENT BIKE/PEDESTRIAN COUNTER	Per Unit	$5,820	$5,800	Count equipment placement and frequency vary (case-by-case evaluation)
	Cost Per Mile (Subtotal)		$113,347.30		
	Additional miscellaneous project costs	20%	$22,669		
	Total Cost Per Mile		**$136,017**	**$136,000**	

WIDENING ROADWAY TO ADD BUFFERED BIKE LANES, CAPITAL COST DESCRIPTIONS		Unit	Cost	Rounded Costs	Remarks/Assumptions
Cost Description	**Layman's Terms**				
ADD **CRCP** PAVEMENT FOR 5FT BICYCLE LANES and 2FT BUFFER	ADD 7' OF **CRCP** PAVEMENT FOR BUFFERED BICYCLE LANES	Per Mile	$571,497	$571,500	Refer to Assumed Pavement Structures Table for details
OR					
ADD **ASPHALT** PAVEMENT FOR 5FT BICYCLE LANES and 2FT BUFFER	ADD 7' OF **ASPHALT** PAVEMENT FOR BUFFERED BICYCLE LANES	Per Mile	$478,300	$478,300	Refer to Assumed Pavement Structures Table for details
CONC CURB & GUTTER (TY II)	ADD CURB AND GUTTER	Per Mile	$208,032	$208,000	
IN RD IL AM (TY SP) 48S-10-10 (400W) S	CENTER-MOUNTED STYLE POLE-LIGHTING	Per Mile	$124,546	$124,500	Assumes Every 100ft or 27 poles per mile
PAV SURF PREP AND PLACEMENT FOR ALL MARKINGS (BIKE ARROW, SYMBOL, AND STRIPES)	SURFACE PREPARATION AND INSTALLATION FOR 6" STRIPES, BIKE ARROW, AND BIKE SYMBOL	Per Mile	$18,964	$19,000	Assumes 4, 6" stripes for one mile; diagonal stripes every 15' on each side; and 40 bike arrows and symbols per mile.
FLEXIBLE DELINEATORS	FLEXIBLE DELINEATORS	Per Mile	$36,960	$37,000	Assumes 530 per mile (1 every 10'). Optional.
BICYCLE ROUTE SIGNS	BICYCLE ROUTE SIGNS	Per Mile	$28,403	$28,400	Assumes signage at start/end of facility and at 2 intersections/mile
INDUCTION & INFRARED BIKE/PEDESTRIAN COUNTER	PERMANENT BIKE/PEDESTRIAN COUNTER	Per Unit	$5,820	$5,800	Count equipment placement and frequency vary (case-by-case evaluation)
CONCRETE SECTION	**Concrete Section - Cost Per Mile (Subtotal)**		$994,222		
	Additional miscellaneous project costs	20%	$198,844		
	Concrete Section - Total Cost Per Mile		$1,193,066	**$1,193,100**	
ASPHALT SECTION	**Asphalt Section - Cost Per Mile (Subtotal)**		$901,025		
	Additional miscellaneous project costs	20%	$180,205		
	Asphalt Section - Total Cost Per Mile		**$1,081,230**	**$1,081,200**	

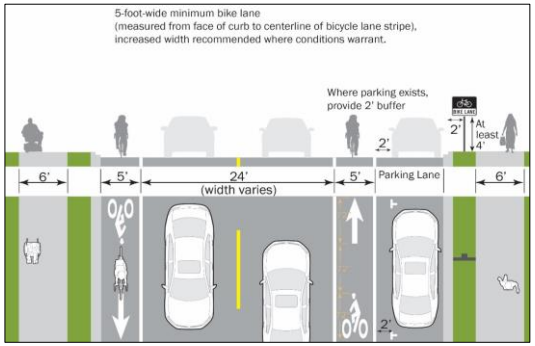
NOTE: Costs have been derived using TxDOT Average Bid Prices [http://www.dot.state.tx.us/insdtdot/orgchart/cmd/cserve/bidprice/s_0101.htm]

ESTIMATED OPERATION AND MAINTENANCE COST PER MILE

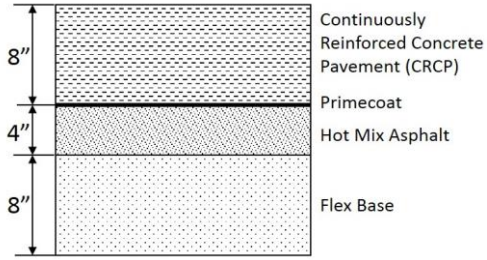
O&M ACTIVITIES		Annual Rounded Costs	Remarks/Assumptions
ROUTINE MAINTENANCE - MORE THAN ONCE PER YEAR		$0	Assumes part of regular roadway maintenance
PERIODIC MAINTENANCE - EVERY FIVE YEARS		$1,600	Includes edging, seal cracking, and re-striping for bikeway portion
LONG TERM MAINTENANCE COST- EVERY 15 YEARS		$0	Includes crack sealing and full depth repair for bikeway portion after 15 years
	ANNUALIZED LIFECYCLE O&M COST PER MILE AFTER 15 YEARS	**$1,600**	

NOTE: Costs have been derived using TxDOT Average Bid Prices [http://www.dot.state.tx.us/insdtdot/orgchart/cmd/cserve/bidprice/s_0101.htm]

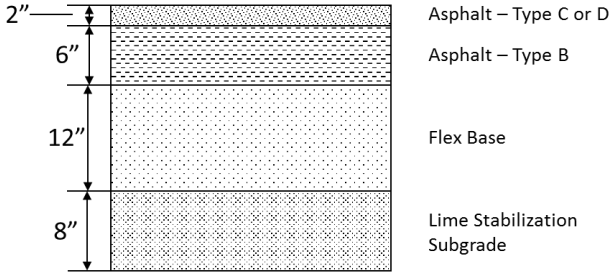
BICYCLE LANE



Concrete Section - Typical Pavement Structure



Asphalt Section - Typical Pavement Structure



ESTIMATED CONSTRUCTION COSTS PER MILE

RESTRIPING TWO-LANE ROADWAY FOR BIKE LANE, CAPITAL COSTS DESCRIPTIONS		UNIT	COST	Rounded Costs	Remarks/Assumptions
Cost Description	Layman's Terms				
REMOVE LANE MARKINGS	REMOVE LANE MARKINGS	Per Mile	$23,200	$23,200	
PAV SURF PREP AND PLACEMENT FOR ALL MARKINGS (BIKE ARROW, SYMBOL, AND STRIPES)	SURFACE PREPARATION AND INSTALLATION FOR 6" STRIPES, BIKE ARROW, AND BIKE SYMBOL	Per Mile	$11,836	$11,800	Assumes 2, 6" stripes for one mile and 40 bike arrows and symbols per mile.
BICYCLE ROUTE SIGNS	BICYCLE ROUTE SIGNS	Per Mile	$28,403	$28,400	Assumes signage at start/end of facility and at 2 intersections/mile
INDUCTION & INFRARED BIKE/PEDESTRIAN COUNTER	PERMANENT BIKE/PEDESTRIAN COUNTER	Per Unit	$5,820	$5,800	Count equipment placement and frequency vary (case-by-case evaluation)
	Cost Per Mile (Subtotal)		$69,259.30	**$69,300**	
	Additional miscellaneous project costs	20%	$13,852		
	Total Cost Per Mile		**$83,111**	**$83,100**	

WIDENING ROADWAY TO ADD BIKE LANES, CAPITAL COST DESCRIPTIONS		UNIT	COST	Rounded Costs	Remarks/Assumptions
Cost Description	Layman's Terms				
ADD **CRCP** PAVEMENT FOR 5FT BICYCLE LANES	WIDEN **CONCRETE** PAVEMENT 5FT ON EACH SIDE	Per Mile	$454,279	$454,300	Refer to Assumed Pavement Structures Table for details
			OR		
ADD **ASPHALT** PAVEMENT FOR 5FT BICYCLE LANES	ADD 5' OF **ASPHALT** PAVEMENT FOR BICYCLE LANES	Per Mile	$439,800	$439,800	Refer to Assumed Pavement Structures Table for details
CONC CURB & GUTTER (TY II)	ADD CURB AND GUTTER	Per Mile	$208,032	$208,000	
IN RD IL AM (TY SP) 48S-10-10 (400W) S	CENTER-MOUNTED STYLE POLE-LIGHTING	Per Mile	$124,546	$124,500	Assumes Every 100 ft or 27 poles per mile
PAV SURF PREP AND PLACEMENT FOR ALL MARKINGS (BIKE ARROW, SYMBOL, AND STRIPES)	SURFACE PREPARATION AND INSTALLATION FOR 6" STRIPES, BIKE ARROW, AND BIKE SYMBOL	Per Mile	$11,836	$11,800	Assumes 2, 6" stripes for one mile and 40 bike arrows and symbols per mile.
BICYCLE ROUTE SIGNS	BICYCLE ROUTE SIGNS	Per Mile	$28,403	$28,400	Assumes signage at start/end of facility and at 2 intersections/mile
INDUCTION & INFRARED BIKE/PEDESTRIAN COUNTER	PERMANENT BIKE/PEDESTRIAN COUNTER	Per Unit	$5,820	$5,800	Count equipment placement and frequency vary (case-by-case evaluation)
CONCRETE SECTION	**Concrete Section - Cost Per Mile (Subtotal)**		$832,916		
	Additional miscellaneous project costs	20%	$166,583		
	Concrete Section - Total Cost Per Mile		$999,499	**$999,500**	
ASPHALT SECTION	**Asphalt Section - Cost Per Mile (Subtotal)**		$818,437		
	Additional miscellaneous project costs	20%	$163,687.38		
	Asphalt Section - Total Cost Per Mile		**$982,124**	**$982,100**	

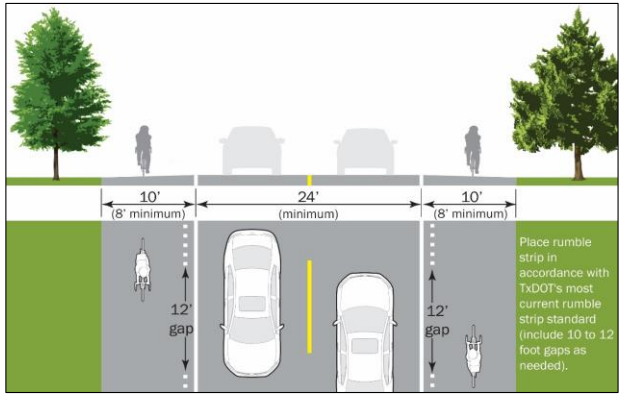
NOTE: Costs have been derived using TxDOT Average Bid Prices [http://www.dot.state.tx.us/insdtdot/orgchart/cmd/cserve/bidprice/s_0101.htm]

ESTIMATED OPERATION AND MAINTENANCE COST PER MILE

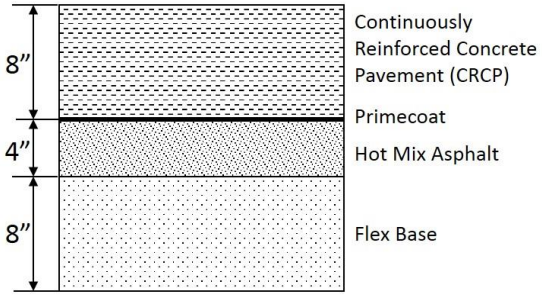
O&M ACTIVITIES		Annual Rounded Costs	Remarks/Assumptions
ROUTINE MAINTENANCE - MORE THAN ONCE PER YEAR		$0	Assumes part of regular roadway maintenance
PERIODIC MAINTENANCE - EVERY FIVE YEARS		$1,600	Includes edging, seal cracking, and re-striping for bikeway portion
LONG TERM MAINTENANCE COST- EVERY 15 YEARS		$0	Includes crack sealing and full depth repair for bikeway portion after 15 years
	ANNUALIZED LIFECYCLE O&M COST PER MILE AFTER 15 YEARS	**$1,600**	

NOTE: Costs have been derived using TxDOT Average Bid Prices [http://www.dot.state.tx.us/insdtdot/orgchart/cmd/cserve/bidprice/s_0101.htm]

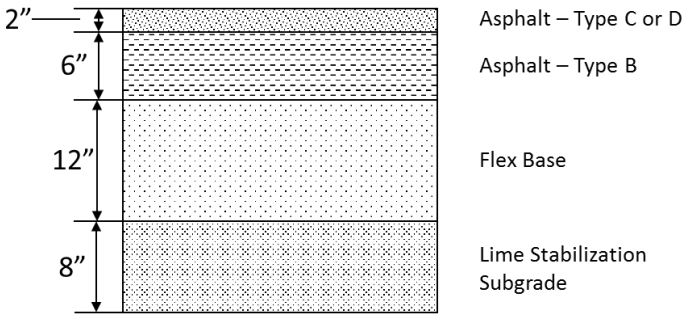
WIDE SHOULDER



Concrete Section - Typical Pavement Structure



Asphalt Section - Typical Pavement Structure



ESTIMATED CONSTRUCTION COSTS PER MILE

WIDE OUTSIDE SHOULDERS CAPITAL COST DESCRIPTIONS Cost Description	Layman's Terms	UNIT	COST	Rounded Costs	Remarks/Assumptions
10 ft Wide Outside Shoulder (**CRCP**)	WIDEN **CONCRETE** PAVEMENT 10 FT (BOTH SIDES)	Per mile	$862,491	$862,500	Refer to Assumed Pavement Structures Table for details
		OR			
10 ft Wide Outside Shoulder (**Asphalt**)	WIDEN **ASPHALT** PAVEMENT 10 FT (BOTH SIDES)	Per mile	$781,080	$781,100	Refer to Assumed Pavement Structures Table for details
PAV SURF PREP AND PLACEMENT FOR STRIPES	SURFACE PREPARATION AND INSTALLATION FOR 6" STRIPES	Per Mile	$4,752	$4,800	Assumes 2, 6" stripes for one mile and 40 bike arrows and symbols per mile.
RUMBLE STRIPS (SHOULDER)	RUMBLE STRIPS (SHOULDER)	Per mile	$1,478	$1,500	Rumble strips are required on many TxDOT roadways. See TxDOT Roadway Design Manual for details.
INDUCTION & INFRARED BIKE/PEDESTRIAN COUNTER	PERMANENT BIKE/PEDESTRIAN COUNTER	Per mile	$233	$200	Cost assumes one counter every 25 miles
CONCRETE SECTION	**Concrete Section - Cost Per Mile (Subtotal)**		$868,954		
	Additional miscellaneous project costs	20%	$173,791		
	Concrete Section - Total Cost Per Mile		$1,042,745	**$1,042,700**	
ASPHALT SECTION	**Asphalt Section - Cost Per Mile (Subtotal)**		$787,543		
	Additional miscellaneous project costs	20%	$157,509		
	Asphalt Section - Total Cost Per Mile		**$945,052**	**$945,100**	

POTENTIAL WIDE SHOULDER ITEMS, CAPITAL COST DESCRIPTIONS Cost Description	Layman's Terms	UNIT	COST	Rounded Costs	Remarks/Assumptions
IN RD IL AM (TY SP) 48S-10-10 (400W) S	CENTER-MOUNTED STYLE POLE-LIGHTING	Per Mile	$124,546	$124,500	Assumes every 100 ft or 27 poles per mile
	Cost Per Mile (Subtotal)		$124,546	**$124,500**	
	Miscellaneous	20%	$24,909		
	Total Cost Per Mile		**$149,455**	**$149,500**	

NOTE: Costs have been derived using TxDOT Average Bid Prices [http://www.dot.state.tx.us/insdtdot/orgchart/cmd/cserve/bidprice/s_0101.htm]

*While 8 foot wide shoulders are acceptable as a minimum, when shoulder widing is needed, 10 foot wide shoulders are recommended

ESTIMATED OPERATION AND MAINTENANCE COST PER MILE

O&M ACTIVITIES	Annual Rounded Costs	Remarks/Assumptions
ROUTINE MAINTENANCE - MORE THAN ONCE PER YEAR	$0	Assumes part of regular roadway maintenance
PERIODIC MAINTENANCE - EVERY FIVE YEARS	$1,600	Includes edging, seal cracking, and re-striping for bikeway portion
LONG TERM MAINTENANCE COST- EVERY 15 YEARS	$0	Includes crack sealing and full depth repair for bikeway portion after 15 years
ANNUALIZED LIFECYCLE O&M COST PER MILE AFTER 15 YEARS	**$1,600**	

NOTE: Costs have been derived using TxDOT Average Bid Prices [http://www.dot.state.tx.us/insdtdot/orgchart/cmd/cserve/bidprice/s_0101.htm]