KTMPO
KILLEEN-TEMPLE
metropolitan planning organization

REGIONAL MULTIMODAL PLAN

2018

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The Regional Multimodal Plan

Historically, the dominant mode of travel in the region of the Killeen-Temple Metropolitan Planning Organization (KTMPO) has been the personal automobile, and a transportation planning process that focused on automobile mobility was appropriate and adequate. However, people and industries are rethinking their transportation needs, preferences, and habits. It is now critical to consider multiple options for mobility and access, and the way we plan for transportation must progress to include all transportation modes for people and freight. Transportation planning must shift from its historic focus on the automobile mode and expand to consider all modes within an **integrated transportation system**.

The vehicle for accomplishing the transportation planning task for an integrated transportation system is this **Regional Multimodal Plan**. The change in names from the previous Regional Thoroughfare Plan to this Regional Multimodal Plan reflects the greater emphasis that this update places on planning for all transportation modes. There are two significant characteristics of an integrated transportation system to be considered in this Plan. First, the integrated transportation system is **regional**, covering the geographic area of the Killeen-Temple Metropolitan Planning Organization (KTMPO) with its member jurisdictions and rural areas. Second, the integrated transportation system is **multimodal**, considering the needs and potential of existing transportation modes for people and freight, and planning for appropriate new modes.

The purpose of a plan is not to predict the future; it is to enable it.

In general terms, the Plan is a tool for defining the orderly development of the integrated transportation system so that all planning and projects are efficient, effective, and mutually supportive. The Plan has a **short-term** component to address existing transportation needs, and a **long-term** component that considers future needs defined by anticipated socioeconomic growth and the performance of the transportation system. Both components support the ultimate Plan goals of enhancing mobility, increasing the connectivity and convenience of the transportation system, supporting opportunities for economic development, and enhancing the quality of life in the region.

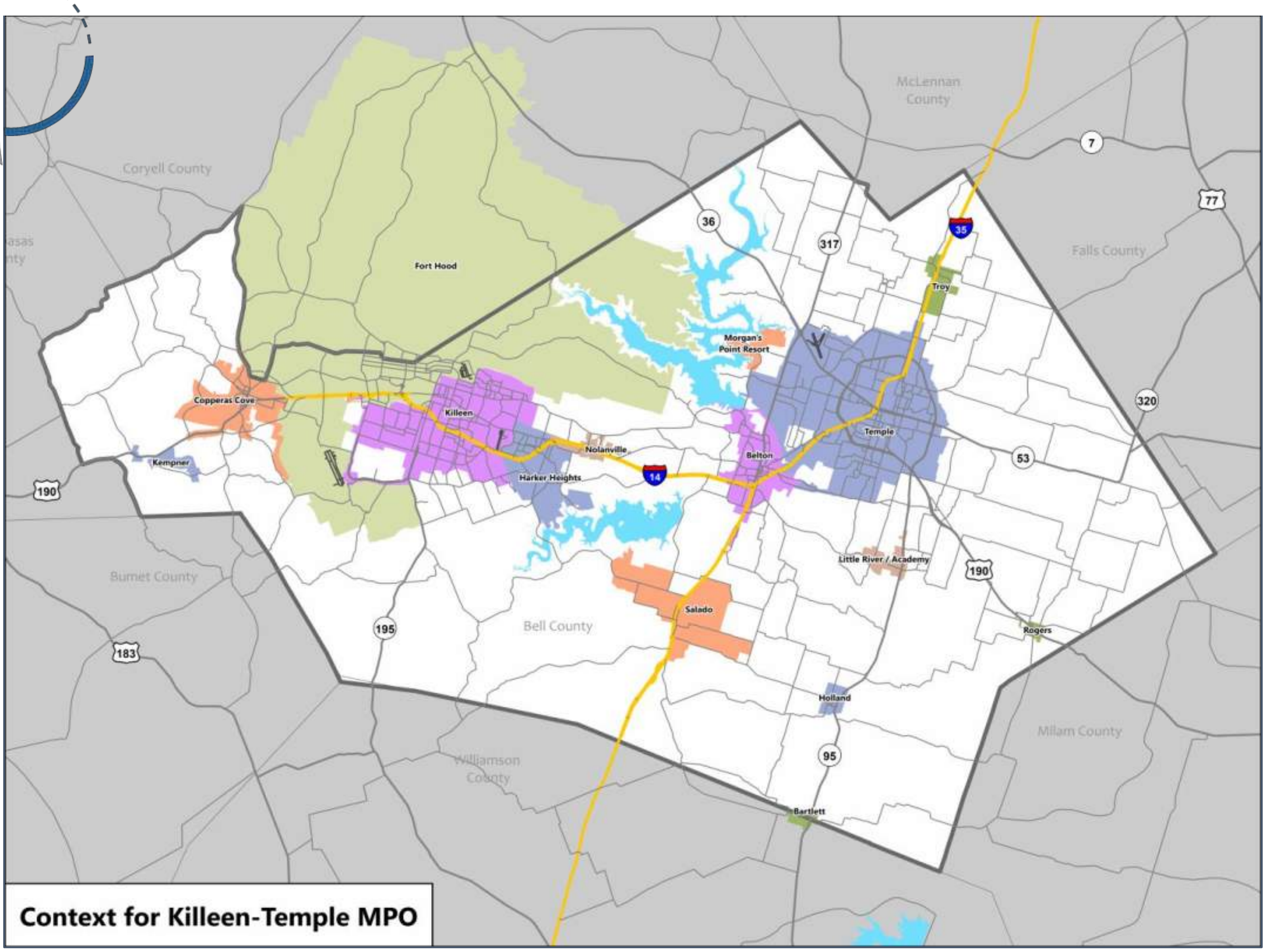
As a practical tool, the Plan includes a Regional Thoroughfare Plan that defines roadway functional classes and typical cross sections. The Regional Thoroughfare Plan considers the individual Thoroughfare Plans from KTMPO member jurisdictions in developing its consistent and comprehensive definitions and cross sections for the full region. The Thoroughfare Plan component of the Regional Multimodal Plan is in no way intended to supersede the plans of the KTMPO member jurisdictions; it is a tool to define consistent roadway standards for the entire region. This enables an orderly system of roadway types and consistent performance, and supports coordination among KTMPO member jurisdictions.

The more proactive you can be, the less reactive you have to be.

The Region

One important feature of the integrated transportation system is that it is **regional**. Regional transportation planning recognizes that the needs of the integrated transportation system are not limited to a single city or corridor, and takes a broader view to consider the needs of the whole region, including smaller communities and rural areas. To fill this need, federal regulations have established the concept of the Metropolitan Planning Organization (MPO) as a planning agency for a region, defining a planning area based on the extent of current and anticipated socioeconomic activity. This provides a vehicle for regional planning that is not constrained by city boundaries. The boundaries and context of the KTMPO planning region are shown in **Figure 1-1**. The planning area includes the full extent of Bell County and portions of Coryell and Lampasas Counties. The Figure shows the boundaries for the travel demand model, which include a small sliver of McLennan County to accommodate the alignment of Stampede Rd., and a small slice of Williamson County, so that the full extent of the City of Bartlett would fall within the study area. The main cantonment, the Robert Gray Army Airfield, and other portions of Fort Hood lie within the study area, but the north cantonment and training area lie outside.

Figure 1-1: KTMPO Planning Region

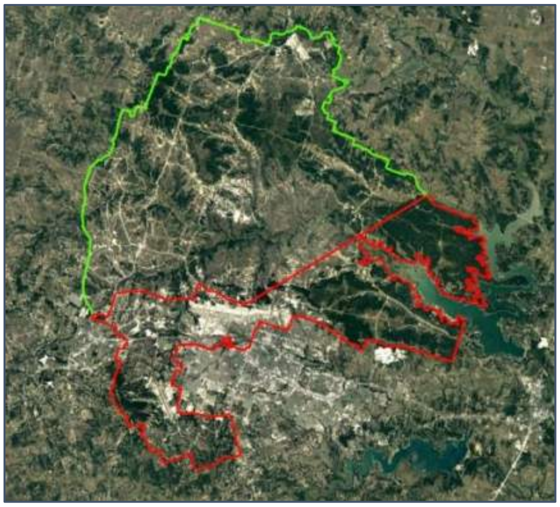


The KTMPO region includes seven larger jurisdictions which are treated in more detail based on their significance in the region and for coordination with their individual planning efforts. Each of these jurisdictions have produced their own Comprehensive Plan or Thoroughfare Plan that must be considered in building this Regional Multimodal Plan.

Belton is located southwest of Temple at the junction of IH-35 and IH-14/US 190. Belton serves as the Bell County seat. Commercial activity in Belton is focused downtown and along N. Main Street and E. 6th Street. Industrial uses lie along IH-35, IH-14/US 190 and E. 6th Street. Major employers are the University of Mary Hardin-Baylor and Bell County government. The US Census estimates a 2017 population of 20,900. Total employment is about 7,900.

Copperas Cove is located to the west of Fort Hood, straddling Coryell and Lampasas Counties. It is best classified as a bedroom community oriented to Fort Hood, with commercial activity along Business Route 190. Retail-oriented employers at the Town Square Shopping Center are collectively the largest employer in Copperas Cove. The US Census estimate of the 2017 population is 32,800 with total employment of about 6,300.

Harker Heights sits between Killeen and Stillhouse Hollow Lake. It is primarily a bedroom community with most of its commercial uses located along US 190, Business Route 190, and Knight's Way/FM 2410. The top employer sectors include Seton Hospital and the Market Heights retail area. The US Census estimates a 2017 population of 29,800. Total employment is about 7,500.



Fort Hood covers around 215,000 acres in Bell and Coryell Counties, bordering directly along Killeen and Copperas Cove. Significant units stationed at Fort Hood include III Corps, 1st Army Division West, and 1st Cavalry Division. The main cantonment with the majority of the residential area lies within the KTMPO area, but much of the training area and the north cantonment are outside the region. Population and employment on the base vary with unit deployments, but typically are around 65,000 active duty service members and dependents and 9,000 civilian employees.

Killeen is located on US 190, bordered by Fort Hood on the north and west sides and Harker Heights on the east side. Killeen is mostly residential, with commercial activity along US 190, Business 190, and SH 195. Killeen also has an industrial park in the eastern portion of the city adjacent to US 190. The top employers are Central Texas College, Metroplex Hospital, Killeen Mall, AEGIS Communications Group, Killeen-Ft. Hood Regional Airport, and Skylark Field. The 2017 population estimate from the US Census is 143,400 and total employment is about 33,000.

The Village of Salado is located south of Belton, with development centered along IH-35 and Salado Creek. The top employers in Salado focus on the arts and tourism, with nineteen sites listed in the National Register of Historic Places. The 2017 estimate of population is 2,000 and total employment is about 1,300.

Temple is located along IH-35 and US 190 in the eastern portion of the KTMPO region. Commercial activity is located on the southern edge of the city, IH-35, and US 190. Industrial parks are located along Loop 363 and southeast of Temple. The top employers include Scott & White Hospital, Temple College, the Veteran's Clinic, Tenneco Packaging, McLane Southwest, Walmart Distribution Center, Wilsonart, Temple Mall, King's Daughters Hospital, and Draughon-Miller Central Texas Regional Airport. The US Census estimate of the 2017 population is 73,600. Total employment in Temple is about 47,100; so while Killeen has the most population of any city in the region, Temple has the most employment.

The remainder of the KTMPO region includes rural areas and eight other communities. Several of these communities have population or employment larger than the other listed jurisdictions, but the communities listed in this group have not produced their own Comprehensive Plans or Thoroughfare Plans.

Total population for the eight other communities is about 18,100 and total employment is about 3,400. In the rural area, total population is about 39,400 and total employment is about 9,000. This calculates to 89% of the regional population lying within the 15 incorporated communities and 11% in the rural area; while 94% of employment falls within the incorporated communities and 6% lies in the rural area.

The eight other communities include:

- Bartlett, straddling Bell County and Williamson County, with a 2017 population estimate of 2,800 and about 600 total employment.
- Holland in Bell County, with an estimated 2017 population of 1,100 and total employment just over 200.
- Kempner in Lampasas County, with a population of 1,100 and about 60 total employment.
- Little River-Academy in Bell County, with an estimated 2017 population of 2,000 and employment just under 350.

- Morgan's Point Resort in Bell County, with an estimated 2017 population of 4,200 and total employment of about 240.
- Nolanville in Bell County, with an estimated population of 5,000 and 560 in total employment.
- Rogers in Bell County, with an estimated population of 1,300 and total employment of 340.
- Troy in Bell County, with an estimated 2017 population of 1,900 and an estimated total employment of 700.

The MPO

Federal law requires that a Metropolitan Planning Organization (MPO) is designated for each urban area with a population of 50,000 or more. The MPO is to provide a continuing, cooperative, and comprehensive transportation planning process that results in plans and programs that consider all transportation modes and supports metropolitan community development and social goals. The ultimate goal of the planning process is the development and operation of an integrated intermodal transportation system that supports the efficient movement of people and goods.

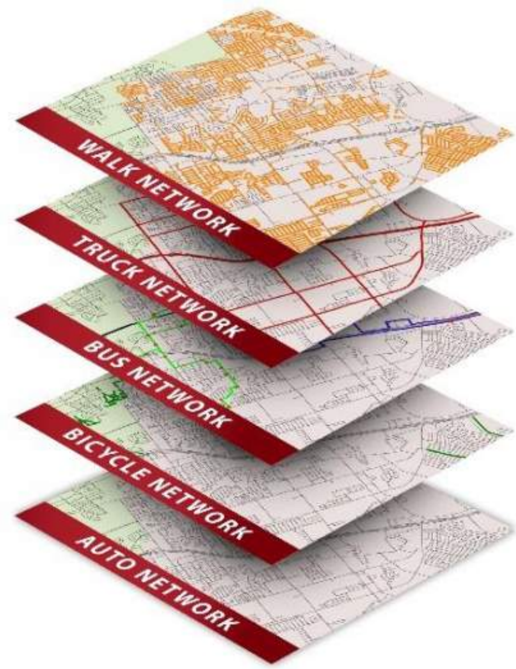
Federal and state legislation requires that each MPO have a long-range transportation plan covering a 25-year period. This plan is called the Metropolitan Transportation Plan (MTP). Its purpose is to develop the overall vision for multimodal planning in the region, develop a systematic and inclusive planning process, determine future needs, and develop a prioritized list of projects that will effectively address future needs in an efficient and equitable manner. The **Regional Multimodal Plan** with its Thoroughfare Plan and Bicycle/Pedestrian Plan are not directly components of the MTP, but they are complementary and feed into the MTP to support the definition and selection of transportation projects.

Preparing the MTP and the Regional Multimodal Plan are only two of the planning purposes of the Killeen-Temple MPO. KTMPO also produces a Transportation Improvement Plan (TIP) for short-term investments and a Unified Planning Work Program (UPWP) to define the annual schedule of planning work performed. Mapped traffic counts in the region, GIS layers, other plans and reports, and studies for specific transportation projects are also produced and available on the MPO website at http://www.KTMPO.org. Public participation is welcomed throughout the process for each of these MPO products, and is guided by the Public Participation Plan, which is also available on the KTMPO website, but direct public participation is not a component of Regional Multimodal Plan development.

Transportation Modes

One important feature of the integrated transportation system is that it is **multimodal**. Multimodal transportation planning recognizes that the needs of the integrated transportation system in the region are not limited to the historic emphasis on personal automobiles, and takes a broader view to consider the needs of all transportation modes for personal travel and for freight. To fill these needs, the Regional Multimodal Plan embraces multimodal transportation planning as the vehicle to develop the historically auto-oriented transportation system into a truly integrated multimodal transportation system.

The integrated multimodal system can be considered as a series of layered networks with some links shared among transportation modes, some links exclusive to one or more modes, and some modes interfacing with the system as points rather than as links. Multimodal transportation planning must consider the features of each mode individually, and must also plan for how each mode interacts with the others. While each mode in theory can operate independently, in practice the interface between modes can be vital in establishing how well each mode performs. In particular, the issue of safety in the interface between active transportation modes and motorized modes is critical. Where facilities such as protected bicycle lanes are provided, users feel much more comfortable and ridership has been seen to increase significantly.



Seven unique networks are components of the integrated multimodal transportation system in the KTMPO region:

The **auto network** is currently the most robust component of the integrated system. This network places the least restrictions on its users in terms of access, barriers, and connectivity. Transportation planning and funding programs have historically had an automobile orientation. The auto network also carries by far the majority of all travel in the KTMPO region, and so the traditional focus of the planning process on the automobile is entirely appropriate. The challenge in developing the integrated multimodal network is to broaden the focus of transportation planning while at the same time preserving the regional mobility provided by the auto network.

The **bicycle network** typically shares the roads with the auto network, and bicycles are in fact classified as vehicles by state law. Bicycle riders are, however, much more vulnerable than the auto users with whom they share the road. The interface between bicycles and motor vehicles is therefore an important issue, both along the street and at intersections. Various types of bicycle facilities have been developed to address this interface, including shared lanes, bike lanes, protected bike lanes, bike boulevards, and protected intersections.

The **bus network** for the KTMPO region is defined by the service provided to the HOP's ten fixed routes that provide service in Temple, Belton, Nolanville, Harker Heights, Killeen, and Copperas Cove. The fixed route system is served by 313 stops with a variety of amenities ranging from simple bus stop signs to intermodal stations providing indoor waiting areas and linkage to taxi, intercity bus, and AMTRAK service for the stations in Killeen and in Temple.

The HOP's paratransit service is also a component of the bus network. It operates within ¾ mile of the fixed routes in Killeen and in Temple, providing bus service and connections to qualified persons with disabilities.

The **truck network** is essentially the same as the auto network, but includes restrictions based on height and loaded weight. Some at-grade railroad crossings and bridges also place restrictions on the routes that trucks may reasonably use, and some jurisdictions have specified routes for hazardous materials. Specific routes defined in the regional network that consider the needs of freight traffic include the National Highway Network, the Freight Analysis Framework network, the Texas Highway Trunk System, and local truck-restricted roads.

While the **walk network** has historically received the least direct attention in transportation planning, it is vital to the transportation system. Every trip begins and ends as a walk trip, even if it is only to walk to access another mode of transportation. As with bicycles, walking is an active transportation mode with users who are particularly vulnerable to motorized vehicles. The safety of the interaction between the walk mode and motorized modes is therefore a critical consideration in multimodal transportation planning.

The **airport system** is not a network co-linear with the other network layers. Rather, it is an independent network that interacts with the other layers at specific points – the discrete and controlled land-side access to public airports. While this narrows the range of issues for multimodal transportation planning, the issues themselves remain the same: access, barriers, and connectivity between the airports and the rest of the networks must still be considered.

Like the airport system, the **rail system** is an independent network that interacts with the other network layers at specific points. The points of interaction are not limited to access points at rail stations; consideration must also be given to locations where the rail network crosses the road network with at-grade crossings. At-grade crossings define concerns with safety and pavement condition. Railroad grade-separated crossings may have height, width, weight, and load restrictions as well.

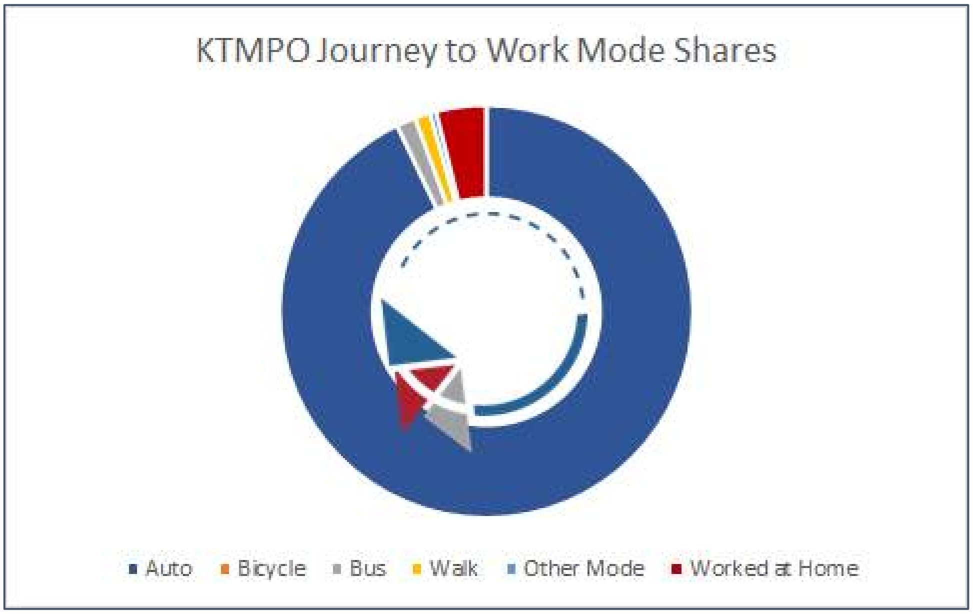
The rail system includes freight service run by Burlington Northern Santa Fe (BNSF) and Union Pacific, and an independent but connected freight network within Fort Hood. Passenger rail service in provided by AMTRAK using Burlington Northern and Union Pacific tracks. There is also about 6 ½ miles of abandoned rail track that lies between Belton and southern Temple which provides opportunities for re-use and can be considered in planning the integrated multimodal network.

Share and Balance of Transportation Modes

The goal of a regional multimodal system is to develop complementary modal networks that interact to provide safe, convenient, and practical transportation options for all users. Within this balanced system, all transportation modes are not equal, nor are all modes equally used. The private automobile is the predominant mode of transportation in the KTMPO area. Transportation planning must recognize this fact, and take care to balance the needs and traditional accommodation of this mode while increasing the integration of all modes into the regional multimodal system.

Figure 1-2 shows the Census data for each transportation mode's share of the total for the Journey to Work (JtW) trip. The auto mode was used by 92.9% of all trips. Transit mode share was 1.5%; walking was the travel mode for 1.2% of trips, and other modes such as taxis were used for 0.5%. The mode share for bicycle was so low that it was reported as 0.0%. The total for all non-automobile modes was 3.2%, compared to a 3.9% share for people working at home.

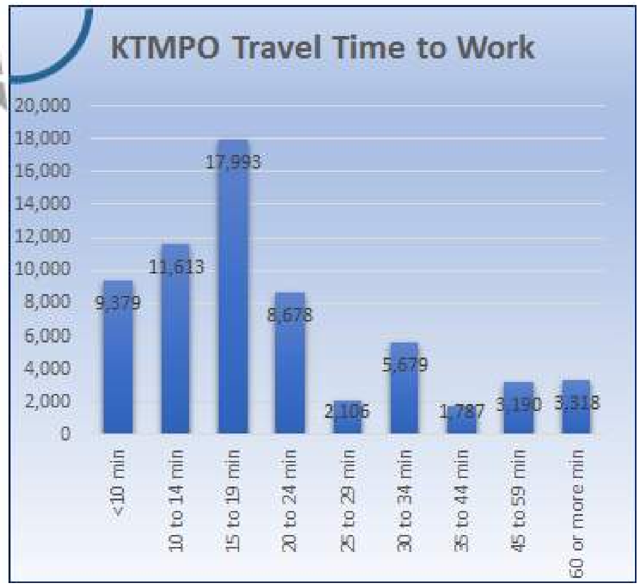
Figure 1-2: KTMPO Journey to Work Mode Shares



The relatively low shares for non-automobile modes can be seen as a testimony of how the region views the safety, convenience, and practicality of those forms of transportation within the existing network. One of the purposes of this Regional Multimodal Plan is to determine the gaps, barriers, and constraints in the network that must be addressed in order to balance all transportation modes. Once the balance is addressed, volumes of use of these modes may be expected to increase.

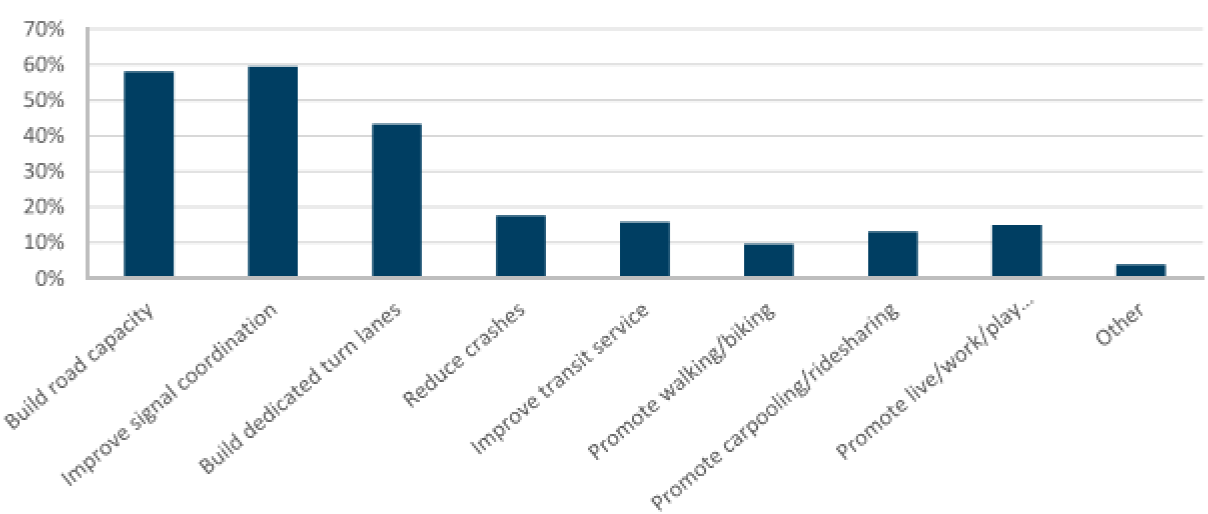
Figure 1-3 shows the distribution of travel time to work for the KTMPO region, based on Census data. A cumulative 32.9% of all work trips are shorter than 15 minutes, and 61% are under 20 minutes. While travel times by bicycle, bus, and walking would undoubtedly be longer, the data show that the majority of work trips can feasibly be made by other transportation modes; the issue is balancing the networks and the operating conditions so that each mode is seen as safe, convenient, and practical.

Figure 1-3: Distribution of Travel Time to Work



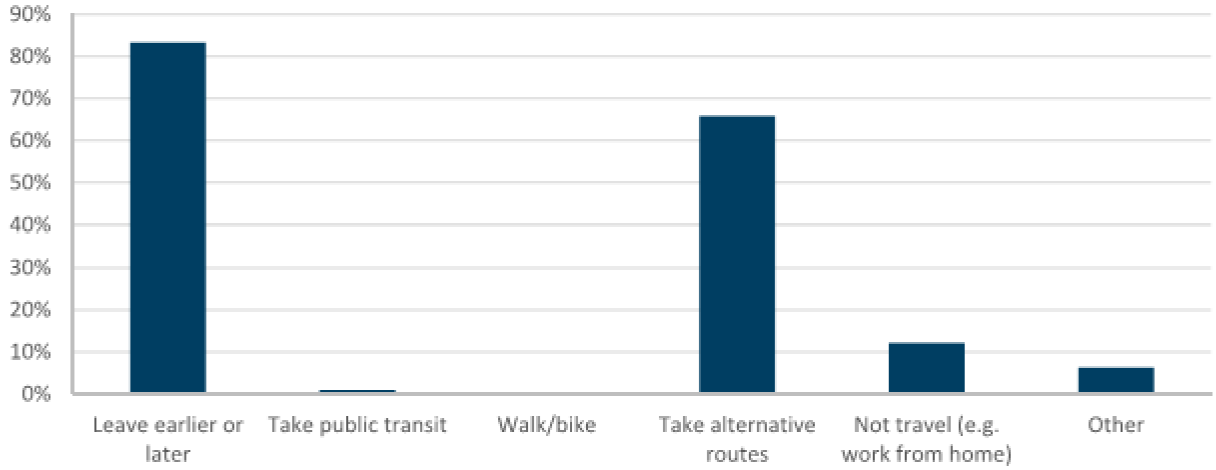
The results of surveys taken for the 2016 Congestion Management Process provide further data on how the auto and other transportation modes are perceived in the KTMPO region. **Figure 1-4** charts the survey results in answer to the question "What do you believe are the most effective strategies for addressing traffic congestion?" The results show that both roadway capacity and operational efficiencies were top strategies. This is consistent with the predominance of the automobile in regional mode shares. Strategies addressing a multimodal system consistently were scored by between 10% and 20% of respondents.

Figure 1-4: Strategies to Address Congestion



Taking this to a personal level, the survey also asked, "What actions do you take to avoid traffic congestion?" The responses, shown in **Figure 1-5**, again show a reliance on strategies based on driving a personal automobile.

Figure 1-5: Actions to Avoid Congestion



Taken together, the Census data and the Congestion Management Process surveys reinforce the perception of the automobile as the predominant mode of transportation. This does not negate the consideration of other transportation modes in the regional multimodal system; but rather outlines the challenge of developing the proper and adequate balance between modes.

Outline of Regional Multimodal Plan Chapters

This first chapter to the Regional Multimodal Plan has introduced:

- The concept and function of the Regional Multimodal Plan.
- An overview of the region and its jurisdictions.
- A definition of the MPO with its establishing Federal regulations and its planning purposes.
- An overview of the transportation modes to be considered in this plan.

Subsequent chapters of the Plan will introduce additional concepts and detail the elements of the Plan:

Chapter 2 will detail the planning context of the Plan. It references the individual Thoroughfare Plans developed by KTMPO member jurisdictions.

Chapter 3 introduces the concept of Complete Streets and associated movements designed to promote the integration of modes into an integrated system serving the needs of all users.

Chapter 4 will define the concept of Functional Classes for planning for modal networks.

Chapter 5 will provide inventories of existing facilities by transportation mode.

Chapter 6 is the regional Thoroughfare Plan for the years 2017 and 2045.

Chapter 7 will define the active transportation networks for bicycles and pedestrians.

Chapter 8 will cover the modes which are defined as group transportation: transit, carpool and rideshare, intercity bus, passenger rail, and passenger air.

Chapter 9 will detail the freight system, focusing on the truck and rail freight networks. Specialized high-value, low-weight air cargo will also be considered in this chapter.

Chapter 10 will define performance measures related to the integrated multimodal system. It will reference and support the project selection criteria used for the latest version of the MTP, but will be independent of them. The performance measures will tie to the required planning factors as defined in the FAST Act.

Chapter 11 will list potential implementation projects for each mode based on identified needs that will be presented to the Technical Advisory Committee, and may be submitted by local jurisdictions for project development. Projects will not be ranked or prioritized in this Plan.

Chapter 12 will provide a summary of the Plan to document its processes and results in a clear but concise manner. Any action items for implementing the Plan will be detailed in this final chapter.

Chapter 2: Planning Context

CHAPTER HIGHLIGHTS

- **Planning Context**
- **Goals and Objectives**
- **Demographics and Growth**
- **Thoroughfare Plans**
- **Travel Demand Model**

The Planning Context

The **Regional Multimodal Plan** defines a consistent integrated transportation system, but it operates within the context of regional goals, regional demographics, regional plans, and the regional travel demand model setup and definitions.

One of the most vital plans to consider is the Thoroughfare Plan. In general terms, a Thoroughfare Plan is a long-range master plan for the orderly development of an efficient roadway transportation system. Most importantly, it defines an interconnected hierarchical system of roads that is required to meet the anticipated long-term growth within an area. The Thoroughfare Plan developed as part of the Regional Multimodal Plan is regional and therefore must not be overly deterministic: it presents typical cross-sections for roadways and general alignments for proposed roads, without dictating specific features of the thoroughfare system to the KTMPO member jurisdictions.

A second vital plan that provides context for the Regional Multimodal Plan is the Bicycle & Pedestrian Plan. Similar to the Thoroughfare Plan, the Bicycle & Pedestrian Plan is a long-range master plan for the orderly development of bicycle and pedestrian facilities. There is a hierarchy of facilities identified within the plan that includes on-street bikeways and off-street trails.

Although the Thoroughfare Plan and the Bicycle & Pedestrian Plan are the more critical elements of the Regional Multimodal Plan, the other transportation modes in the region play an important role in providing mobility for people and freight, and are accommodated in the Plan as well. Facilities supporting group transportation modes must be supported, barriers must be identified and addressed, and connectivity between modes must be enhanced so that all users are served by the integrated transportation system.

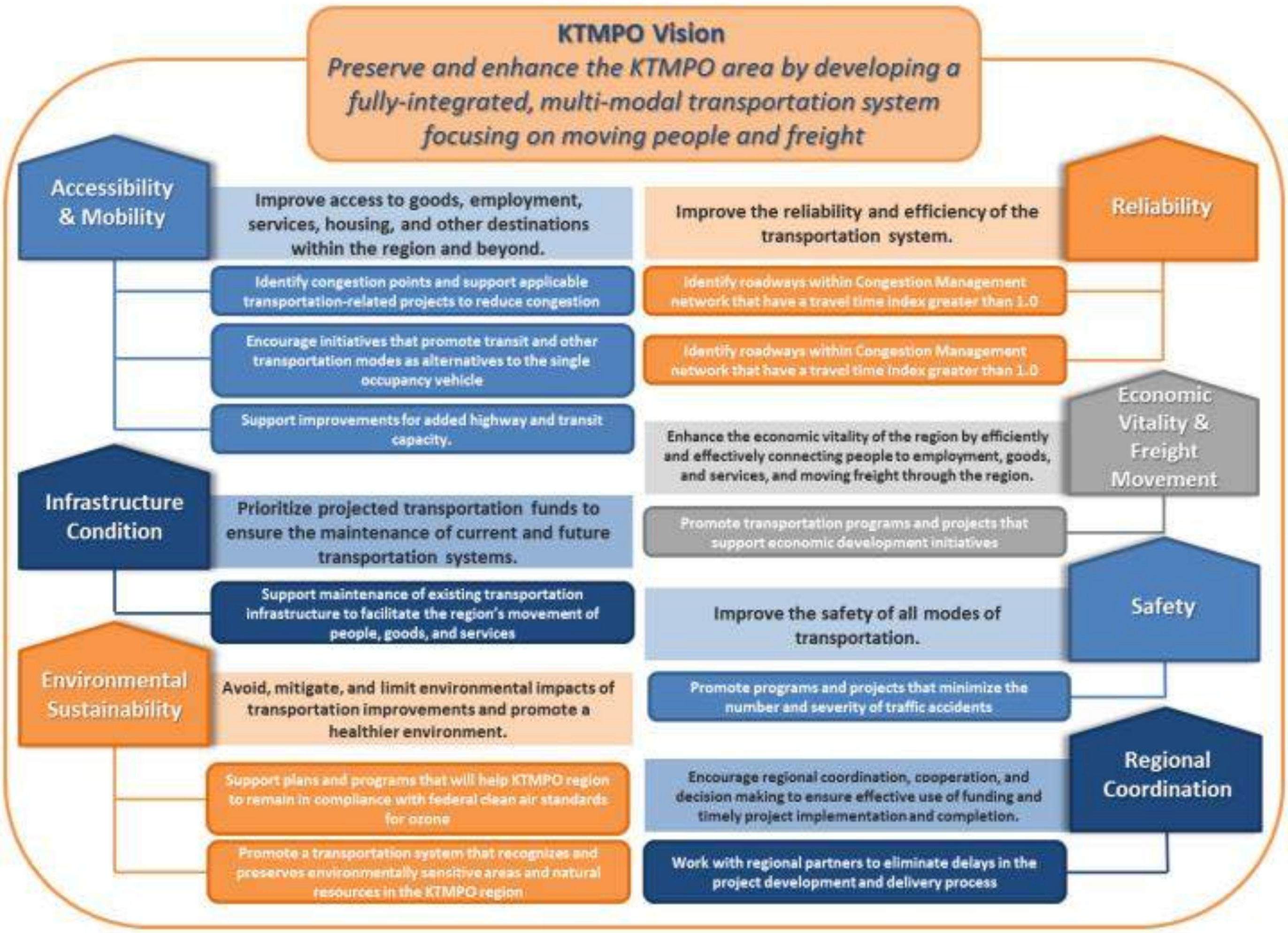
The Context of Regional Goals and Objectives

As one of the purposes of the Regional Multimodal Plan is to feed into the next update of the 2045 Metropolitan Transportation Plan (MTP), the goals and objectives of regional transportation planning as outlined in the current Mobility 2040 MTP are relevant to Plan development. The MTP goals are themselves derived from the eight Planning Factors first specified under the MAP-21 Federal Highway Authorization in 2012, and continued under the latest FAST Act Authorization in 2015. The component goals and objectives of the MTP are likewise supported by the Regional Multimodal Plan, and are shown in **Figure 2-1**.

The overall vision for the MTP is directly applicable to the Regional Multimodal Plan: **to preserve and enhance the KTMPO area by developing a fully-integrated, multi-modal transportation system focusing on moving people and freight**. Five of the MTP's sub-goals are particularly applicable to the Regional Multimodal Plan:

- Identify congestion points and support applicable transportation-related projects to reduce congestion.
- Encourage initiatives that promote transit and other transportation modes as alternatives to the single occupancy vehicle.
- Support improvements for added highway and transit capacity.
- Identify roadways within Congestion Management network that have a travel time index greater than 1.0.
- Enhance the economic vitality of the region by efficiently and effectively connecting people to employment, goods, and services, and moving freight through the region.

Figure 2-1: Goals and Objectives of the Mobility 2040 Metropolitan Transportation Plan



Source: Mobility 2040: KTMPO Metropolitan Transportation Plan

The Context of Regional Demographics and Growth

Current and forecast demographics also form an important context for regional transportation planning. Both the intensity and the distribution of population and employment affect how the transportation system should be designed to provide access and mobility for persons and freight.

Figure 2-2 illustrates the intensity and distribution of regional population for the year 2015. Population concentrations can be seen in cities along I-14, I-35, US 190, SH 36, SH 95, and SH 317. Note that on the periphery of the region, the larger Traffic Analysis Zone (TAZ) sizes causes the graphic to show more cumulative population, even though these are rural areas with low density.

Figure 2-2: 2015 Regional Population

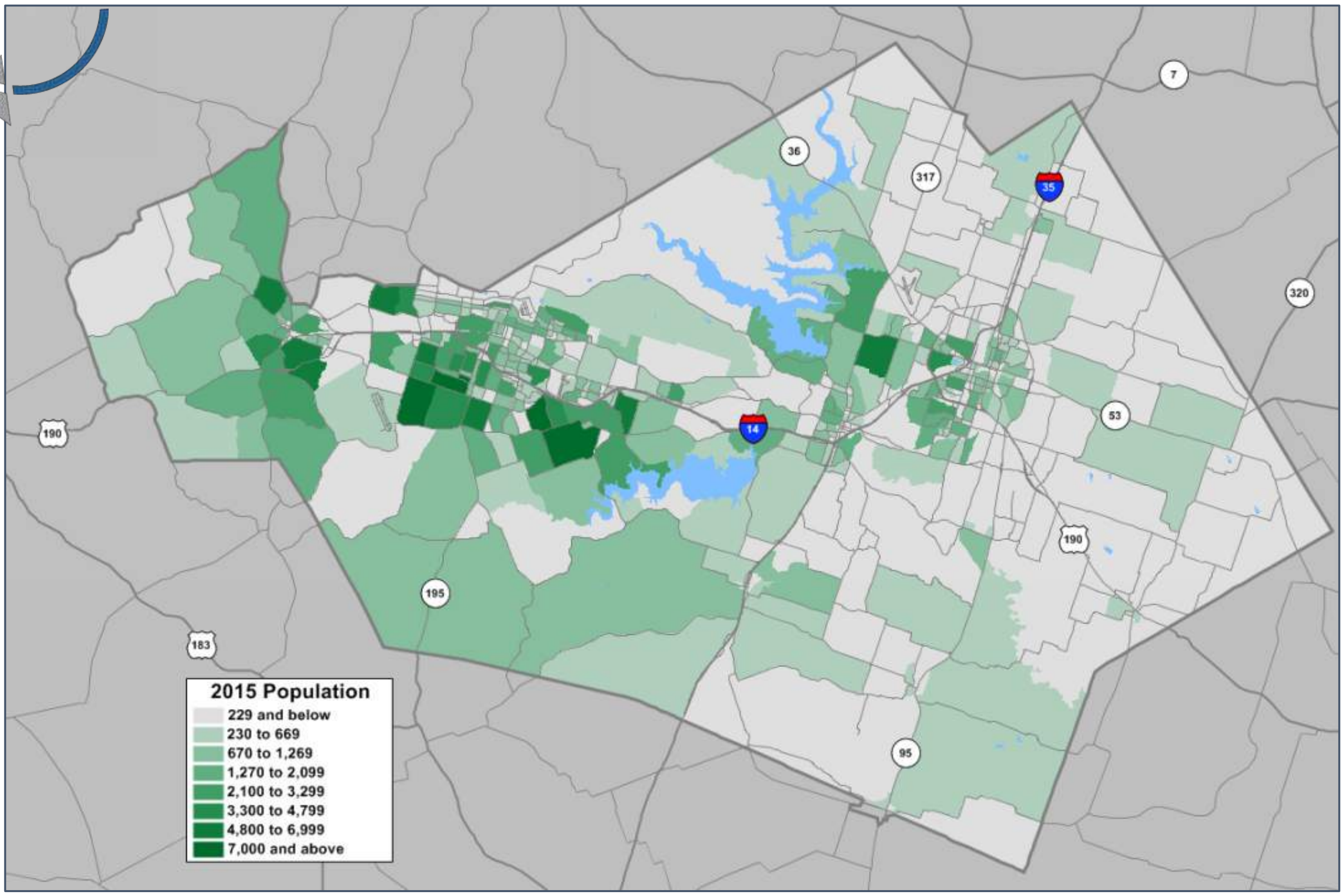
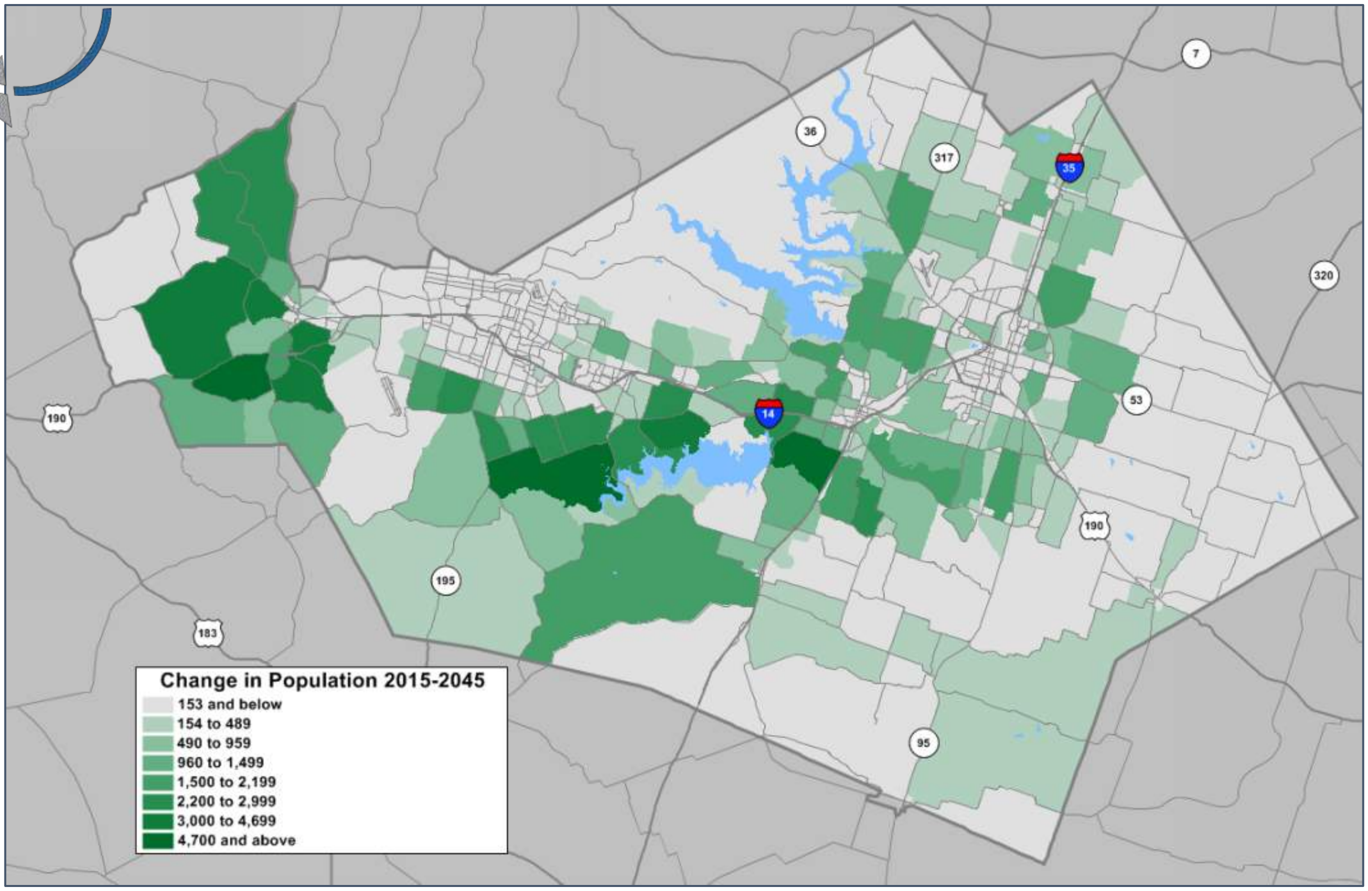


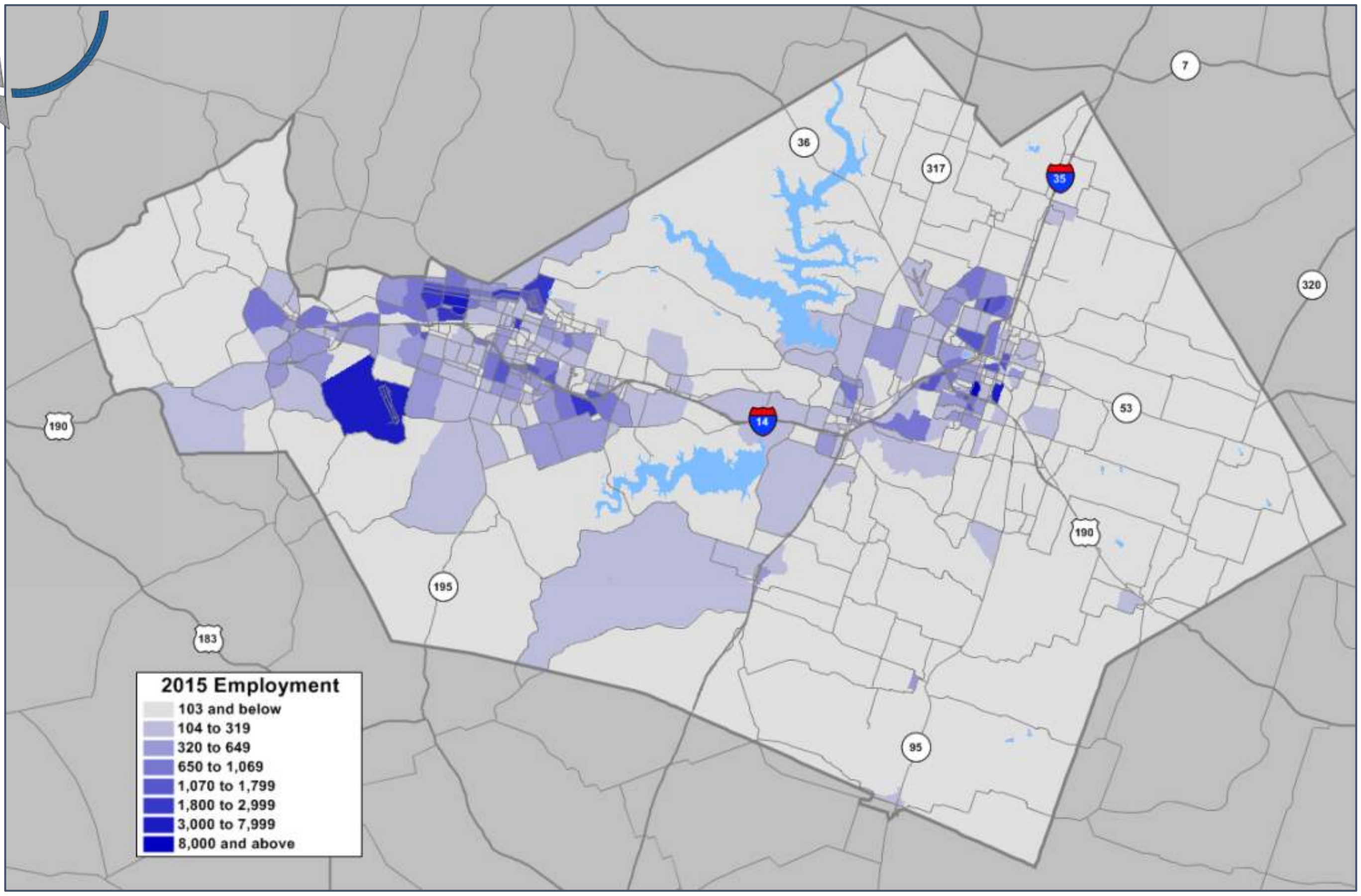
Figure 2-3 shows the projected changes in regional population from 2015 to the forecast year 2045. Population is generally shown growing outward from established areas to areas which are currently more rural and have available buildable land. The population change is greatest in the areas around Copperas Cove, south of Killeen, and along IH-35 and SH 317 west of Temple.

Figure 2-3: Change in Regional Population From 2015 to 2045



Regional employment for the year 2015 is shown in **Figure 2-4**. Concentrations of employment can be seen at Fort Hood and the Killeen-Fort Hood Regional Airport, in the retail areas along US 190 in Killeen, along I-35, and around Loop 363 in Temple.

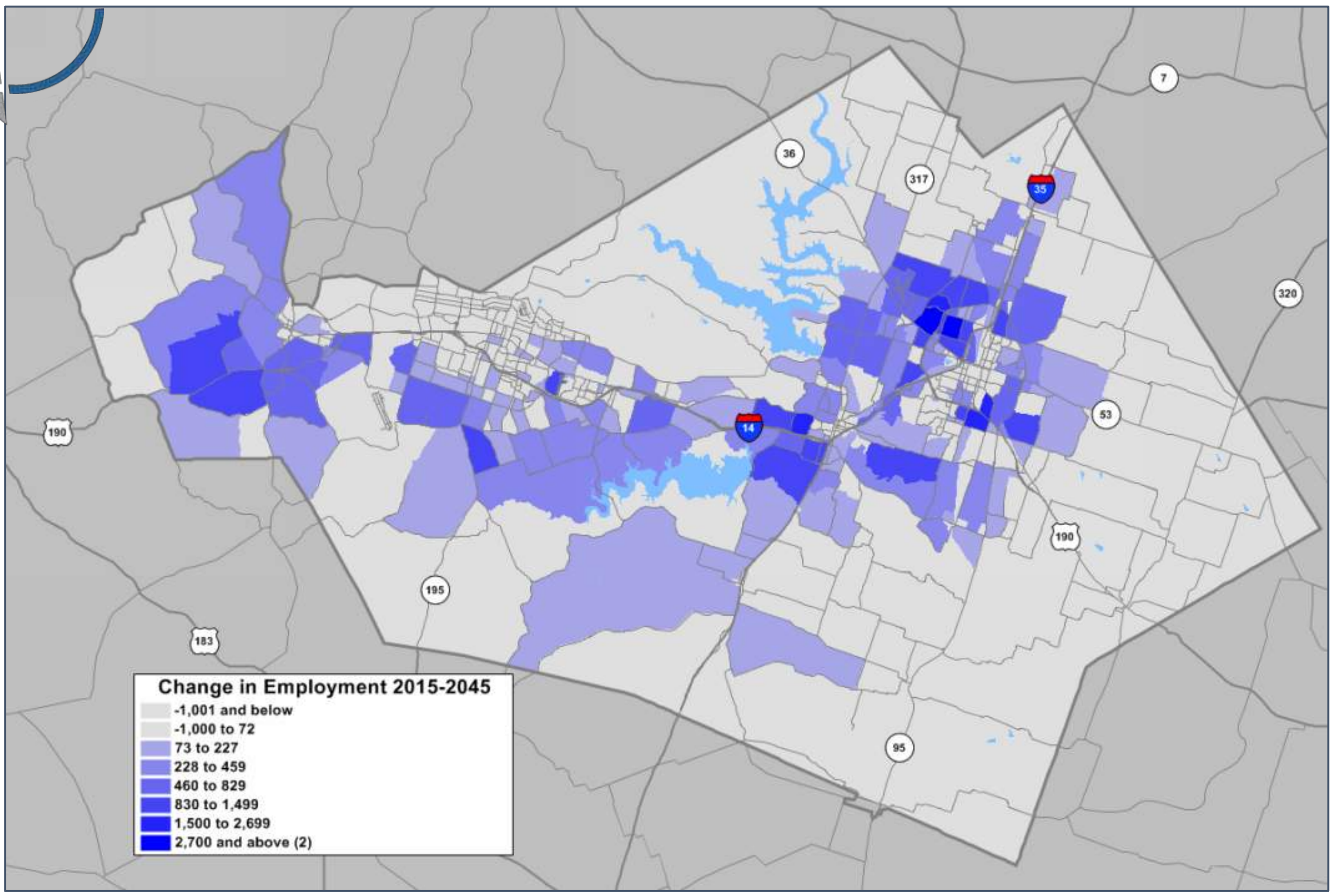
Figure 2-4: 2015 Regional Employment



Forecast employment change for the year 2045 is shown in **Figure 2-5**. Forecast employment is concentrated in existing areas and around industrial parks, but to some extent also follows population growth to new areas. Employment growth is evident surrounding Temple, along I-35, south of Killeen, and surrounding Copperas Cove. The data also shows forecast reductions in employment in several smaller areas in the downtowns of Temple, Belton, Killeen, and Copperas Cove.

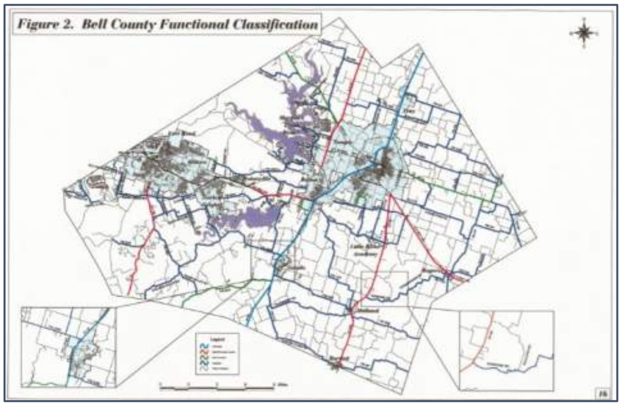
The intensity and distribution of forecast population and employment provide context for the integrated transportation system by defining new areas of need, revealing the need for additional connectivity in one mode and between modes, and defining new barriers to transportation. Each of these needs should be addressed in the new Regional Multimodal Plan.

Figure 2-5: Change in Regional Employment From 2015 to 2045



The Context of Local Thoroughfare Plans

In addition to the KTMPO Mobility 2040 MTP, which includes cross sections for typical roadway functional classes, the other planning documents with the most applicability to the Regional Multimodal Plan are the individual Thoroughfare Plans from the KTMPO member jurisdictions. Each of the Thoroughfare Plans for the member jurisdictions responds to their specific local conditions and needs. Each defines their own customized Functional Classification system for the roads in their local area.



KTMPO and the Central Texas Council of Governments (CTCOG) prepared a Thoroughfare Plan for Bell County in October 2001. That plan considered TxDOT design standards and defined a county-wide system of typical cross-sections for Interstates, Arterials, Minor Arterials, Collectors, and Local Roads. This plan recognized that there was no accepted regional Functional Classification system or policies for roadway spacing by Functional Class, and developed the plan to address these deficiencies.

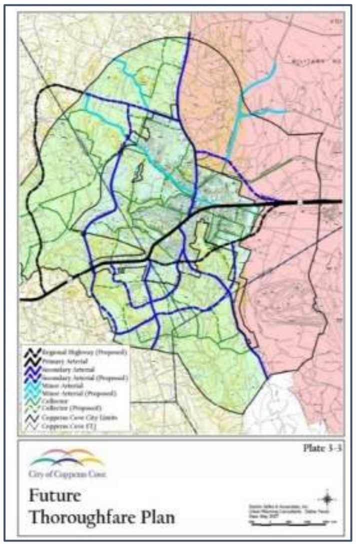
The four Functional Classes defined for roadways in the Bell County Thoroughfare Plan are:

- Interstate
- Major Arterial
- Minor Arterial
- Collector

The Thoroughfare Plan for Belton is embedded in its Draft 2017 City Comprehensive Plan. The plan defines certain **Land Use Center** types around key intersections, which is a variation on the standard Functional Classification system which has been codified in the recent *NCHRP Report 855: An Expanded Functional Classification System for Highways and Streets*. The NCHRP Report likewise defines several Context Settings which modify the roadway and streetside features defined for each Functional Class.

The Belton Thoroughfare Plan defines five Functional Classes for roadways:

- Interstate
- Major Arterial
- Minor Arterial
- Major Collector
- Minor Collector



The Copperas Cove Thoroughfare Plan is part of its 2007 Comprehensive Plan. Their Functional Class system considers the context of the street system, with attention given to each Functional Class' function, spacing, intersection spacing, land access, speed limits, and provisions for parking.

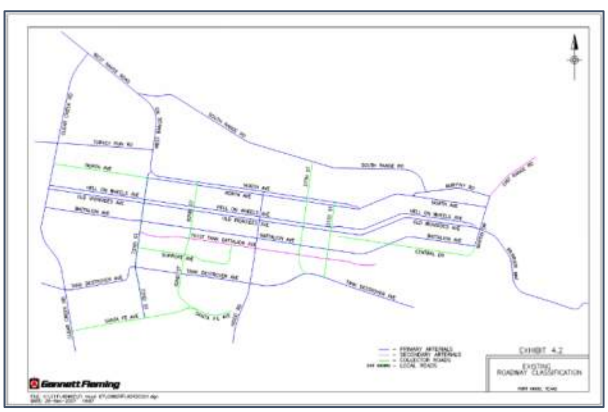
Seven Functional Classes are defined for roadways:

Regional Highway	Primary Arterial	Major Collector
	Secondary Arterial	Collector
	Minor Arterial	Residential

Harker Heights' Thoroughfare Plan is based on function, spacing, and width.

Although the Thoroughfare Plan map shows only Arterials and Collectors, the text of the plan defines four Functional Classes:

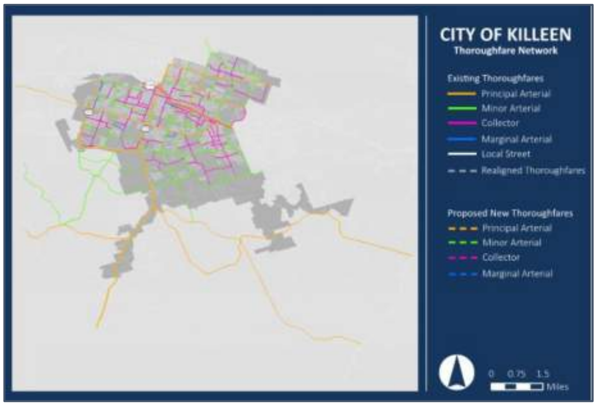
Major Arterial	Collector
Minor Arterial	Local



A Post-Wide Traffic Engineering and Safety Study was developed for Fort Hood in 2008. Primary goals of the study were traffic control, access control, an evaluation of intersections, traffic signals, pedestrian crossings, and a listing of planned projects. The study noted significant pedestrian activity on post, particularly during the morning physical training sessions. It noted that Battalion Ave, classified as a Primary Arterial, is closed to auto traffic each weekday morning to accommodate pedestrians and physical training. Bicycle traffic on post was observed to be minimal.

Four Functional Classes were defined for roads in Fort Hood:

Primary Arterial
Secondary Arterial
Collector
Local



The Thoroughfare Plan for the City of Killeen was developed in 2015. This plan evaluates existing conditions and growth patterns to define development scenarios for the city. The Thoroughfare Plan then defines an appropriate Functional Classification system with typical roadway cross sections.

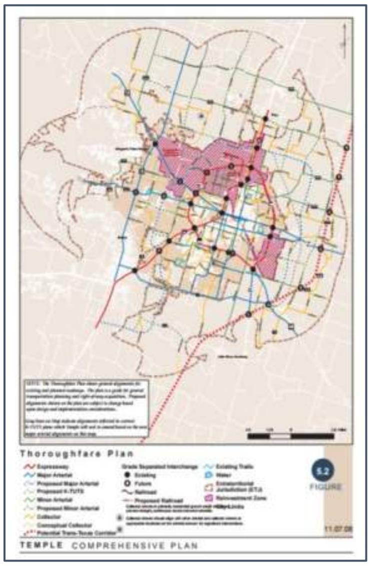
Five Functional Classes are defined for roadways:

Principal Arterial
Minor Arterial
Marginal Arterial
Collector
Local

The Village of Salado does not appear to have an active Thoroughfare Plan. An artifact graphic labeled as the transportation plan was found referenced in another planning document, but is not posted or referenced on the village website. The map is dated May 2002. The artifact map shows village streets with a Functional Classification system and typical cross sections. Future as well as current roads are shown.

There are five Functional Classes in the map:

Interstate
Minor Arterial
Major Collector
Minor Collector
Local



The Thoroughfare Plan for Temple is part of its 2008 Comprehensive Plan. The plan shows a commitment to reviewing regional mobility issues as well as the local network, and considers future growth and changes in land uses. Neighborhood connectivity is a concern, and one of the goals of the plan is to accommodate the needs of bicycles, pedestrians, and transit modes within the system.

The Functional Classification system for Temple considers roadway function, spacing, continuity, posted speeds, and parking. Multimodal issues are considered by defining criteria for through truck routes, bikeways, and sidewalks for each Functional Classification.

The five Functional Classifications defined for Temple are:

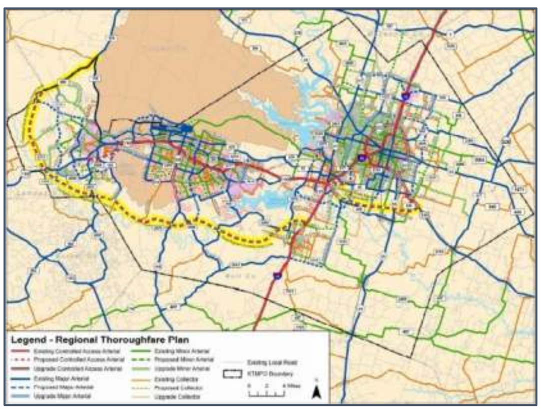
Expressway

Principal Arterial

Minor Arterial

Collector

Local



The previous KTMPO Regional Thoroughfare Plan, adopted in January 2011, is embedded in the Mobility 2040 MTP as Appendix E-2. Key elements of this plan are the synthesis of consistent roadway Functional Classification definitions based on local Thoroughfare Plans, and the inclusion of bicycle and pedestrian networks in the regional plan. The previous plan was termed a Regional Thoroughfare Plan, which emphasized the automobile portion of the plan. With this update, it is being termed a true Regional Multimodal Plan to highlight its role in providing planning for all transportation modes.

The previous Regional Thoroughfare Plan defines four Functional Classes based on the local jurisdictions' plans, the purpose of the road, access and access management, posted speed, and typical daily traffic volumes:

Controlled Access Arterial

Major Arterial

Minor Arterial

Collector

The Context of the KTMPO Travel Demand Model

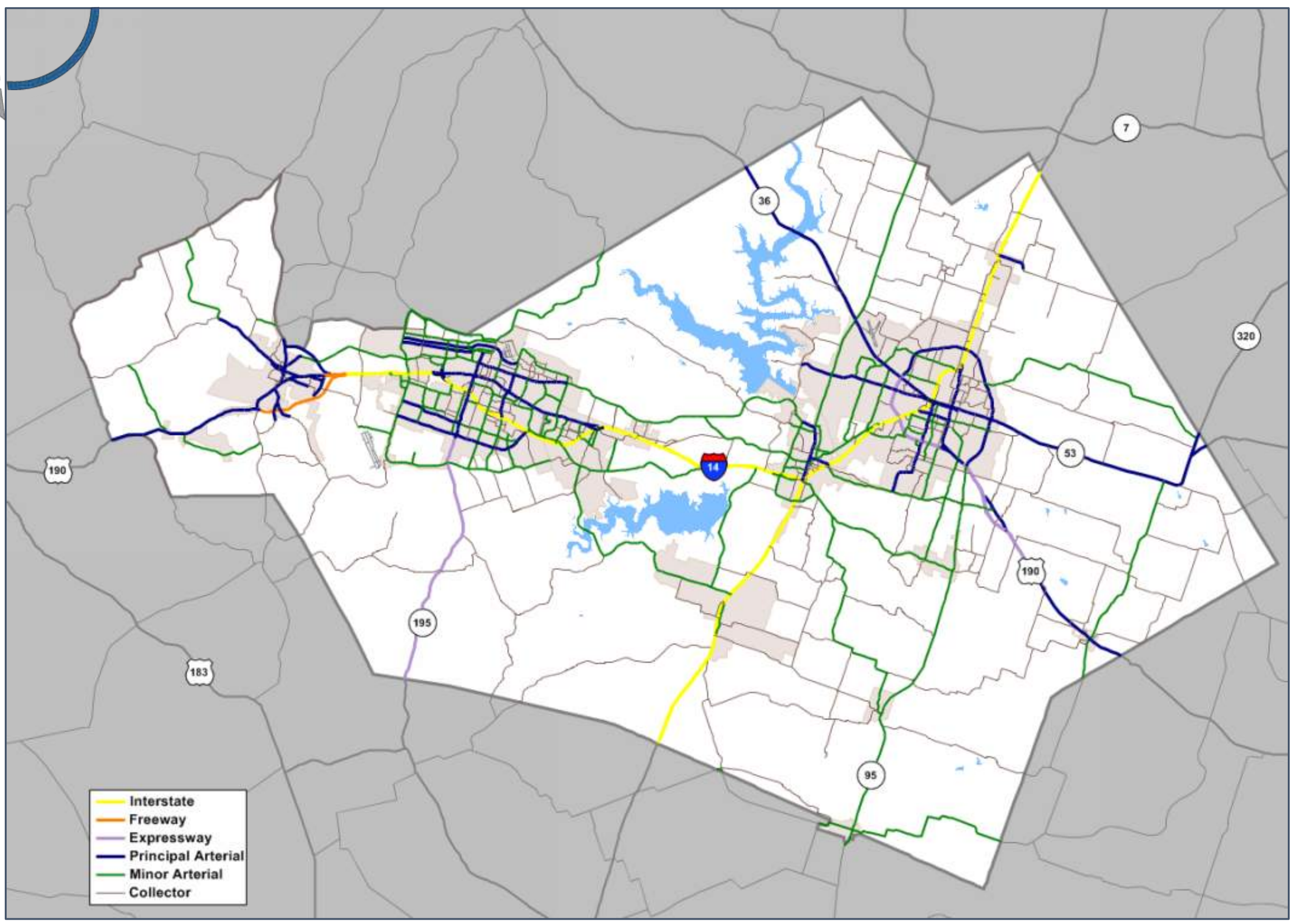
Consistent regional roadway Functional Classes are defined in the KTMPO Mobility 2040 MTP based on a review and compilation of the Functional Classes contained in the member jurisdictions' Thoroughfare Plans, FHWA and TxDOT standards, and the TxDOT standard travel demand model Functional Classification system. The Functional Classes are shown in **Figure 2-6**.

The six Functional Classes in the KTMPO travel demand model are:

Interstate	Principal Arterial	Collector
Freeway	Minor Arterial	
Expressway		

Detailed coding of Interstates, Freeways, and Expressways includes supporting Functional Classes of Frontage Roads and Ramps. The travel demand model further stratifies Arterials and Collectors into three Facility Types: Divided, Continuous Center Turn Lane, and Undivided.

Figure 2-6: KTMPO Travel Demand Model Functional Classes



Each region is different with its own specific mix of Functional Classes, conditions, and geography, so there is no hard and fast guidance on the appropriate mix of classes. However, FHWA has listed general guidelines for the appropriate percentages of each Functional Class within a typical region. The mix of Functional Classes in the KTMPO region is appropriate when compared to these general standards, as detailed in **Table 2.1**. For sake of comparison with FHWA guidance, the Functional Classes for Interstate, Expressway, and Freeway were combined to be considered as Controlled Access. The Principal Arterial Functional Class from the KTMPO travel demand model was re-named to Major Arterial for this Plan. Each Functional Class falls within its expected range except for Local Streets, which falls slightly under the generally recommended percentages.

Table 2-1: Regional Mix of Functional Classes

Regional Mix of Functional Classes			
Functional Class	Mileage	Percent	Guidelines
Controlled Access	143	4%	0 - 9%
Interstate	71	1.9%	
Expressway	51	1.4%	
Freeway	21	0.6%	
Major Arterial	110	3%	2 - 4%
Mnor Arterial	246	7%	4 - 8%
Collector	760	21%	20 - 25%
Local	2,406	66%	65 - 75%

General guidance is also provided for the spacing of Functional Classes in a region, as shown in **Table 2.2**.

Table 2-2: Regional Spacing of Functional Classes

Regional Mix of Functional Classes	
Functional Class	Spacing Guidelines
Regional	5 miles or more
Major Arterial	2 miles or more
Mnor Arterial	1/2 to 2 miles
Collector	1/4 to 1/2 mile
Local	less than 1 mile

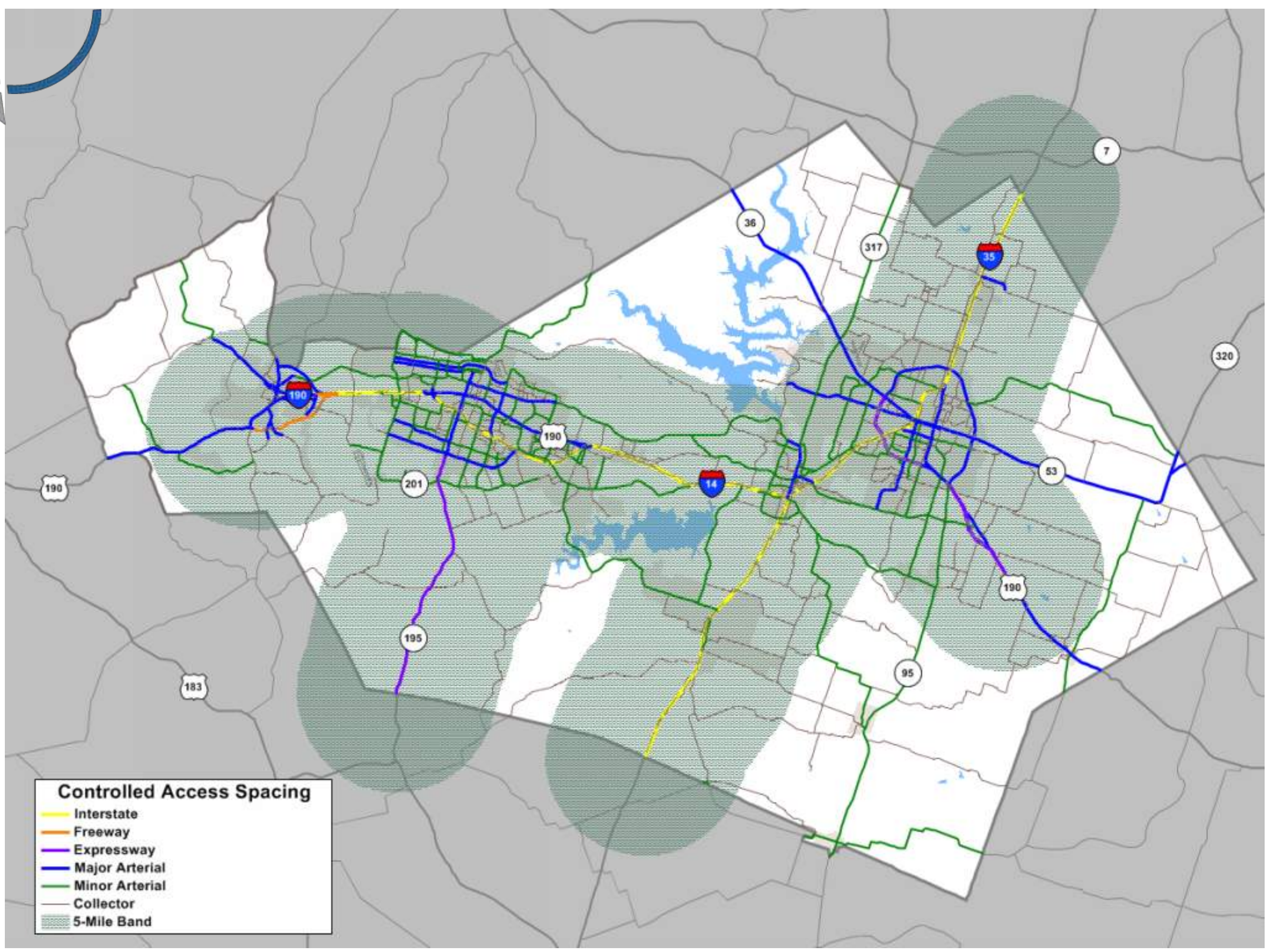
This general guidance recognizes that the appropriate spacing of functionally classified streets depends on the types and lengths of the trips that they serve, access to land uses and access control, posted speeds, and traffic levels. The mix of attributes for each Functional Class determines the context of each in the regional setting. Overall, the spacing of functionally classified roads in the region falls within the recommended guidelines.

Controlled Access roads include the Interstate, Freeway, and Expressway Functional Classes. Interstates have the most access control with frontage roads and grade-separated crossings, while Expressways may have limited numbers of at-grade intersections and traffic signals. These facilities provide regional mobility with longer-distance trips. Posted speeds are in the 55-70 mph range and average daily traffic volumes are greater than 40,000.

Controlled access roads in the KTMPO region include the Interstate, Freeway, and Expressway Functional Classes: the Copperas Cove Bypass on US 190, IH-14, IH-35, the southwest quadrant of Loop 363, and part of US 190 between Temple and Rogers.

Figure 2-7 shows a five-mile buffer around the controlled access roads in the region. All the urbanized areas in the region fall within the buffer area except for Holland, Bartlett, and a portion of Morgan's Point Resort bordering Lake Belton.

Figure 2-7: 5-Mile Buffer Around Controlled Access Roads

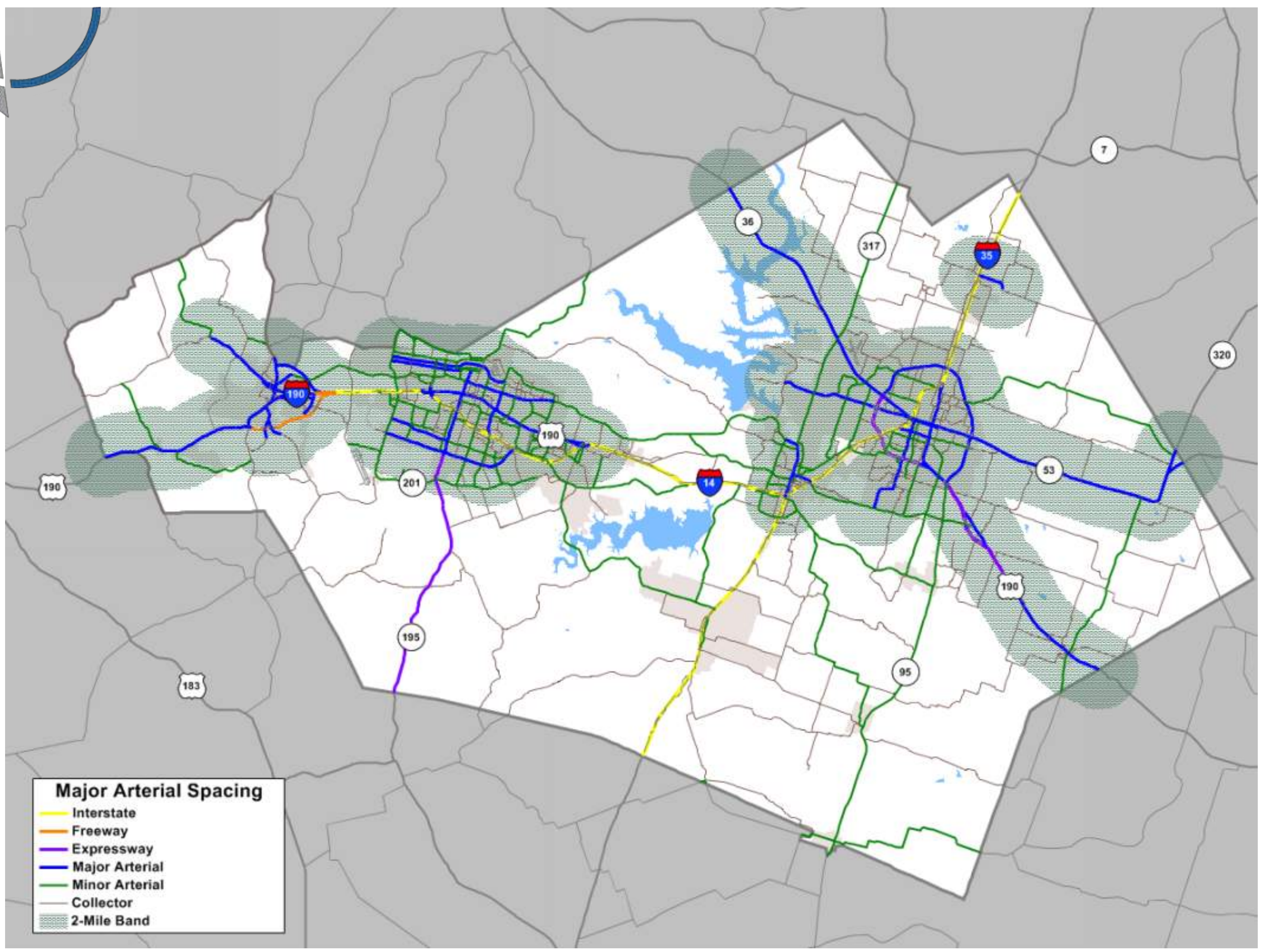


Major Arterials focus on providing regional mobility, but provide a greater amount of access to land uses than controlled access roads do. Posted speeds are in the 35-60 mph range and average daily traffic volumes are 15,000 to 50,000.

Prominent Major Arterials in the KTMPO region include Business 190, Stan Schleuter Loop, Fort Hood St, SH 36, SH 53, and portions of Loop 363.

Figure 2-8 shows a two-mile buffer around the Major Arterials in the region. The majority of urbanized areas fall within the buffer area. Gaps in coverage are associated with Lake Belton and Stillhouse Hollow Lake, along with the southern portion of Bell County.

Figure 2-8: 2-Mile Buffer Around Major Arterials

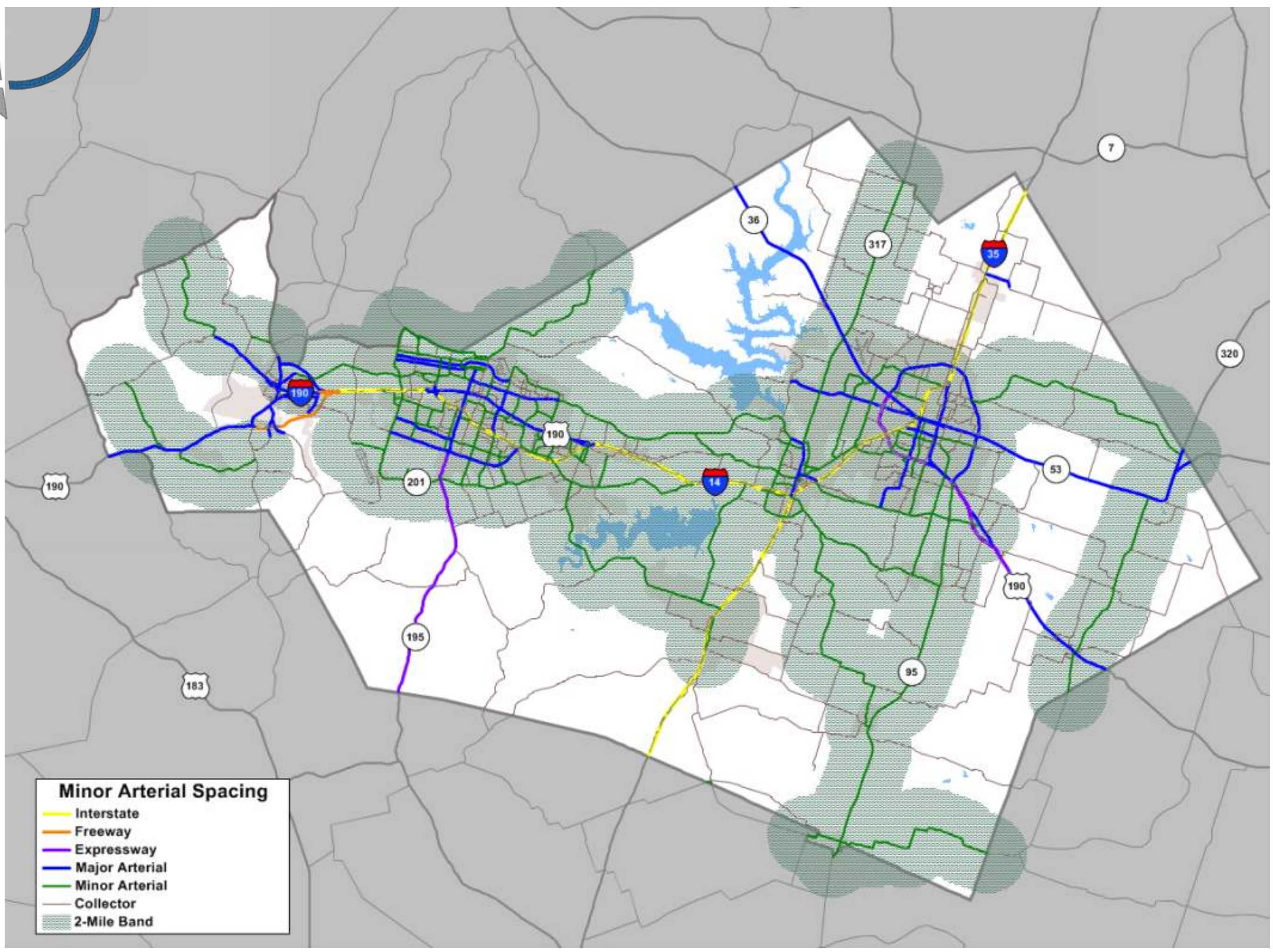


Minor Arterials are critical facilities for providing access to land uses. Regional mobility is a secondary purpose for Minor Arterials. Posted speeds are in the 30-40 mph range, but can be higher in rural areas. Average daily traffic volumes are in the range from 5,000 to 30,000.

Prominent Minor Arterials in the KTMPO region include Elms Rd, FM 439 between Killeen and Belton, SH 95, and SH 317.

Because of their different purposes within the transportation network, the general recommended spacing for Minor Arterials is ½ to 2 miles. **Figure 2-9** shows a 2-mile buffer around Minor Arterials, illustrating how they cover the region. All the region's urbanized areas except for Troy, the western portion of Copperas Cove, and a sliver of Morgan's Point Resort are covered by the buffer area.

Figure 2-9: 2-Mile Buffer Around Minor Arterials



Collector streets often serve residential uses, but can also provide access for commercial areas. They function primarily to collect traffic from smaller streets for access to the road network and to provide access to land uses. Most trips on the Collector system are shorter length trips, with speeds below 35 mph and average daily volumes of 1,000 to 5,000.

Because Collectors primarily serve local trips and provide access to the network, the general recommended spacing is ¼ to ½ mile. **Figure 2-10** shows how this smaller buffer defines areas of coverage which are more dense in urban areas, but which are relatively sparse in rural undeveloped areas.

Figure 2-6: 1/2-Mile Buffer Around Collectors

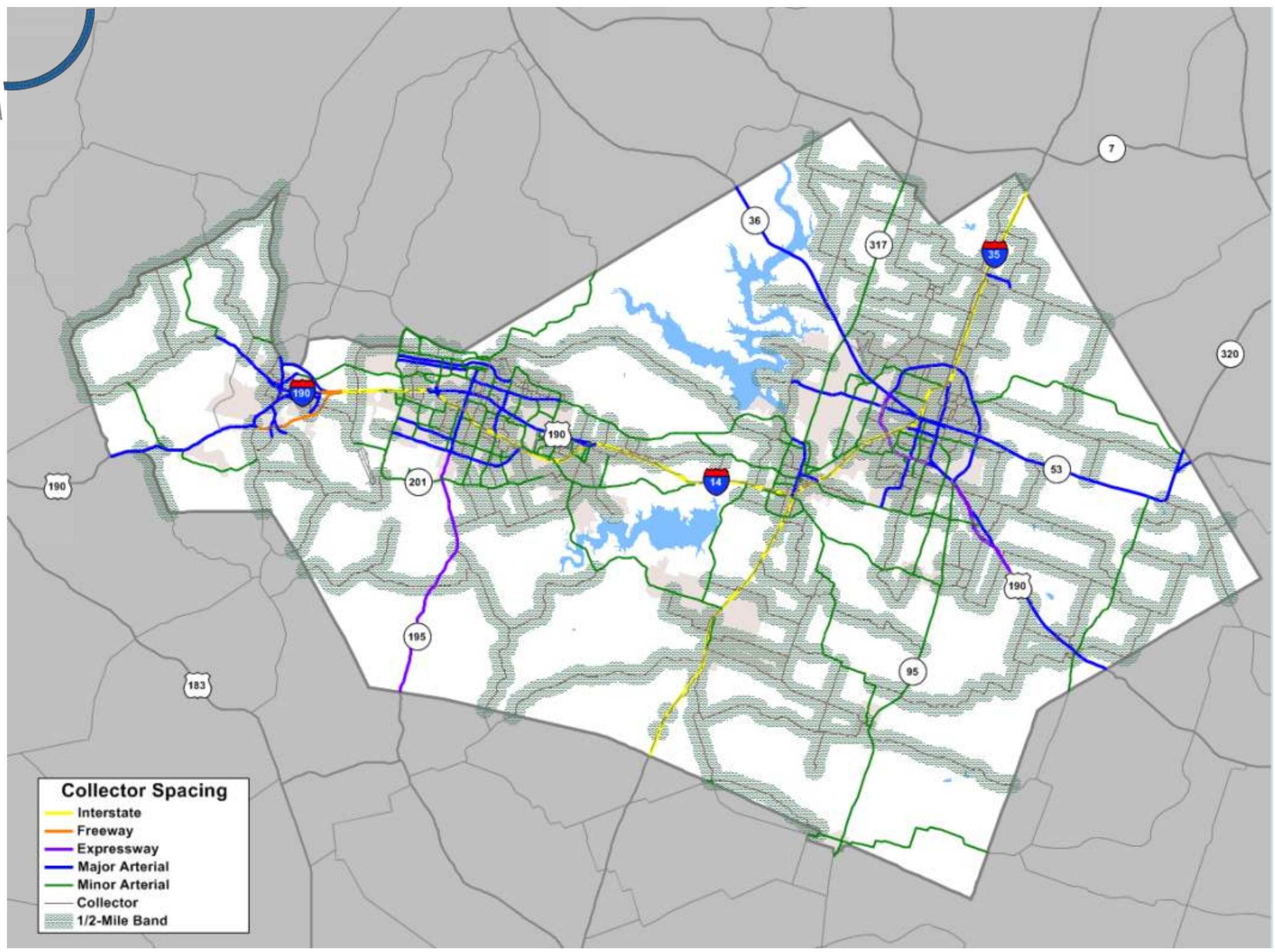
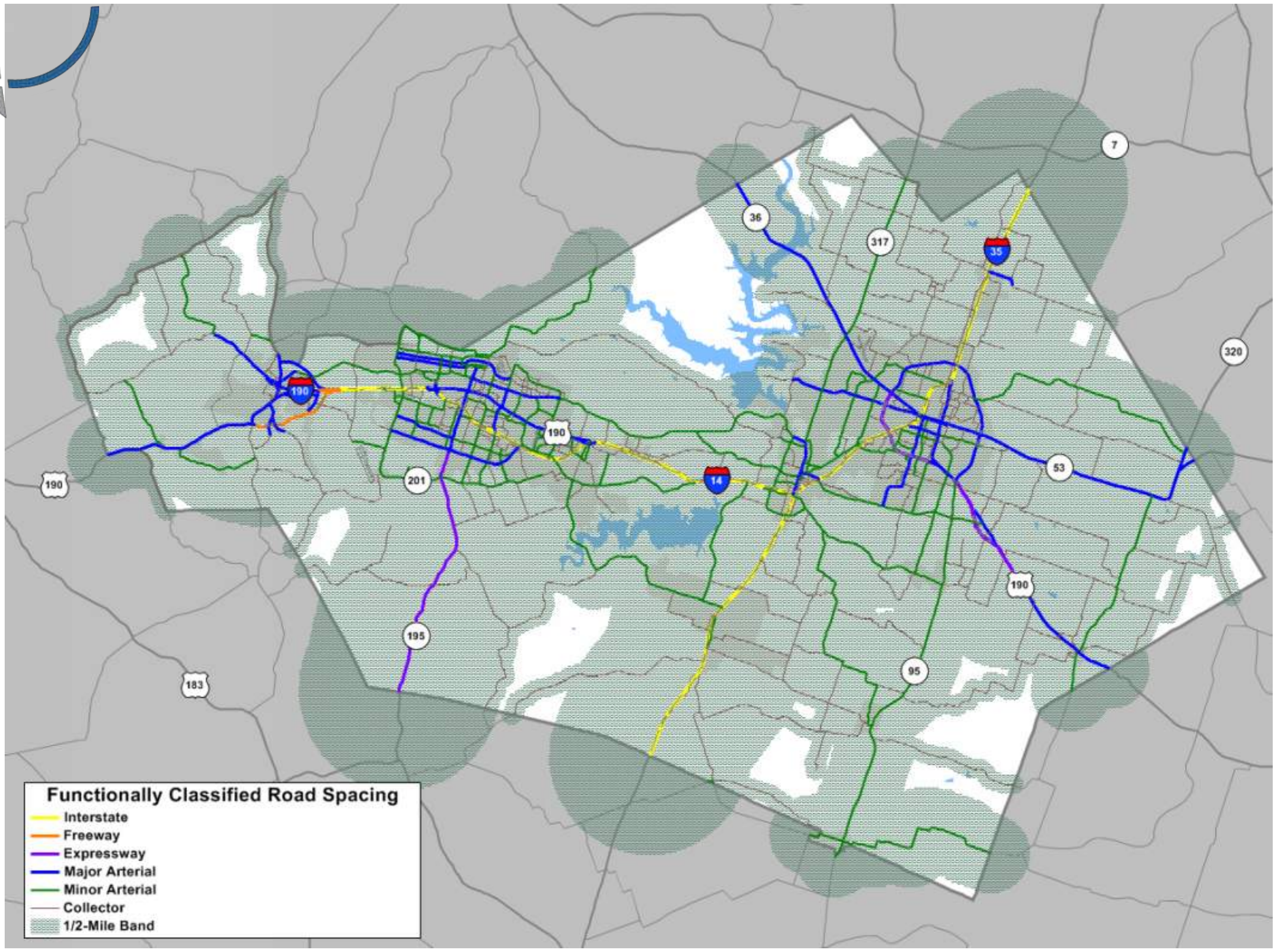


Figure 2.11 shows the overall coverage of the combined functionally classified road network with their respective spacing buffers ranging from ½ mile to 5 miles. All urbanized areas in the KTMPO region fall within the combined buffer area. The rural areas not covered include the lakes and unbuildable park lands, active agricultural areas, and low-density rural areas. Overall, the buffer area from the combined functionally classified road network covers slightly over 92% of the total land area in the KTMPO region.

Figure 2-7: Coverage of Functionally Classified Roads



Summary

The **Regional Multimodal Plan** defines a consistent integrated transportation system, but it operates within the context of regional goals, regional demographics, regional plans, and the travel demand model setup and definitions.

A review of each of these contexts shows that the existing transportation planning process and transportation infrastructure in the region are robust and supportive of the Plan.

The current Mobility 2040 MTP has an intermodal focus, and complies with the Federal and State planning regulations which were active at the time of its development. The embedded Regional Thoroughfare Plan and Bicycle & Pedestrian Plan provide a comprehensive review of regional facilities.

The intensities and patterns of existing demographics and projected growth show that the road infrastructure is generally well patterned to serve transportation demand.

The individual Thoroughfare Plans from the KTMPO member jurisdictions define Functional Class systems that are appropriate to their local needs.

A review of general Federal guidelines for the definition of Functional Classes, their functions, their mix, and their spacings shows that the infrastructure in the region follows the guidelines.

Chapter 3: Complete Streets Concepts

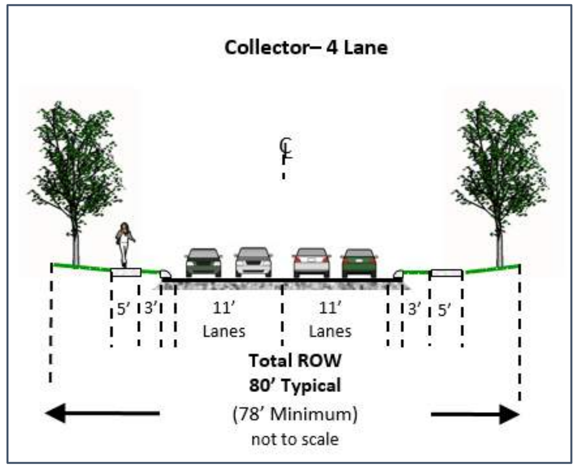
CHAPTER HIGHLIGHTS

- Complete Streets
- Vision Zero
- Road Diets & Traffic Calming
- Common Street & Sidewalk Treatments
- Common Intersection Treatments

Introduction

It has already been recognized that people and industries are rethinking their transportation needs, preferences, and habits. To accomplish the needed shift in transportation planning to consider all modes within an **integrated transportation system**, a suite of planning concepts should be considered. The consideration of the **Complete Streets** movement in transportation planning has defined a set of tools and priorities that impact how streets are designed. Similar movements for **Vision Zero**, **Road Diets**, and **Traffic Calming** have consistent and compatible goals of providing increased support for other modes of travel and promoting street safety. With similar goals, they also share a set of common treatments for streets, sidewalks, and intersections. Taken together, Complete Streets movement and its associated movements contribute a more multimodal and more livability-oriented approach to street design.

Complete Streets Concepts



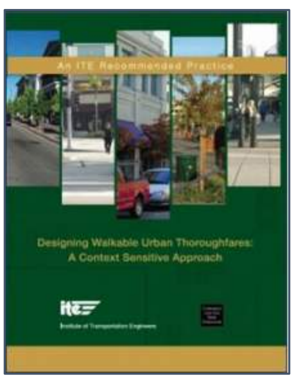
Historically, a city would adopt standard cross sections for each street functional class. While it was recognized that the cross sections were "typical" and each street had unique context and constraints, the general purpose was to define consistent characteristics for streets. In practice, this has led to streets being optimized for the automobile mode over other transportation modes, and automobile throughput has been the controlling priority. Pedestrians, bicyclists, and transit riders are theoretically able to use the streets, but those modes are seen as incidental and are not prioritized or supported. The unintended consequences of these over-optimized streets is that they can limit transportation choices by making walking, bicycling, and using transit inconvenient, unattractive, or dangerous. These types of streets can be called "incomplete streets" in that they do not accommodate all transportation modes. To remedy this, a movement has emerged to encourage a new way of designing roadways called **Complete Streets**.

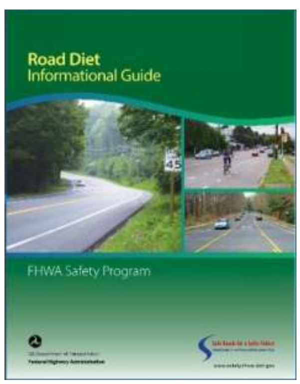
The concept of Complete Streets gives pedestrians, bicyclists, and transit modes the same priorities in street design that automobiles have traditionally had, so that the street can routinely support safe and convenient uses for all modes of transportation within an integrated multimodal system.

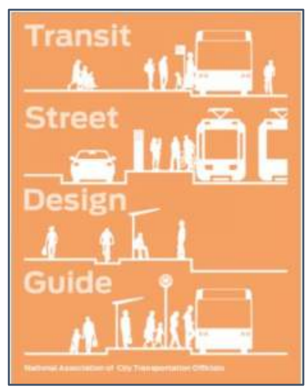
Elements of Complete Streets treatments are designed to make the street more supportive of all modes. Operating within an integrated multimodal system, the specific mix of modes that are appropriate to a street and the treatments used to make it a complete street vary with the function of the street, its Functional Class, and characteristics such as right-of-way, lane width, speed, and topography.

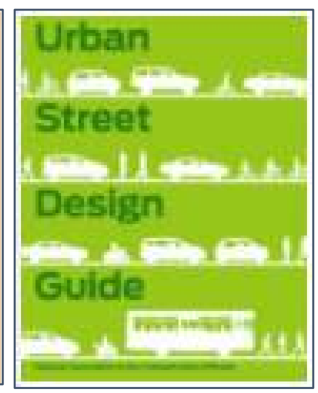
There is no singular design prescription for complete streets; each one is unique and responds to its context.

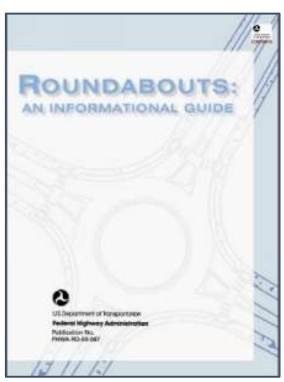
The concept of Complete Streets may be seen as a comprehensive suite of design requirements and priorities to be considered for all streets. The primary source for guidance on street design remains the Institute of Transportation Engineers' (ITE) *Highway Design Manual*, which is the most widely accepted standard for roadway design. The many different additional publications providing guidance for complete streets approaches illustrate just how widely the concept has been accepted. Publications include the ITE *Walkable Urban Thoroughfares: a Context-Sensitive Approach*, which has been endorsed by TxDOT. The ITE *Road Diet Handbook: Setting Trends for Livable Streets* and the FHWA *Road Diet Informational Guide* both provide guidance for "right-sizing" streets to re-purpose right-of-way for Complete Streets treatments. FHWA guidance also includes *Roundabouts: an Informational Guide*, dealing with this particular type of intersection treatment. The National Association of City Transportation Officials (NATCO) has published several manuals to provide "a blueprint for designing 21st century streets", with focus on urban streets, transit streets, bikeways, and bike share.

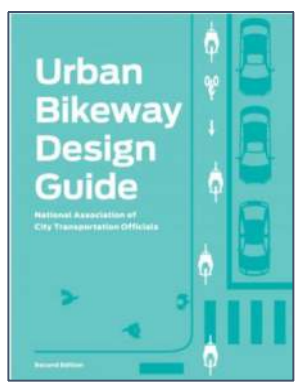










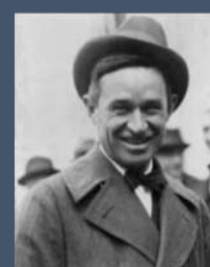


Vision Zero

The **Vision Zero** movement complements Complete Streets concepts with a focus on adapting street design to reduce fatalities. Many of the same street treatments associated with Complete Streets are also supported by the Vision Zero movement. While road safety depends on many factors, the thrust of the Vision Zero movement is that redesigning streets and lowering speed limits are vital elements that can reduce the chance of crashes and also reduce their severity. While people will inevitably make mistakes while driving, the goal of Vison Zero is that those mistakes do not inevitably lead to crashes and loss of life.

Excessive speed is typically a factor in about a third of all traffic fatalities, so controlling vehicle speeds in areas with multimodal uses is a critical strategy. Speed reductions in areas where vehicles mix with vulnerable street users such as bicyclists and pedestrians are therefore an important element of Vision Zero.

The Vision Zero movement often uses the term **dangerous by design** to describe streets that are over-optimized for automobile throughput. This term is inaccurate and often wrongly applied, but the general point is valid: if streets are designed so that people are comfortable driving at excessive speeds, then crashes are more likely, fatalities are more likely, and vulnerable street users are disproportionally at risk.



All I know is just what I read in the papers. And there is something that we all read in the papers every morning of our lives, no matter what paper it is we pick up, and it has generally happened right in the town that particular paper is printed in. It's in there every morning "Four Killed and Three Wounded Yesterday by Automobiles in This Town." Maybe it's more; maybe it's less, but it's there every day. In another part of the paper it tells that 22 thousand met their death last year by auto and that we are well on our way to beat that record.

Suppose around 25 years ago when automobiles were first invented, that a man had gone to our government, and he had put this proposition up to them: "I can in 25 years' time have every person in America riding quickly from here to there. Shall I go ahead with it?"

"Why sure, if you can accomplish that wonderful thing, why we are heartily in accord with you."

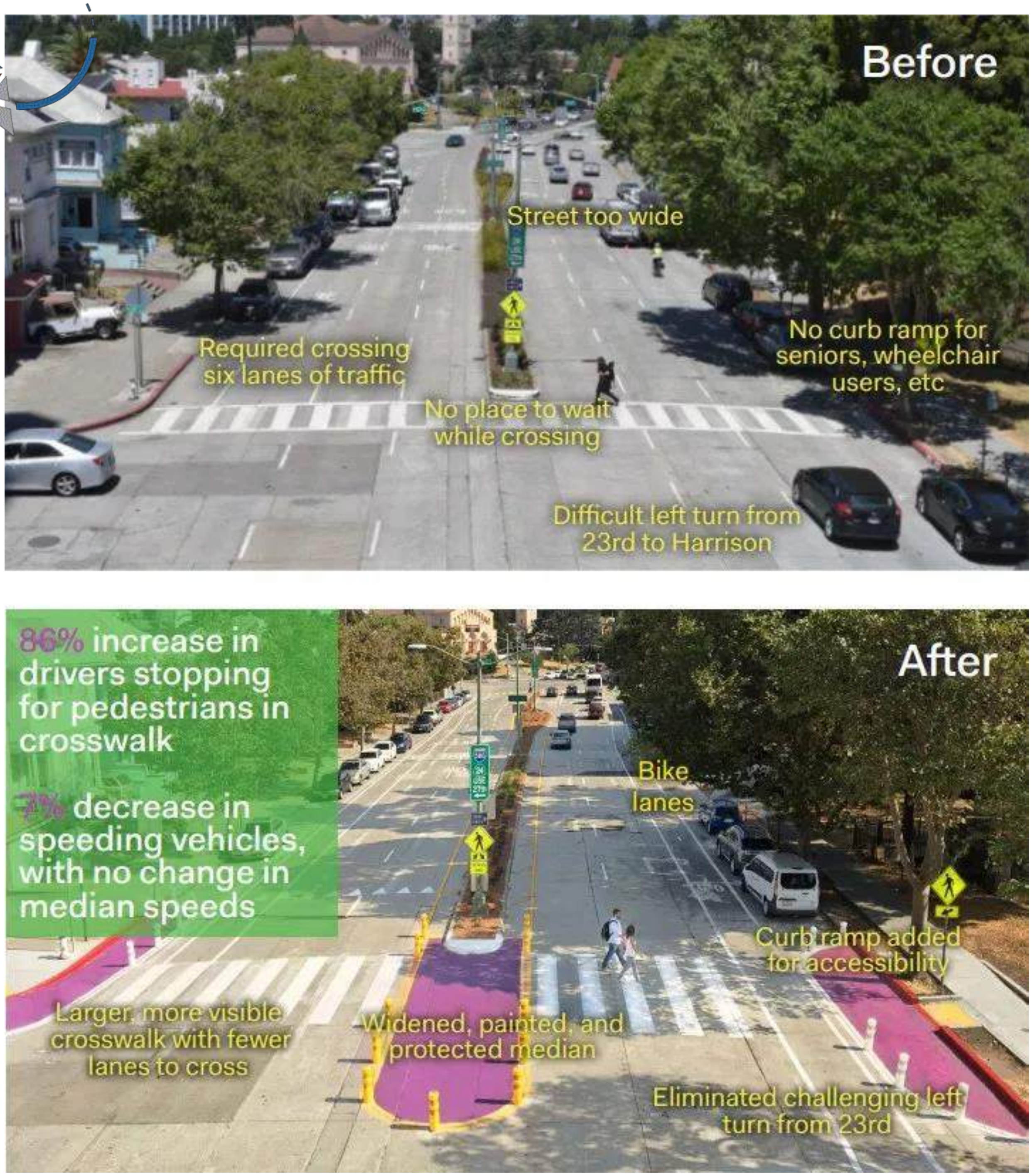
"But," he says, "I want you to understand it fully, in order to accomplish it and when it is in operation it will kill 20 to 25 thousand a year of your women and children and men."

Now they call all these accidents PROGRESS. Well maybe it is Progress. But I tell you it certainly comes high priced.

Will Rogers
Syndicated newspaper column
April 4, 1926

An example from Oakland, California illustrates some elements of Vision Zero and how it complements Complete Streets concepts with some of the same implementation strategies.

Figure 3-1: Before and After Example of Vision Zero Treatments



Following a pedestrian fatality at the intersection of 23rd Street and Harrison Street, the Oakland Department of Transportation (DOT) reviewed how changes in street design might be used to slow traffic and increase the safety of vulnerable users. As shown in **Figure 3.1**, multiple elements were positioned to heighten drivers' awareness of their environment and reduce their comfort with excessive speeds. A feature of this example is that it was implemented in a very short time frame, with low-cost infrastructure such as paint, bollards, and other simple fixes. After the area is made safe and drivers are used to the changes, the DOT plans to implement more permanent fixes.

Data collected by the Oakland DOT before and after implementation of the Vision Zero fixes shows their effectiveness. It is interesting to note that median vehicle speeds are unchanged, but that the outlier speeding vehicles saw a 7% drop. The 86% increase in drivers stopping for pedestrians in the crosswalk is a testimony not only to the design of the crosswalks, but also to the design of the street environment that makes drivers more aware of their surroundings, with a slower-speed regime that gives them more time to stop.

Other safety elements in addition to street design are considered in Vision Zero treatments. One element of concern is that large trucks pose a disproportionate threat to people biking and walking. Large trucks are hindered by their height, larger blind spots, and larger turning radii, making the risk of conflicts with all road users greater. At the same time, bicyclists and pedestrians are particularly vulnerable to the open wheels which are a feature of large trucks. The Volpe Center, a research institute of the US Department of Transportation, has studied the issue of vulnerable road users and heavy trucks. Their study cites a statistic that nearly half of bicyclist fatalities and more than one quarter of pedestrian fatalities from heavy trucks first impacted the side of the truck and were swept under the wheels. By attaching a side guard that runs along the gaps in the side of the truck similar to those shown in **Figure 3-2**, a person who is hit by a truck has a better chance of being pushed out of the way of the following wheels.

A study cited by the Volpe Center notes that implementation of truck side guards in London reduced fatalities

Figure 3-2: Examples of Truck Side Guards

by 61% for people biking and 20% for pedestrians.

Cities of course do not have the legal authority to require side guards for all trucks operating in their area. However, they do have control over their own municipal fleets of large trucks, box trucks, garbage trucks, and trailers. Some cities in the United States were cited in the Volpe Center study as requiring side guards on trucks for contractors who do business with the city.

Vision Zero treatments may also focus on street operations. Leading Pedestrian Intervals (LPIs) are an approach to reduce the conflict between pedestrians and vehicles at crosswalks by configuring traffic signals for a 7- to 10-second head start for pedestrians before the signal turns green for vehicles. This interval gives pedestrians time to enter into the crosswalk, where they are more visible to drivers, before cars get a green signal. The small interval increases pedestrian visibility enough that crash rates decline significantly. A study in *Transportation Research Record 22198* concluded that a 46% reduction in crashes can generally be expected with the installation of LPIs. Installation requires simply re-programming the signal, so no trenching, concrete pouring, or lane closures are required, and implementation costs are low. LPIs have been called "Dollar for dollar…a really smart, life-saving investment that ought to be a part of any city's effort to eliminate traffic deaths."

Road Diets & Traffic Calming

One of the issues with implementing Complete Streets and Vision Zero treatments on existing streets is the limitations of the available street right-of-way. The concept of a **road diet** addresses this issue by "right-sizing" a street where the current and projected traffic volumes permit. Right-sizing involves narrowing or removing travel lanes and re-purposing them for bicycle lanes, sidewalks, sidewalk bulb-outs, and other Complete Streets elements. As shown in **Figure 3-3**, the classic configuration of a road diet converts a 4-lane undivided street into a street with 2 travel lanes and a continuous center turn lane, with bicycle lanes on each side.

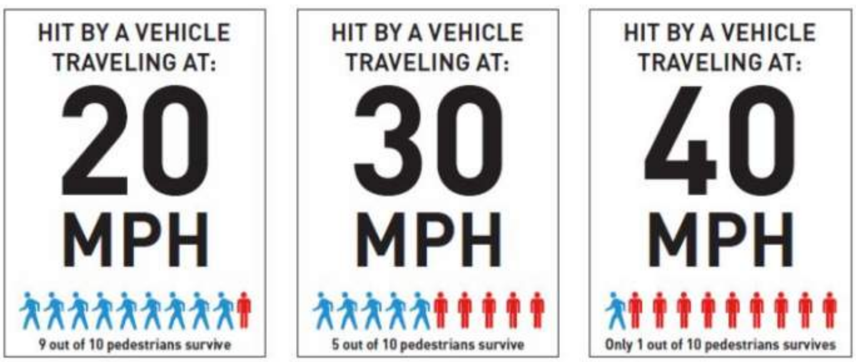
Figure 3-3: Road Diet Implemented on a 4-Lane Street

Other configurations of road diets vary the mix of bike lanes and parking lanes, sometimes placing the bike lanes on the curb side so that the parking lanes buffer them from moving traffic. Another configuration creates a two-way cycle track on one curb side of the street, protected from traffic by a buffer strip and a parking lane.

Traffic Calming is a similar concept, with treatments complementary to Complete Streets concepts that are primarily aimed at reducing vehicle speeds by addressing drivers' perceptions and behavior. Speeds in residential areas and other places with vulnerable road users are a particular focus of traffic calming.

Small differences in speed can make a big difference in safety and survivability. VisionZeroNetwork.org reports the survivability chances of a person hit by an automobile, as shown in **Figure 3.4**. The position of the traffic calming movement is that the proper balance of vehicle speeds and safety can reduce traffic violence and eliminate traffic fatalities.

Figure 3.4: Speed and Vulnerable User Survivability



The basis for traffic calming is that people naturally tend to drive at a speed that they are comfortable with. Traffic calming treatments take advantage of this trend by placing physical or perceptual barriers in the driver's sight to shift their comfort level to a lower speed.

Common Street & Sidewalk Treatments

With the commonality in purpose among the Complete Streets, Vision Zero, Road Diets, and Traffic Calming movements, it is not surprising that they share a common set of street and sidewalk treatments that contribute towards the goals of each movement. Treatments include reduced lane widths, in-lane treatments, median islands, curb extensions, sidewalk and parking lane treatments, parklets, bike lanes, and crosswalk treatments.

Reduced Lane Widths run contrary to the historic practice of lane widths of 12 to 13 feet. The wide traditional lane widths create an in-lane buffer that is more forgiving to drivers, particularly for higher-speed streets. However, these widths also make drivers more comfortable with higher speeds, even when it is not appropriate within the street context of bicycle and pedestrian activity, intersections, and sight lines. Reducing lane widths to 10 or 11 feet has been shown to reduce speeds and improve safety without a reduction in capacity. Lanes wider than 11 feet are not recommended, but may be necessary locally to accommodate trucks and buses.

In-Lane Treatments are also called vertical speed control, in that they place one of several forms of humps in the travel lane to slow traffic speeds. Common types include speed humps, which are 12 – 14 feet long to raise one axle at a time; and speed tables, which are long enough that the entire vehicle is raised at one time. Stormwater drainage and street cleaning are issues with any in-lane treatment.

Median Islands are refuge spots for pedestrians in the center of the street, so that they don't have to cross the full width of the street without protection. They are most useful for multi-lane streets where traffic volumes and total street width makes the crossing a safety issue. Median islands can be emphasized with landscaping or textured surfaces to highlight their role as part of the pedestrian realm. The purple painted areas in **Figure 3.1** show an example of a median island treatment.

Curb Extensions function to narrow the width of the street in particular locations. They may include pinch points, bulb-outs, and bus bulb-outs. In addition to slowing vehicle speeds, curb extensions increase safety by reducing the length of the pedestrian path crossing the street. The purple painted areas in **Figure 3.1** show an example of curb extensions treatments. A chicane can be built from a set of staggered curb extensions that further reduce speeds by shifting the street path from one side of the street to the other.

Sidewalk and Parking Lane treatments are part of Complete Streets and Traffic Calming for their definitions of space and use as buffers from traffic. Increasing activity in the sidewalk zone heightens drivers' awareness, and helps define a pedestrian realm adjacent to and intersecting with the street. Wider sidewalks, distinct paving, pedestrian-scaled lighting, and buffering with landscaping are all treatments intended to promote pedestrian visibility and activity.

Parklets extend the sidewalk activity area to temporarily or permanently use parking spots for seating areas. Parklets provide additional sidewalk space and increase the visibility of the pedestrian realm. This treatment enhances the use of parking as a buffer for the sidewalk. Potential issues with parklets include stormwater drainage, street cleaning, and possible interruption of bike lanes.

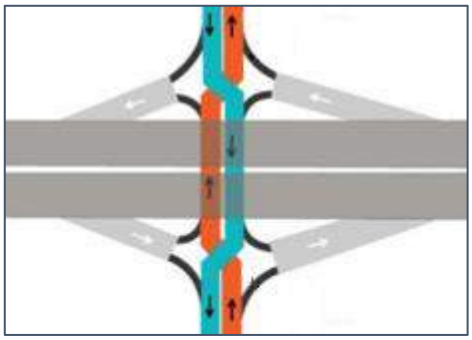
Bike Lanes address safety and smooth traffic flows by placing the flow of bicycles outside the flow of automobiles. Several striped bike lanes have already been developed in the KTMPO region. Numerous configurations of bike lanes are in common use, with notable variations including striped lanes, striped lanes buffered by parking, protected bike lanes, and cycle tracks. Bicycle traffic may also be routed off of high-volume arterials, with equivalent paths provided on a system of lower-volume streets designated as **bicycle boulevards**. Issues with curbside bike lanes include people parking in the lanes, obstruction by garbage bins on pickup days, and street cleaning.

Crosswalk Treatments use color and design to highlight the presence of a crosswalk. The concept of **creative crosswalks** uses distinct and sometimes whimsical designs to capture drivers' attention. Crosswalks are considered a traffic control device, and guidelines for their colors and designs are specified in the FHWA's *Manual on Uniform Traffic Control Devices* (MUTCD), but US cities have not always strictly followed MUTCD guidelines with their creative crosswalks. Maintenance of the painted designs of creative crosswalks has been an issue.

Common Intersection Treatments

Accommodating the safe interaction of the numerous modes and users in the integrated multimodal network is essential. The most interactions within and between the transportation modes occurs at street intersections.

Two general types of intersection treatments are in use: those that seek to increase the efficiency of vehicle throughput, and those that seek to increase the safe accommodation of all transportation modes. Both general types of intersection treatments are consistent with the goals of Complete Streets and its associated movements.



Intersection Efficiency Treatments often include designs that limit the conflict between through movements and turning movements. In a Diverging Diamond Interchange, the left turn movement is physically displaced from the intersection by crossing over the travel lanes before the turn. All turns at the remaining intersection are through movements, eliminating the need to accommodate turns in the traffic signal cycle and therefore increasing the green time. With fewer vehicle conflict points, the remaining intersection is more safe as well. The Displaced Left Turn Intersection is a modified intersection treatment with the same theme, which has the left turn crossing, but keeps the through movements on the right side of the road. Other similar treatments include the Super Street and the Michigan Left intersections, which accomplish traffic signal cycle simplification by completely prohibiting left turns, replacing them with a right turn followed by a U-turn.

Roundabouts are a type of intersection offering dramatic improvements in safety and vehicle throughput under favorable conditions. Where a conventional intersection with its numerous vehicle crossings and turnings has 32 conflict points, a roundabout reduces the number of conflicts to only 8 points. Additionally, the 8 remaining conflict points are merging movements rather than head-on or right-angle conflicts, so crashes in a roundabout tend to be less serious than crashes in a conventional intersection. Roundabouts reduce vehicle speeds while preserving throughput, and can be more efficient than stop signs or traffic signals at lower-volume intersections.

Accommodating All Modes is a general type of intersection treatment that concentrates on safety. A typical intersection with a bike lane forces a vehicle making a right turn to cross over the bike lane at an angle that creates visibility issues for both the driver and the bicyclist.

The protected intersection is designed to address this issue by continuing the bike lane through the intersection for both through movements and turning movements. With this design, the lane-changing conflict before the intersection is eliminated. Splitter islands at the corners protect bicyclists on the curve and slow vehicle speeds. The vehicle and bicycle crossing conflict is placed so that they meet at a right angle within the turn, which increases the visibility to reduce the risk of crashes.

Summary

The Complete Streets, Vision Zero, Road Diets, and Traffic Calming movements contribute to planning for an integrated multimodal system with a compatible focus on supporting and protecting all transportation modes and users. The street, sidewalk, and intersection treatments proposed by each movement are similar and consistent. Consideration of these types of treatments is a valuable addition to the concept of typical street cross sections which have historically been used.

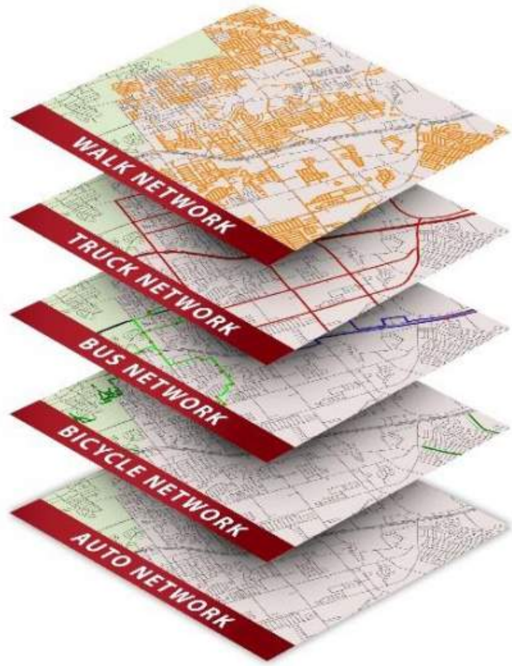
Chapter 4: Functional Classification Systems

CHAPTER HIGHLIGHTS

- The Concept of Multimodal Functional Class and Facility Type
- The Auto Network
- The Bicycle Network
- The Bus Network
- The Truck Network
- The Walk Network

The Concept of Multimodal Functional Classes

The general concept of Functional Class was introduced in Chapter 2 to show the context of the hierarchy of different types of roads in the KTMPO region. That Chapter included a review of Thoroughfare Plans from KTMPO jurisdictions to show the street Functional Classes that were defined in their Plans, and showed that they were defined differently within each Plan. A set of accepted street Functional Classes were introduced that could be used consistently throughout the region, and which could be supported by the regional travel demand model in compliance with TxDOT standards.



With the general concept of Functional Class for streets having been introduced, this Chapter will expand the concept to cover the five discrete networks in the region which are layered together to form the regional multimodal network. Two additional transportation modes, the airport and railroad systems, interact with the networks as points of access rather than as travel links, and so the concept of Functional Class is not applicable to them.

For each discrete network layer, a mode-specific Functional Classification system is introduced. Where applicable, sub-classes of Facility Types are detailed to define additional features that may be applied to each Functional Class. Each Functional Class is described with its purpose, benefits, and applications.

Extending the concept of Functional Class and Facility Type to all transportation networks is proposed in order to bring the same level of precision to the analysis of all modes' needs. At the same time, transportation planners must recognize the relative shares of each mode and their respective contributions to mobility in the region. **Table 4-1** shows the national-level mode shares for commuting and for all trips, illustrating the significantly heavier use of the automobile over the other transportation modes of transit, bicycling, and walking. Recognizing this fact does not mean that the other modes are less important; rather it calls for transportation planning that preserves the mobility granted by the automobile while at the same time developing the mobility, sustainability, and livability that is promised by other transportation modes. It calls for the development and support of a balanced regional multimodal transportation system.

Table 4-1: National-Level Mode Shares

Mode of Travel	% of Commuters		% of All Trips Nationwide [3]
	Nationwide [1]	52 Large U.S. Cities [2]	
Walk	2.8%	5.0%	10.4%
Bicycle	0.6%	1.0%	1.0%
Bus	5.0%	17.2%	2.2%
Car [4]	91.6%	76.7%	86.4%
All Modes	100%	100%	100%

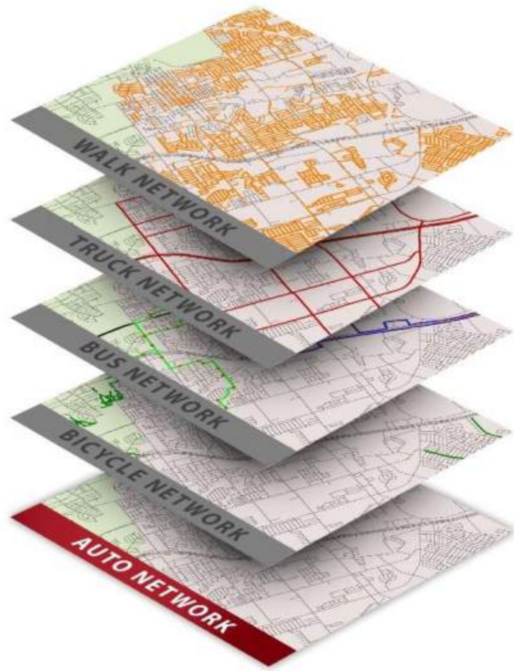
Sources: (1) ACS 2011 (2) ACS 2009–2011 (3) NHTS 2009 **Notes**: The term "mode share" is used to describe the percentage of all trips or percentage of trips to work by each mode of transportation. (4) This includes trips by private car and "other" means that are not public transportation, bicycling, or walking—such as taxi, motorcycle, recreational vehicle, school bus, etc.

This community [was planned] when the car was king, and now we're recognizing the value of multiple modes and there are certain areas where we need to re-imagine, rethink, so they work for pedestrians.

- Eugene Howard
Project Manager
Denver Community Planning & Development Department

Auto Network Functional Classification

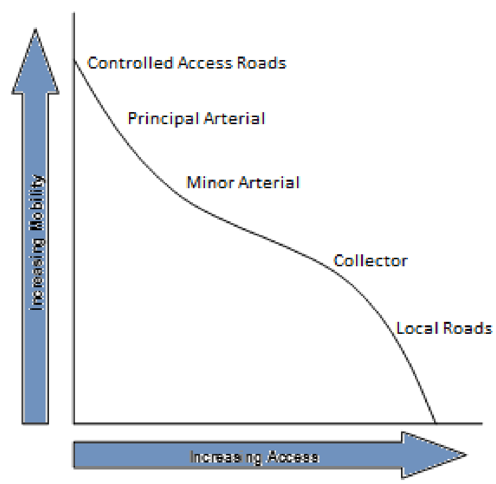
The functional classification of roadways with a comprehensive, systematic hierarchy of street type definitions considers the relationship between the type of trips served, the type of areas served, and characteristics of the streets themselves. The use of functional classification was mandated by the Federal-Aid Highway Act of 1973 to guide the provision of aid for transportation improvement projects, and this legislative requirement is still in effect today through provisions of the current FAST Act highway funding authorization. The Federal Highway Administration Functional Classification system is commonly accepted to define the functional and operational requirements for streets. These classifications are also used as the primary basis for geometric design criteria.



Purpose

The fundamental basis of street functional classification is the need to balance the two conflicting but complementary purposes of access and mobility. The Functional Classification system recognizes the hierarchy of purpose among streets that channel traffic flow from the highest level of access (local streets), to facilities collecting these flows (collector streets), then to facilities able to conveniently transport these larger flows over longer distances (arterials), and then even larger flows over even longer distances (controlled access roads), with the highest levels of mobility but least amount of access to adjacent land uses.

Unavoidably, as the provision for access to adjacent land uses increases with connecting street intersections, curb cuts, and provisions for turning movements, the level of mobility that a facility provides must decrease. The balance that a facility demonstrates between serving access and mobility is a substantial part of defining a facility's Functional Classification.



Recognizing this balance between access and mobility in a street's purpose is important to consider when planning for the balance between the street's accommodation of auto traffic and ensuring the safe and comfortable use of the street for users of all ages and abilities, using all appropriate transportation modes. This second balancing is a critical part of updating the previous Regional Thoroughfare Plan into a Regional Multimodal Plan.

Benefits

From a practical perspective, identification of the functional role of roadways is a useful tool for communities to plan for their transportation system. The Functional Classification system directly supports the Metropolitan Transportation Plan (MTP) project selection process by establishing a consistent relationship among all streets. This in turn is the basis for establishing a consistent system of street speeds and capacities that is linked to street attributes. For the purposes of project evaluation, any project for a change in a street's Functional Class (Minor Arterial to Major Arterial), Facility Type (undivided to divided), number of lanes (2 lanes to 4 lanes), or associated Area Type (rural to suburban) has a consistent and realistic effect on the street's speed and capacity attributes for itself and in relation to all other streets in the network. This allows each street project to be properly evaluated using the travel demand model, supporting a consistent and objective evaluation of projects.

Applications

The derived regional street Functional Classification system that has been developed with reference to the FHWA system and to the systems defined in the individual Thoroughfare Plans from KTMPO member jurisdictions is incorporated into the regional travel demand model network. The regional street Functional Classification system defines facilities as:

Controlled Access Functional Class roads include Interstate Highways, Freeways, and Expressways. Interstate Highways are high speed, divided highways with no direct access to adjacent land uses. All interchanges are grade-separated. Freeways and Expressways have a lesser amount of control over access, and may have a limited number of at-grade intersections controlled by traffic signals. The primary function of Controlled Access roads is to serve mobility, so they tend to serve longer-distance trips.

Major Arterial Functional Class roads are higher speed, higher volume facilities which provide regional mobility, but are balanced with a greater degree of access. They often serve significant regional activity centers, and provide major access points with at-grade intersections. While access is important, the principal function of this Functional Class is to provide mobility.

The ***Minor Arterial Functional Class*** augments and feeds the major arterial system and distributes traffic flows to smaller regions. This Functional Class places more emphasis on providing access.

The ***Collector Streets Functional Class*** is the lowest level Functional Class that is considered to have regional significance and to be routinely included in the travel demand model. They function to gather and concentrate the traffic from local streets, and funnel it onto the higher Functional Class System in the street network. For Collector Streets, providing access is by far the most important concern. Low speed and low capacity reflect the lesser importance given to mobility.

Frontage Roads and ***Ramps*** are secondary street Functional Classes associated with detail coded Controlled Access Arterials. They provide the linkage to connect Controlled Access Arterials to the network.

Local Streets Functional Class is typically not included in a regional travel demand model, as the modeled network is designed to include only streets which have regional significance. However, provisions have been made to include local streets if they provide necessary connectivity for the network.

There are currently no ***Toll Roads*** or managed lanes (High-Occupancy/Toll, or ***HOT*** lanes) in the KTMPO region, and no toll roads or managed lane projects are included in the adopted 2040 KTMPO modeled street network. The standard TxDOT Functional Class System has been updated to define this Functional Class, so it can be added to the KTMPO regional network if needed for the analysis of projects.

Several tolled Facility Types have been defined to distinguish between radial and circumferential facilities, and to support the definition of truck-only facilities. Facility types for HOT lanes distinguish between the travel lanes and HOT ramps that provide connections to the non-tolled main lanes.

Facility Types

The standard TxDOT definition street attributes defines three Facility Types for roads. To support the concept of livability in the transportation planning process, two additional street Facility Types have been defined in this Plan. In general, Facility Types are optional attributes within the street cross section which may be applied to a street regardless of its Functional Class.

The **Divided Facility Type** applies to Major Arterials, Minor Arterials, and Collectors that have a median that physically separates the travel lanes by direction. Periodic median crossings are provided to accommodate turning movements.

In most instances of divided streets in the KTMPO region, the median is formed by a grassy or landscaped buffer strip. Divided streets may also be defined by a raised curb with paving, as shown in this illustration.

The **Continuous Left Turn Lane Facility Type** also applies to Major Arterials, Minor Arterials, and Collectors. The purpose of the continuous left turn lane is to provide opportunities for vehicles to pull out of the travel lane as they wait for oncoming traffic to clear before making their turn, so they are most commonly applied to higher Functional Class roads with higher speeds and higher volumes of traffic.

The **Undivided Facility Type** is common throughout the system, and has no physical barrier between the travel lanes by direction. While this allows unlimited turning movements, vehicles queueing for a turn can block the travel lanes. Undivided streets are more common on lower Functional Class roads with lower speeds and lower volumes of traffic.

Complete Streets are an additional **Facility Type** defined for this Regional Multimodal Plan. The concepts of Complete Streets and Context Sensitive Solutions have been endorsed by FHWA and TxDOT, which promote their development and provide guidance and design standards. The goal of Complete Streets is to design street attributes so that they consider the needs of all appropriate users and transportation modes. This does not imply that all modes must be present on all streets, but that accommodations are made as appropriate. Complete Streets design features were introduced in Chapter 3, and include treatments such as narrower travel lanes, median islands, curb extensions, parklets, bike lanes, and crosswalk treatments. Streetscape treatments such as landscaping and shade trees may also be considered as Complete Streets features.

The **Green Street Facility Type** is also newly defined in this Plan. A Green Street integrates stormwater management into the street design, often using natural water diffusion and infiltration techniques rather than simply channeling water to drains. While Green Streets may be seen as an environmentally-friendly approach to water management, the natural processes which are used are often more efficient and more cost-effective than traditional engineering approaches. Green Streets treatments include pervious pavement, rain gardens, bioswales, and retention basins.

Bicycle Network Functional Classification

While the use of a Functional Classification system for streets is mandated by Federal regulations, there are no regulatory requirements to establish a system for other modes, including the bicycle mode. This bicycle Functional Classification system is therefore offered as a tool to define a hierarchy of bicycle facilities which can be implemented as appropriate.

A balanced bicycle network defines infrastructure to provide safe, convenient, and comfortable access to the street network. This does not conflict with the right of bicycles to use any street in the network. Bicycles are legally defined as vehicles and have the same rights to the road and obligations to obey traffic laws as other vehicles. Bicycles are prohibited only from controlled access facilities such as Interstates, Freeways, and Expressways. For all other streets, including Frontage Roads, every street is a bicycle street, regardless of its bikeway designation or infrastructure.

Purpose

While the basis for a Functional Classification system for the auto network is primarily that of balancing the purposes of access and mobility, in contrast, the basis for a bicycle Functional Classification system can be seen primarily as addressing safety. Bicyclists operate a vehicle and are legitimate road users, but they are slower and less visible than motor vehicles. Bicyclists are also more vulnerable in a crash than motorists.

Conversely, when bicycles interact with pedestrians, it is the bicycle that is the higher speed and higher mass object, and the pedestrians who are the more vulnerable users. Bicycles travel 15 to 20 mph faster than pedestrians, so mixing bicycle and pedestrian traffic is inappropriate in most cases. Therefore, within the regional multimodal network, the purpose of bicycle infrastructure is managing the interactions of the bicycle network with all other modal networks, not just the automobile.

Benefits

The best evidence of the quality and fitness of a region's bicycle infrastructure is its volume of users. The highest-volume examples are in Europe, where significant bicycle facilities, denser development patterns, high gas prices, and a cycling culture combine to give the bicycle mode shares which are commonly in the 20% to 40% range. The average bicycle mode share for U. S. cities is 1.0%. American cities with high bicycle mode shares reported in the American Community Survey include Portland, Oregon with a 7.0% share, and only four other cities with mode shares of 4.0% or higher.

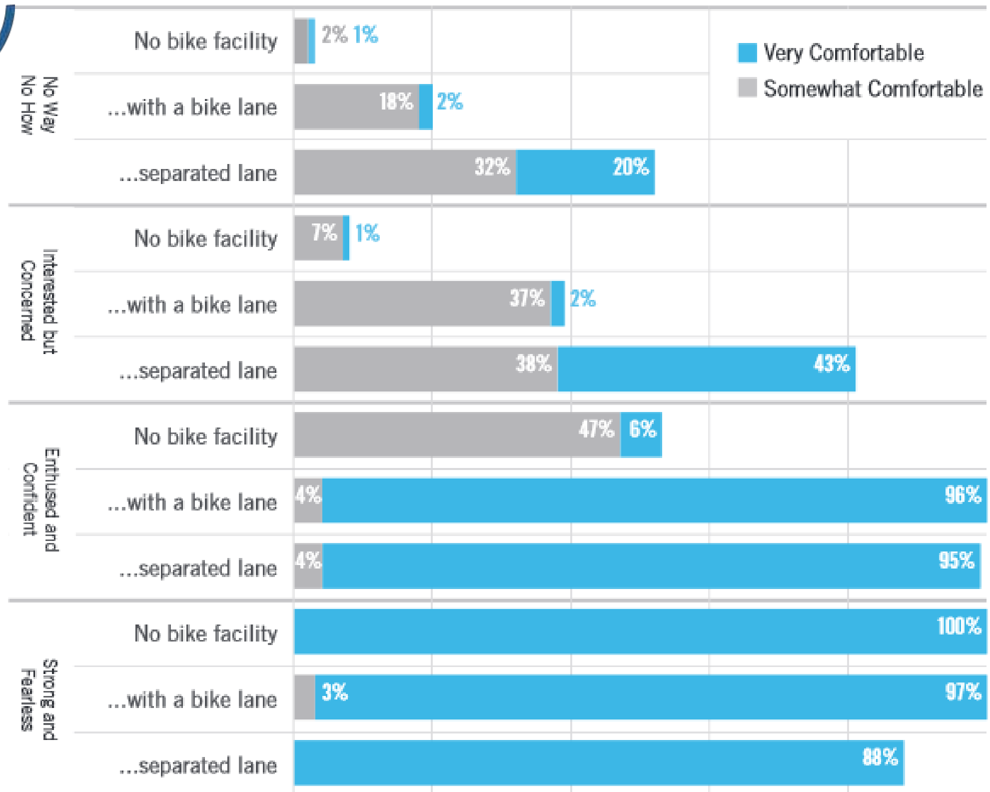
The data for Texas cities shows even smaller bicycle mode shares. Only four Texas cities are in the top fifty as reported by the Census Journey-to-Work data: Austin, ranked # 19 with a 1.3% mode share; Corpus Christi, ranked #43 with 0.5%; Houston, with a 0.5% mode share and a #44 ranking; and Plano, ranked #50 with an 0.4% share. The overall bicycle mode share for Texas is 0.6%. The bicycle mode share for the KTMPO region is reported in the Census data as rounded to 0.0%.

The low volumes of bicycle ridership in U. S. cities as compared to European cities validates a common saying among advocates that bicycling in the United States is geared towards **"the young, the fit, and the brave…and not too many of them"**. It also illustrates the challenge of bringing the existing bicycle network in the KTMPO region into balance.

The bicycling environment in Portland, Oregon illustrates the need for bicycle infrastructure. Portland is known for its extensive bicycle infrastructure and has the highest bicycle mode share of any U. S. city, yet a 2013 survey revealed that fully 80% of residents were "very concerned" or "extremely concerned" about the safety of cycling in their city. Commenting on the survey, Portland Bicycle Planning Coordinator Roger Geller estimated that about 60 percent of people in Portland would like to bike more, but are **afraid to ride**.

As shown in **Figure 4-1**, the survey classified respondents into four groups based on their confidence in riding, ranging from "No Way No How" to "Interested but Concerned", "Enthused and Confident" and "Strong and Fearless". The survey showed that bike infrastructure, particularly a separated (protected) bike lane, had a significant impact on the perception of safety.

Figure 4-1: Portland, Oregon Survey on Safety and Bike Infrastructure

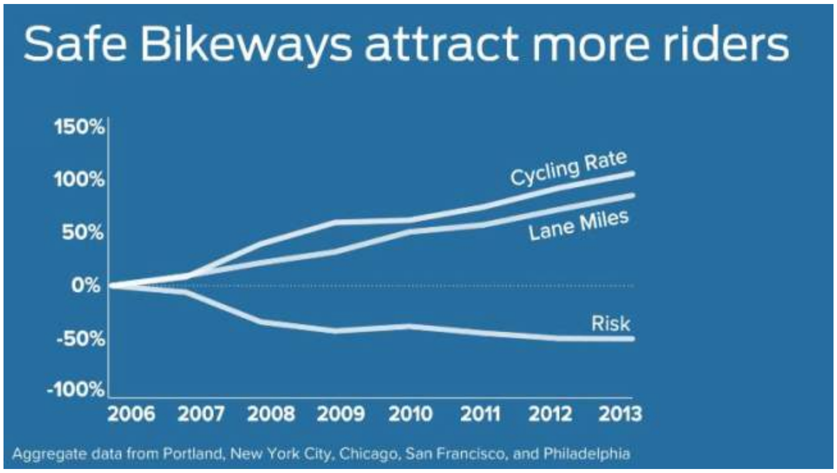


Source: https://peopleforbikes.org/blog/selling-biking-perceived-safety-the-barrier-that-still-matters/

One benefit of balancing the bicycle network is that developing a network of safe bicycling infrastructure has been shown to increase ridership, which in turn increases the visibility of bicyclists and improves safety. **Figure 4-2** uses data from five U. S. cities which have been active in building protected bike lanes. The chart shows a clear correlation: as more bike lanes are built, people feel more safety in riding, and ridership increases. The inverse is also true: if bicycle infrastructure is not built, then people will continue to be **afraid to ride**, bicycle safety and fatalities will continue to be an issue, and bicycle ridership will continue at very low levels.

If you always do what you always did, you'll always get what you always got

Figure 4-2: Safety and Bicycle Use



Bicycle infrastructure can also be seen as an educational and visibility tool. Although it is historically, logically, and legally inaccurate, some motorists have the attitude that bicycles do not have a right to the road. Developing highly visible bicycle infrastructure provides riders with protection from these motorists and reminds them of the fact of bicyclists' rights.

> **One of the challenges that we often have in communities is that there can be a perspective that roads are for cars, and cyclists are interfering with the use of cars. This mindset can lead to aggressive driving and potentially endanger lives.**
> **- Derek Bouchard-Hall**
> **CEO, USA Cycling**

Figure 4-3: Ridership and Safety

Others accept the rights of bicycles as vehicles, but feel that bike lanes are not necessary because bicycles can share the lane with cars, trucks, and buses. Safety data and ridership data show the error of this attitude, as shown in **Figure 4-3**. This data from the International Transport Forum shows a strong correlation between higher volumes of ridership and lower rates of fatalities. The Netherlands logged the highest amount of travel by bicycle and the lowest fatalities rate. In contrast, the United States showed a much lower travel volume of travel and a much higher rate of fatalities. Bicycle infrastructure clearly plays a role in establishing safety and ridership volumes.

Dr. John Snow is regarded as one of the founding fathers of modern epidemiology. As London suffered a series of cholera outbreaks during the mid-19th century, Snow theorized that cholera was spread through contaminated water. During the September 1854 cholera outbreak, he mapped known cholera deaths around thirteen public water wells and noted a strong correlation for one particular location. He had the pump handle removed and the outbreak quickly subsided.

Noah Budnick, Deputy Director of the Transportation Alternatives advocacy group, uses this historic example to promote bicycle infrastructure as a safety measure. "…then they built infrastructure, and people stopped dying", says Budnick. "If you build infrastructure like protected bike lanes, then people stop dying."

Applications

The bicycle Functional Classification system as proposed in this Plan is based on promoting visibility, safety, convenience, and building ridership volumes. Each of the bicycle Functional Classes, ranging from **Protected Bike Lanes** to **Shared Roadways**, therefore has multiple roles in developing a balanced regional multimodal network.

The ***Protected Bike Lane Functional Class*** is defined as conventional bicycle lanes paired with a designated buffer space and some type of barrier that physically separates the bicycle lane from the adjacent travel lane or parking lane. The protected bike lane is designed to heighten safety and, perhaps even more importantly, to promote the perception of safety among bicyclists in order to appeal to a wider cross-section of potential riders.

Facility Types for Protected Bike Lanes

The advocacy group *People for Bikes* has developed a guide of different treatments for a protected bike lane, which may be inferred as defining different Facility Types. The guide is based on information developed for the 2014 Austin Bicycle Plan. Summarizing the treatments found in this Plan, six general Facility Types for Protected Bike Lanes are proposed:

Curbs Facility Type can be cast-in-place or prefabricated to provide a visible physical barrier that is mountable for emergency vehicles, but which discourages routine encroachment from autos.

A curb-protected bike lane may have issues accommodating street cleaning equipment, so debris may accumulate in the lane.

Flexible Bollards Facility Type have a higher profile and so are more visible to motorists. They also have the advantage of being readily recognized as lane barriers.

Debris in the bike lane is still an issue, but the bollards do not interfere with stormwater drainage in any way.

Several varieties of **Low Bumps Facility Type** are available. Low Bumps have the advantage of defining the lane while still being mountable for emergency vehicles and street sweepers, so they perform well for debris sweeping and stormwater drainage. However, this can also be a disadvantage if motorists disrespect the laws and park in the bike lane.

The **Parking Stops Facility Type** is readily available and recognizable for defining the edges of lanes. Drainage is unimpeded, and the spacing between parking stops can be adjusted to allow access to the bike lanes or turning requirements at intersections.

In this example from Boulder, Colorado, the parking stops are augmented with flexible bollards and a painted buffer to further define the bike lane.

The **Parking Facility Type** can provide a solid physical barrier. As shown in this illustration from Austin, a second form of physical barrier is sometimes provided to prevent the cars from encroaching on the bike lane. In this example, Flexible Bollards were installed. Opening car doors can also present an issue for bikes in the lane.

This installation also shows the use of colored green pavement to define the bike lane.

The **Planters or Jersey Barriers Facility Type** provides a permanent and highly visible insurmountable barrier to protect the bike lane. They also provide space for landscaping to make the entire street more attractive, although this imposes a maintenance cost.

Jersey Barriers can also be used, which have the advantage of being a readily-recognized form of traffic control. Jersey Barriers may also be painted or have cast-in decorative treatments.

The **Rigid Bollards Facility Type** has all the advantages of flexible bollards, while at the same time having the advantages of a permanent and insurmountable barrier.

Installation costs for Rigid Bollards are higher than for other Facility Types. They are more susceptible to damage than linear treatments such as Jersey Barriers, but can be replaced more readily.

In practice, multiple Facility Types for Protected Bike Lanes can be implemented on the same facility when they are appropriate to reinforce the message of the protected lanes, heighten visibility of the lanes, or direct motorists and bicyclists at the entrances to the lanes. In this example, planting and a wider buffer help define the entrance to a protected bike lane.

As a special instance of a Protected Bike Lane, a ***Cycle Track Functional Class*** is an on-road facility with bicycle traffic in two directions. It is located on one side of the road. As shown in the illustration, applications can be placed on one-way streets, so the Cycle Track allows two-way movement within the street grid.

A cycle track may be at the same level as the street, as shown here, or may be raised to the level of the sidewalk to deter encroachment from autos wherever the track does not have a barrier.

Facility Types for a Cycle Track would be the same as for the Protected Bike Lane. With two directions of bicycle traffic and two delineated lanes, separation from pedestrian traffic is important as well. Treatments of the Cycle Track at intersections are more complex and require careful consideration of auto turning movements conflicting with both directions of bicycle traffic.

A ***Conventional Bike Lane Functional Class*** is defined as a portion of the roadway that has been designated for bicyclists by pavement markings. Bike lanes are intended to enable bicyclists to ride without conflicts with other traffic. As an upgrade in protection over shared wide travel lanes, Conventional Bike Lanes provide a greater space for bicycles without making the bike lane appear so wide that it might be mistaken for a travel lane or a parking lane.

Conventional bike lanes are a common Functional Class of facility in use in the US, and most jurisdictions are familiar with their design and application as described in the MUTCD and AASHTO Guide for the Development of Bicycle Facilities. Safety and volume data show that Conventional Bike Lanes have largely been unsuccessful in making bike trips on high-speed, high-volume streets comfortable for most bicyclists. They can be more effective in lower-speed, lower-volume situations.

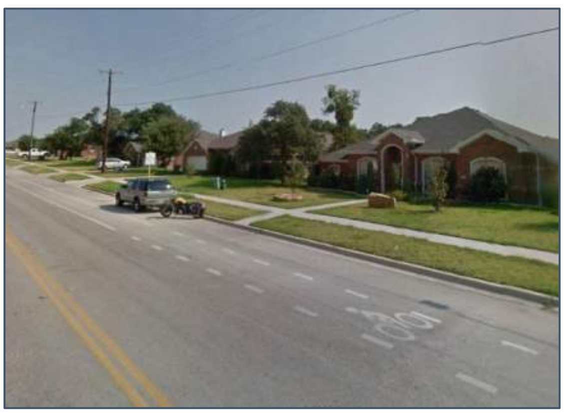
Since a Conventional Bike Lane has no physical barrier that restricts motorized traffic or parking, in practice encroachment on bike lanes by traffic, parked vehicles, and curbside trash containers has been common. Protected Bike Lanes were developed in part to address this issue.

Facility Types for Conventional Bike Lanes

The Conventional Bike Lane Functional Class is marked with painted lines rather than with physical barriers. Three Facility Types can be defined: Outboard, Inboard, and Buffered.

The **Outboard Facility Type** is illustrated by this bike lane in Temple. It is also known as a Curbside Facility Type, with the wide travel lane marked with a consistent white stripe against the curb. Bike lane symbols are provided at intersections to guide motorists and alert them of the definition of the lane.

In this application, there is no designated parking strip to conflict with the bike lane.



Killeen provides an example of an **Inboard Facility Type** for a Conventional Bike Lane, where the bike lane is defined inboard of a parking lane. This Facility Type recognizes the need to park along the curb while still providing a bike lane. It also addresses a common issue of debris in a bike lane by placing it more into the street.

The **Buffered Facility Type** separates an Outboard or Curbside Bike Lane from traffic with a painted buffer, but unlike the Protected Bike Lane, it does not have physical barrier. Styles of the painted buffer can vary, with the MUTCD providing guidance on buffer widths and on the use of stripes and chevrons to define the buffer.

Bicycle Boulevard Functional Class

Bicycle boulevards are streets with low motorized traffic volumes and speeds, designed to give priority to bicycles over motorized vehicles. The goal of the Bicycle Boulevard is to divert bicycle trips to alternate routes, avoiding high-speed and high-volume arterial streets and intersections. Bicycle Boulevards use signs, pavement markings, and speed and volume management measures which are typically consistent with Complete Streets treatments to discourage through trips by motorized vehicles and create safe, convenient bicycle crossings of busy arterial streets.

Bicycle boulevards have the potential to play a key role in a low-stress bikeway network, as they can complement and provide strategic connections between dedicated bicycle lane treatments, multi-use trails, and off-street paths. They can make cost-effective use of existing roadways and connections with a series of relatively minor treatments that substantially improve bicycling conditions on local streets. Many local streets offer the basic components of a safe bicycling environment. These streets can be enhanced using a range of design treatments to create bicycle boulevards. Many of the treatments not only benefit people on bicycles, but also help create and maintain quiet streets that benefit residents and improve safety for all road users.

Bicycle boulevards should be kept in good condition, with a smooth riding surface. Many cities have maintenance schedules for resurfacing and rehabilitating road surfaces that give priority to higher-volume streets. Local streets are typically the lowest priority for repaving, but bicycle boulevards should have a higher priority for repaving or spot improvements than other local streets.

The goal of the Bicycle Boulevard is to divert bicycle trips to alternate routes, so good wayfinding signs and markings are critical to clearly establish and publicize the routes

Shared Roadway Functional Class

A shared roadway is a street in which bicyclists ride in the same travel lanes as other traffic. There are no specific dimensions for shared roadways. On narrow travel lanes, motorists have to cross over into the adjacent travel lane to pass a cyclist. Shared roadways work well and are common on low-volume, low-speed neighborhood residential streets, rural roads, and even low-volume highways.

On streets where bike lanes would be more appropriate but with insufficient width for bike lanes, wide curb lanes may be provided. This may occur on retrofit projects where there are physical constraints and all other options, such as narrowing travel lanes, have been pursued. Wide curb lanes are not particularly attractive to most cyclists; they simply allow a passenger vehicle to pass cyclists within a travel lane, if cyclists are riding far enough to the right.

Shared-lane marking stencils, commonly called "sharrows", may be used as an additional treatment for shared roadways. The stencils can make motorists aware of bicycles potentially in the travel lane, and they show bicyclists the correct direction of travel.

Among other benefits, shared lane markings and signs reinforce the legitimacy of bicycle traffic on the street, recommend proper bicyclist positioning, and may be configured to offer directional and wayfinding guidance. The shared lane marking is a pavement marking or a sign with a variety of uses to support a complete bikeway network; it should not be considered as equivalent bike lanes, cycle tracks, or other separation treatments.

Off-Street Multi-Use Trail Functional Class

An off-street trail provides the greatest amount of separation and protection from traffic. Off-street trails are often multi-use, intended to serve bicycle and pedestrian trips. Multi-use trails must be wide enough to accommodate safe interactions between bicycles and pedestrians.

Depending on their width, alignment, connections to the street network, and connections to other bicycle facilities, off-street multi-use trails can accommodate recreational use, but have the potential to accommodate bicycles as a practical mode of transportation serving regional destinations.

Facility Types for Multi-Use Trails

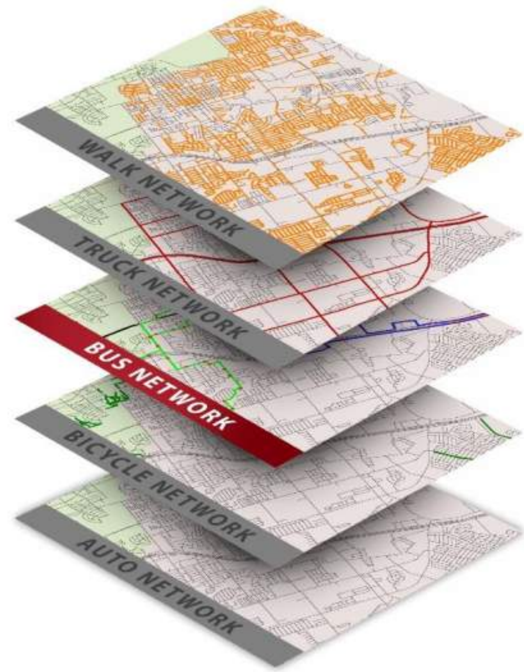
The **Hard Paved Facility Type** features a hard and smooth surface to provide a path free of impediments and to accommodate high-end road bikes and strollers. Concrete or asphalt are common surfaces. Brick or other paver types are not recommended for bicycle facilities because of their effects on the quality of the ride.

The **Soft Paved or Unpaved Facility Type** is paved with materials which can reduce costs or provide a more recreational user experience. This Facility Type is generally more amenable for recreational use. Gravel, decomposed granite, and dirt are typical soft paving materials.

The **Dual Track Facility Type** is designed to provide a greater separation of bicycle flows and pedestrian flows. Examples of implementation of Dual Track facilities are typically off-road because of the greater right-of-way required. The buffer between the bicycle and the pedestrian tracks may be a grassy strip, as shown in the example, or it may be a painted line. Sturdy barriers such as those used to separate bicycle flows from auto traffic are generally not necessary in this context.

Bus Network Functional Classification

As with other non-auto transportation modes, there are no regulatory requirements to establish a Functional Classification system for the bus network. This bus network Functional Classification system is therefore offered as a tool to define a hierarchy of bus stop facilities.



Purpose

The concept of Functional Classification for the bus network does not relate to routes or operations, but to the transit system infrastructure of bus stops. A consideration of passenger amenities is the primary driver in this Plan's definition of bus stop Functional Class. The definition of Facility Types considers other aspects of bus stop infrastructure related to the context of the stops. Context considerations for Facility Types include bus pull-outs or on-street placements, pedestrian access and ADA compliance, and stormwater treatments.

Bus stops operated by The HOP in the KTMPO region are internally classified as being located on the Near Side, Far Side, or Mid-Block relative to the closest intersection. This distinction is important, but it is primarily an operational issue rather than an infrastructure issue relating to a bus stop Functional Classification system, and so is not addressed in this Plan.

Benefits

Collating the various attributes of the passenger amenities and bus stop context into a defined Functional Classification system is intended to assist transportation planners in defining the inventories, needs, and gaps in the balanced multimodal network, and to develop and evaluate projects to address those gaps.

Increased ridership is an added benefit of a balanced bus network with improved passenger amenities at bus stops. *TCRP Synthesis 117: Better On-Street Bus Stops* cited data that supports the logical conclusion that transit ridership increases with bus stop improvements. However, most increases were found to occur at high-ridership stops; little or no increases were seen when amenities were improved at low-ridership stops. This finding indicates that the overriding requirement of the bus system is that it must provide safe, convenient, and practical trips. Transit coverage area, route orientation, service hours, and connectivity to desired destinations were shown to be more important than stop infrastructure in the Mineta Transportation Institute report *Investigating the Determining Factors for Transit Travel Demand by Bus Mode*. Convenient and comfortable access to the system is not a benefit if the system does not provide the desired services.

Applications

Each of the bus Functional Classes, ranging from **Station** to **Basic Bus Stop** is defined to support the development of a balanced regional multimodal network.

The selection of amenities at individual bus stops is generally driven by the volume of ridership. Stops with higher volumes generally support a higher level of amenities.

The ***Station Functional Class*** has the highest level of amenities. Stations are enclosed, weather-controlled facilities with waiting areas, seats, manned stations for tickets and information, and restrooms. Many stations also feature advanced amenities such as vending machines and wireless internet.

Intercity bus routes schedule rest stops and breaks for meals at commercial sites such as gas stations and fast food restaurants. Although not officially listed as stations, for the purposes of the Functional Classification system these facilities exhibit a high level of amenities, and so can reasonably be classed as Stations.

A consideration to be made for some stations, particularly intercity bus and AMTRAK, is that they are privately owned and operated. Some partner with The HOP to allow joint access to their stations and stops, but the stations remain private. Planning for stations must accommodate this fact.

The ***Shelter Functional Class*** in the KTMPO region includes two distinct styles of shelters. The Handi-Hut, as shown, is green metal with a peaked roof. The Brasco bus shelter has a black frame with flatter plexiglass. Both styles are open-fronted and have integral benches.

TCRP Synthesis 117: Better On-Street Bus Stops reports that the most common request for an amenity at a bus stop is a shelter, and nationally, transit agencies overwhelmingly rate shelters as the amenity most valued by their riders.

The ***Bench Functional Class*** uses a bench and typically includes a paved area, but does not have a shelter. Additional amenities such as informational signs and trash cans may also be present.

Bus stops with benches typically also have a hard surface paved landing pad to accommodate waiting. In this illustration, the bench is set back from the curb far enough to allow space for wheelchair users and the deployment of bus ramps.

The ***Basic Bus Stop Functional Class*** is typically used for the lowest-ridership locations. This Functional Class typically has a sign identifying the location as a bus stop. The sign may or may not include schedule information. Other amenities such as trash cans and paved places to wait are typically not provided with this Functional Class.

Facility Types for Bus Stops

In general, Facility Types are attributes which may be applied to any bus stop regardless of its Functional Class. Four Facility Types have been defined in this Plan.

The **ADA Access Facility Type** refers to the ease of pedestrian access to bus stops and to their compliance with the Americans with Disabilities Act (ADA). ADA details specific design parameters to ensure that users are able to access facilities regardless of their disabilities, which include mobility or vision impairments.

The illustrations shows an example of an access accommodation at a bus stop. The illustration shows an ADA-compliant stop with a loading platform connected to the sidewalk, and the bench is set back far enough to allow maneuvering a wheelchair and deployment of a bus ramp.

Cities throughout the country are incorporating rain gardens and planters in their streetscapes, either as Complete Streets projects or as Green Roads projects addressing stormwater runoff. The improved streetscapes can enhance the attractiveness of bus stops, but the design of streetscapes can impact the ADA compliance of bus stops by blocking access.

The **Bulb-Out Facility Type** is designed with two considerations in mind, both based on the needs of transit in high-volume areas. In practice, a bus bulb-out often is placed within a parking lane, rather than taking space out of the travel lane.

The first consideration is that a bus pulling out of the travel lane for a stop may have difficulty pulling back into traffic on a congested road. Breaks in traffic of sufficient size to allow a bus to safely enter can be infrequent, and can therefore impact the busses' on-time performance. A bus bulb-out addresses this by keeping the bus in the travel lane for the stop. This treatment gives the bus priority over other traffic, as the bus blocks the travel lane during its stop.

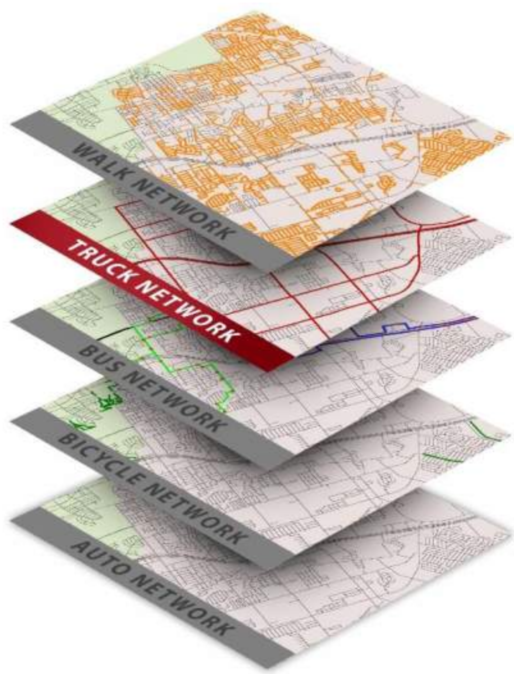
The second consideration in a bus bulb-out is pedestrian mobility. In high-volume areas, sidewalks are often crowded as well, and a bus stop can take up room on the sidewalk that is needed for walking. The bus bulb-out provides additional space on the sidewalk, and separates the waiting area from the walking area.

With the **In-Street Facility Type**, the bus stops directly in the travel lane to load passengers. This design is well suited to locations where traffic volumes are relatively low and the stopped bus blocking one lane is acceptable, or, as in the illustration, on multi-lane streets where traffic can change lanes to bypass the stopped bus. Since the bus stays in the travel lane, this design avoids issues with the bus merging back into traffic.

In contrast to the Bulb-Out and In-Street Facility Types, the **Pullout Facility Type** gives priority to keeping traffic moving by displacing the bus out of the travel lane for loading.

A Pullout can be appropriate in many locations where traffic volumes are low or Level of Service (LOS) is relatively high. Potential issues with a bus Pullout are shown in the illustration, and include the difficulty of the bus pulling back into traffic, narrowing of the sidewalk, and conflicts with bicycle facilities.

Truck Network Functional Classification



The definition of Functional Classes for trucks is intended to inform the street design process of the needs and impacts of trucks. As with other non-auto transportation modes, there are no regulatory requirements to establish a Functional Classification system for the truck network. This Functional Classification system is therefore offered as a tool to define a hierarchy of street facilities as used by trucks.

The definition of a truck is important when considering the different impacts of the different types of truck. While the FHWA and TxDOT use a very detailed classification system based on the number of axles and trailer combinations, for planning purposes the three types defined in the FHWA *Quick Response Freight Manual* (QRFM) are adequate.

The three truck types in the QRFM system are:

- Heavy trucks such as 18-wheeled tractor-trailers and single unit trucks with four or more axles.
- Medium trucks are typically 6-tire single-unit box trucks.
- Light trucks are two axle, 4-tire commercial vehicles, including standard pickup trucks.

Purpose

The purpose of a Functional Classification system for trucks is to provide a basis for planning which highlights the different needs and impacts that trucks have on the regional multimodal network. The concept of Functional Classification for trucks as proposed in this Plan is to define streets according to the differences in the desirability of the presence of trucks.

Benefits

The identification of the desirability of trucks on any particular street is the primary benefit to be developed from this Functional Classification system. This supports transportation planners in defining the needs and gaps in the regional multimodal network, and to develop and evaluate projects to address them.

Applications

The truck Functional Classification system defines facilities as:

The ***Truck Priority Functional Class*** designates preferred truck routes documented in plans or policies. In all cases for this Functional Class, the routes are defined as a preference, and no regulations mandate that trucks use the routes. Both Federal and Texas State plans have designated certain routes as preferred truck routes. Planning networks which define preferred truck routes include:

- National Highway System (NHS), which includes the Interstate Highway system. The NHS includes only 4% of the total mileage of road in the nation, but carries 75% of all heavy truck traffic.
- National Highway Freight Network (NHFN), defined in the FAST Act highway authorization bill.
- Primary Highway Freight System, a component of the NHFN focusing on roads.
- Strategic Highway Network (STRAHNET), a component of the NHS focusing on access for military installations.
- Texas Highway Freight Network, defined in the Texas Freight Mobility Plan.

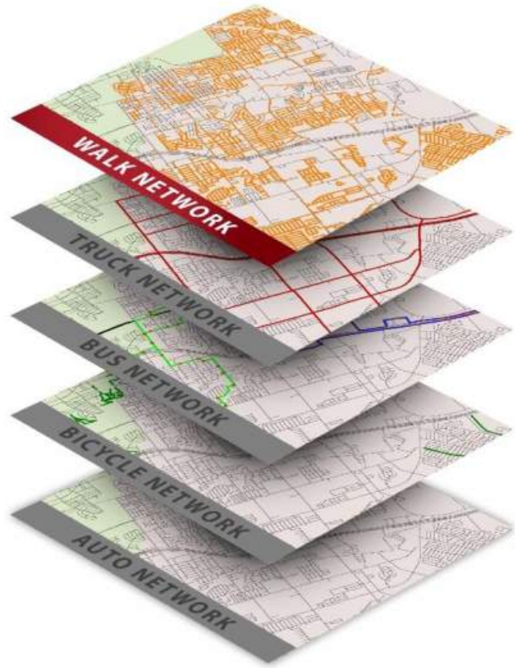
The ***Truck Restricted Functional Class*** is defined as facilities where some trucks are denied access, but others are allowed. The restrictions are typically based on truck heights, widths, or weights. In the cases of height and weight, the restrictions are often points such as bridges or overpasses where larger trucks do not have enough clearance to pass. Truck weight restrictions may apply to entire roads where the road structure is not adequate to bear the weight, but may also apply to points such as bridges.

A truck's weight is distributed according to the number and the spacing of axles, so the configuration as well as the weight is one of the issues to consider. Therefore, some weight-restricted roads or bridges specify different weight limits based on the configuration of the truck.

The ***Truck Hazardous Material Functional Class*** is a hybrid of the Truck Priority and the Truck Restricted Functional Classes. This designation is more than a preference, as there is a legal mandate for trucks carrying non-radioactive hazardous materials loads to travel only on the designated routes. Likewise, all other routes are restricted for these trucks, and the restrictions are legally defined. Radioactive hazardous materials form a special class, and the routes for those loads are "preferred routes".

The ***Truck Prohibited Functional Class*** refers to streets or bridges where all medium and heavy trucks are legally prohibited, regardless of their dimensions or weights. Prohibitions typically apply to residential streets, although exceptions may be made for trucks making deliveries. Trucks are also often prohibited from High Occupancy Vehicle (HOV) and High Occupancy or Toll Managed Lanes (HOT).

Walk Network Functional Classification



As with the other non-auto transportation modes, there is no regulatory requirement to establish a Functional Classification system for the walk mode. This walk network Functional Classification system is therefore offered as a tool to define a hierarchy of facilities which can be implemented as appropriate when the walk network interacts with the other modal networks.

Purpose

The bicycle and the pedestrian modes are often grouped together in transportation planning under the label of "active transportation". This is appropriate in many contexts, including the definition of the primary purpose of the walk network Functional Class System: to promote the safety of the user. Pedestrians are the most vulnerable of all road users, and the mix of pedestrians can include children, children in strollers, the elderly, wheelchair users, and others with limited mobility. Defining pedestrian infrastructure is therefore not only a matter of balancing the regional multimodal network; it is a vital element in planning for the safety of the network.

Benefits

The definition of a Functional Classification system for the walk network is intended to support planning for a balanced regional multimodal network. By describing the attributes of walk Functional Classes, a more precise and more accurate inventory of facilities can be developed. This is a critical tool in defining network attributes, needs, and gaps, and in developing projects to address any needs and gaps which are identified in the network.

Applications

As the "active transportation" modes of bicycles and pedestrians share many attributes, they also appropriately share some but not all infrastructure. Bicycles and pedestrians have different speeds, different trip lengths, and different mixes of users. Therefore, while some of the infrastructure and Functional Classes are common between the two transportation modes, there are also some differences.

Off-Street Multi-Use Trail Functional Class

An off-street trail provides the greatest amount of separation and protection from traffic. Off-street trails are often multi-use, intended to serve bicycle and pedestrian trips. Multi-use trails must be wide enough to accommodate safe interactions between bicycles and pedestrians.

Facility Types for Multi-Use Trails

The **Hard Paved Facility Type** features a hard and smooth surface to provide a path free of impediments and to accommodate high-end road bikes and strollers. Concrete or asphalt are common surfaces.

The **Soft Paved or Unpaved Facility Type** is paved with materials which can reduce costs or provide a more recreational user experience. This Facility Type is generally more amenable for recreational use. Gravel, decomposed granite, and dirt are typical soft paving materials.

The **Dual Track Facility Type** is designed to provide a greater separation of bicycle flows and pedestrian flows. Examples of implementation of Dual Track facilities are typically off-road because of the greater right-of-way required. The buffer between the bicycle and the pedestrian tracks may be a grassy strip, it may be a painted line, or the separation may be unmarked, as in this illustration. Sturdy barriers such as those used to separate bicycle flows from auto traffic are generally not necessary in this context.

The ***Sidewalk Functional Class*** is the most common type of pedestrian infrastructure, and is unique in that it is the only facility in the balanced multimodal network that is intended solely for a single mode of transportation. This is an instance where the grouping of bicycle and pedestrian modes into the “active transportation” category is not appropriate for shared infrastructure.

The illustration shows some of the best practices in sidewalk design as well as some common limitations. The curb cut for ADA compliance is generous, well-marked, and has a bordering tactile surface for traction and to alert the visually impaired. The sidewalk is set well back from the driveway cut, allowing cars to complete their turns so that they are oriented at 90^0 when they meet the sidewalk, allowing better visibility of pedestrians and giving more space to stop out of the flow of traffic on the street. The sidewalk width of three to four feet is generous for pedestrians in this suburban context, but is not sufficient for pedestrians and bicyclists to share the same space. For this reason, sidewalks are not intended for bicycles. Many jurisdictions prohibit adult riders from sidewalks, allowing only children on smaller bikes.

Facility Types for Sidewalks

Three Facility Types are suggested for Sidewalks to distinguish their design and attributes within the context of their environment.

The **Conventional Sidewalk Facility Type** is common in both urban and suburban settings. These types of sidewalks are generally three to four feet wide, which is adequate for their purposes and for their existing volumes of traffic.

An issue with conventional sidewalks is that their relatively narrow width may not be sufficient in special circumstances. The illustration shows a conventional sidewalk on the Adams Ave. bridge crossing over the railroad tracks in Temple. Because the necessary side rails on the bridge line one edge of the sidewalk, the width seems inadequate to protect pedestrians from traffic in the travel lanes.

Other instances where conventional sidewalks may be too narrow to function adequately include cases where barriers lie within the sidewalk, such as telephone poles, fire hydrants, curb cuts, and street furniture.

The **Landscaped Sidewalk Facility Type** is often wider than the Conventional Sidewalk, and can be as wide as twelve feet. This Facility Type often features decorative pavement or trim, landscaping, street trees, and pedestrian-scaled lighting.

While a Landscaped Sidewalk addresses contextual issues to build a pleasant and "walkable" pedestrian environment, its primary purpose still focuses on walking rather than on urban development.

In a further development of the Landscaped Sidewalk, the **Urbanized Sidewalk Facility Type** is intended to stimulate an active street environment. Urbanized Sidewalks are divided into zones for storefronts, walking, street furniture, landscaping, and buffer areas. Total sidewalk width may be greater than twelve feet. Urbanized Sidewalks may include "parklets" or "pocket parks", which convert one or two curbside parking spots into street furniture areas. Urbanized Sidewalks with their specialized zones are a part of the movement for Context-Sensitive Solutions, which has been endorsed by TxDOT.

Desire Lines are not infrastructure like the other Functional Classes, but they rather are facilities that define the need for infrastructure. They are defined as a Functional Class to recognize a unique feature of the walk network, where pedestrians create their own infrastructure. Where sidewalks are missing but a demand exists, pedestrians will wear a path into the ground that reveals their desire for travel in the area. Desire Lines can be found where there are short gaps in the sidewalk network, but also in places where there are no sidewalks at all. They may be located alongside a road as shown in the illustration, or may be "short cuts" across vacant fields.

Transportation planners should be aware of Desire Lines as the public's demonstrations of their needs for walk network infrastructure.

Another unique aspect of the walk network is that movements crossing the street are as important as movements along designated pedestrian routes. The ***Crosswalk Functional Class*** is proposed so that transportation planners can define infrastructure to evaluate and to promote safety as pedestrians interact with vehicles when they cross streets.

Texas state law specifically outlines the responsibilities of vehicles and of pedestrians in marked and in unmarked crosswalks. Essentially, every intersection is a crosswalk, and pedestrians have the right-of-way over vehicles in every instance. In this respect, the Texas Transportation Code does not distinguish between marked and unmarked crosswalks.

Vehicles have the right-of-way over pedestrians when they are crossing the street anywhere other than at intersections (mid-block crossings).

Facility Types for Crosswalks

The **Complete Streets Crosswalk Facility Type** is defined to accommodate the various types of Complete Streets treatments as they apply to street crossings. The illustration shows a raised crosswalk that lifts the street surface up to the same level as the sidewalk as a way to emphasize the presence of pedestrians and to capture motorists' attention. Other Complete Streets treatments relative to crosswalks include median refuge islands, sidewalk bulb outs, and traffic calming.

The **Creative Crosswalk Facility Type** references an international movement to augment the standard markings of crosswalks with innovative designs or colors in order to highlight the crossing and to better capture motorists' attention. Common approaches to Creative Crosswalks have included artistic designs, painted patterns to simulate brick or paving stones, actual brick or paving stones laid in designs and with enough texture to draw attention to the crossing, or a combination of all treatments.

Creative Crosswalks may be considered as related to decorative treatments for intersections or streets that help define specific areas or neighborhoods. In all cases, one of the purposes of the treatments is to improve safety by emphasizing the presence of the crosswalk.

The MUTCD has recognized Creative Crosswalks, but recommends restrictions on the colors and patterns to be used so as not to cause confusion. From a practical standpoint, painted treatments will wear down and need maintenance, so designs which can be applied with templates are recommended rather than freehand artwork.

The MUTCD also stipulates that the Creative Crosswalk is not permitted to give information, as that would make it a traffic control device, which is governed by a different set of regulations.

The **Marked Crosswalk Facility Type** marks the crossing with MUCTD-mandated white bars or white bars within a set of parallel bars.

In this illustration from Killeen, the various legs of the intersection are marked separately. The crosswalk is placed mid-way through the dedicated right turn lane to heighten the visibility of the pedestrian. The curb cuts in the pedestrian refuge island serve as the anchor for the crosswalks going in each direction across the streets of the intersection.

The **Unmarked Crosswalk Facility Type** is assumed at every unmarked crossing of every intersection by Texas state law. In this illustration, the crosswalks are marked on three legs of the intersection. The dashed green lines show the Unmarked Crosswalk.

Summary

A Functional Classification system is required for the auto network by Federal legislation. Functional Classes and their associated Facility Types are useful in defining the inventory of streets by their types to support a more precise analysis of modal needs and gaps.

Although it not required, extending the concept of Functional Class and Facility Type to the bicycle, bus, truck, and walk networks is proposed in order to bring the same level of precision to the analysis of these modes' needs. This augmentation of the transportation process is intended to address each mode's unique needs and to support the development of a more balanced regional multimodal network.

Chapter 5: Current Conditions Inventories

CHAPTER HIGHLIGHTS

- The Auto Network
- The Bicycle Network
- The Bus Network
- The Truck Network
- The Walk Network
- The Airport and Rail Systems

Introduction

Inventories of current conditions by mode are vital to define the extent of the respective infrastructure by Functional Class, along with the notable constraints and barriers faced by each network. This data is the basis for defining and evaluating potential network improvement projects.

The inventories by mode have been gathered from available data in Geographic Information System (GIS) layers provided primarily by KTMPO. Layers were verified through a review of online data, aerial photos, and limited on-site field work. For almost every layer, the verification effort showed that the GIS layers were generally complete and accurate, and only minor editing was required. The only GIS layer which was discovered to need more extensive updates is the sidewalk inventory. For this layer, several specific areas where an update of the inventory is needed were noted, as shown in the Walk Network section.

In addition to the five modal networks, the airport and railroad system are also inventoried to document their points of interaction with the networks. For the airport system, this refers to the individual streets providing access to the terminals. For the railroad system, a layer of rail routes was developed, but the primary interaction with the networks is the layer of railroad crossings.

Because of the scale of the region, detailed illustrations of each modal network for each KTMPO member jurisdiction would require a document of excessive length, so the inventories are primarily documented through GIS layers to support further work for this Plan. The GIS layers which were used in the inventories are shown in **Table 5-1**. Sources of the layers and the methods used to verify their coverage and accuracy are also listed.

Table 5-1: GIS Layers for the Modal Inventories

GIS Layers, Sources, and Verification Methods		
Modal Network	**GIS Layer**	**Notes on GIS Layer**
Auto	2017 Network	Updated from the 2010 network based on TIPs and verified through aerial photos.
Bicycle	Bike Ped Paths and Trails	Layer provided by KTMPO and verified.
	Bike Ped Bridges	Layer developed through review of aerial photos.
Bus	The HOP Fixed Routes	Layer provided by KTMPO and verified.
	The HOP Bus Stops	Layer provided by KTMPO and verified. Added data for shelters.
Truck	Truck Priority Routes	Developed layer from Federal and State data.
	Load Restricted Routes	Developed layer from Federal and State data.
	Load Restricted Bridges	Developed layer from Federal and State data.
	HAZMAT Routes	Developed layer from Federal and State data.
	Truck Prohibited Routes	Developed layer from field review.
Walk	Bike Ped Paths and Trails	Layer provided by KTMPO and verified.
	Sidewalks	Layer provided by KTMPO and verified.
	Sidewalk Inventory Needed Areas	Layer developed from review of aerial photos.
Airport	Airports	Layer developed from review of aerial photos.
Railroad	Railroads	Developed layer from GIS layer and updated based on aerial photos.
	Railroad Crossings	Layer developed through review of aerial photos.

To provide a compromise between the high-level regional view and a detailed view of networks at local scales, each modal network is provided with three Figures: an overall view showing the entire region, a western area view showing cities from Kempner to Salado, and an overlapping eastern area showing cities from Harker Heights to Troy and Rogers.

The **auto network** is the base layer for the Thoroughfare Plan, with Functional Classes for ***Controlled Access***, ***Major Arterial***, ***Minor Arterial***, and ***Collector.***

For the use of the regional travel demand model, the ***Controlled Access Functional Class*** is divided into three components: ***Interstate Highway***, ***Freeway***, and ***Expressway***.

The model standards from TxDOT defines ***Interstate Highways*** as fully controlled access facilities with no at-grade intersections and an Interstate designation. These facilities typically have grassy medians or raised concrete dividers, and frontage roads. Examples of Interstate Highways in the region include IH-35 and IH-14.

Freeways have similar standards, but are not designated as Interstates. Like Interstates, their primary function is to provide mobility for regional and through trips. The Copperas Cove bypass is an example of the Freeway Functional Classification in the region.

Expressways generally are multi-lane arterials with a mix of grade-separated and signal-controlled at-grade intersections. There is no exact specification on signal spacing, but signals are typically spaced no closer than at four-mile intervals. Examples of Expressways in the region include SH 195, the southwest portion of Loop 363, and US 190 / SH 36 between Temple and Rogers.

These Functional Classes for ***Controlled Access*** facilities are supported by the addition of ***Frontage Roads*** and ***Ramps*** to allow detailed network coding.

Figure 5-1 shows the 2017 regional inventory of the Thoroughfare Network by Functional Class. The following **Figure 5-2** and **Figure 5-3** are insets for the western and eastern areas to show the data in greater detail.

Figure 5-1: 2017 Regional Inventory of the Auto Network

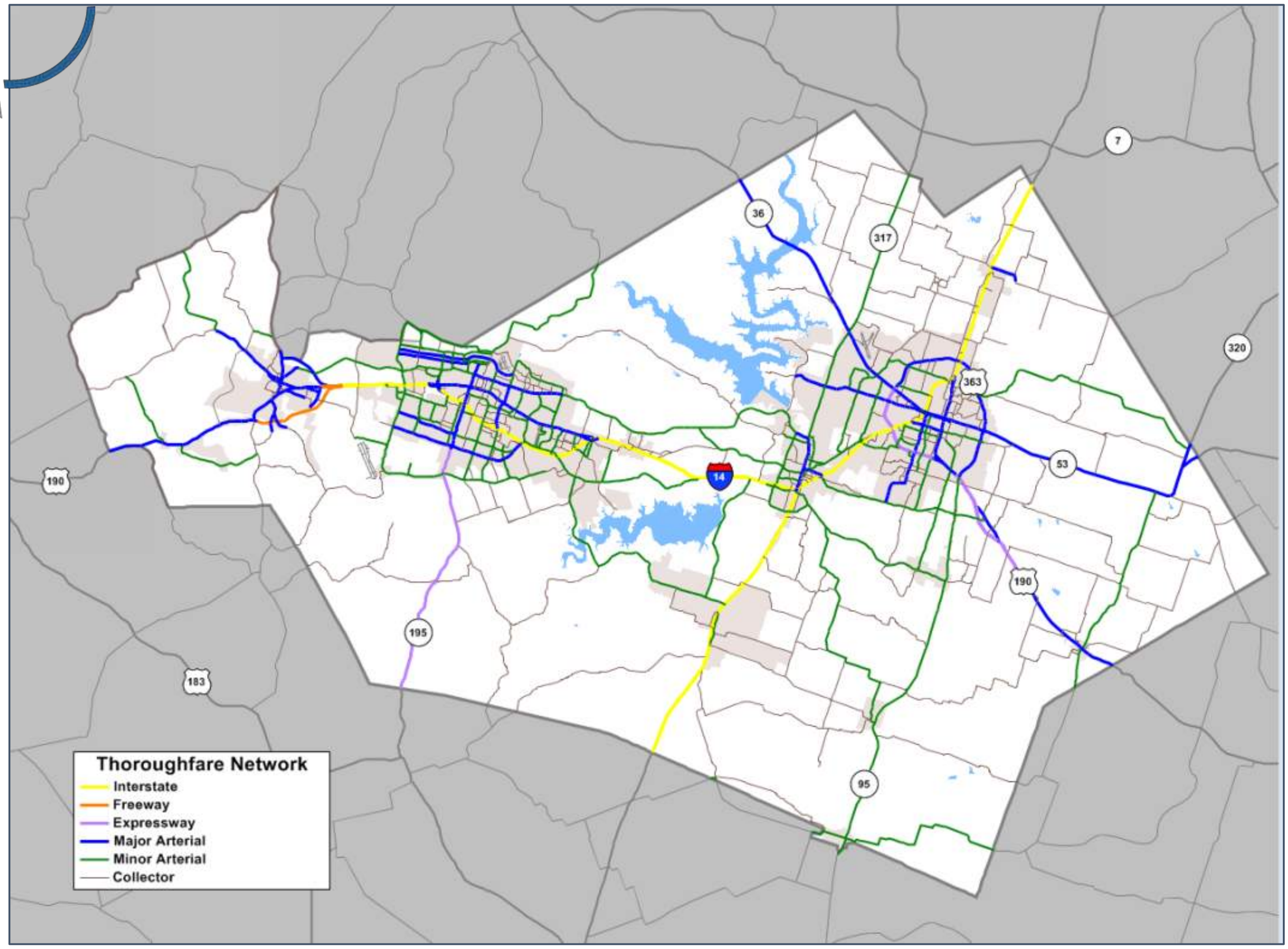


Figure 5-2: 2017 Regional Inventory of the Auto Network in the Western Area

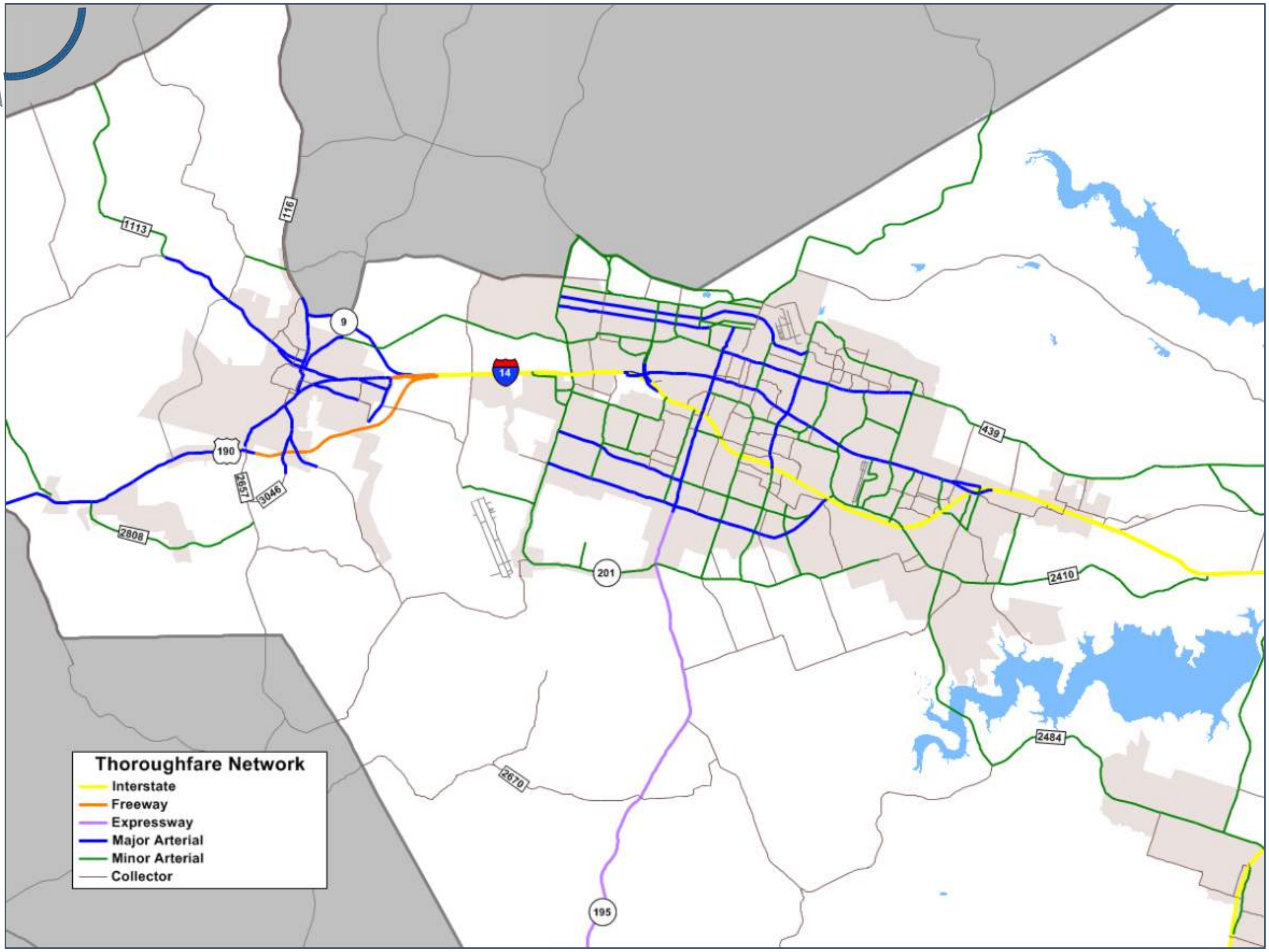
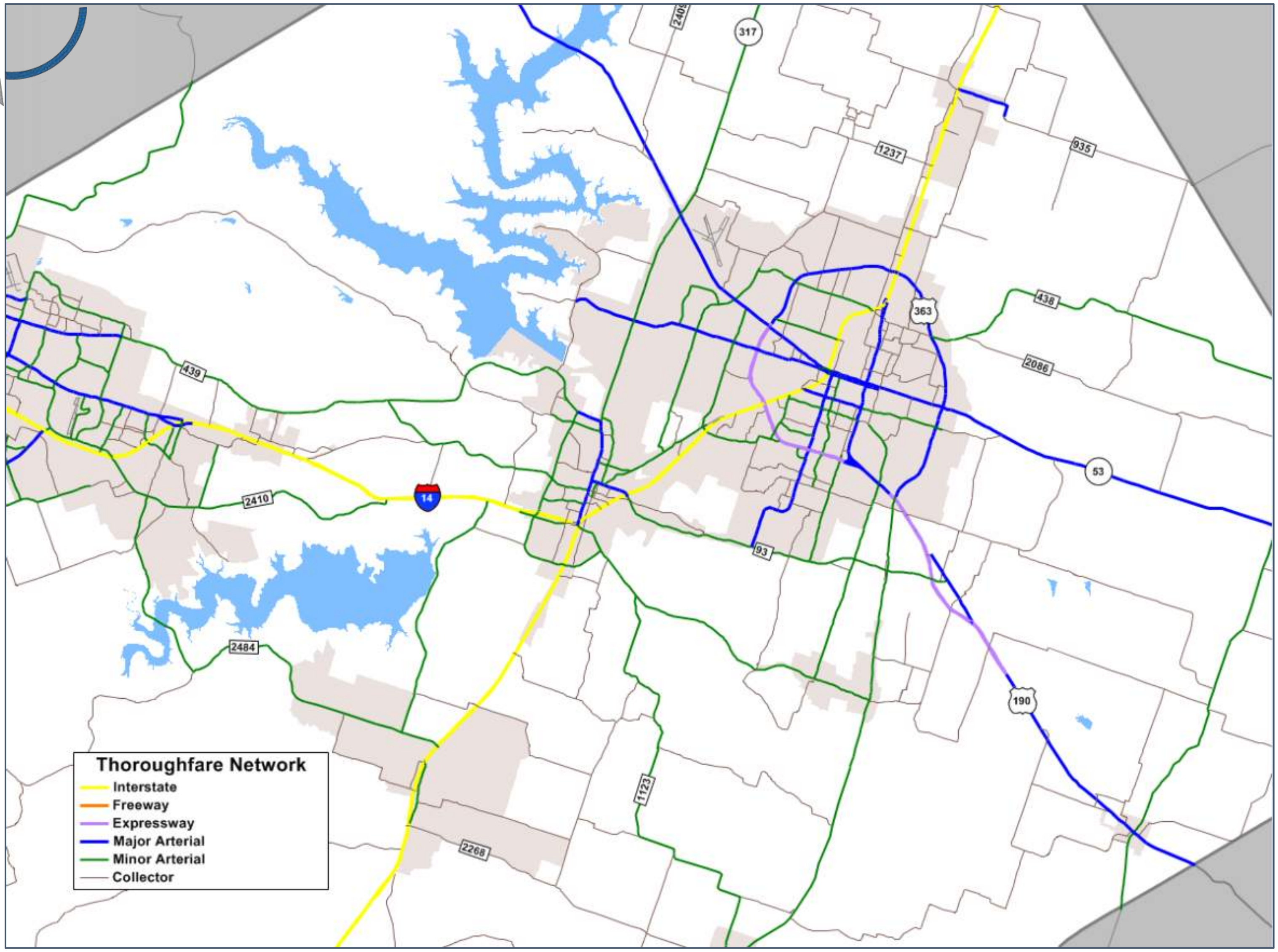


Figure 5-3: 2017 Regional Inventory of the Auto Network in the Eastern Area



As bicycles are legally defined as vehicles, the **bicycle network** includes all streets where they are not specifically prohibited, regardless of the designation of formal bicycle facilities. Bicycles are prohibited only from high speed, limited access facilities such as Interstate Highways.

Not all the Functional Classes which were defined for the bicycle network are present in the 2017 inventory. Those which are present include the ***Conventional Bike Lane***, the ***Shared Roadway***, and the ***Off-Street Multi-Use Trail***.

The 2017 inventory of bicycle facilities is shown in **Figure 5-4**, with insets of the western and eastern areas shown in **Figure 5-5** and **Figure 5-6**.

Figure 5-4: 2017 Regional Inventory of the Bicycle Network

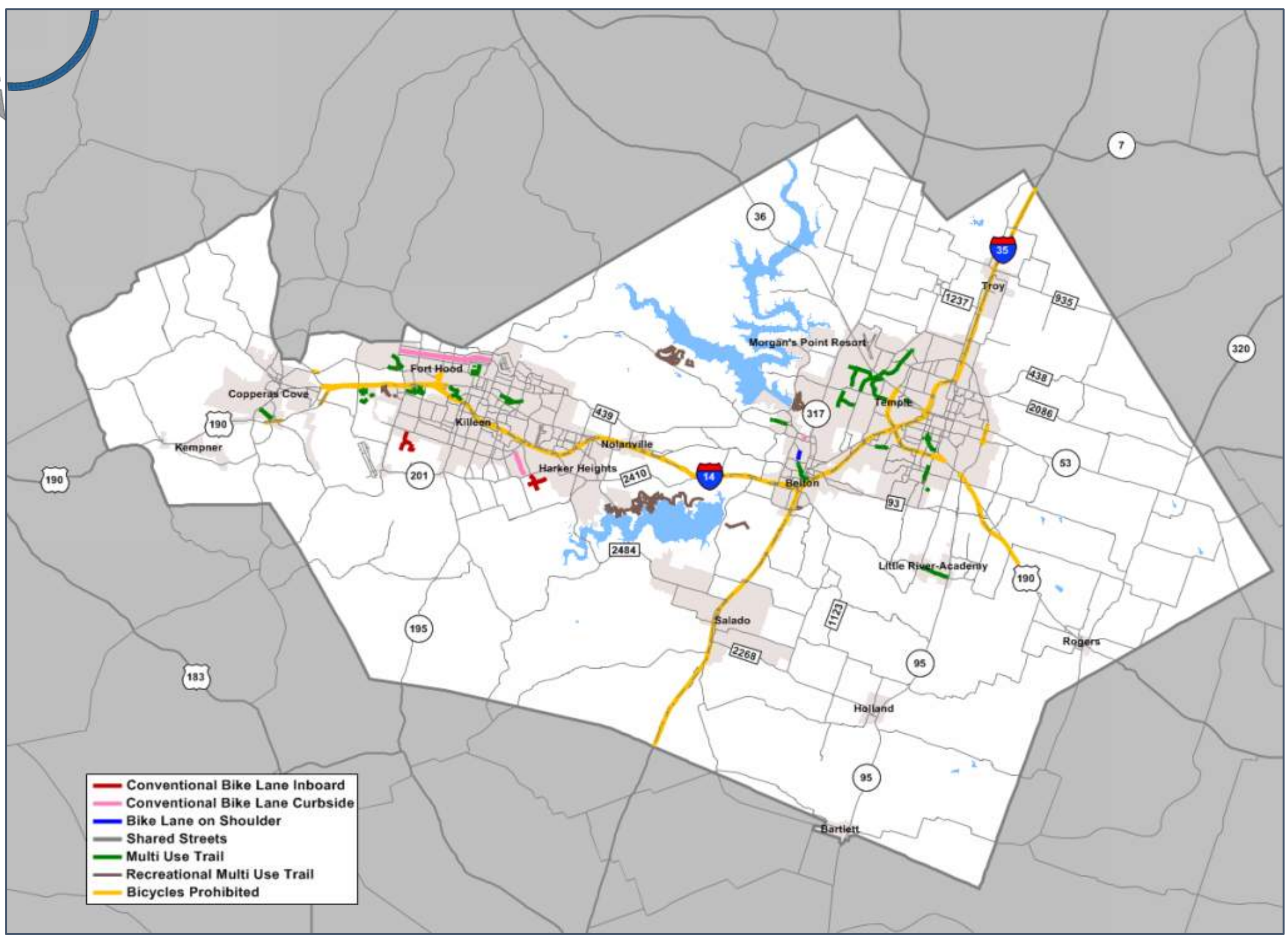


Figure 5-5: 2017 Regional Inventory of the Bicycle Network in the Western Area

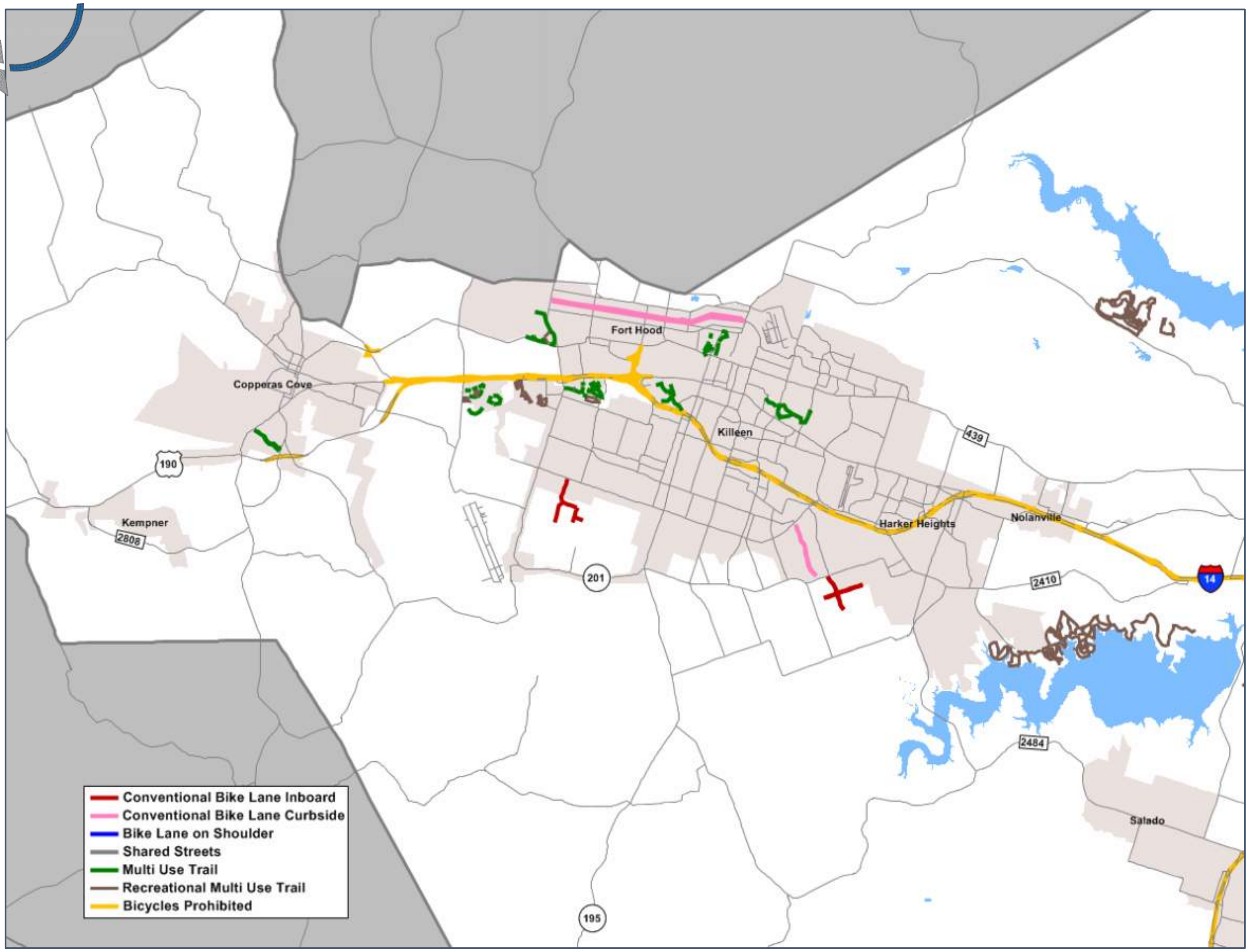
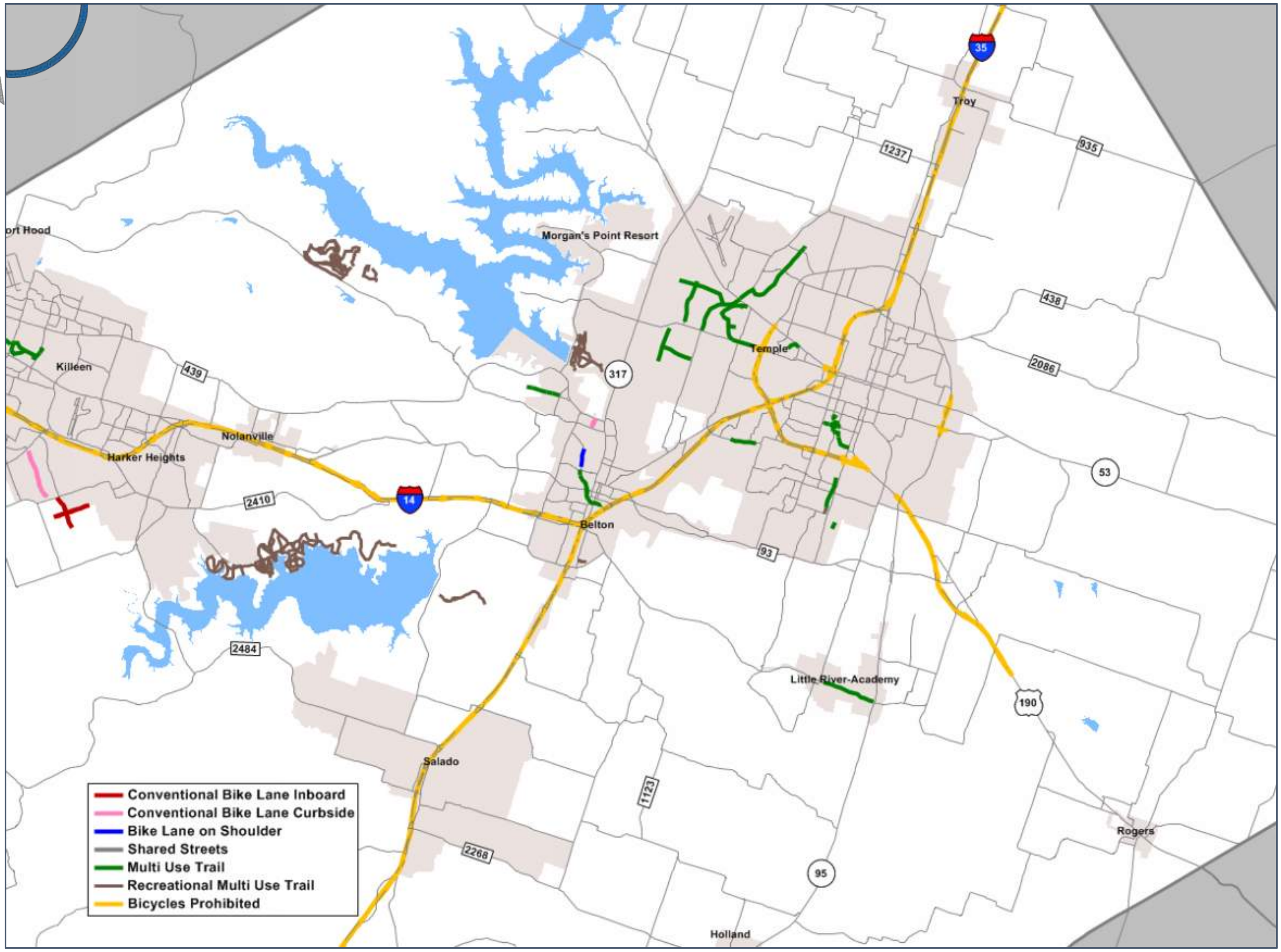


Figure 5-6: 2017 Regional Inventory of the Bicycle Network in the Eastern Area



For the **bus network**, Functional Classes were defined to establish a hierarchy of passenger amenities at bus stops. Four Functional Classes were defined as ***Station***, ***Shelter***, ***Bench***, and ***Basic Bus Stop***. All Functional Classes are present in the 2017 inventory of the region.

The HOP's bus system has a greater proportion of stops with shelters when compared to other transit systems. Overall, 43% of all stops have shelters. The system has a total of 359 active stops serving its 10 fixed routes. Of these, 154 stops have shelters, 1 has a bench only, and 204 are basic stops.

Figure 5-7 shows the 2017 regional inventory of the Bus Network by Functional Class. The following **Figure 5-8** and **Figure 5-9** are insets for the western and eastern areas to show the data in greater detail.

Figure 5-7: 2017 Regional Inventory of the Bus Network

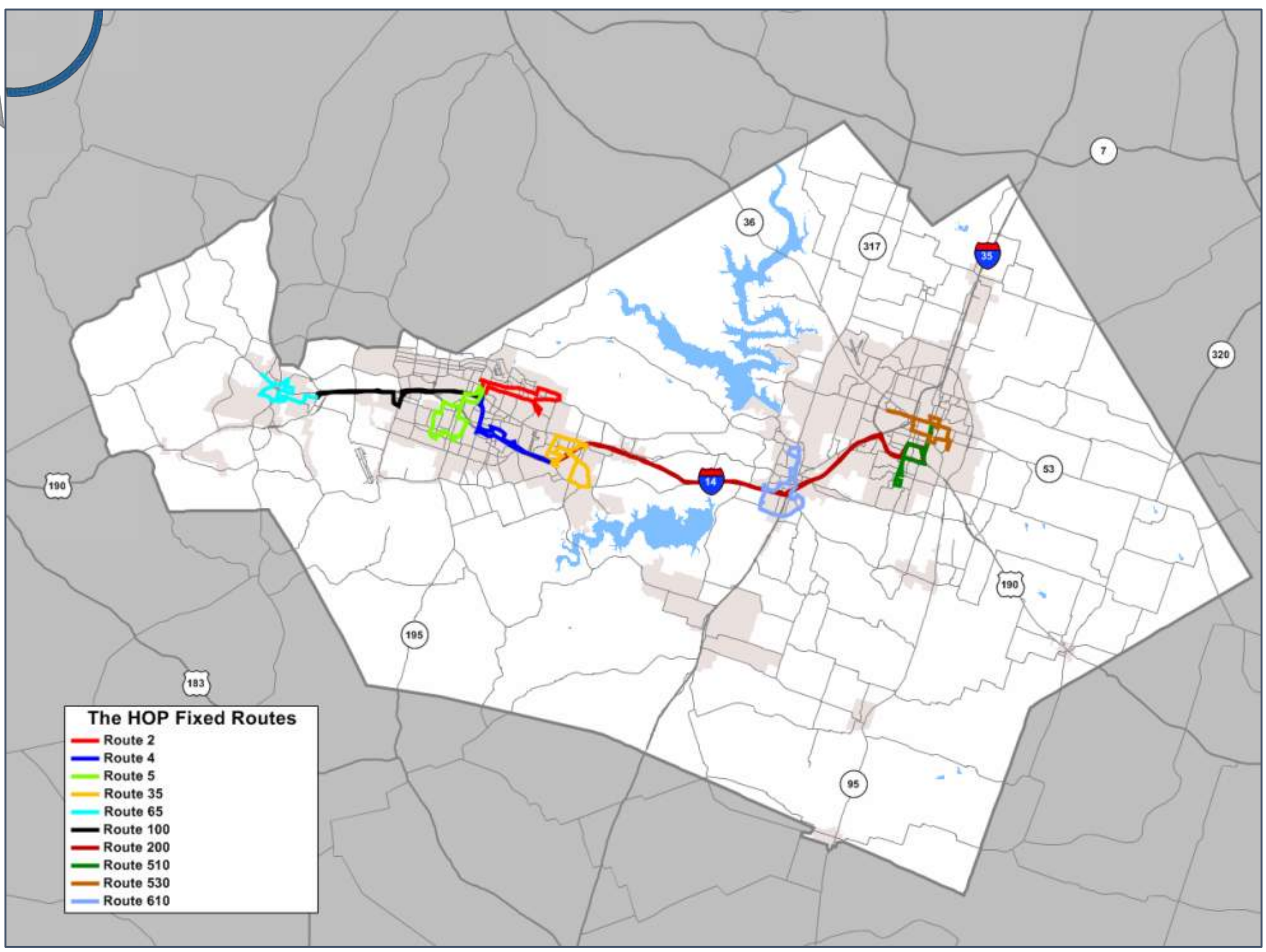


Figure 5-8: 2017 Regional Inventory of the Bus Network in the Western Area

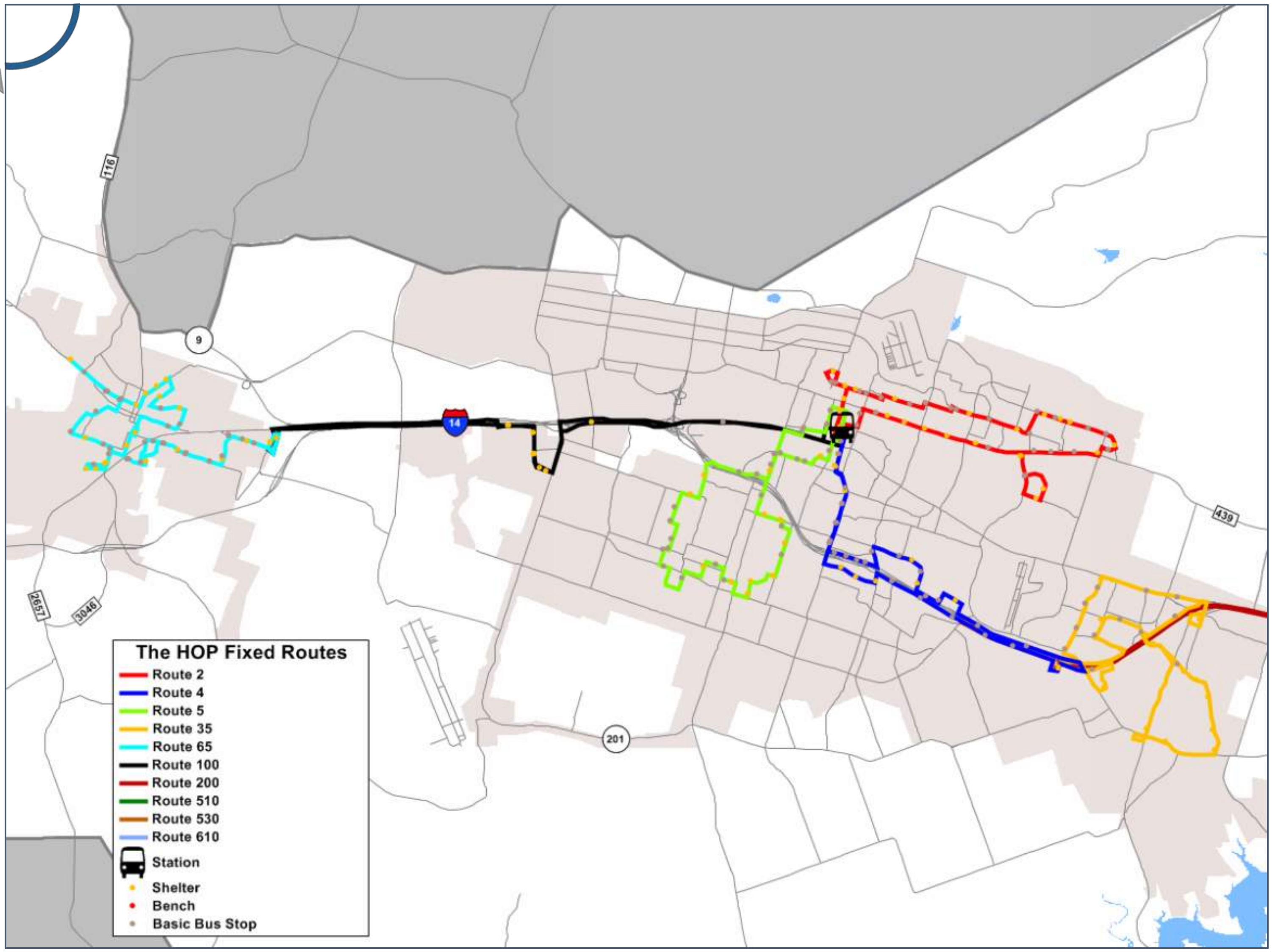
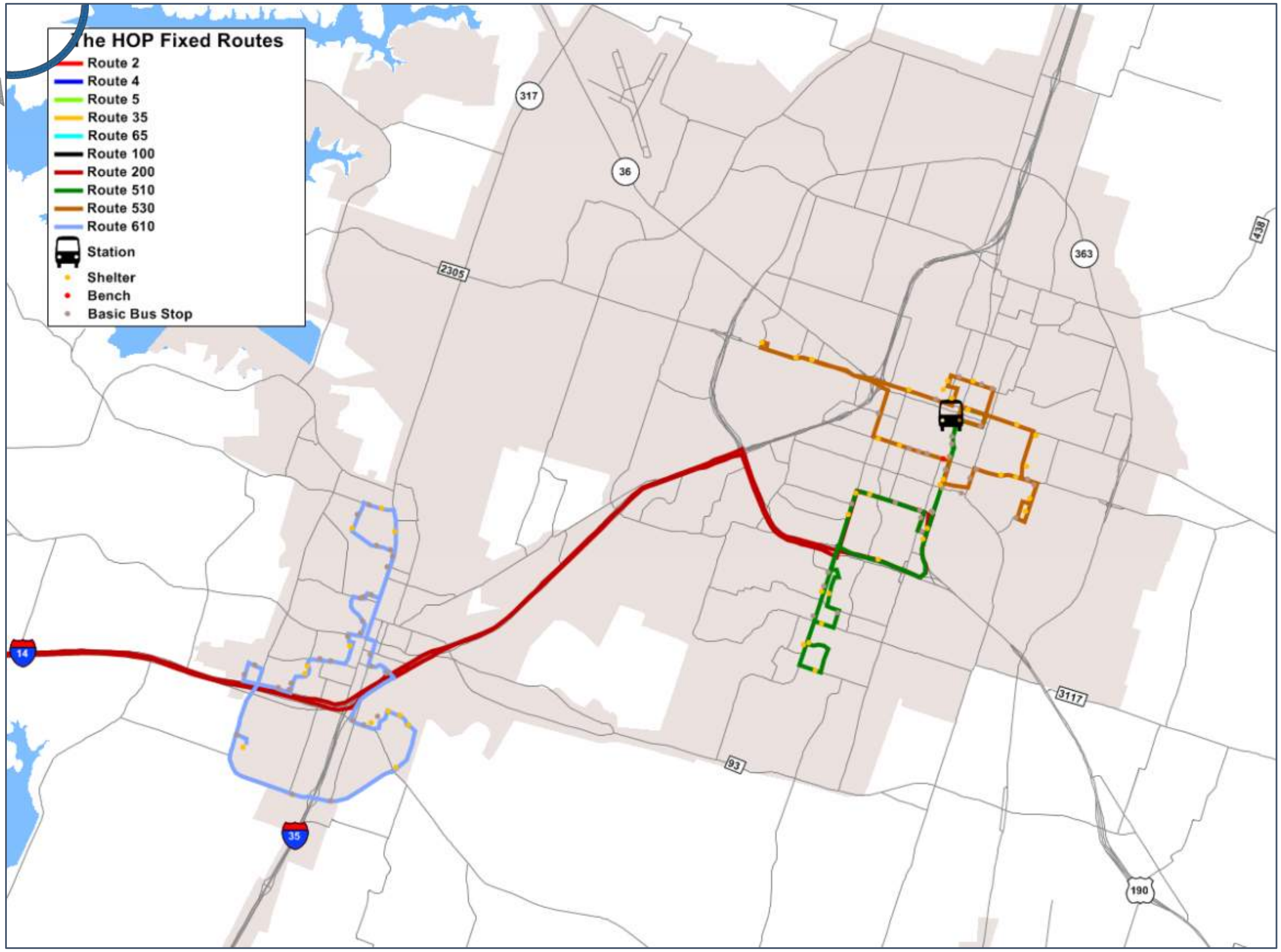


Figure 5-9: 2017 Regional Inventory of the Bus Network in the Eastern Area



Functional Classes for the **truck network** were defined to establish a hierarchy of streets based on the desirability of truck traffic. Four Functional Classes were defined as ***Priority***, ***Restricted***, ***Hazardous Materials***, and ***Prohibited***. All Functional Classes are present in the 2017 inventory of the region.

The ***Truck Priority Functional Class*** as shown for the region in **Figure 5-10**, with insets for the western and eastern areas in **Figure 5-11** and **Figure 5-12**, is a composite of several designated networks for trucks. Component networks include the National Highway System (NHS), the Eisenhower Interstate Highway System, other NHS routes and connectors, NHS intermodal connectors, and the Strategic Highway Network (STRAHNET). Truck priority networks introduced through the FAST Act include the National Highway Freight Network (NHFN) with its component Primary Highway Freight System (PHFS), other Interstate portions, Critical Rural Freight Corridors (CRFC) and Critical Urban Freight Corridors (CUFC). At the State planning level, Texas has defined a Texas Highway Freight Network complementing the Federal designations. There is considerable overlap among the designations, with critical regional routes such as IH-35 being listed in several different truck priority networks.

Truck Restricted Functional Class roads are based on the TxDOT listing of load-restricted roads, found online at http://www.txdot.gov/apps/gis/loadzone. Roads are restricted by gross vehicle weight or by the number of axles, or both. Bridges with load restrictions are listed by TxDOT at http://apps.dot.state.tx.us/apps/gis/lrbm. The data show thirty-five routes in Bell County and four routes in Coryell County with designated load restrictions. Thirteen bridges in Bell County are also designated with load restrictions. These published truck restrictions are supplemented by local ordinances which define general restrictions without specifically designating truck routes.

There are additional areas where trucks have not been officially prohibited, but where infrastructure or conditions do not support their safe or efficient operation. The geometric constraints at certain railroad crossings illustrate the issue. While the majority of railroad crossings in the KTMPO region are either at-grade or are grade separated with generous vertical and horizontal clearances, trucks have special needs and railroad crossings may present issues. Four locations are inventoried with geometric restrictions: two at-grade railroad crossings with high crowns, and two railroad underpasses with constrained clearances. The February 26, 2018 crash of a train and an 18-wheeler at an at-grade crossing on Teague Dr. in Moody (outside the KTMPO region) illustrates the issue.


Photo: Temple Daily Telegram

The crown of the road is such that the jacks on truck trailers can get caught, so the truck is unable to move forwards or backwards off the tracks. The crossing is well known locally and local officials say that trucks are prohibited from that crossing, but there are no signs prohibiting trucks and the crossing is not on the TxDOT list of restricted routes. This shows that the available routing data may not be sufficient in all cases, and very specific local knowledge of truck restrictions, constraints, and barriers is needed.

Local jurisdictions may also designate certain routes for their ***Hazardous Materials Functional Class*** roads, and enter them into the National Hazardous Materials Route Registry, which is maintained by the Federal Motor Carrier Safety Administration (FMCSA) and posted online at https://www.fmcsa.dot.gov/regulations/hazardous-materials/national-hazardous-materials-route-registry-state. In the KTMPO region, only Loop 363 in Temple and the portion of IH-35 inside the Loop are designated in the national registry.

Only one example of a route or bridge absolutely ***Prohibited*** to trucks was found in the KTMPO region: the bridge on W. Central Ave in Belton, which is not only load restricted, but also is narrow, one-lane, one-way, with concrete guardrails which constrict the horizontal clearance.

Figure 5-10: 2017 Regional Inventory of the Truck Network

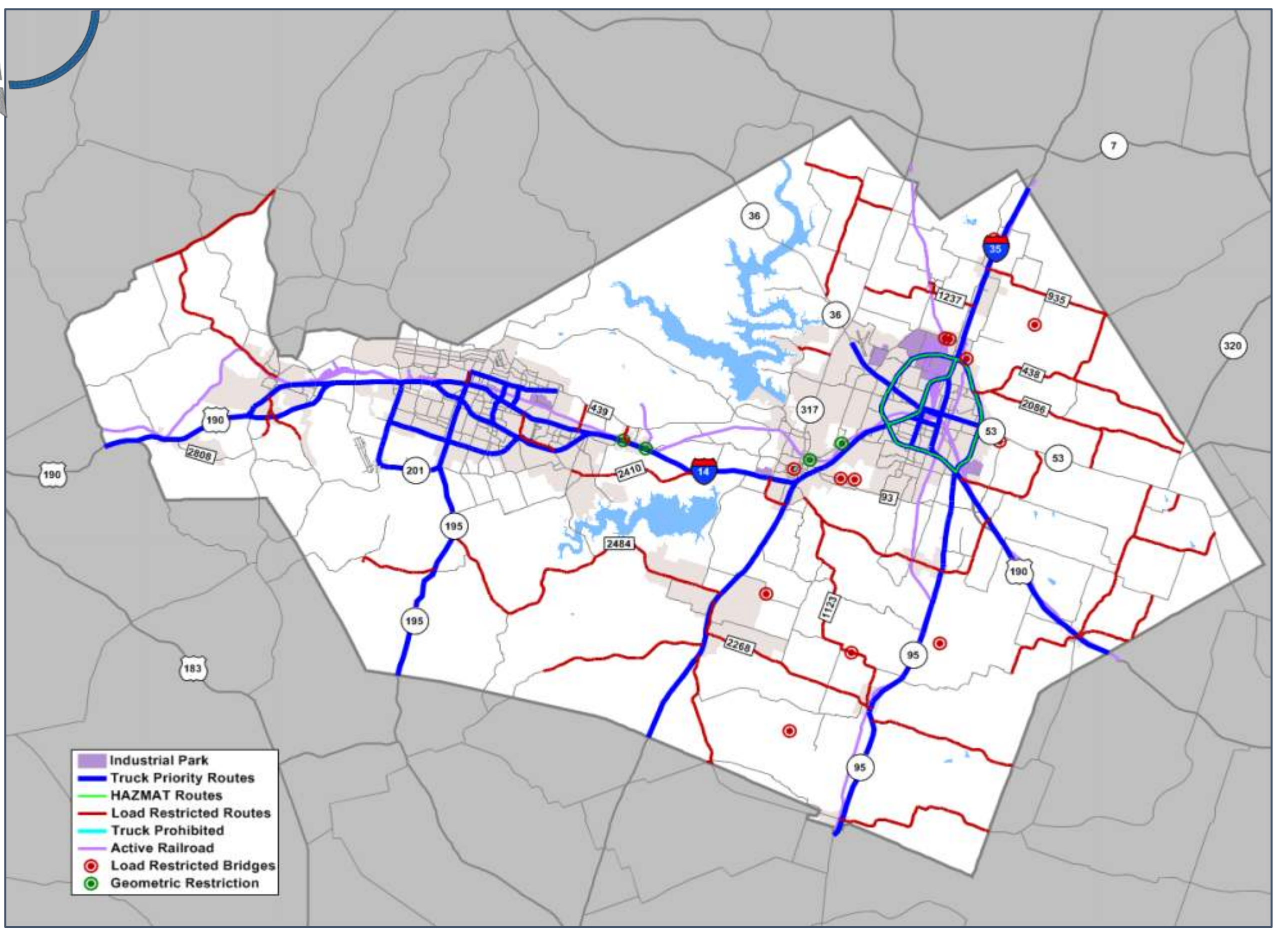


Figure 5-11: 2017 Regional Inventory of the Truck Network in the Western Area

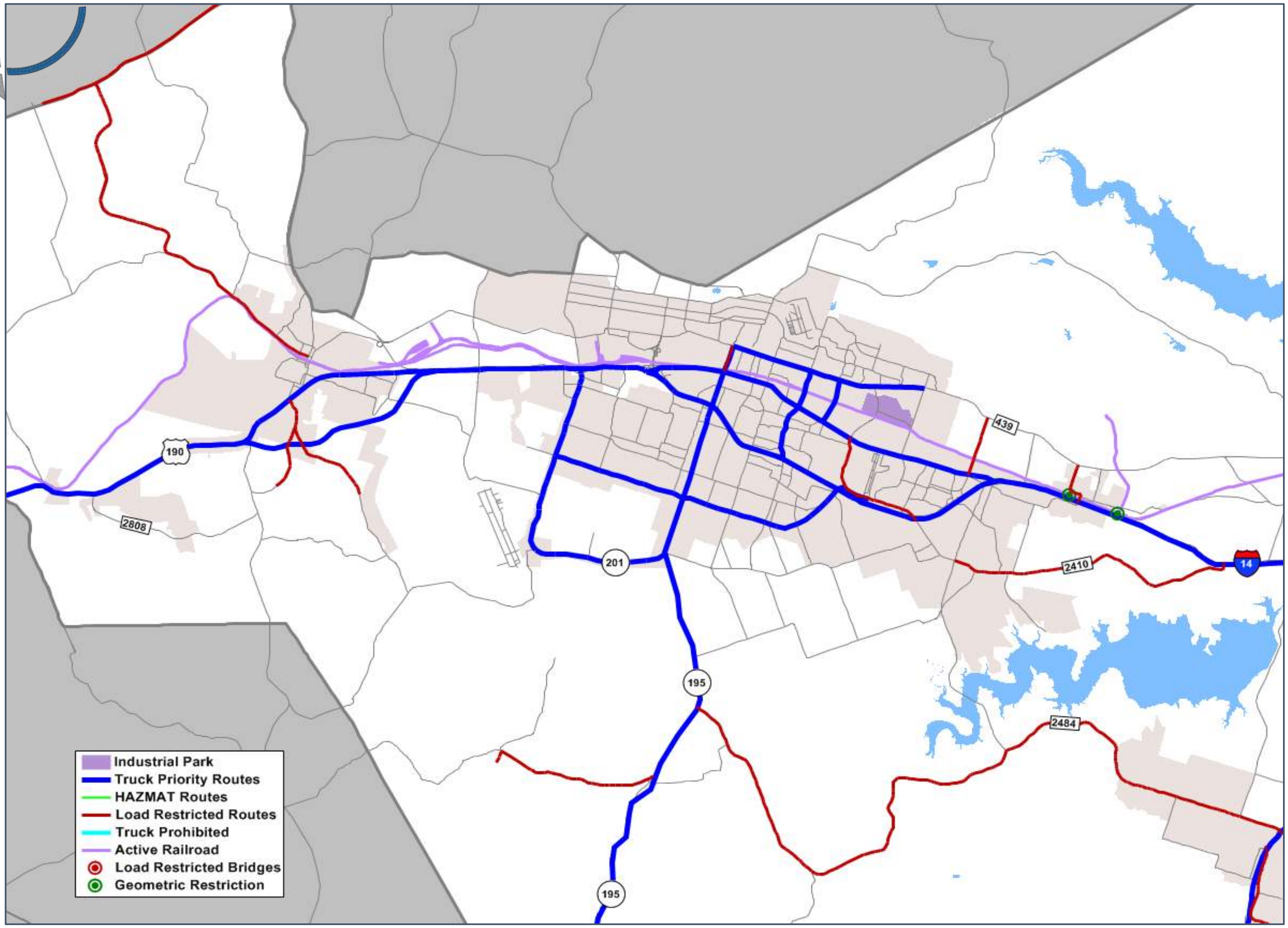
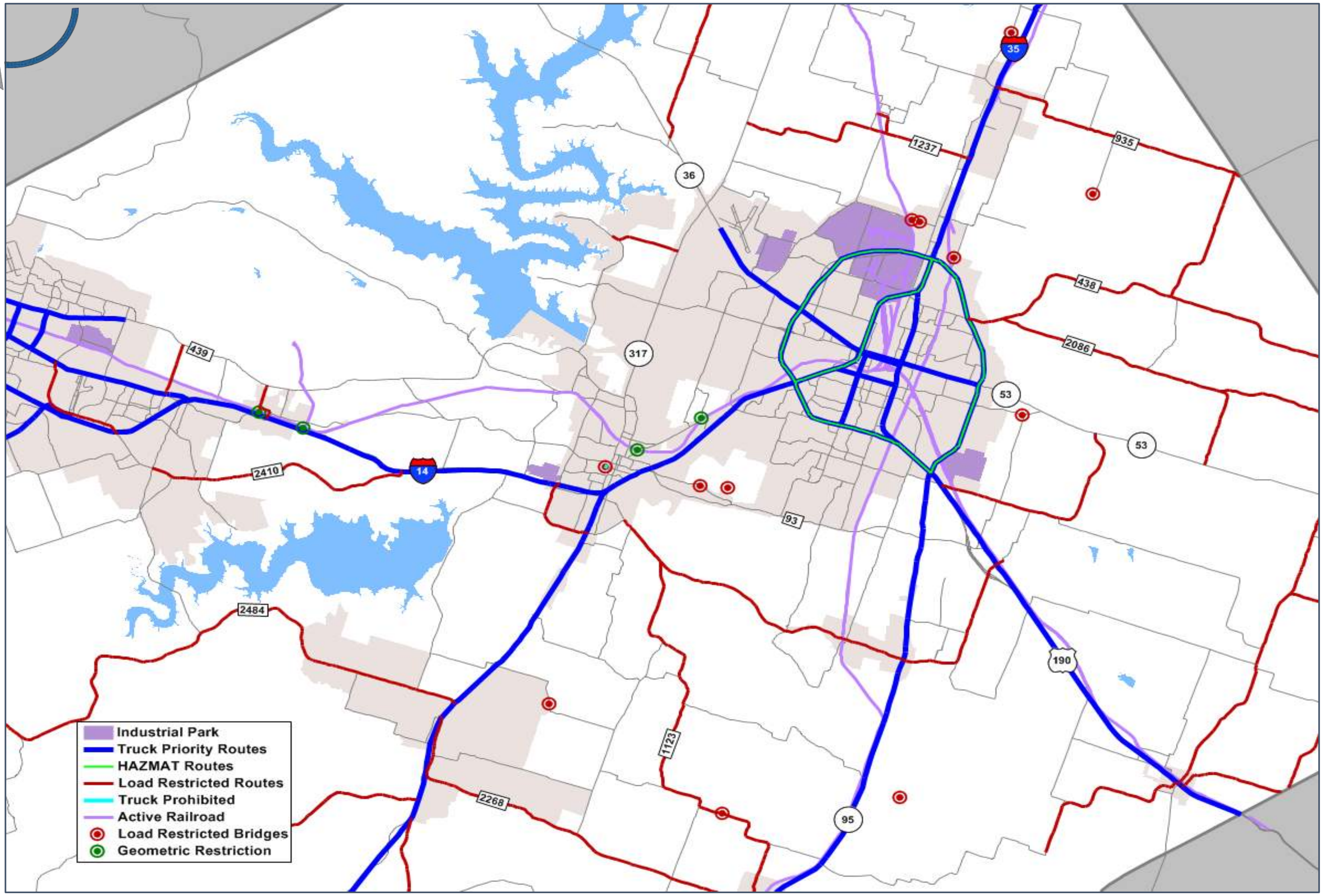


Figure 5-12: 2017 Regional Inventory of the Truck Network in the Eastern Area



The **walk network** has been defined with four Functional Classes. ***Sidewalks*** and ***Multi-Use Trails*** are included in the inventories, and are tracked by KTMPO with current infrastructure and projects. Inventories of these two Functional Classes are shown in **Figure 5-15**, with insets for the western area in **Figure 5-16** and for the eastern area in **Figure 5-17**.

The review of the inventories found several areas where the sidewalk inventory needs to be updated. The areas needing inventory updates are noted in the Figures with key "Sidewalk Inventory Needed". The areas needing inventory updates include both new developments and older residential areas in Copperas Cove, south of Killeen and Harker Heights, north of Belton, Temple, and Troy.

The exact distinction between on-street multi-use trails and sidewalks should be defined to add more precision to the network inventory. In general, the width of the facility is the most important distinction, with multi-use trails serving both bicycles and pedestrians requiring a width of at least five feet. Neither the current bicycle path and trails inventory nor the sidewalk inventory include width as an attribute, so adding this level of precision will require additional field work to update the inventories.

Compliance of the walk network with the requirements of the Americans with Disabilities Act (ADA) is also an important attribute which will add precision to the inventories. Extensive efforts to make the walk network ADA compliant are evident throughout the region, particularly with curb cuts, ramps, and texturing. However, the nuances of ADA compliance are complicated. **Figure 5-13** shows a bus stop which is set back from the curb to allow room for buses to drop their wheelchair ramps, while still allowing room for wheelchairs to maneuver to get into position. However, while this setup is compliant for access to the bus for wheelchair users, the shelter blocks the path of the sidewalk and may not be compliant for sight-impaired users. These types of nuances and the potentially conflicting needs of multiple users mean that an inventory of ADA compliance would be complex, and would require extensive

Figure 5-13: Sidewalk ADA Compliance at a Bus Stop

knowledge of requirements as well as extensive field work.

The ***Multi-Use Trails*** are shared with the **bicycle network**, and are shown here as well. Two Facility Types of Multi-Use Trails are distinguished: on-street and recreational. As shown in the Figures, the recreational multi-use trails are typically located in parks or recreational areas and form closed loops rather than forming connections to the network.

The ***Desire Line*** and the ***Crosswalk*** Functional Classes have been newly defined for the walk network in this Plan, and therefore are not included in the KTMPO inventories. **Figure 5-14** shows the walk network along S. 31st Street in Temple to illustrate the issues. Several residential and commercial areas are shown which have no walk network coverage, and some sidewalks are shown to have linear gaps. Desire line paths are shown on both sides of S 31st Street: on the east side along the gap in the line of sidewalks, and on the west side where there are no sidewalks. An inventory for sidewalks, desire lines, and crosswalks will require extensive field work. A review of aerial photos could contribute to the inventories but would not be sufficient to fully describe the networks.

Figure 5-14: Sample of Sidewalks and Desire Lines

In general, the regional view in **Figure 5-15** shows how the walk network inventory varies by area. Killeen and Harker Heights show an extensive sidewalk network in their newly-developed residential areas both north and south of IH-14. In contrast, the eastern area has a much less dense sidewalk network, even in its areas of recent residential development along SH 317 north of Belton and around S 5th Street south of Temple.

Figure 5-15: 2017 Regional Inventory of the Walk Network

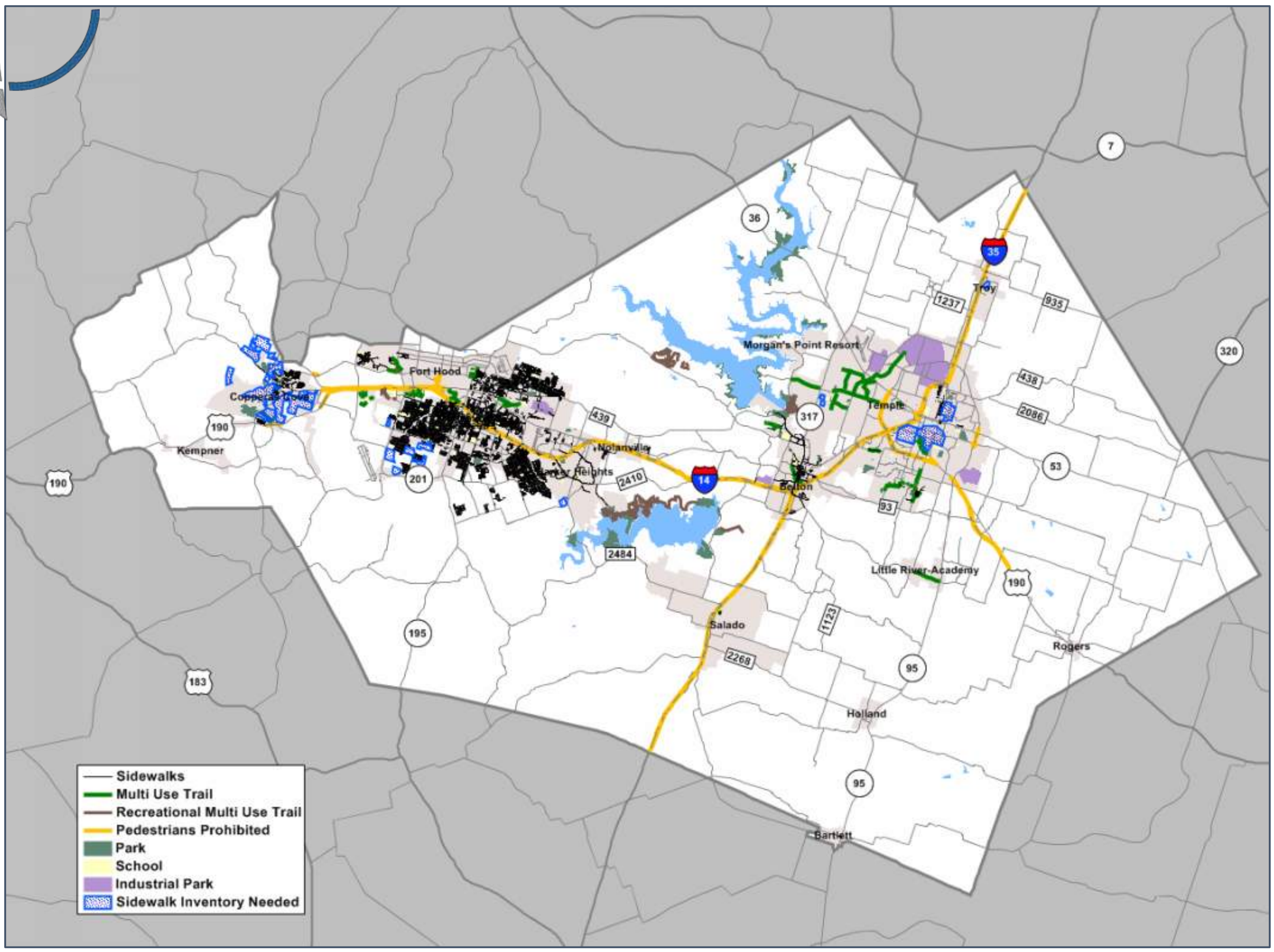


Figure 5-16: 2017 Regional Inventory of the Walk Network in the Western Area

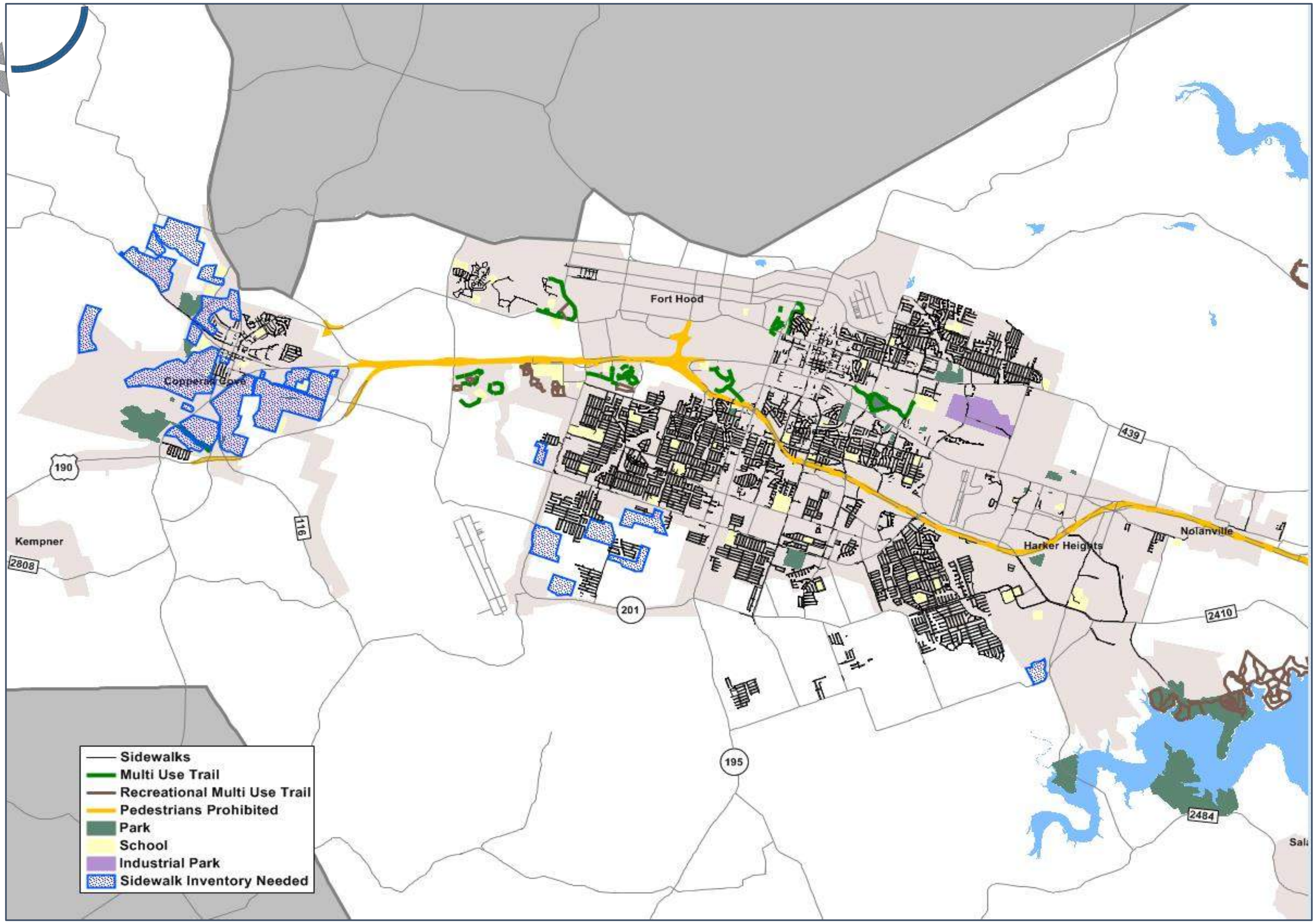
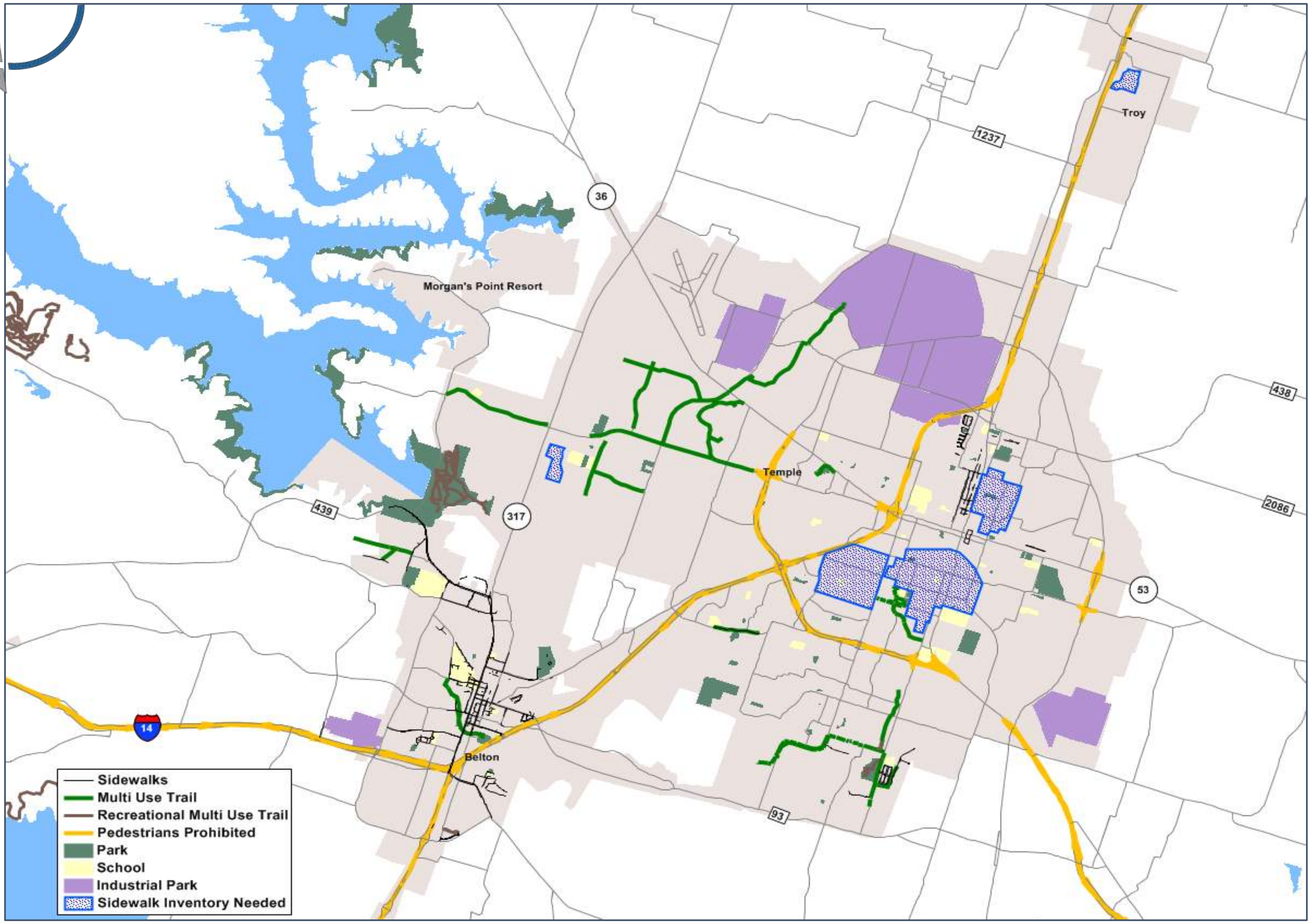


Figure 5-17: 2017 Regional Inventory of the Walk Network in the Eastern Area



The **Airport System** and the **Rail System** are not treated as networks in this Plan, but as points that are accessed by the other networks. For airports, those points are the single roads that serve the airport entrances. The interaction of railroads with the other networks is primarily found at railroad crossings. Railroad crossings can be either at-grade or grade separated with an overpass or underpass.

The airport and railroad system inventories are shown in **Figure 5-19**, with insets for the western area in **Figure 5-20** and for the eastern area in **Figure 5-21**.

There are four major airports in the region. The Killeen-Fort Hood Regional Airport is a shared field with the Robert Gray Army Airfield. Access to the civilian side of the airport is provided by Chet Edwards Loop. It is classed as a primary commercial service airport, and is served by American Eagle and United Airlines. Service by Delta Airlines was terminated in January 2018. The Hood Army Airfield is not open to civilian air traffic, but is noted for completeness of the inventory. Skylark Field is the former Killeen Municipal Airport; commercial operations were moved to the Killeen-Fort Hood Regional Airport in 2004. Airport Drive provides access to the terminal. It is not served by scheduled passenger air service, but is open for general aviation. The Draughon-Miller Central Texas Regional Airport is also a general aviation facility. One street provides access to the airport's administrative buildings, and three other streets provide access to individual areas of hangers.

At-grade railroad crossings impact the network with the quality of the crossing. All of the 140 at-grade crossings in the KTMPO region have a smooth crossing, typically with pre-cast concrete pads between the rails. The only issues found with at-grade crossings were at two locations in Nolanville: N 5th Street and Levy Crossing Road, where a high crown with a steep grade on both sides of the tracks may cause issues with longer vehicles bottoming out.

There are twenty-seven grade separated railroad crossings in the region. All except two provide generous horizontal and vertical clearance for crossing traffic. The two exceptions, on Waco Road and on Charter Oak Drive (which are actually the same road) in Belton, have low horizontal and vertical clearance that may constrain larger trucks. They are also both located on curves and in dips, which can restrict visibility and speed. The crossing on Charter Oaks Drive is shown in **Figure 5-18**. Neither the two at-grade crossings with high crowns nor the two grade-separated crossings with constrained geometries are posted as truck restricted, but larger trucks may have difficulty with the routes.

Figure 5-18: Railroad Overpass on Charter Oaks Drive

This shows that the available routing data may not be sufficient in all cases, and very specific local knowledge of truck restrictions, constraints, and barriers is needed.

Figure 5-19: 2017 Regional Inventory of the Airport and Rail Systems

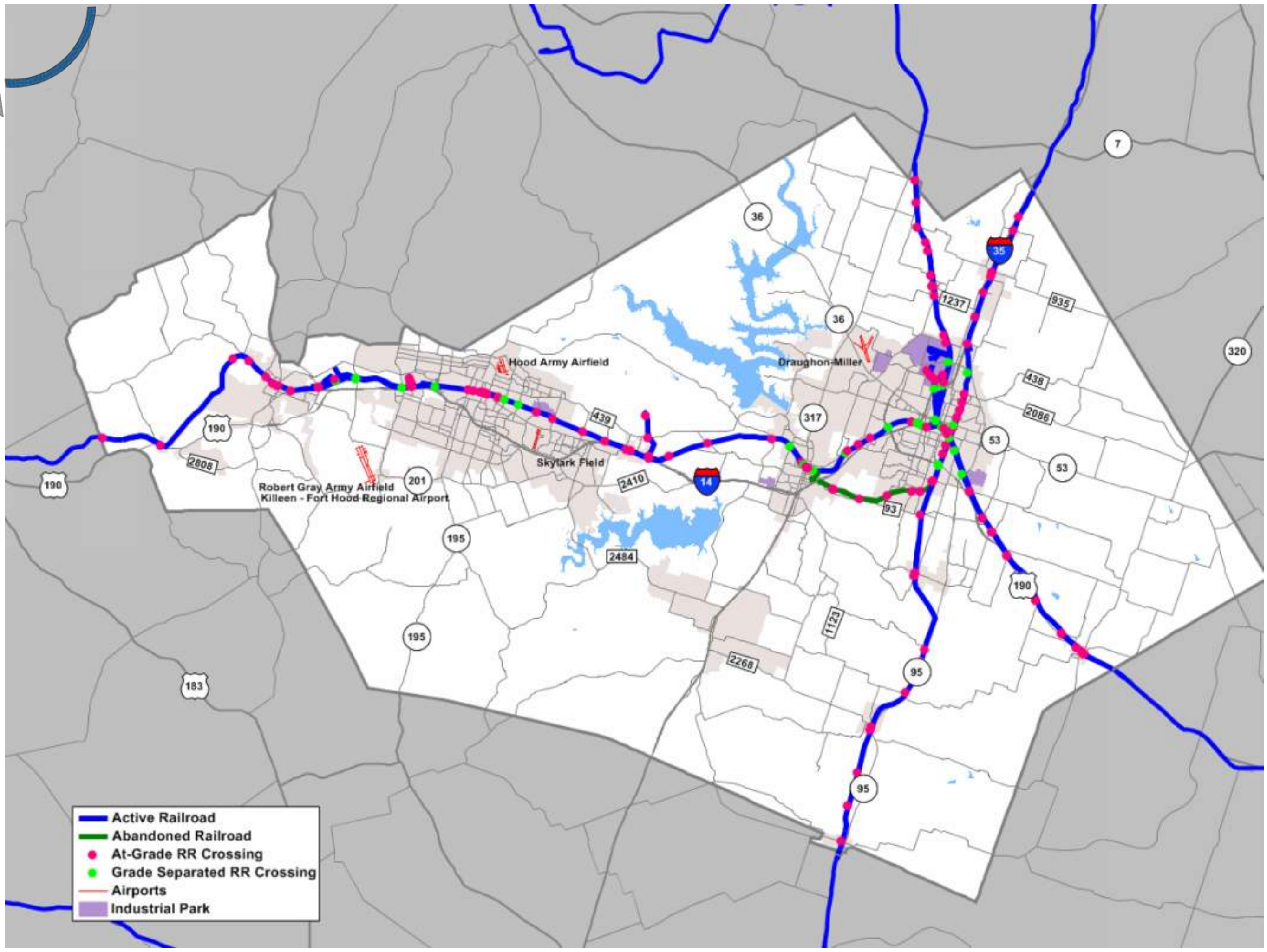


Figure 5-20: 2017 Regional Inventory of the Airport and Rail Systems in the Western Area

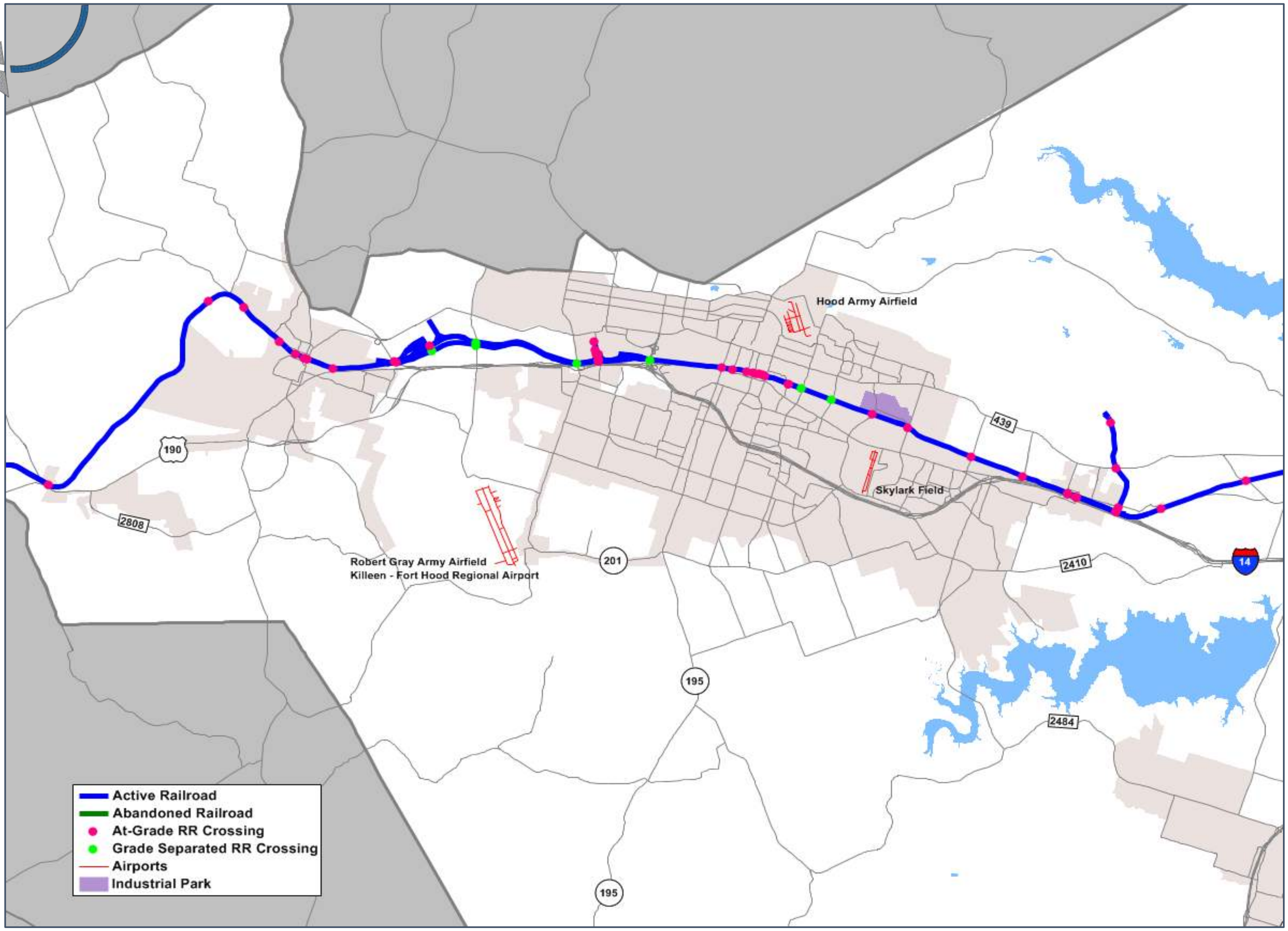
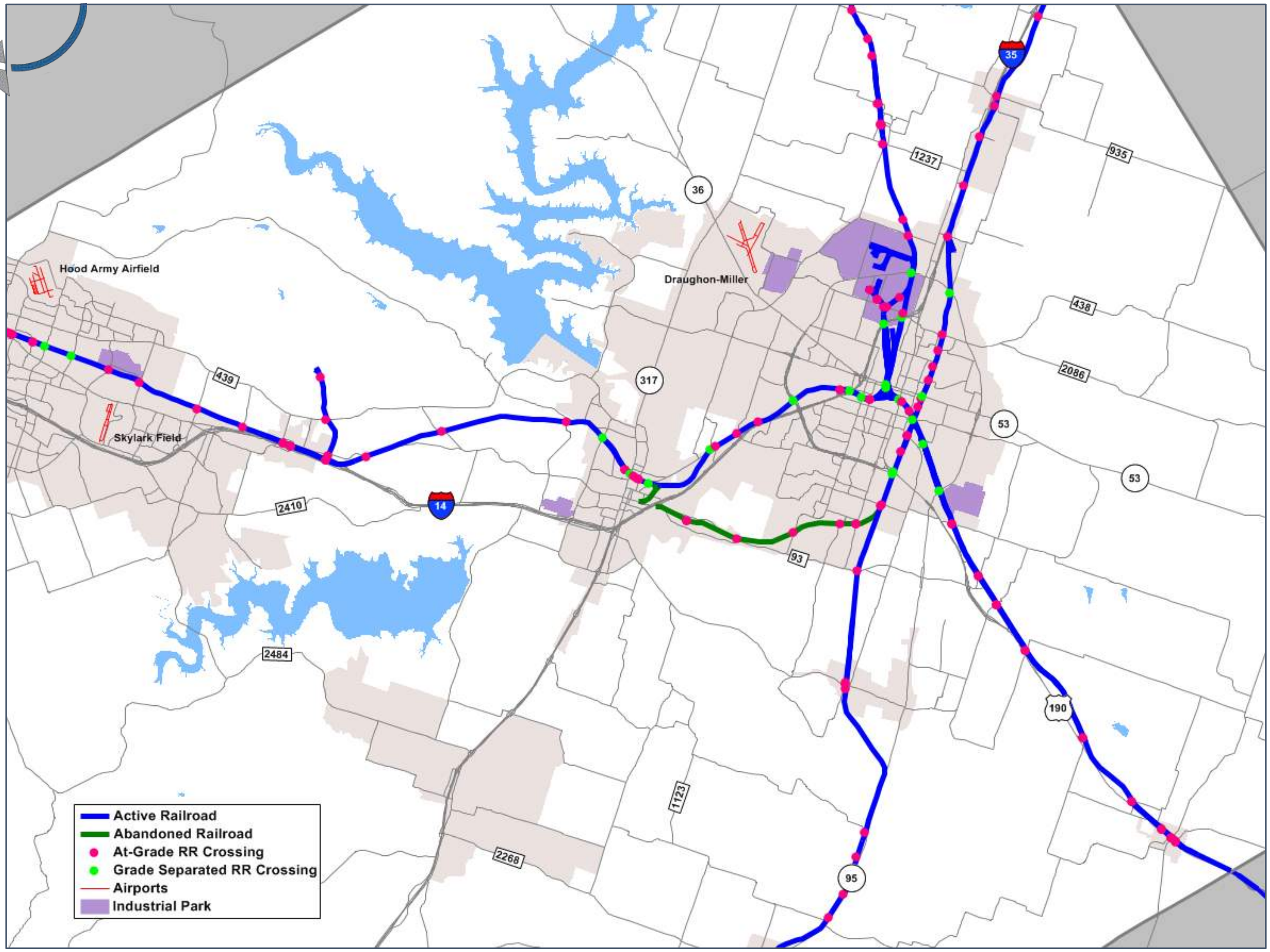


Figure 5-21: 2017 Regional Inventory of the Airport and Rail Systems in the Eastern Area



Summary

Inventories of current conditions by mode are vital to define the extent of the respective infrastructure by Functional Class, along with the notable constraints and barriers faced by each network. This data is vital to both define and to evaluate potential network improvement projects.

Inventories were developed as GIS layers and verified for each of the five modal networks and the airport and railroad systems. The inventories are primarily documented through GIS layers rather than paper maps to support further work for this Plan because of their necessary level of detail, which is cumbersome to show in printed maps. The inventories were primarily based on available data gathered from the KTMPO and other sources and extensive field work was not intended. The verification effort showed that the GIS layers were generally complete and accurate, and only minor editing was required. The only GIS layer which was discovered to need more extensive updates is the sidewalk inventory, which showed several areas where updates to the inventory are needed. Additionally, the inventories, coupled with the definitions of Functional Classes and Facility Types by mode which were developed for this Plan in Chapter 4, show the need for additional data attributes to add precision to the inventories for several of the modal networks.

The **auto network** is the base layer for the Thoroughfare Plan, with Functional Classes for the Plan generally following the defined Functional Classes for the regional travel demand model. Important differences are that the model breaks the Controlled Access Functional Class down to Interstate, Freeway, and Expressway, and includes frontage roads and ramps for detailed coded sections. Additionally, the model Principal Arterial Functional Class is re-named as Major Arterial for the Plan. The auto network was reviewed and updated for all street projects up to the year 2017.

For the **bicycle network**, the Facility Types defined in Chapter 4 can be added to the inventories to distinguish the Conventional Bike Lane Functional Class as either the Inboard or the Curbside Facility Type. The Multi-Use Trail Functional Class, which is shared with the Walk Network, needs additional data to define its Facility Types as Hard Paved or Soft Paved. In addition, the exact and consistent definitions and the distinctions between a Multi-Use Trail and a sidewalk need to be established, and data collected accordingly to supplement the inventories. In general, the width of the facility is the most important distinction, with multi-use trails serving both bicycles and pedestrians requiring a width of at least five feet. Neither the current bicycle path and trails inventory nor the sidewalk inventory include width as an attribute, so adding this level of precision will require additional field work to update the inventories.

The **bus network** includes a Facility Type for ADA Access to define pedestrian access to bus stops. Defining this Facility Type would require extensive field work to supplement the bus stop inventory with this attribute. The bus network includes The HOP's ten fixed routes and three stations where these routes connect with intercity bus and AMTRAK passenger rail.

All Functional Classes in the **truck network** have been adequately defined and inventoried, but there are additional areas where trucks have not been officially prohibited, but where infrastructure or conditions do not support their safe or efficient operation. This shows that the available routing data may not be sufficient in all cases, and very specific local knowledge of truck restrictions, constraints, and barriers can be added as attributes in the truck network inventory.

For the **walk network**, several areas needing an update to the sidewalk inventory were defined in a GIS layer. In addition, the exact distinction between the Multi-Use Trail and the Sidewalk Functional Classes needs to be established, and the inventories updated accordingly. Additional attributes to establish the Conventional, Landscaped, and Urbanized Sidewalk Facility Types would add precision to the inventory.

Finally, Desire Lines and Crosswalks are new Functional Classes for the walk network, and inventories should be established for them.

The updated inventories and attributes are based on the need to support the definition and evaluation of network improvement projects. The full level of precision specified by the new Functional Classes and Facility Types for each modal network may or may not be immediately necessary, based on the network projects that are under consideration in order to build a fully **integrated regional multimodal transportation system**. In general, the updates would require extensive field work to complete. A review of aerial photos could contribute to the inventories, but would not be sufficient to fully describe the networks and their attributes.

Chapter 6: Thoroughfare Plan

CHAPTER HIGHLIGHTS

- Typical Cross Sections by Functional Class
- Funded and Unfunded Projects
- Thoroughfare Plan

Introduction

The concept of Functional Classes for the street network was introduced in Chapter 4, followed by an inventory of the network in Chapter 5. In this Chapter, these two concepts are combined with potential projects for the street network and developed into a future Thoroughfare Plan. This Thoroughfare Plan applies to the street network only, but typical bicycle and pedestrian facilities are shown in the street cross sections to detail the full right-of-way needs. Additional detail for other transportation modes in the Regional Multimodal System are detailed in other Chapters for each mode.

The purpose of this regional Thoroughfare Plan is to define the future street network so that all potential projects may be displayed and reviewed together, and so that the appropriate right-of-way may be identified and planned for. A key component of this planning task is to define the Functional Class for each proposed project, and to define a typical cross-section for each Functional Class.

Typical cross sections are intended to illustrate the maximum right-of-way needed for each street Functional Class. It is recognized that the actual cross section needed for any specific project at a given time depends on several factors, including the physical characteristics of the street, traffic volumes, mix of multimodal traffic, safety considerations, local standards and preferences, and funding. Therefore, the cross sections presented in this plan are meant as guidance for the typical conditions, and should be refined as needed for each specific project.

Typical Cross Sections by Street Functional Classification

General design standards for ***Controlled Access Functional Class*** call for a minimum right-of-way width of 250' for four lanes, with the desirable standard being six lanes and 500'. Design details are determined by TxDOT. Bicycles and pedestrians are prohibited due to the high speeds of these classes of roads, so the design of supporting bicycle and pedestrian infrastructure (including shared use of wide shoulders) is not applicable.

Figure 6-1: Six Lane Controlled Access Facility with Frontage Roads

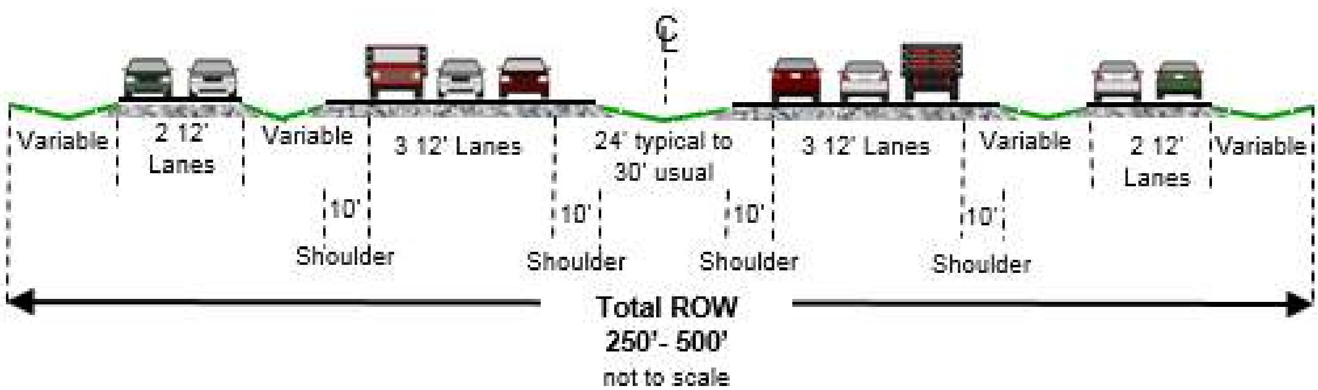
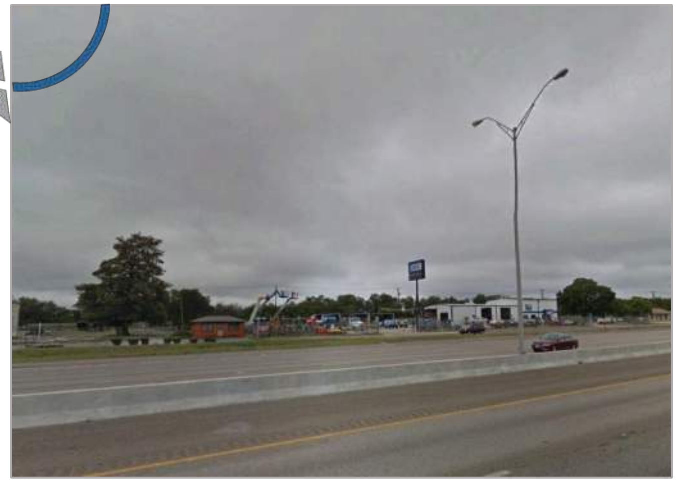


Figure 6-1 shows a typical cross section for a Controlled Access Facility with six lanes. The figure shows a grassy center median with a typical 24' to 30' width, and smaller median areas buffering between the main lanes and the frontage roads. Safety treatments in the medians or road margins such as guardrails and cable barriers are common to prevent vehicle cross-overs, but are not shown in the illustration.

Where a wide grassy median is not desired, a raised concrete median such as a "Jersey barrier" can be installed. **Figure 6-2** shows a Jersey barrier in the median IH-35, with a wide inside shoulder and rumble strip also visible. In this location, the light standards have been installed on the Jersey barrier as a safety measure to protect them from vehicle crashes.

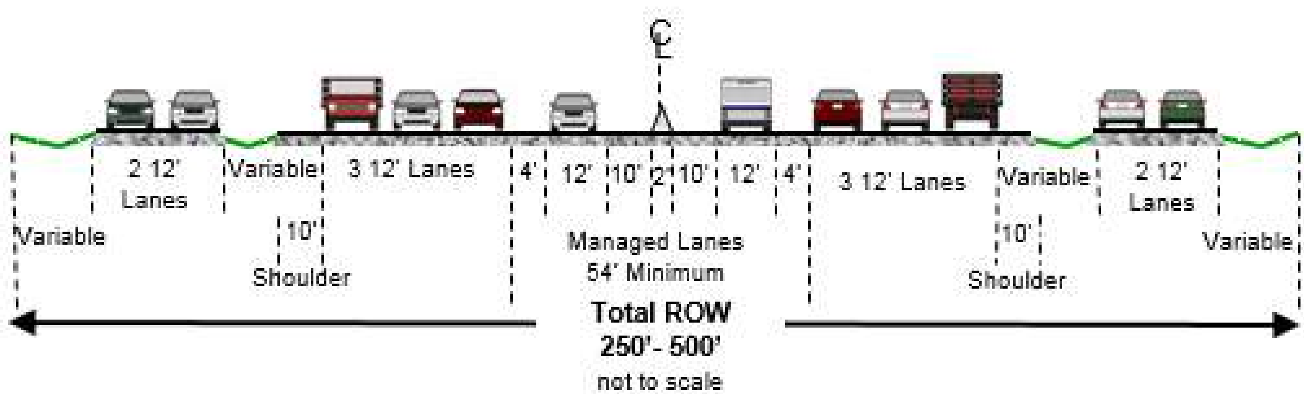
Figure 6-2: Jersey Barrier on IH-35



The use of Jersey barriers on IH 35 at the newly-reconstructed US 190 overpass shows the flexibility that is possible. In that installation, Jersey barriers were placed on either side of the median, about 12' apart, and the middle section was filled and paved. The middle section serves as the base for light sandards and for sign posts. Jersey barriers also serve as the bases for the retaining walls between the main lanes and the frontage roads, allowing landscaping in those medians.

When toll roads or managed lanes are developed, they are typically placed in the inside lanes of Controlled Access facilities. **Figure 6-3** shows a typical cross section for a six lane Controlled Access facility with frontage roads and with managed lanes. In this design, a 10' inside shoulder and a 4' painted median buffer the managed lanes.

Figure 6-3: Six Lane Controlled Access Facility with Frontage Roads and Managed Lanes



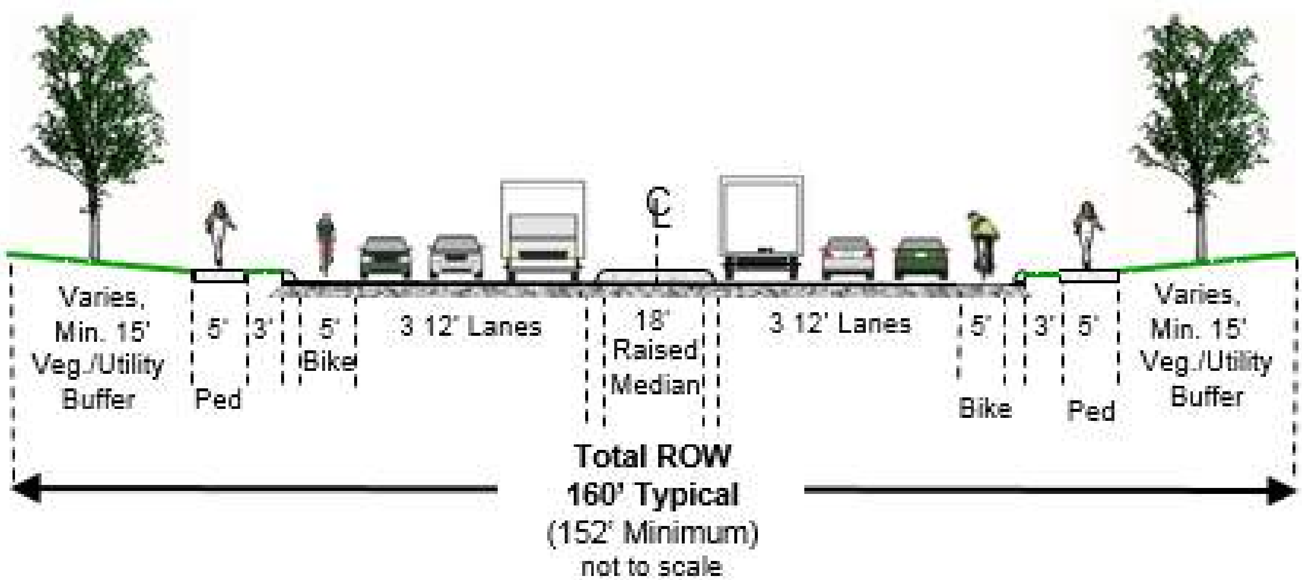
Major Arterial Functional Class general design standards call for a 130' minimum right-of-way for a four lane facility, with 160' desirable for six lanes. A travel lane width of 12' as specified is common for existing Major Arterials in the KTMPO region, but Complete Streets and Vision Zero guidance calls for narrowing travel lanes to 11' to slow traffic to speeds that are more safe for all road users.

For divided Major Arterials, a minimum median width of 18" is desirable for a curb or a raised concrete barrier. For landscaped medians, a minimum width of 15' is recommended. Typical practice in the KTMPO region has been to install wider grassy medians, with widths of 15' typical for older urban streets such as Ave H in Temple, and 20' to 40' typical for new construction streets in suburban areas such as SH 201 in Killeen and S. 5th Street in Temple.

Bicycle and pedestrian facilities are permitted on Major Arterial and lower Functional Classes. Therefore, the cross sections for typical Major Arterials include sample variations in the different classes of bicycle and pedestrian infrastructure as well as differences in the number of lanes, lane widths, medians, and other road attributes.

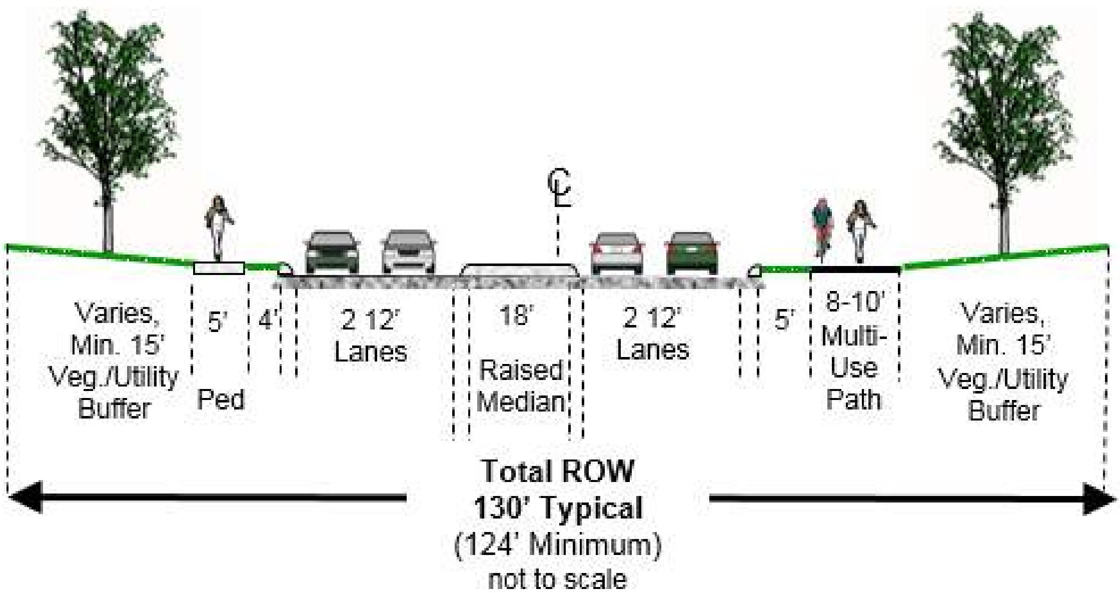
Figure 6-4 shows a typical six lane Major Arterial with bicycle and pedestrian accommodations of separated off-street paths or sidewalks and on-street conventional unbuffered bike lanes. This illustration shows a raised median, which is often paved and defined with curbs; other installations may use a landscaped median.

Figure 6-4: Six Lane Major Arterial



A typical cross section for a Major Arterial with four lanes and bicycle and pedestrian accommodations consisting of separated off-street paths or sidewalks and a separated off-street multi-use path is shown in **Figure 6-5**. In this instance there are no distinct on-street bicycle facilities, but this does not affect the bicycle's status as a vehicle and their right to the road.

Figure 6-5: Four Lane Major Arterial



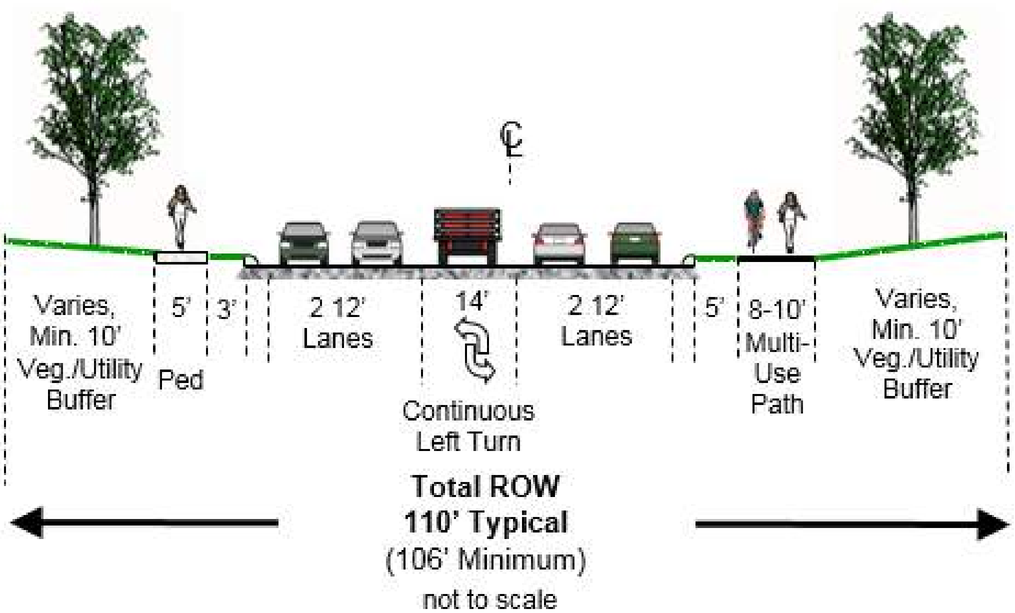
Minor Arterial Functional Class general design standards call for a minimum right-of-way of 80' for three lanes, increasing to 110' for four lanes. The desirable right-of-way is 120', which will accommodate five lanes.

As with Major Arterials, a travel lane width of 12' is common in the KTMPO region. The Complete Streets and Vision Zero guidance calling for travel lanes of 11' to slow traffic to speeds that are more safe for all road users is even more pertinent for Minor Arterials, given their position in the access/mobility continuum that has greater emphasis on access and on multimodal uses.

A continuous center turn lane has been recommended as an appropriate median treatment for Minor Arterials, with a desirable width of 16'. Landscaped buffer areas on the edges of a Minor Arterial are recommended with a 10' width.

Figure 6-6 shows a typical cross section for a four lane Minor Arterial with a continuous center turn lane. Minor Arterials may have greater accommodations for bicycles and pedestrians than Major Arterials, as they typically have lower speeds, lower traffic volumes, and a smaller percentage of trucks in the traffic stream. The figure also shows separated off-street paths or sidewalks and a separated off-street multi-use path. Although bikes may share the roadway with other vehicles, no special infrastructure is represented in this cross section.

Figure 6-6: Four Lane Minor Arterial with a Continuous Center Turn Lane



More extensive bicycle and pedestrian accommodations are shown in the cross section in **Figure 6-7**. Separated off-street paths or sidewalks and on-street conventional unbuffered bike lanes are shown.

Figure 6-7: Four Lane Minor Arterial with Bike Lanes

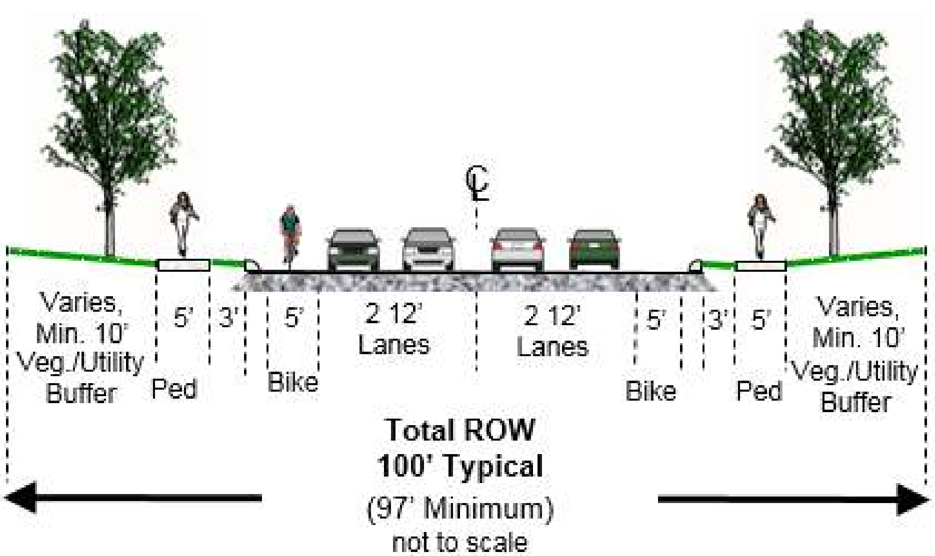
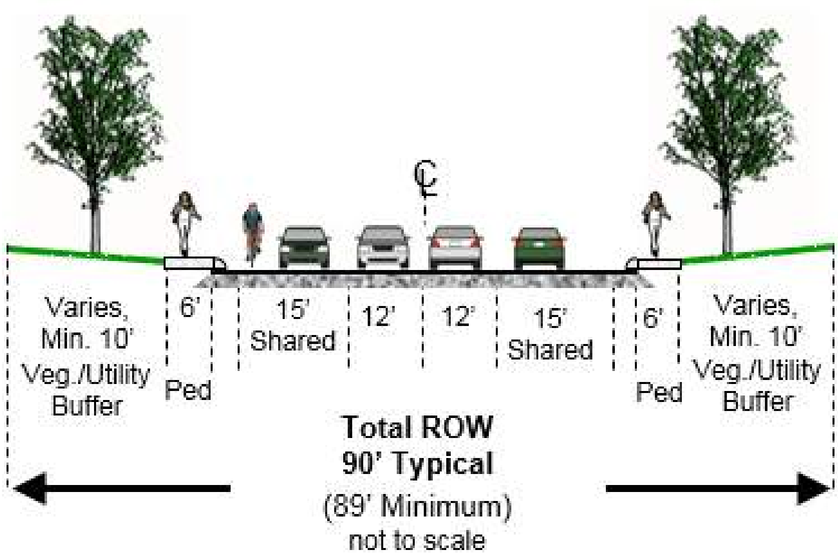


Figure 6-8 shows a typical four-lane Minor Arterial with wide outside lanes, intended to permit autos and bicycles to safely share a lane. The recommended width of the shared lane is 15'. The wider outside lanes should be carefully marked with visual clues to discourage excessive vehicle speeds and preserve street safety for all users. The width of the street can compromise the safety of the pedestrian crossing, but this can be mitigated by the use of median pedestrian refuges and well-marked crosswalks.

Figure 6-8: Four Lane Minor Arterial with Shared Outside Lanes



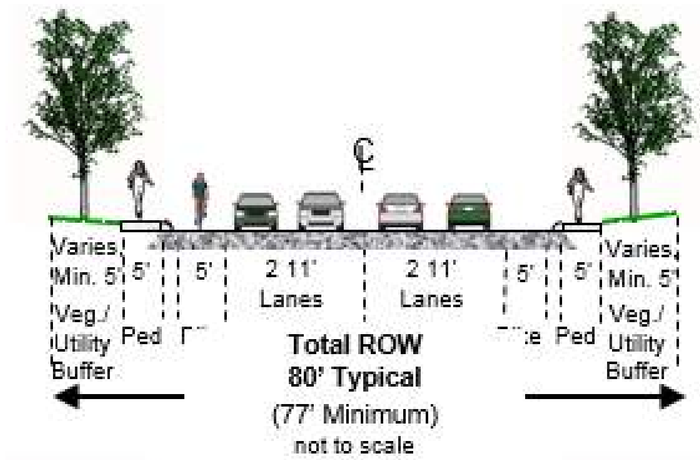
Collector Functional Class is the Functional Class which is most geared to providing access. With mobility as a less critical attribute, narrower lane widths of 11' are recommended, although widths as narrow as 10' are cited in Complete Streets and Vision Zero guidelines. Shared auto and bicycle outside lanes may be as narrow as 14'. Minimum right-of-way of 60' for two lanes and 70' for three lanes are listed in the guidance. For four lanes, a desirable right-of-way is 80'.

Due to the lower speeds and lower volumes of traffic, continuous center turn lanes on Collector streets may be as narrow as 14'. Medians and buffers should have a minimum width of 5'.

More extensive bicycle and pedestrian treatments should be expected on Collector streets.

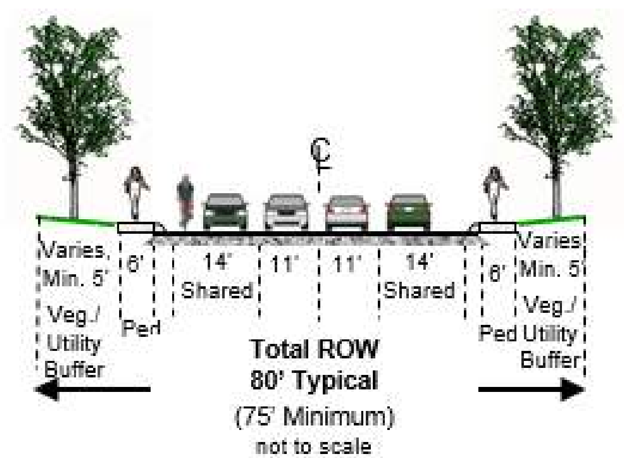
Figure 6-9 through **Figure 6-11** show how different configurations of travel lanes, bike lanes, and parking can fit within an 80' right-of-way. **Figure 6-9** shows a four lane Collector configured with on-street bike lanes and off-street paths or sidewalks.

Figure 6-9: Four Lane Collector with Bike Lanes



In an alternate on-street treatment, **Figure 6-10** does not have discrete bike lanes, but has 11' inside lanes and 14' shared outside lanes. With this configuration, the shared outside lanes would typically be marked with sharrows to emphasize the rights of bicycles to use the lane.

Figure 6-10: Four Lane Collector with Shared Outside Lanes



Also fitting with an 80’ right-of-way, **Figure 6-11** has two 12’ travel lanes and 8’ parking lanes. Pedestrian and bicycle facilities are placed off-street.

Figure 6-11: Two Lane Collector with Parking

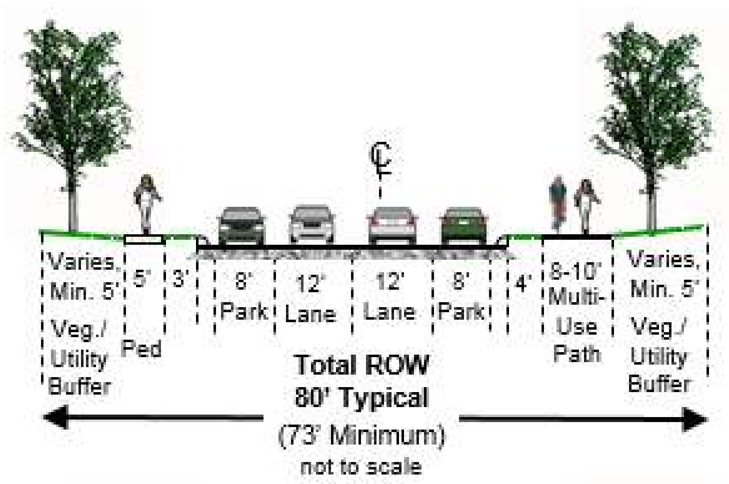
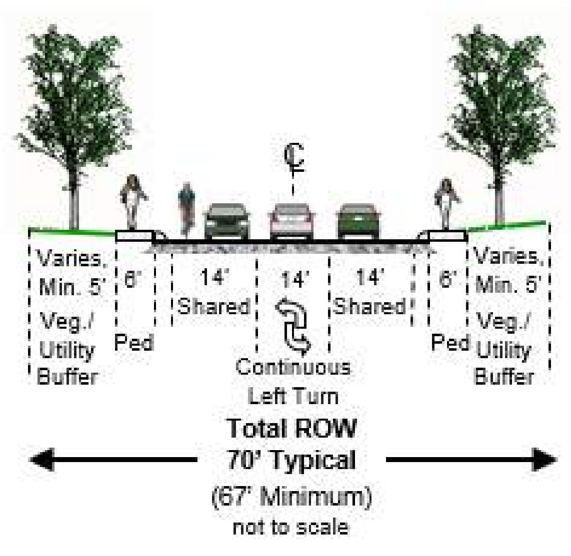


Figure **6-12** illustrates a two lane Collector with shared lanes and a continuous center turn lane. With a width of 14’, the shared lanes recommended for Collectors are narrower than the 15’ shared lanes recommended for Minor Arterials. This difference is consistent with the lower speeds and traffic volumes which are typically found on Collector streets.

Figure 6-12: Two Lane Collector with a Continuous Center Turn Lane and Shared Lanes



Local Functional Class streets have the lowest speeds and volumes of all the Functional Classes. With these attributes, travel lane widths can consistently be narrower, with 10.5' recommended as a minimum. Widths as narrow as 10' are cited in Complete Streets and Vision Zero guidelines.

A right-of-way width of 50' is recommended for Local streets.

Figure 6-13 shows a typical cross section for a two lane local street. In this illustration, shared lanes of 13.5' are provided. Narrower travel lane widths may be implemented to reduce traffic speeds to levels that are safe for users of all ages and abilities.

Figure 6-13: Two Lane Local Street with Shared Lanes

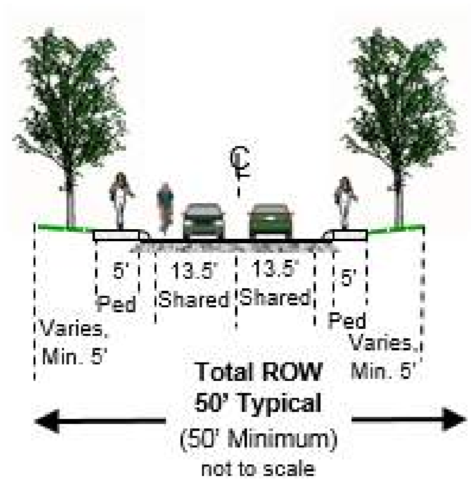


Table 6-1 summarizes the recommendations for right-of-way (ROW) considerations by street Functional Class. Minimum ROW is based on 4 lanes for Major Arterials, 3 lanes (two travel lanes and a center turn lane) for Minor Arterials, and 2 lanes for Collectors and Local streets.

Table 6-1: Summary of ROW Recommendations by Functional Class

Functional Class	Minimum ROW	Preferred ROW	Lane Width	Pavement Width	Median	Outside Buffer	Notes
Controlled Access	250'	Varies, up to 500'	Minimum 12'	Varies	Minimum 36' rural Minimum 10' urban	Varies	Inside shoulder minimum 4' Outside shoulder minimum 10' Vertical clearance minimum 14'
Major Arterial	130'	160'	Preferred 12'	82' to 106'	Preferred 18'	15'	ROW may be greater with parking, bicycle and pedestrian facilities, bus stops, and intersection treatments
Minor Arterial	80'	120'	Preferred 12'	47' to 75'	Center Turn Lane 14'	10'	
Collector	60'	80'	Minimum 11'	31' to 57'	Center Turn Lane 14'	5'	
Local	44'	50'	Minimum 10.5'	23' to 29'	None	5'	

Potential Thoroughfare Projects

The thoroughfare network is developed based on a regional network updated to 2017 conditions, with the addition of potential projects from KTMPO and its six member jurisdictions which have their own Thoroughfare Plans. The individual Thoroughfare Plans were introduced in Chapter 2: Planning Context, and include:

- Belton Thoroughfare Plan, embedded within the 2017 Comprehensive Plan.
- Copperas Cove Thoroughfare Plan, embedded within the 2007 Comprehensive Plan.
- Harker Heights Thoroughfare Plan.
- Fort Hood Post-Wide Traffic Engineering and Safety Study
- Killeen Thoroughfare Plan, developed in 2015.
- Temple Thoroughfare Plan, embedded within the 2008 Comprehensive Plan.

The previous KTMPO Regional Thoroughfare Plan, which is embedded in the Mobility 2040 Metropolitan Transportation Plan (MTP), also provided potential projects, both as compilations of projects from member jurisdictions and for coverage of other urban and rural areas in the region. A listing of potential projects which are identified by the MTP as funded is provided in **Table 6-2**. **Table 6-3** lists the remaining projects in the region for which funding has not been identified. Additional projects which were sourced from the individual Thoroughfare Plans from KTMPO member jurisdictions are listed in **Table 6-4**.

Table 6-2: Potential Thoroughfare Projects Identified as Funded in the 2040 MTP

Project ID	Project	Project Description	Limits From	Limits To	City	Status	Year
W30-17	FM 93	Widen from 2 to 4 lanes	SH 317	Wheat Rd	Belton	Long Range Funded	2030
B40-11	Lake-to-Lake Road (FM 2271)	Construct 4 lane divided roadway	FM 439	US 190	Belton	Long Range Funded	2030
W40-04a	Loop 121 Phase 1	Widen from 2 to 4 lanes with bike/ped improvements	FM 439 (Lake Rd)	IH 35	Belton	August 2017, KTMPO selected project	2021
W40-04b	Loop 121 Phase 2	Widen from 2 to 4 lanes with bike/ped improvements	IH 35	FM 436	Belton	Funded for project development	2040
W40-05	US 190	Widen from 4 to 6 lanes with ramp realignments	FM 2410 in W Belton	IH 35	Belton	Short Range Funded Prop 1	2040
C30-03b	Business US 190 Phase I	Construct a median and repurpose lanes	FM 1113 (Avenue D)	Constitution Dr	Copperas Cove	Short Range Funded	2020
G03-MT	FM 116	Construct a left turn lane	Cactus Lane	House Creek Bridge	Copperas Cove	Grouped Projects	2018
W35-01	US 190 Bypass	Phase 2 - Construct final 2 lanes of ultimate 4 lane divided highway	East of Copperas Cove	.5 mi W of Lampasas County Line	Copperas Cove	Short Range Funded	2035
H15-02b	FM 2410	Widen from 2 to 4 lanes with sidewalks, median and turn lanes	Harker Heights City Limit	US 190	Harker Heights	Short Range Funded Prop 1	2018
H40-02	Heights Drive Roundabout	Construct traffic circle	Commercial Dr.	Heights Dr.	Harker Heights	Funded MPO CAT 7	2018
W40-02	US 190	Widen from 4 to 6 lanes with bridge improvements	1 mi W of FM 2410	FM 3423 (Indian Trail)	Harker Heights	Short Range Funded Prop 1	2018
G03-MT	SH 95	Widen and add passing lanes	FM 436	Holland City Limits	Holland	Grouped Projects	2018
K30-02	Rosewood Dr Extension	New construction 4 lane road	Riverstone Dr	Chaparral Rd	Killeen	Funded MPO CAT 7	2018
K35-03	W. Trimmier Rd	Widen and add continuous left turn lanes	Jasper Dr	Elms Rd	Killeen	Funded MPO CAT 7	2017
W40-06	US 190	Widen from 4 to 6 lanes with ramp realignments	FM 3423 (Indian Trail)	FM 2410 in W Belton	Nolanville	August 2017, KTMPO selected project	2019
H30-05	Warriors Path	New construction 2 lane road	Knights Way/FM 2410	Old Nolanville Rd	Nolanville	Long Range Funded	2030
S40-04b	Main St Sidewalks Phase 2	Widen and add bike paths, with drainage improvements	College Hill Dr	Salado Plaza Dr	Salado	Funded for project development	2040
T40-07	Outer Loop 3b	Widen from 2 to 4 lanes with hike & bike trail	South of FM 2305	S of Jupiter Drive	Temple	Long Range Funded	2040
T35-24	Realign Prairie View Road	Realign FM 2483 and Prairie View Road	West of SH317	N. Pea Ridge	Temple	Funded MPO CAT 7	2018
G03-MT	SH 317	Widen and add shoulders and passing lanes	McLennan Co Line	SH 36	Temple	Grouped Projects	2018
W40-01	SH 317	Widen from 2 to 4 lanes with a raised median	FM 2305	FM 439	Temple	Short Range Funded Prop 1	2018
G01-PE	Spur 290 / S. 1st St.	Roadway operational and landscape improvements	Avenue O	0.2 mi S of Avenue U	Temple	Grouped Projects	2017

Table 6-3: Potential Thoroughfare Projects Identified as Unfunded in the 2040 MTP

Project ID	Project	Project Description	Limits From	Limits To	City	Status
B30-03	Belton Outer Loop East	Construct 2 lane road with shoulder and 10' hike/bike trail	IH 35 at Shanklin	IH 35 at Shanklin	Belton	Unfunded
B40-07	Connell Street	Widen from 2 to 4 lanes with center turn lane and 5' wide sidewalks	US 190	Loop 121	Belton	Unfunded
B40-10	FM 1670	Widen from 2 to 4 lanes with a 10' hike and bike trail	US 190	Three Creeks Boulevard	Belton	Unfunded
B30-01	George Wilson Extension	Construct 2 lane road with shoulder	FM 93 at George Wilson Road	FM 439	Belton	Unfunded
B40-01	Huey Drive	Construct 2 lane road with center turn lane	Washington Drive	IH 35 Frontage Rd	Belton	Unfunded
T15-06k	IH 35	Widen to 8 lanes	South Loop 363	US 190	Belton	Unfunded
B30-02	Shanklin Road West, Outer Loop	Construct 4 lane road with 10' hike/bike trail	IH 35	Existing roundabout	Belton	Unfunded
B40-02	Southwest Parkway	Construct 2 lane road with center turn lane	Loop 121	W Avenue O	Belton	Unfunded
B40-08	Sparta Rd	Construct protected turn lane with 10' ft wide hike/bike trail	Loop 121	Dunn's Canyon Rd	Belton	Unfunded
B40-09	West Avenue D	Construct 2 lane roadwith sidewalks and bike lanes	Loop 121	Wheat Rd	Belton	Unfunded
C25-03	Big Divide Loop	Widen from 2 to 4 lanes with raised median	US 190	FM 1113	Copperas Cove	Unfunded
C30-03a	Business US 190 Phase II	Road diet with bike/ped accommodations	FM 116 S @ Business US 190	Avenue D	Copperas Cove	Unfunded
C25-02	FM 1113	Widen from 2 to 4 lanes with sidewalks	Signal Light at FM 116/Ave B	Summers Road	Copperas Cove	Unfunded
C35-02a	FM 116 Railroad Underpass	Create a 2 lane railroad underpass with 10' sidewalks	S. Main	Ave. B	Copperas Cove	Unfunded
C40-01	FM 116 South	Widen and upgrade to Farm to Market status	Copperas Cove City Limits	SH 201	Copperas Cove	Unfunded
C25-04	Northside Loop	Widen from 2 to 4 lanes with raised median	FM 1113	FM 116	Copperas Cove	Unfunded
H30-03	FM 3219	Widen from 2 lane to 4 lanes with 6' sidewalks	Veterans Memorial Blvd	FM 439	Harker Heights	Unfunded
H15-01	FM 3423/Indian Trail	New construction road with pedestrian enhancements	Veterans Memorial Blvd	US 190	Harker Heights	Unfunded
H30-07	FM 3481	Widen from 2 to 4 lanes	Prospector Dr	FM 2484	Harker Heights	Unfunded
W35-04	FM 439	Widen from 4 to 6 lanes	Roy Reynolds Dr	FM 3219	Harker Heights	Unfunded

Table 6-3: Potential Thoroughfare Projects Identified as Unfunded in the 2040 MTP (continued)

Project ID	Project	Project Description	Limits From	Limits To	City	Status
K30-13	Chaparral Rd	Widen from 2 to 4 lanes with center turn lane	SH 195	FM 3481	Killeen	Unfunded
K40-26	Cunningham Rd	Widen from 2 to 4 lanes with hike/bike trail	US 190	FM 3470	Killeen	Unfunded
K40-16	East Trimmier Road Improvements	Widen from 2 to 4 lanes with center turn lane	Stagecoach Rd	Chaparral Rd	Killeen	Unfunded
K40-24	Featherline Drive	Widen from 2 to 4 lanes with center turn lane and roundabouts	Stagecoach Rd	Chaparral Rd	Killeen	Unfunded
K25-05	Florence Rd	Widen from 2 to 5 lanes	Elms Road	Jasper Drive	Killeen	Unfunded
K40-03	FM 3470 (Stan Schlueter Loop)	Construct 4 lane FM Road with countinous turn lane and shoulders	SH 201	US 190 Bypass	Killeen	Unfunded
W35-03	SH 195	Reconstruct to 4 lane freeway with frontage roads	FM 3470	Chaparral Rd	Killeen	Unfunded
K40-17	Trimmier Road Improvements	Widen from 2 to 4 lanes with center turn lane	Stagecoach Rd	Chaparral Rd	Killeen	Unfunded
K40-11	WS Young	Add turn lane and operational improvements	Mall Dr	AJ Hall Blvd	Killeen	Unfunded
H40-04	E FM 2410	Widen from 2 to 4 lanes with access management	.16 mi west of Indian Trail	Simmons Rd	Nolanville	Unfunded
N40-03	Old Nolanville Road	Widen bridge and construct multi-use trail	Warriors Path	US 190	Nolanville	Unfunded
N40-07	Warrior's Path Extension Phase 1	Construct 2 lane road with shoulder	Old Nolanville Rd	US 190	Nolanville	Unfunded
N40-08	Warrior's Path Extension Phase 2	Construct 2 lane road with shoulder	US 190	FM 439	Nolanville	Unfunded
W35-12	US 190	Widen to 4 lane divided rural highway	2 mi south of FM 436	Milam County Line	Rogers	Unfunded
W30-13	FM 2484	Widen from 2 to 4 lanes	FM 1670	IH 35	Salado	Unfunded
S40-03	Salado West Village Road	Widen road, add turn lanes and bike/ped facilities	Thomas Arnold Rd	IH 35	Salado	Unfunded
T35-36a	1st Street	Widen from undivided to divided road with hike/bike trails	SE Loop 363	Avenue M	Temple	Unfunded
W35-08	FM 93	Widen from 2 to 4 lanes with railroad grade separation	FM 1741 (S 31st)	SH 95	Temple	Unfunded
W35-09	FM 93	Widen from 2 to 4 lanes with a raised median	SH 95	SH 36	Temple	Unfunded
T40-04	Hogan Road	Widen from 2 to 3 lanes with sidewalks and hike/bike trail	SH 317	S Pea Ridge Rd	Temple	Unfunded
T15-02	Kegley Road (Phase 2)	Widen road, add turn lanes and bike/ped facilities	856 ft S of FM 2305	450' S of Wildflower Lane	Temple	Unfunded
W30-23	Loop 363	Reconstruct to 4 lane freeway with continuous frontage roads	SP 290	SH 95	Temple	Unfunded
W35-07	NW Loop 363	Reconstruct to 4 lane freeway	Lucious McCelvey Dr	Industrial Blvd	Temple	Unfunded
T40-10	Outer Loop	Extend divided road, with hike/bike trail	Floodplain	IH 35	Temple	Unfunded
T25-09	Outer Loop / Research Parkway	Widen from 2 to 4 lanes with hike/bike trail	IH 35	Central Pointe Pkwy	Temple	Unfunded
T40-09	Outer Loop 4	Widen from 2 to 4 lanes with hike/bike trail	S of Jupiter	Floodplain	Temple	Unfunded
W25-02	SH 36	Widen from 2 to 4 lanes	SH 317	Lake Belton Bridge	Temple	Unfunded
T25-06	SL 363	Construct at grade Interchange at US 190 and Spur 290	SP 290	SP 290	Temple	Unfunded
T40-05	Westfield Blvd (Phase 2)	New construction 4 lane road with sidewalk and hike/bike trail	Prairie View Rd	Airport Rd/SH 36	Temple	Unfunded
D40-01	North Waco Rd. (Old 81)	Widen from 2 to 4 lanes with bridge improvements.	West Main St	West Big Elm	Troy	Unfunded
D40-03	Old 81 South	Widen from 2 to 4 lanes with bike lanes	FM 1237	Loves Overpass	Troy	Unfunded
K40-06	FM 2484	Widen from 2 to 4 lanes divided	SH 195	IH 35	Youngsport	Unfunded

Table 6-4: Potential Projects Identified in Local Thoroughfare Plans

Project ID	Project	Project Description	Limits From	Limits To	City	Status
NewB 16	190 Ln	Extend & connect existing roads	190 Ln	Mesquite Ln extension	Belton	Unfunded
NewB 11	22nd Ave	Construct new road	Hilltop St	S Pea Ridge Rd	Belton	Unfunded
NewB 18	2nd St	Construct new road	Mesquite Ln extension	Loop 121	Belton	Unfunded
NewB 19	2nd St	Construct new road	Shanklin Rd	0.6 mi S	Belton	Unfunded
NewB 35	Armstrong Rd	Extend, realign, & connect existing roads	Armstrong Rd	FM 1123	Belton	Unfunded
NewB 26	Belton Outer Loop East	Construct new road	IH 35 S	IH 35 N	Belton	Unfunded
NewB 24	Capital Way	Construct new road	Elm Grove Spur	Mesquite Ln extension	Belton	Unfunded
NewB 2	DIGBY DR	Extend & connect existing roads	S Wheat Rd	George Wilson Rd	Belton	Unfunded
NewB 33	Dillard Rd	Construct new road	Amity School Rd	Smith Dairy Rd	Belton	Unfunded
NewB 34	E Amity Rd	Construct new road	Heritabe Ln	Armstrong Rd	Belton	Unfunded
NewB 23	Elm Grove Rd	Realign existing road	Elm Grove Spur	Shady Grove Ln	Belton	Unfunded
NewB 28	Elm Grove Rd	Construct new road	FM 436	IH 35	Belton	Unfunded
NewB 36	Elm Grove Rd	Extend existing road	Elmer King Rd	E Amity Rd	Belton	Unfunded
NewB 37	Elmer King Rd	Construct new road	Elm Grove Rd	Armstrong Rd realignment	Belton	Unfunded
NewB 14	Kegley Rd	Upgrade existing road	Tem Bel Ln	IH 35	Belton	Unfunded
NewB 27	Laila Ln	Construct new road	Loop 121	IH 35	Belton	Unfunded
NewB 17	Mesquite Ln	Extend & connect existing roads	Mesquite Ln	190 Ln extension	Belton	Unfunded
NewB 25	Mesquite Ln	Extend existing road	IH 35	Elm Grove Rd	Belton	Unfunded
NewB 20	New road	Construct new road	2nd St extension	IH 35	Belton	Unfunded
NewB 21	New road	Construct new road	IH 35	Elm Grove Rd	Belton	Unfunded
NewB 29	New road	Construct new road	IH 35 at E Ave K	FM 93	Belton	Unfunded
NewB 3	New road	Construct new road	N Wheat Rd	FM 93	Belton	Unfunded
NewB 31	New road	Construct new road	FM 93	S 5th St	Belton	Unfunded
NewB 4	New road	Construct new road	West Avenue D	Powell Dr	Belton	Unfunded
NewB 6	New road	Construct new road	George Wilson Rd extension	Spring Canyon Rd	Belton	Unfunded
NewB 8	New road	Construct new road	Sparta Rd	N Wheat Rd extension	Belton	Unfunded
NewB 12	Park Ave	Extend existing road	Park Ave	Guthrie Dr	Belton	Unfunded
NewB 13	Poison Oak Rd	Construct new road	N Main St	Kegley Rd	Belton	Unfunded
NewB 15	Rocking M Ln	Construct new road	Rocking M Ln	Outer Loop	Belton	Unfunded
NewB 22	Sand and Gravel Ln	Extend existing road	Sand and Gravel Ln	Elm Grove Rd	Belton	Unfunded
NewB 1	Simmons Rd	Extend existing road	US 190	FM 93	Belton	Unfunded
NewB 30	Spanish Oak Rd	Extend existing road	Stratford Dr	FM 93	Belton	Unfunded
NewB 5	Spring Canyon Rd	Construct new road	US 190	FM 439	Belton	Unfunded
NewB 32	Tahuaya Rd	Construct new road	Smith Dairy Ln	FM 1670	Belton	Unfunded
NewB 10	W 9th Ave	Construct new road	N Main St	N Beal St	Belton	Unfunded
NewB 9	W 9th Ave	Construct new road	University Dr	Loop 121	Belton	Unfunded
NewB 38	West Village Rd	Construct new road	Williams Rd	FM 1670	Belton	Unfunded
NewB 39	Williams Rd	Realign existing road	W of West Village Rd	IH 35	Belton	Unfunded
NewB 40	Williams Rd	Construct new road	Williams Rd	0.4 mi S	Belton	Unfunded
NewB 7	Yturria Rd	Construct new road	Spring Canyon Rd	Dunns Canyon Rd	Belton	Unfunded

Table 6-4: Potential Projects Identified in Local Thoroughfare Plans continued)

Project ID	Project	Project Description	Limits From	Limits To	City	Status
NewCC 21	Arista Rueda Rd	Extend existing road	FM 2808	Herradura Calzada Rd	Copperas Cove	Unfunded
NewCC 4	Ashley Rd	Upgrade and extend existing road	FM 116	Big Divide Rd	Copperas Cove	Unfunded
NewCC 11	Big Divide Rd	Extend existing road	Grimes Crossing Rd	Outer Loop	Copperas Cove	Unfunded
NewCC 16	Big Divide Rd	Extend existing road	US 190	FM 2808	Copperas Cove	Unfunded
NewCC 13	Courtney Ln	Extend & connect existing roads	W Ave B	Oak Hill Dr	Copperas Cove	Unfunded
NewCC 5	Coy Dr	Construct new road	Ashley Rd	Lutheran Church Rd	Copperas Cove	Unfunded
NewCC 14	CR 24	Construct new road	CR 3340	Big Divide Rd	Copperas Cove	Unfunded
NewCC 8	CR 24	Re-align intersection	CR 3300	N of CR 3300	Copperas Cove	Unfunded
NewCC 7	CR 3300	Re-align intersection	W of CR 24	E of CR 24	Copperas Cove	Unfunded
NewCC 9	CR 3340	Extend & connect existing roads	CR 314	FM 1113	Copperas Cove	Unfunded
NewCC 18	Edward Dr	Extend & connect existing roads	Edward Dr	Big Divide Rd	Copperas Cove	Unfunded
NewCC 22	FM 2808	Extend existing road	FM 2657	US 190	Copperas Cove	Unfunded
NewCC 23	FM 2808	Extend existing road	Risen Star Ln	US 190	Copperas Cove	Unfunded
NewCC 19	FM 3046	Extend existing road	FM 3046	US 190	Copperas Cove	Unfunded
NewCC 17	FM 3046/Pony Express Ln	Extend existing road	FM 3046	US 190	Copperas Cove	Unfunded
NewCC 1	Glass Rd	Extend existing road	Kubitz Rd	FM 116	Copperas Cove	Unfunded
NewCC 2	New Collector	Construct new road	Lutheran Church Rd	Glass Rd	Copperas Cove	Unfunded
NewCC 27	New Collector	Construct new road	FM 3046	FM 2808	Copperas Cove	Unfunded
NewCC 24	Northern Dancer Dr	Extend existing road	Joe Morse Dr	FM 2808	Copperas Cove	Unfunded
NewCC 25	Northern Dancer Dr	Extend existing road	Joe Morse Dr	FM 2808	Copperas Cove	Unfunded
NewCC 26	Ogletree Pass	Extend existing road	Ogletree Pass	US 190	Copperas Cove	Unfunded
NewCC 3	Outer Loop	Construct new road	Lutheran Church Rd	FM 1113	Copperas Cove	Unfunded
NewCC 6	Outer Loop	Construct new road	US 190	FM 1113	Copperas Cove	Unfunded
NewCC 20	Sikes Dr	Extend existing road	FM 2808	FM 3046	Copperas Cove	Unfunded
NewCC 12	Skyline Dr	Extend existing road	Skyline Dr	Bradford Dr	Copperas Cove	Unfunded
NewCC 15	Winchester Ln	Extend existing road	Winchester Ln	Big Divide Rd	Copperas Cove	Unfunded
NewHH 4	Deer Trail	Extend existing road	Cattail Cir	Vineyard Trl	Harker Heights	Unfunded
NewHH 6	Douglas Fir Dr	Extend & connect existing road	Hazelnut Dr	Mesa Oaks Cir	Harker Heights	Unfunded
NewHH 7	Hazelnut Dr	Construct new road	Douglas Fir Dr N	Douglas Fir Dr S	Harker Heights	Unfunded
NewHH 2	New road	Extend existing road	Deer Trail extension	Rosewood Dr	Harker Heights	Unfunded
NewHH 8	New road	Construct new road	Hazelnut Dr	Comanche Gap Rd	Harker Heights	Unfunded
NewHH 3	Prospector Trl	Extend existing road	Cedar Knob Rd	Stillhouse Lake Rd	Harker Heights	Unfunded
NewHH 1	Scarlet Ln	Extend existing road	Brooke Ln	Rosewood Dr	Harker Heights	Unfunded
NewHH 9	Shoreline Dr	Extend & connect existing road	Lakeview Dr	Rummel Rd	Harker Heights	Unfunded
NewHH 5	Waco Trce	Construct new road	Osage Trce	Warriors Path	Harker Heights	Unfunded

Table 6-4: Potential Projects Identified in Local Thoroughfare Plans (continued)

Project ID	Project	Project Description	Limits From	Limits To	City	Status
NewK 30	Atkinson Ave	Extend existing road	N 52nd St	N Twin Creek Dr	Killeen	Unfunded
NewK 7	Atlas Ave	Extend existing road	Fort Hood St	W of Trimmier Rd	Killeen	Unfunded
NewK 27	Barrington Trl	Extend existing road	Jim Ave	Elms Rd	Killeen	Unfunded
NewK 28	Black Orchid Dr	Extend existing road	Autumn Valley Dr	Watercrest Rd	Killeen	Unfunded
NewK 9	Bridgewood Dr	Construct new road	Tumut Ln	SH 201	Killeen	Unfunded
NewK 2	Chaparral Rd	Extend existing road	Chaparral Rd	Maxdale Rd	Killeen	Unfunded
NewK 1	FM 116 South	Extend existing road	SH 201	Maxdale Rd	Killeen	Unfunded
NewK 11	Founders Trail	Extend existing road	John Helen Dr	SH 201	Killeen	Unfunded
NewK 14	Love Rd	Extend and connect existing roads	Onion Rd	Riley Dr	Killeen	Unfunded
NewK 6	Mohawk Dr	Extend existing road	E of Clear Creek Rd	Fort Hood St	Killeen	Unfunded
NewK 29	N 60th St	Extend existing road	Lake Rd	E Rancier Ave	Killeen	Unfunded
NewK 26	New Bacon Ranch Rd	Extend existing road	New Bacon Ranch Rd	Cunningham Rd extension	Killeen	Unfunded
NewK 4	New FM	Construct new road	SH 195	FM 2843	Killeen	Unfunded
NewK 10	New road	Construct new road	Bunny Trl	Founders Trl extension	Killeen	Unfunded
NewK 12	New road	Construct new road	Atlas Ave extension	Stagecoach Dr	Killeen	Unfunded
NewK 16	New Road	Construct new road	SH 195	Featherline Rd	Killeen	Unfunded
NewK 17	New Road	Extend existing road	SH 195	Onion Rd Extension	Killeen	Unfunded
NewK 18	New Road	Construct new road	Onion Rd Extension	Platinum Dr Extension	Killeen	Unfunded
NewK 21	New Road	Construct new road	Stagecoach Rd	New Road	Killeen	Unfunded
NewK 22	New Road	Construct new road	New Road	New Road	Killeen	Unfunded
NewK 3	New Road	Construct new road	Oakalla Rd	SH 195	Killeen	Unfunded
NewK 31	New road	Construct new road	Roy J Smith Dr extension	FM 439	Killeen	Unfunded
NewK 8	New road	Construct new road	Clear Creek Rd	Bridgewood Dr extension	Killeen	Unfunded
NewK 13	Nichols Dr	Construct new road	Nichols Dr	Stan Schleuter Loop	Killeen	Unfunded
NewK 23	Onion Rd	Extend existing road	Stagecoach Rd	Chaparral Rd	Killeen	Unfunded
NewK 24	Platinum Dr	Extend existing road	Platinum Dr	Chaparral Rd	Killeen	Unfunded
NewK 32	Roy J Smith Dr	Extend existing road	N Roy Reynolds Dr	0.6 mi east	Killeen	Unfunded
NewK 5	Trimmier Rd	Extend existing road	Chaparral Rd	New FM	Killeen	Unfunded

Table 6-4: Potential Projects Identified in Local Thoroughfare Plans (continued)

Project ID	Project	Project Description	Limits From	Limits To	City	Status
NewT 22	1st Street	Extend & realign existing road	SE Loop 363	S 5th St	Temple	Unfunded
NewT 16	Apple Cider Rd	Construct new road	Middle Rd	SH 53	Temple	Unfunded
NewT 33	Asa Rd	Construct new road	Cedar Creek Rd	Willow Grove Rd extension	Temple	Unfunded
NewT 15	Berger Rd	Upgrade existing road	Elm Rd	FM 438	Temple	Unfunded
NewT 21	Blackland Rd	Extend & realign existing road	Little River Rd	Barnhardt Rd	Temple	Unfunded
NewT 12	Bottoms East Rd	Extend and connect existing roads	IH 35	Lower Troy Rd	Temple	Unfunded
NewT 13	Bottoms East Rd	Extend and connect existing roads	Bottoms Rd	Arthur Cemetery Rd	Temple	Unfunded
NewT 14	Bottoms Rd	Extend and connect existing roads	Bottoms East Rd	FM 438	Temple	Unfunded
NewT 40	Brewster Rd	Extend existing road	Luther Curtis Rd	Shine Branch Rd	Temple	Unfunded
NewT 32	Cedar Creek Rd	Upgrade existing road	SH 317	Asa Rd	Temple	Unfunded
NewT 9	Enterprise Rd	Extend existing road	NW HK Dodgen Loop	Eberhardt Rd	Temple	Unfunded
NewT 28	FM 2483	Extend & realign existing road	Westfield Blvd	Old Howard Rd	Temple	Unfunded
NewT 11	Gun Club Rd	Construct new road	Cottonwood Creek Rd	Berger Rd	Temple	Unfunded
NewT 7	Hopi Trl	Extend existing road	Keller Rd	IH 35	Temple	Unfunded
NewT 18	Lorraine Ave	Construct new road	SE HK Dodgen Loop	Outer Loop	Temple	Unfunded
NewT 2	Lower Troy Rd	Extend existing road	Zenith Ave	E Adams Ave	Temple	Unfunded
NewT 41	Luther Curtis Rd	Extend & connect existing roads	FM 2409	Community Center Ln	Temple	Unfunded
NewT 42	Luther Curtis Rd	Extend & connect existing roads	Willow Grove Rd	Guyton Rd	Temple	Unfunded
NewT 43	Luther Curtis Rd	Extend & connect existing roads	W of Vaughn Rd	Vaughn Rd	Temple	Unfunded
NewT 44	Luther Curtis Rd	Extend & connect existing roads	Franklin Rd	Pendleton Troy Loop	Temple	Unfunded
NewT 34	Mouser Rd	Upgrade existing road	Willow Grove Rd extension	Moores Mill Rd	Temple	Unfunded
NewT 25	N Pea Ridge Rd	Extend & connect existing roads	Prairie View Rd	W Adams Ave	Temple	Unfunded
NewT 30	N Pea Ridge Rd	Construct new road	Airport Rd	FM 2483	Temple	Unfunded
NewT 27	New road	Construct new road	SH 317	Old Howard Rd	Temple	Unfunded
NewT 29	New road	Construct new road	SH 317	Westfield Blvd	Temple	Unfunded
NewT 35	New road	Construct new road	Moores Mill Rd	McLane Pkwy	Temple	Unfunded
NewT 46	New road	Construct new road	FM 2483	W Adams Ave	Temple	Unfunded
NewT 10	Outer Loop	Construct new road	IH 35	SH 53	Temple	Unfunded
NewT 17	Outer Loop	Construct new road	SH 53	FM 93	Temple	Unfunded
NewT 3	Private Dr	Construct new road	Young Ave	HK Dodgen Loop	Temple	Unfunded
NewT 20	Red Barn Ln	Extend & connect existing roads	S of SH 53	N of FM 3117	Temple	Unfunded
NewT 5	S 17th St	Construct new road	W Ave T	Arrangement Way	Temple	Unfunded
NewT 26	S Pea Ridge Rd	Extend & connect existing roads	Tarver Dr	Hogan Rd	Temple	Unfunded
NewT 37	Shine Branch Rd	Realign & connect existing roads	Willow Grove Rd	W of Willow Grove Rd	Temple	Unfunded
NewT 45	Shine Branch Rd	Extend & connect existing roads	SH 317	FM 2409	Temple	Unfunded
NewT 23	Tarver Dr	Extend & realign existing road	Coastal Dr	Kegley Rd	Temple	Unfunded
NewT 19	Tower Rd	Extend existing road	Payne Ln	Apple Cider Rd	Temple	Unfunded
NewT 6	Tower Rd	Extend existing road	MLK Dr	SE HK Dodgen Loop	Temple	Unfunded
NewT 38	Vaughan Rd	Extend existing road	Pendleton Troy Rd	1237 Spur	Temple	Unfunded
NewT 39	Vaughan Rd	Realign & connect existing roads	FM 1237	Old Howard Rd	Temple	Unfunded
NewT 4	W Ave U	Construct new road	S 11th St	Scott & White Blvd	Temple	Unfunded
NewT 36	Wendland Rd	Upgrade existing road	NW HK Dodgen Loop	Wilsonart Dr	Temple	Unfunded
NewT 8	Wendland Rd	Extend existing road	Industrial Blvd	W Nugent Ave	Temple	Unfunded
NewT 24	Westfield Rd	Extend & connect existing roads	W Adams Ave	Tarver Dr	Temple	Unfunded
NewT 31	Willow Grove Rd	Construct new road	Shine Branch Rd	Industrial Blvd	Temple	Unfunded
NewT 1	Zenith Ave	Realign & extend existing road	Zenith Ave	Young Ave	Temple	Unfunded

Future Regional Thoroughfare Network

All the potential projects defined by KTMPO and by its member jurisdictions' individual Thoroughfare Plans have been included in the future network, as shown for the region in **Figure 6-14**. Insets to show better detail of projects are included as **Figure 6-15** for Copperas Cove, **Figure 6-16** showing Killeen, Harker Heights, and Nolanville, **Figure 6-17** for Belton and Salado, and **Figure 6-18** for Temple. The Figures distinguish all streets by their Functional Class for Controlled Access through Collector streets. Local streets are not shown in this Thoroughfare Plan. The Figures include two ongoing studies which affect planning: coordination with the Capital Area Metropolitan Planning Organization (CAMPO) for six roads which cross the KTMPO study area into Williamson and Burnet Counties, and five alternative alignments for upgrades or new routes for US 190, which are identified in the study as "Primary Routes". The five Primary Routes for the US 190 study are shown in **Figure 6-19**.

All Figures show the existing 2017 streets and the proposed projects for upgrades to existing streets and for construction of new streets. The alignments of new construction streets are presented as approximations for planning purposes, and are not intended to represent the final alignments or to constrain KTMPO member jurisdictions in any way.

The key purpose of the Thoroughfare Plan is to identify future projects so that right-of-way can be planned for. Supporting this purpose, the Plan is coded with all projects defined by KTMPO and by its member jurisdictions, not just the projects which have been identified as funded in the previous Mobility 2040 Metropolitan Transportation Plan (MTP). This listing has been developed as an input into the updated KTMPO MTP for the year 2045. One of the functions of the 2045 MTP will be to prioritize the listing of projects and to balance them against the anticipated available funding to derive funded and unfunded project listings.

Figure 6-14: Regional Future Thoroughfare Network

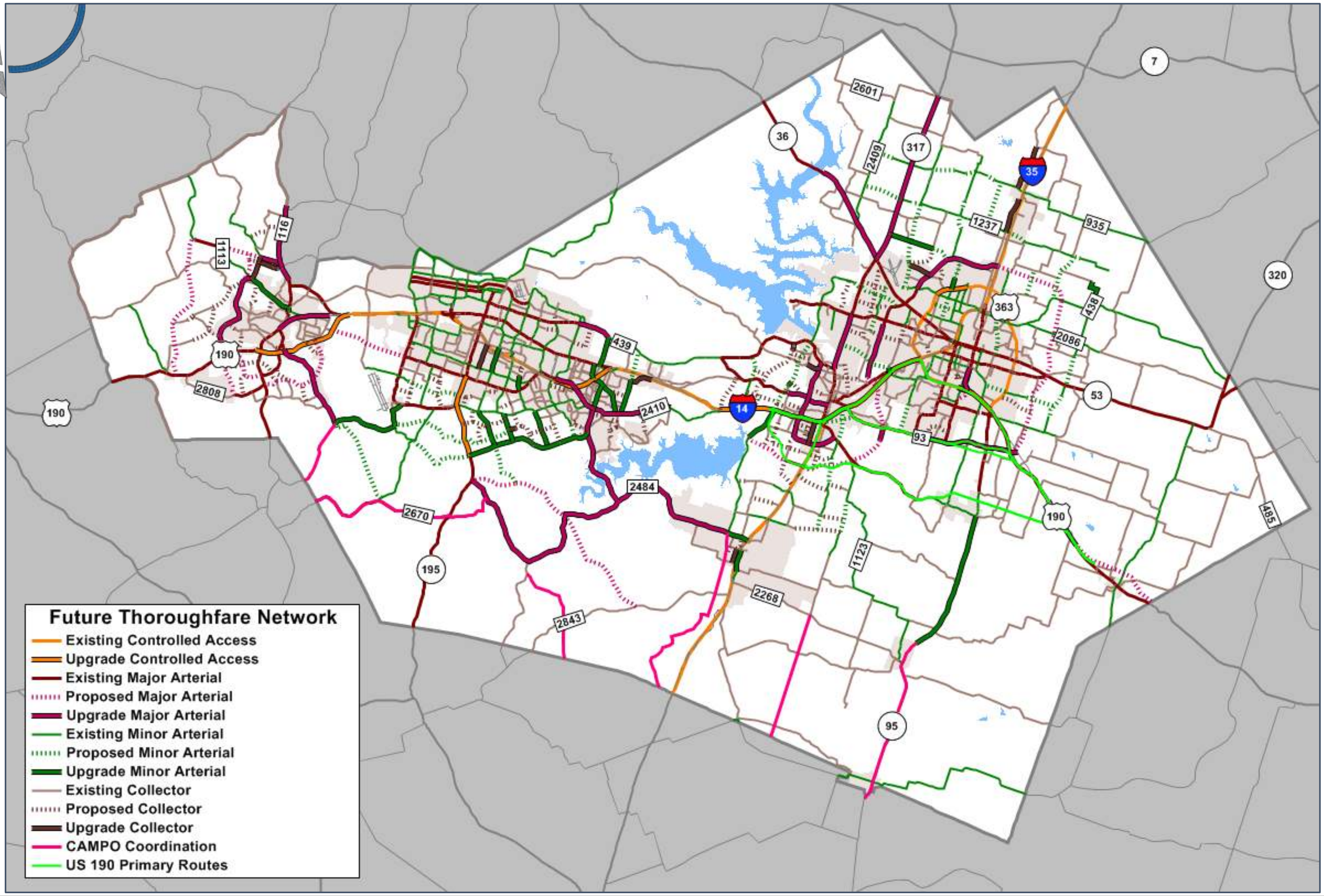


Figure 6-15: Future Thoroughfare Network Around Copperas Cove

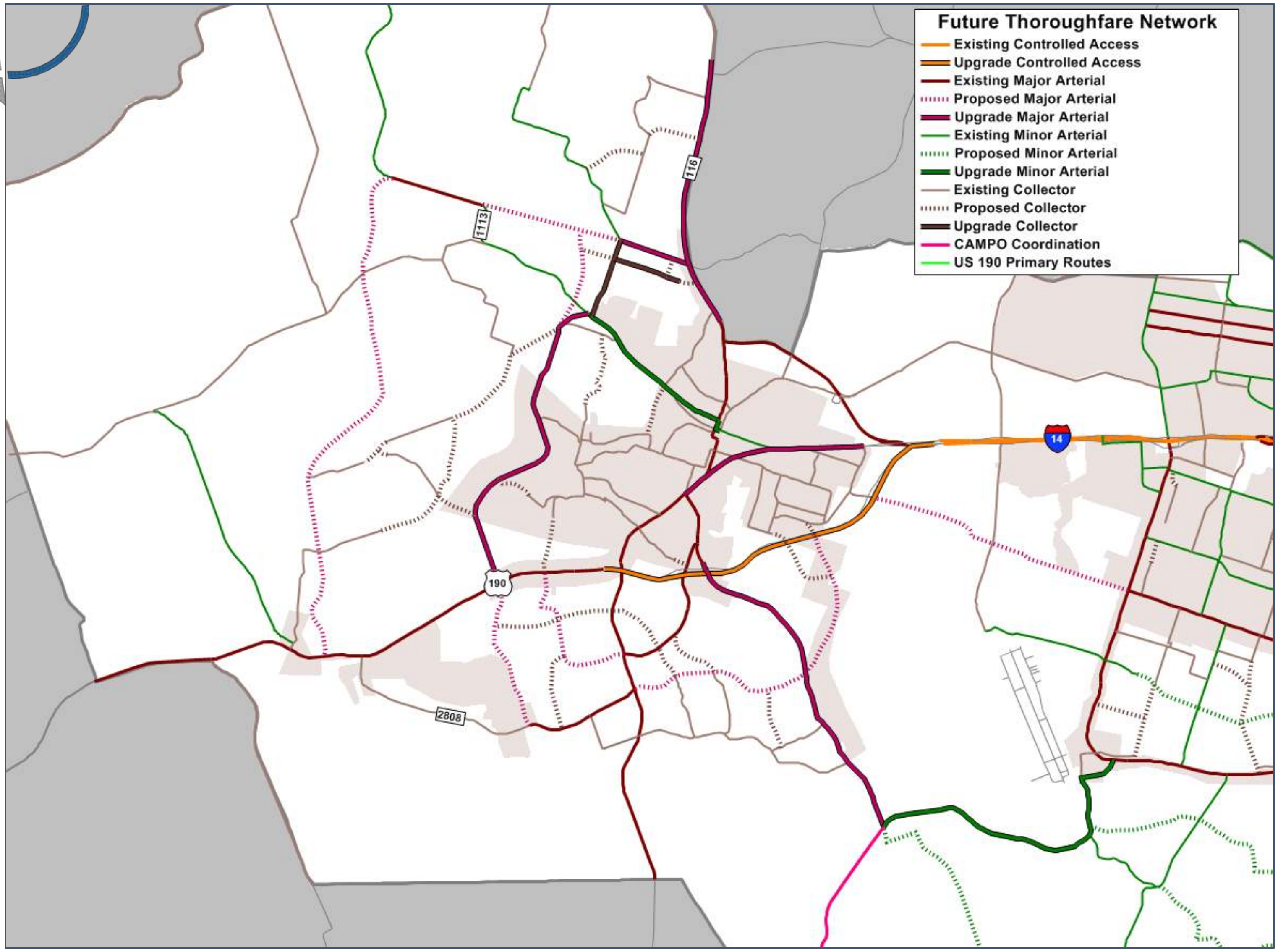


Figure 6-16: Future Thoroughfare Network Around Killeen, Harker Heights, and Nolanville

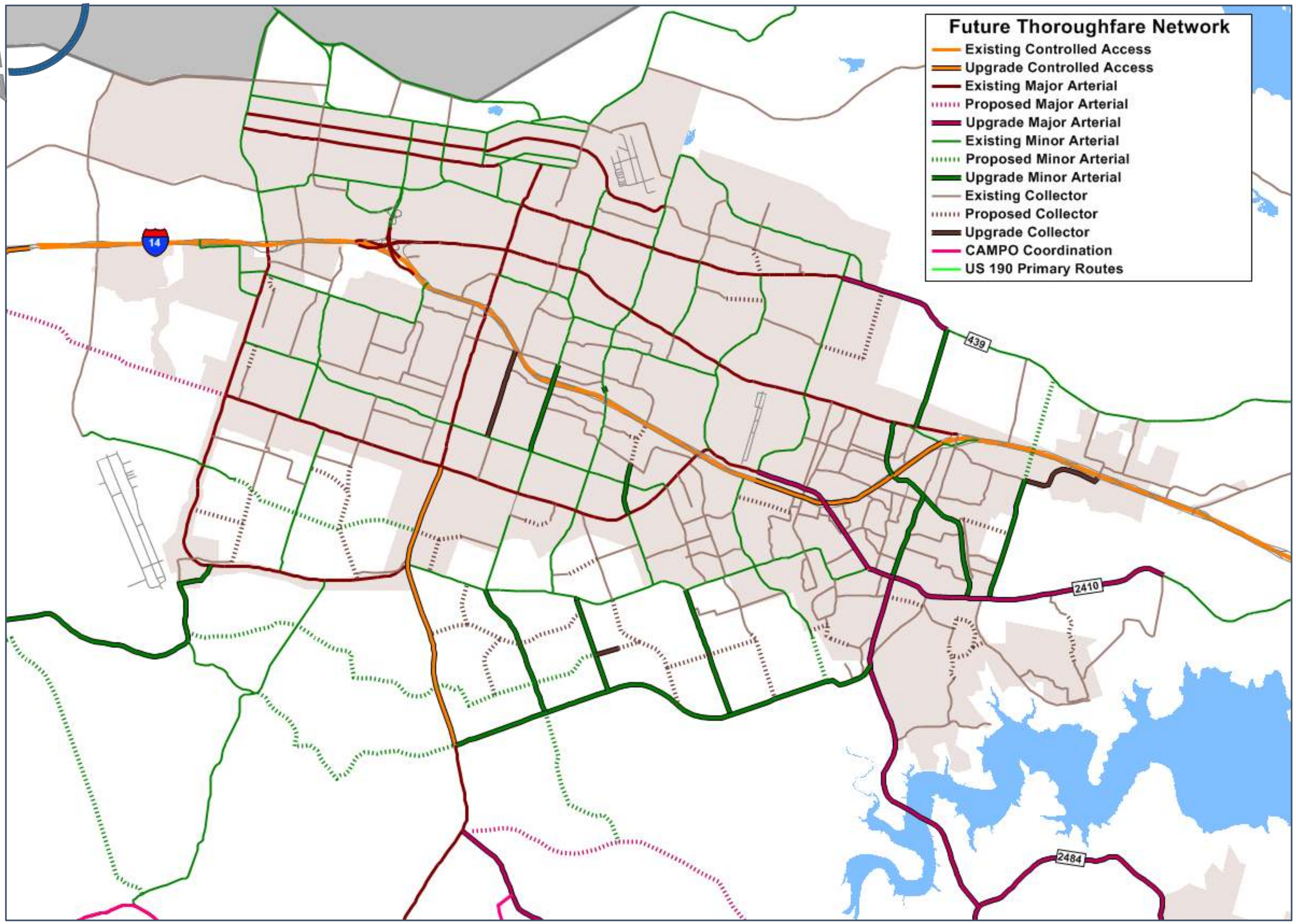


Figure 6-17: Future Thoroughfare Network Around Belton and Salado

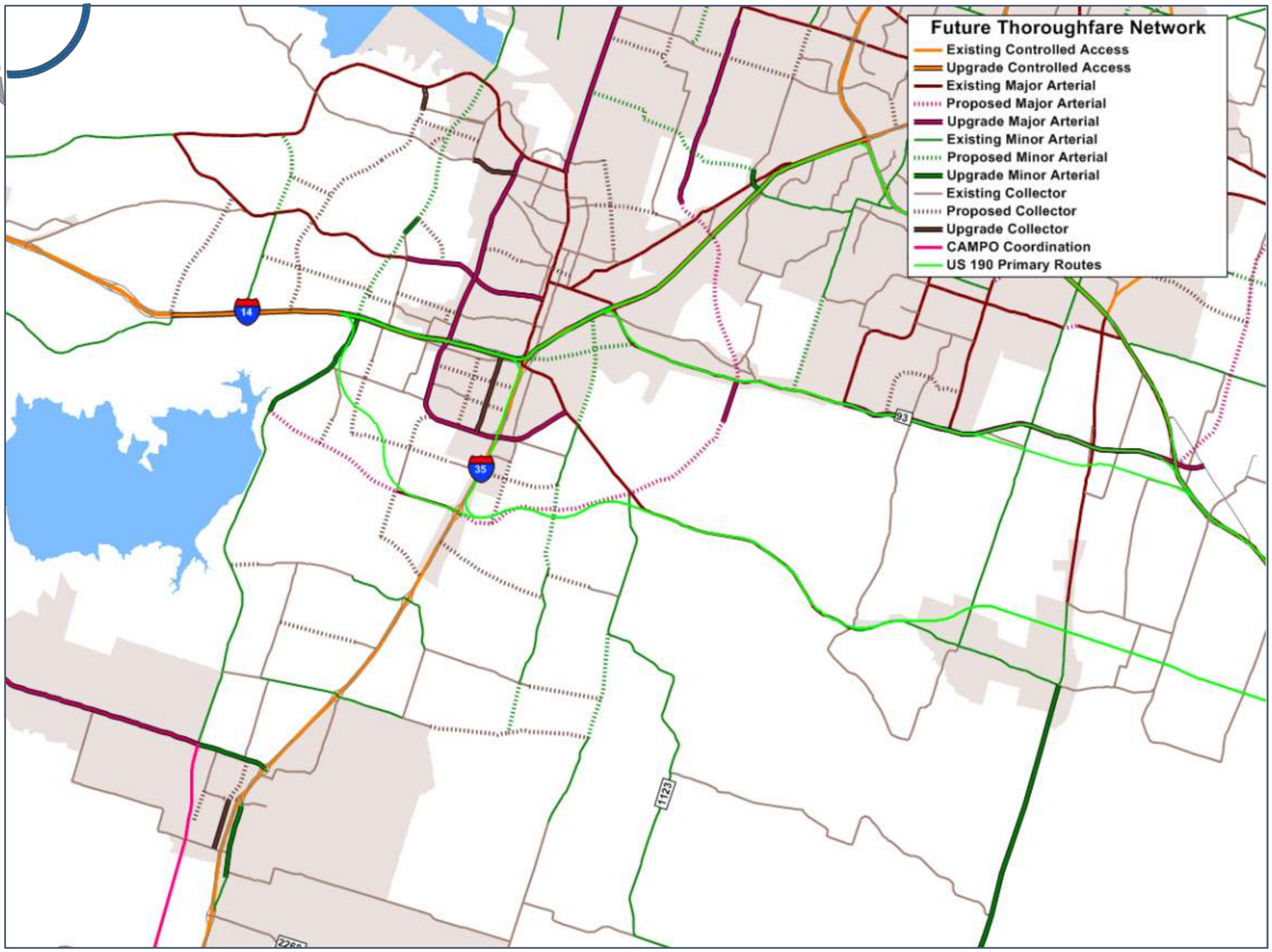
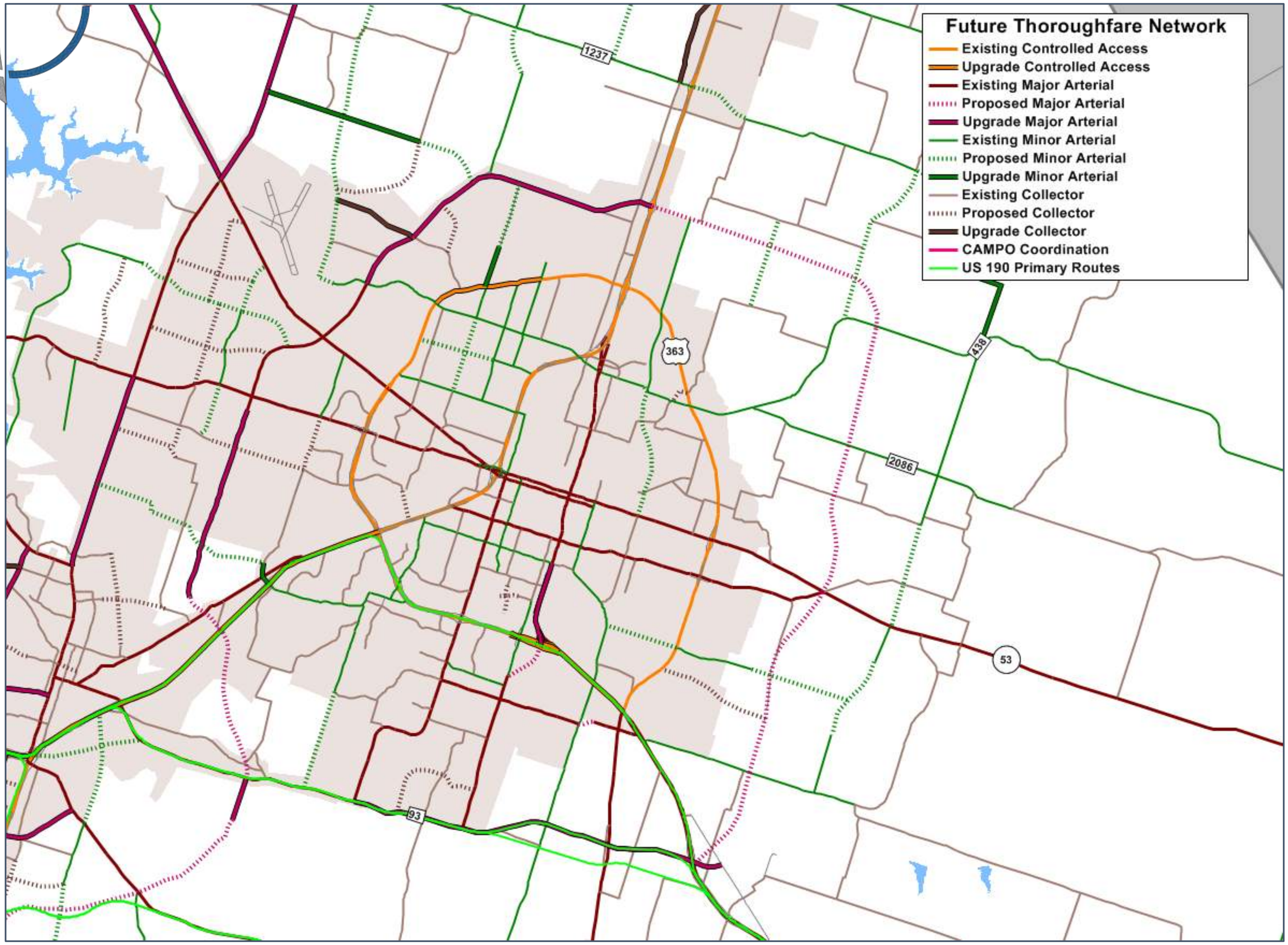


Figure 6-18: Future Thoroughfare Network Around Belton and Temple



The US 190 feasibility study being conducted jointly by the KTMPO and TxDOT is exploring options for upgrades and possible new alignments of US 190 between FM 1670 west of I-35 and the proposed relief route north of Rogers. The forty route options identified in early stages of the study have been parsed to five options, labeled as "Primary Routes", which will be the basis for further study and public participation. Only one of the Primary Routes will ultimately be selected, but at this stage of the study and for the purposes of the Regional Multimodal Plan, all options are presented in Figure 6-19.

The five Primary Routes include:

- Pink Route, 21.9 miles long, which maximizes the use of existing roads but is the most indirect.
- Blue Route, 19.1 miles long, one of the most direct routes.
- Brown Route, 19.3 miles long, one of the most direct routes.
- Black Route, 20.5 miles long, which avoids heavily populated areas.
- Aqua Route, 19.6 miles long, which maximizes the use of existing roads.

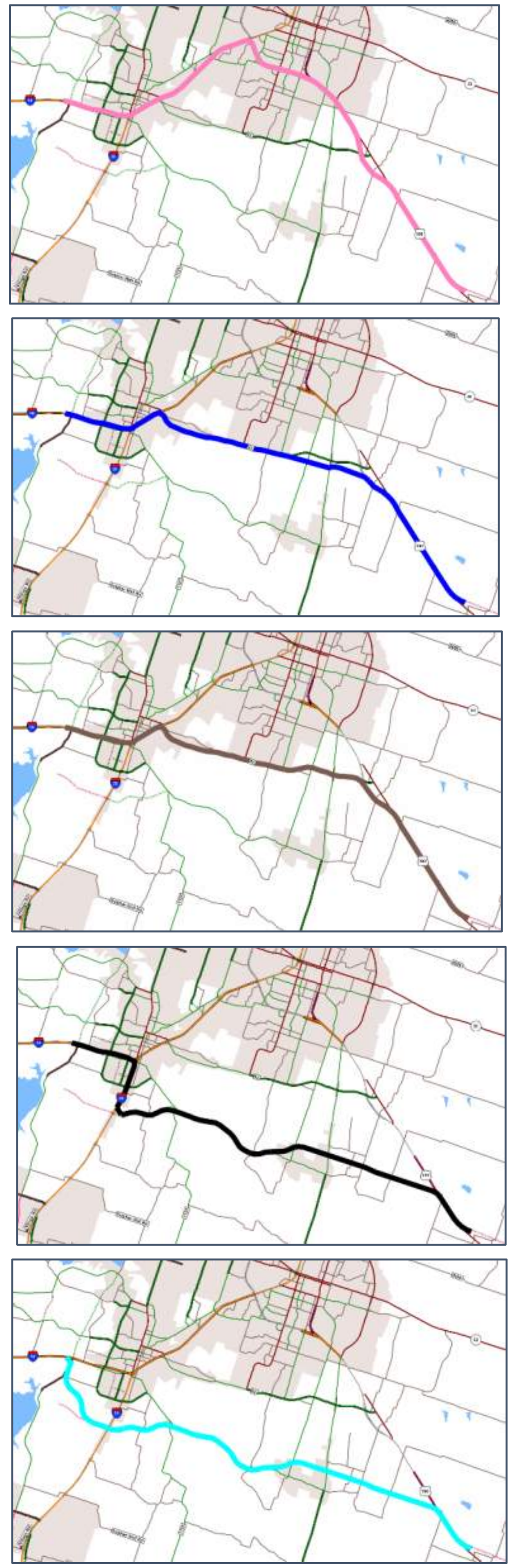
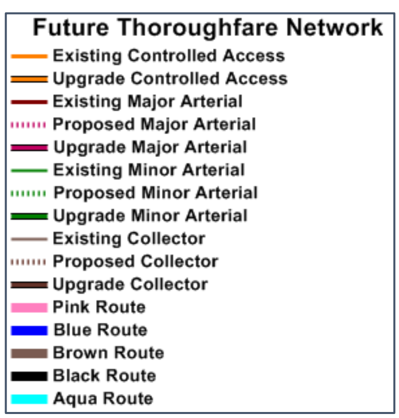


Figure 6-19: US 190 Study Designated Primary Routes



Summary

Based on the definitions of Functional Class for the street network, general design guidance for typical street cross sections have been provided. The guidance is generalized to recognize that the implemented Functional Class and cross section for each project must consider that the specific context of the project at any given time. Specific details depend on several factors, including the physical characteristics of the street, traffic volumes, mix of multimodal traffic, safety considerations, local standards and preferences, and funding. Therefore, the cross sections presented in this Thoroughfare Plan are meant as guidance for typical conditions, and should be refined as needed for each specific project.

Potential projects for this Thoroughfare Plan are derived from the Thoroughfare Plans and studies from KTMPO and its member jurisdictions. At this stage of the planning process, the project list includes all projects, regardless of any designation as funded or unfunded in the previous Mobility 2040 MTP.

Each region is different with its own specific mix of Functional Classes, conditions, and geography, so there is no hard and fast guidance on the appropriate mix of classes. However, FHWA has listed general guidelines for the appropriate percentages of each Functional Class within a typical region. A comparison of the 2017 conditions and the future conditions with all network projects implemented is shown in **Table 6-5**. The tabulation shows that the majority of potential projects are proposed streets rather than upgrades to existing streets. In general, the Functional Classes with the most mileage of potential projects to upgrade existing streets are Major Arterials and Minor Arterials. For new construction streets, the Functional Classes with the most mileage of potential projects are Minor Arterials and Collectors.

The overall statistics for the mix of streets by Functional Class does not change significantly with the future network. With all potential projects implemented, the mix of Functional Classes in the KTMPO region remains appropriate when compared to the general FHWA standards.

Table 6-5: Regional Mix of Functional Classes for 2017 and the Future Thoroughfare Plan Network

Regional Mix of Functional Classes							
	2017 Network		Potential Projects		Future Network		
Functional Class	Mileage	Percent	Upgrades	New Construction	Mileage	Percent	Guidelines
Controlled Access	143	4%	20	10	144	4%	0 - 9%
Interstate	71	1.9%	20	5	76	2.1%	
Expressway	51	1.4%		5	56	1.5%	
Freeway	21	0.6%			12	0.3%	
Major Arterial	110	3%	9	7	115	3%	2 - 4%
Mnor Arterial	246	7%	86	12	258	7%	4 - 8%
Collector	760	21%	43	5	765	21%	20 - 25%
Local	2,406	66%	0	0	2,406	65%	65 - 75%

Construction costs for the types of projects listed in this Thoroughfare Plan can vary significantly based on site geologic conditions, drainage, subsurface utilities, and materials specifications. Environmental and social considerations can also have a significant impact on project costs. However, average costs for typical projects may be estimated based on a review of costs for multiple instances of project types. Typical costs for projects were developed in **Table 6-6** based on compilations of typical project costs documented from several sources: the American Road & Transportation Builders Association (ARTBA), the Arkansas Department of Transportation (ARDOT), the Florida Department of Transportation (FDOT), the North Carolina Department of Transportation (NCDOT), the United States Department of Transportation (USDOT), the Texas Department of Transportation (TxDOT), and the Victoria Transport Policy Institute (VTPI). The resultant costs for projects listed in the table cannot be considered as appropriate for budget estimates, but can be valuable in comparing the relative costs of different types of projects.

Table 6-6: Typical Construction Costs

Typical Construction Costs for Street Project Types		
General Project Description	**Typical Cost**	**Cost Units**
New Construction Streets		
New construction 2 lane undivided	2,800,000	per mile
New construction 2 lane, curb & gutter, parking each side	4,000,000	per mile
New construction 4 lane, curb & gutter, raised median	4,700,000	per mile
New construction auxiliary lane	180,000	per mile
New construction turn lane	180,000	per mile
Upgrade Existing Streets		
Widen 2 lane undivided to 4 lane undivided	3,100,000	per mile
Widen 2 lane undivided to 4 lane divided	3,600,000	per mile
Widen 4 lane to 6 lane divided	3,600,000	per mile
Intersections		
Diamond intersection	20,500,000	each
Grade separation	3,300,000	each
Traffic signal	180,000	intersection
Protected intersection	70,000	each
Roundabout	250,000	each
Multi-lane Roundabout	350,000	each
Crosswalk	3,000	each
Bicycle & Pedestrian Facilities		
Widen street 4' for bike lane	300,000	per mile
12' multi use trail	200,000	per mile
5' sidewalk, both sides	250,000	per mile
Curb bulb-out	13,000	each
Pedestrian median island	13,000	each
Crosswalk	2,500	intersection
Utilities & Bridges		
Extend or relocate underground water line	70	linear foot
Extend or relocate underground sewer line	60	linear foot
Single-circuit overhead power line	285,000	per mile
New construction bridge over stream	105	square foot of deck
Wetland mitigation	60,000	acre

Chapter 7: Bicycle & Pedestrian Plan

CHAPTER HIGHLIGHTS

- General Design Guidance
- Typical Cross Sections by Functional Class
- Funded and Unfunded Projects
- Bicycle & Pedestrian Plan

Introduction

The concept of Functional Classes for the bicycle and pedestrian networks was introduced in Chapter 4, followed by an inventory of the networks in Chapter 5. In this Chapter, these two concepts are combined with potential projects and developed into a future Plan. While the bicycle and pedestrian networks are distinct and have different operational requirements, they do share many similarities and can be treated together. In particular, they share the Multi-Use Path Functional Class and can have similar treatments at intersections.

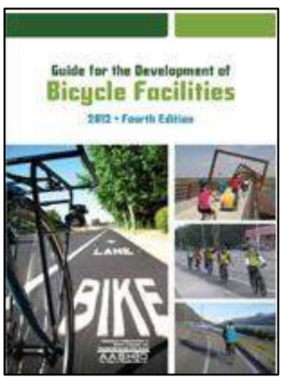
The purpose of this Regional Multimodal Plan is to define the future networks for all transportation modes so that all potential projects may be displayed and reviewed together, and so that the appropriate right-of-way may be identified and planned for. A key component of this planning task is to define the Functional

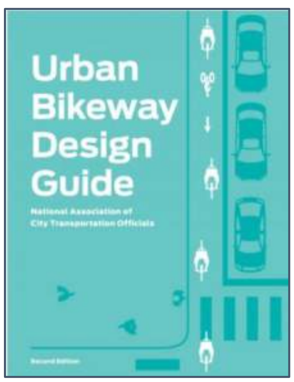
Class for each proposed project. Unlike the auto network, the bicycle and pedestrian networks do not feature specific cross-sections for each Functional Class. This Chapter presents general design guidance instead of specific cross-sections.

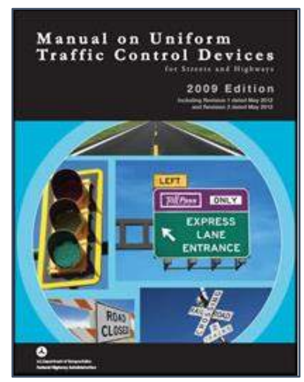
Bicycle & Pedestrian Networks General Design Guidance

General Design Guidance for the Bicycle Network

Design guidance for all types of bicycle facilities is provided at the national and state levels. Guidance for infrastructure is provided at the national level by the *AASHTO Guide to Bikeway Facilities* and by the *NACTO Urban Bikeway Design Guide*. Both guides provide detailed design standards with an emphasis on flexibility in design to encourage sensitivity to local context in travelers' needs. TxDOT has endorsed both guides, and has collated their guidance and standards into their own *Opportunities for TxDOT's Bicycle Program*. National-level guidance on pavement markings, signs, and traffic signals is provided by the *Manual on Uniform Traffic Control Devices* (MUTCD).







All the guidebooks recommend a minimum bike lane width of 4 feet, but 5 feet is common and 6 feet is desirable. Bike lanes should be as wide as possible to allow bikes to ride side by side, but where the bike lane is not protected by an insurmountable barrier, the width may be reduced to discourage vehicles from illegally driving or parking in the bike lanes. TxDOT guidance calls for either a 5 foot bike lane or a shared outside lane with a width of 14 feet.

The MUTCD specifies that painted buffer strips be marked with solid white lines. Buffers should be at least 18 inches wide. If the buffer strip is 36 inches or wider, it should have interior diagonal cross hatching or chevron markings.

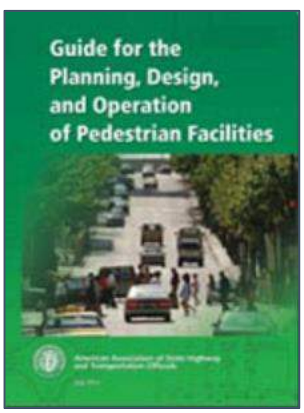
Table 7-1 summarizes the recommendations for right-of-way (ROW) considerations by street Functional Class. Minimum ROW is based on 4 lanes for Major Arterials, 3 lanes (two travel lanes and a center turn lane) for Minor Arterials, and 2 lanes for Collectors and Local streets.

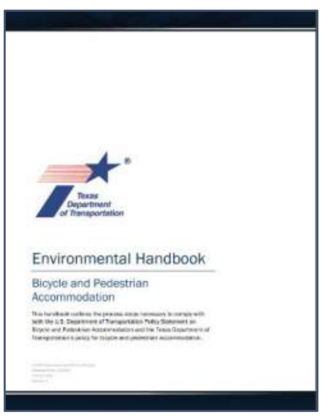
Table 7-1: Summary of ROW Recommendations by Functional Class

Functional Class	Minimum ROW	Preferred ROW	Lane Width	Pavement Width	Median	Outside Buffer	Notes
Controlled Access	250'	Varies, up to 500'	Minimum 12'	Varies	Minimum 36' rural Minimum 10' urban	Varies	Inside shoulder minimum 4' Outside shoulder minimum 10' Vertical clearance minimum 14'
Principal Arterial	130'	160'	Preferred 12'	82' to 106'	Preferred 18'	15'	ROW may be greater with parking, bicycle and pedestrian facilities, bus stops, and intersection treatments
Minor Arterial	80'	120'	Preferred 12'	47' to 75'	Center Turn Lane 14'	10'	
Collector	60'	80'	Minimum 11'	31' to 57'	Center Turn Lane 14'	5'	
Local	44'	50'	Minimum 10.5'	23' to 29'	None	5'	

General Design Guidance for the Pedestrian Network

Bicycles are defined as vehicles and are therefore entitled to the use of the street, so bicycle facility design is treated in a similar manner as the auto network street design. Conversely, pedestrian facilities are defined to separate pedestrians from vehicle traffic, and so the design standards are markedly different. Guidance for the pedestrian network as provided by the *AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities* and the *TxDOT Handbook for Bicycle and Pedestrian Accommodation* therefore provides more guidance on the provision of pedestrian facilities than on their design. In fact, the TxDOT handbook is published by the Environmental Division (responsible for the Transportation Enhancements program) rather than the Design Division.





In general, design guidance for the pedestrian network relates to the Sidewalk Functional Classes. Sidewalks are generally specified at a minimum of 5 feet wide. New construction multi-use trails are specified with widths of up to 12 feet. Curb ramps for ADA compliance are required for all sidewalks.

Other Design Features for the Bicycle & Pedestrian Networks

Because of the vulnerability of bicycles and pedestrians, several additional design features in their networks are appropriate to properly and safely manage the interactions between all the networks.

Intersection Treatments

There is a conflict between curbside conventional bike lanes and right turning autos at intersections. The state-of-the-practice for mitigating the conflict is to shift the bike lane to the left side of the turn lane, as shown in **Figure 7-1**. This is the conventional treatment as recommended in Federal and State design guidance, but it creates a weaving movement between autos and bicycles prior to the intersection. On intersection approaches with right turn only lanes, the bike lane should be transitioned to a through bike lane to the left of the right turn only lane, or a combined bike lane/turn lane should be used if available road space does not permit a dedicated bike lane. On intersection approaches with no dedicated right turn only lane, the buffer markings should transition to a conventional dashed line. Where the bike lane has merging movement approaching the intersection, the recommendation is to dash the lane stripe 50 to 200 feet in advance.

Figure 7-1: Conventional Treatment of Bike Lanes at an Intersection

A **protected intersection** is a design intended to avoid this conflict by carrying the bike lane through the intersection while still preserving its separation from car traffic. The protected intersection, shown in **Figure 7-2**, has two main features: corner islands and the backset stop bar. The corner islands direct cars into a wider turn. This places the vehicle at a 90° angle to the cross street before its crosswalk, so bicycles or pedestrians in the crosswalk are more visible. Turning cars also have room to stop without blocking through traffic.

Figure 7-2: Protected Intersection

The backset stop bar places the car stopping line behind the bike lane at the intersection. Like the corner island, the setback places the vehicle at a 90° angle to the cross street to improve visibility. The setback also provides more room within the intersection.

Curbside Treatments

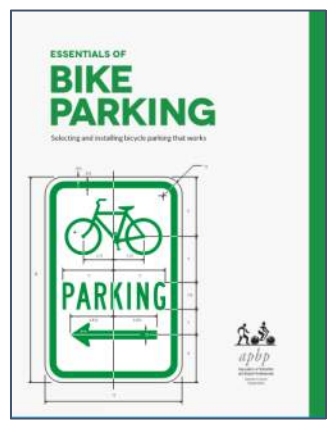
Outboard bike lanes, shared use streets, bike boulevards, and other infrastructure types that place bicycles close to the curbside should consider the effect of gutter seams, drainage inlets, grates, and utility covers. Grates in particular have the potential to trap bicycle tires if they are not properly designed.

Although Federal and State design guidelines do not mention this issue, anything which encroaches on bike lanes should be flush and designed to cause no conflicts with bicycle tires.

Bicycle Parking

Bicycle parking is a related issue that is recognized in the AASHTO guide. The Association of Pedestrian and Bicycle Professionals (APBP) have also contributed guidance with their publication *Essentials of Bike Parking*. The APBP guide defines four criteria for practical and usable bike racks for parking:

- Supports the bike upright without stressing the wheels.
- Accommodates a variety of bikes and attachments.
- Allows locking of the frame and at least one wheel with a single U-lock.
- Proper use is intuitive, not needing extensive instructions to operate.



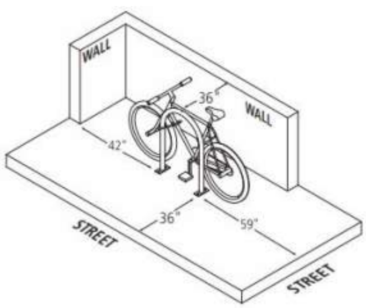
The APBP guide recommends two types of bike racks as meeting these criteria, and lists other types of racks as not meeting the criteria and as not recommended for use.

The two types of bike racks which are recommended by the APBP guide are the Inverted U and the Post & Ring types, as shown in **Figure 7-3**.

Figure 7-3: APBP-Recommended Bike Rack Types

Both these types of bike racks meet the criteria by providing a solid locking surface and keeping the bike's wheels on the ground. A wide variety of bikes are accommodated by their simple design, and several ways to attach a U-lock to the frame, wheel, and rack are accommodated.

Figure 7-4: Recommended Installation Setbacks for Bike Racks



Recommended setbacks between the bike rack, walls, and the street are shown in **Figure 7-4**. These setbacks are defined by the bike rack manufacturer, and are listed on the Maintenance Agreement and Installation Guide for bike racks by the City of San Antonio.

Requirements of the MUTCD are that a bicycle parking space should be a minimum of 2 feet wide and 6 feet long. Parallel racks should be at least 30 inches apart; and if they are 48 inches apart the rack may be considered as serving two bikes (one on each side).

The types of bike parking racks which are not recommended include the schoolyard rack and wheel well racks, which do not provide sufficient support points or locking points, wave racks and bollard racks, which are not intuitive to use, and types such as the swing arm, spiral, and coat hanger, which in practice accommodate only limited types of bikes and are cumbersome to use.

Pavement Treatments

The MUTCD allows for the use of color to distinguish special - use lanes, and green is specified as the preferred color for bicycle lanes. Color is intended to "…enhance the conspicuity of where bicyclists are required to operate, and areas of the bicycle lane where bicyclists and other roadway traffic might have potentially conflicting weaving or crossing movements." Dashes of color may also be used to highlight weaving movements, as when a curbside bike lane crosses to the left of a dedicated right turn lane.

Green pavement marking a protected intersection has been constructed at Ross St. and Bizzell St. on the Texas A&M University main campus in College Station. This installation features an experimental treatment of luminous paint that is intended to make them glow in the dark. The paint absorbs solar energy during the day and glows with a soft light during the night.

Potential Bicycle & Pedestrian Projects

The listing of potential bicycle and pedestrian projects is developed from the KTMPO 2040 Metropolitan Transportation Plan (MTP) and from public input on desired projects which was received through the KTMPO website.

A listing of potential projects which are identified by the MTP as funded is provided in **Table 7-2**. **Table 7-3** lists the remaining projects in the region for which funding has not been identified. Projects sourced from the public through the KTMPO website are listed in **Table 7-4**.

Table 7-2: Bicycle & Pedestrian Projects Listed in the 2040 MTP as Funded

Project ID	Project	Project Description	Limits From	Limits To	City	Status	Year
B40-03	Main Street Sidewalk	Repair and installation of sidewalks	Avenue C	Avenue J	Belton	Funded MPO CAT 7	2020
B40-04	Chisholm Trail Corridor Hike and Bike Phase II	Construct multi-use path	Judge Baylor Dr.	Sparta Road	Belton	Funded Statewide TAP	2020
C30-03b	Business US 190 Phase I	Conversion of one travel lane in each direction to a multiuse path	FM 1113 (Avenue D)	Constitution Dr	Copperas Cove	Short Range Funded	2020
C35-02b	FM 116 Railroad Underpass Sidewalks	Constuct 10' wide sidewalk	S Main	Ave B	Copperas Cove	Short Range: Livability	2035
C40-04a	The Narrows-Phase 1	Construction of sidewalks for pedestrian/bicycle use	Constitution Dr	0.2 mi S of MLK Blvd	Copperas Cove	August 2017 KTMPO Selected Projects	2020
C40-04b	The Narrows-Phase 2	Construction of sidewalks for pedestrian/bicycle use	RG III from Constitution Dr	Old Copperas Cove Road	Copperas Cove	August 2017 KTMPO Selected Projects	2020
C40-04c	The Narrows-Phase 3	Construction of sidewalks for pedestrian/bicycle use	Charles Tillman Way	Charles Tillman Way	Copperas Cove	August 2017 KTMPO Selected Projects	2019
C40-05	FM 116 & FM 3046 Sidewalks	Construct ADA-compliant sidewalks and bike lanes	Business 190	Dennis St	Copperas Cove	August 2017 KTMPO Seleceted Projects	2019
H15-02b	FM 2410	Widen with sidewalks in a context sensitive design	Harker Heights City Limit	US 190	Harker Heights	Short Range Funded Prop 1	2019
H30-05	Warriors Path	Construct a 6' multiuse path	Knights Way/FM 2410	Old Nolanville Rd	Harker Heights	Long Range Funded	2040
K35-02	Killeen - Fort Hood Regional Trail, Segment 3	Construct multi-use path	Elms Rd	Watercrest	Killeen	Funded MPO TAP	2019
K40-21a	Heritage Oaks Hike and Bike Trail, Segment 4	Construct multi-use path	Platinum Drive	Chaparral Road	Killeen	Funded Statewide TAP	2017
K40-21b	Heritage Oaks Hike and Bike Trail, Segment 5	Construct multi-use path	Chaparral Rd	USACE Property	Killeen	August 2017 KTMPO Selected Project	2019
K40-23	Heritage Oaks Hike and Bike Trail, Segment 3A	Construct multi-use path	Nickelback Dr	Pyrite Dr.	Killeen	Funded MPO TAP	2018
N40-01	Main Street Connectivity	Construct multi-use path along Main Street and under US 190	Avenue I	US190 Frontage	Nolanville	Funded MPO CAT 7	2019
N40-02	Nolanville Elementary Sidewalk	Construct multi-use path near school	Warriors Path	Bluebonnet	Nolanville	Funded Statewide TAP	2019
S40-01	Salado Creek SUP	Construct multi-use path	Salado Creek	Royal Street	Salado	Funded Statewide TAP	2019
S40-04a	Main St	Construct sidewalks, lighting and striping for bicycles	Salado Plaza Drive	College Hill Dr	Salado	August 2017 KTMPO Selected Project	2020
S40-04b	Main St	Pavement widening & bike paths	College Hill Dr	Salado Plaza Dr	Salado	Funded for project development	2035
T40-07	Outer Loop 3b	Construct multi-use trail	S. of FM 2305	S. of Jupiter Drive	Temple	Long Range Funded	2040
T40-11	N. 31st St.	Construct multi-use trail	Adams Ave (SH 53)	Nugent Ave	Temple	Funded MPO TAP	2020
T40-12	31st St Sidewalks	Installation of 6' sidewalks on both sides	Marlandwood Rd	Canyon Creek Rd	Temple	August 2017 KTMPO Selected Project	2020
T40-15	Adams Ave	Construct on-street bike lane and sidewalks	IH 35	Martin Luther King Jr. Blvd	Temple	August 2017 KTMPO selected projects	2020
W40-04a	Loop 121 Phase 1	Bike/ped improvements	FM 439	IH 35	Belton	August 2017 KTMPO selected project	2021
W40-04b	Loop 121 Phase 2	Bike/ped improvements	IH 35	FM 436	Belton	Funded for project development	2035

Table 7-3: Bicycle & Pedestrian Projects Listed in the 2040 MTP as Unfunded

Project ID	Project	Project Description	Limits From	Limits To	City	Status	Year
B30-02	Belton Outer Loop West	Construct 10' multi-use trail	IH 35	Three Creeks Subdivision	Belton	Unfunded	2040
B30-03	Belton Outer Loop East	Construct 10' multi-use trail	IH 35	Shanklin	Belton	Unfunded	2040
B40-05	Belton Hike and Bike Trail Extension South	Construct 10' multi-use trail	Confederate Park	Griggs Field	Belton	Unfunded	2040
B40-06	Belton Hike and Bike Trail Extension North	Construct 10' multi-use trail	Confederate Park	Nolan Creek	Belton	Unfunded	2040
B40-07	Connell Street	Construct 5' sidewalks	US 190	Loop 121	Belton	Unfunded	2040
B40-08	Sparta Rd	Construct 10' multi-use trail	Loop 121	Dunn's Canyon Rd	Belton	Unfunded	2040
B40-09	West Avenue D	Construct sidewalks and bike lanes	Loop 121	Wheat Rd	Belton	Unfunded	2040
B40-10	FM 1670	Construct 10' multi-use trail	US 190	Three Creeks Boulevard	Belton	Unfunded	2040
B40-12	Belton Hike and Bike Trail Extension SW	Construct 10' multi-use trail	Conferedate Park	Nolan Creek Pedestrian Bridge	Belton	Unfunded	2040
C25-02	FM 1113	ADA compliant sidewalks	FM 116 / Ave B	Summers Road	Copperas Cove	Unfunded	2025
D40-02	North Waco Rd.	Construct 10' multi-use path	West Main St	West Big Elm	Troy	Unfunded	2040
D40-03	Old 81 South	Construct on-street bike lane	FM 1237	Loves Overpass	Troy	Unfunded	2040
H30-03	FM 3219	Construct 6' sidewalk	Veterans Memorial Blvd	FM 439	Harker Heights	Unfunded	2040
K40-26	Cunningham Rd	Construct bike/ped facility	US 190	FM 3470	Killeen	Unfunded	2040
N40-03	Old Nolanville Road	Construct multi-use path	Warriors Path	US 190	Nolanville	Unfunded	2040
N40-04	City Park Connectivity	Construct 10' wide sidewalk, ramps, and crosswalks	Mesquite	10th Street	Nolanville	Unfunded	2040
N40-05	FM 439 Spur Connectivity	Construct 10' wide sidewalk, ramps, and crosswalks	Main Street	North Drive	Nolanville	Unfunded	2040
N40-09	Pleasant Hill Road Bicycle Ln	Construct buffered on-street bike lane	Lonsesome Oak Drive	Avenue I	Nolanville	Unfunded	2040
N40-11	Nolan Creek Off-System Trail	Construct 10' multi-use path bordering Nolan Creek	Bridge on Old Nolanville Rd	Levy Crossing	Nolanville	Unfunded	2040
N40-12	Jack Rabbit Road Bike Thoroughfare	Constuct bike lanes	US 190	FM 439	Nolanville	Unfunded	2040
N40-13	Wild Wood Trail	Construct 8' multi-use trail	Lonsesome Oak Drive	Avenue I	Nolanville	Unfunded	2040
S40-02	Salado Creek/Pace Park Off-Road Trail	Construct 10' wide concrete trail, ped/bike crossing	SW Pace Park Road	NE Pace Park Rd	Salado	Unfunded	2040
S40-03	Salado West Village Road	Construct bike/ped facilities	Thomas Arnold Rd	IH 35	Salado	Unfunded	2040
T15-02	Kegley Road (Phase 2)	Construct 12' multi-use path	856 ft S of FM 2305	450' S of Wildflower Lane	Temple	Unfunded	2040
T25-05	FM 2271	Construct 8' hike/bike trail	FM 2305	Miller Springs Park	Temple	Unfunded	2025
T25-09	Outer Loop / Research Parkway	Construct on-street bike lane and sidewalks	IH 35	Central Pointe Pkwy	Temple	Unfunded	2040
T35-36a	1st Street	Construct multi-use trail	SE Loop 363	Avenue M	Temple	Unfunded	2035
T40-04	Hogan Road	Construct multi-use trail	SH 317	S Pea Ridge Rd		Unfunded	2040
T40-05	Westfield Blvd (Phase 2)	Extend sidewalk and multi-use path	Prairie View Rd	Airport Rd/SH 36		Unfunded	2040
T40-09	Outer Loop 4	Construct multi-use trail	S of Jupiter	Floodplain	Temple	Unfunded	2040
T40-10	Outer Loop	Construct multi-use trail	Floodplain	IH 35	Temple	Unfunded	2040
T40-13	Georgetown RR Trail	Construct 10' multi-use trail	S. 5th Street	Belton City Limits	Temple	Unfunded	2040
T40-25	Bird Creek Interceptor Trail	Construct 8' multi-use path	Lions Community Park	Midway Drive	Temple	Unfunded	2040

Table 7-4: Bicycle & Pedestrian Projects Sourced from Public Input from the KTMPO Website

Project ID	Project	Project Description	Limits From	Limits To	City	Status
B00-14	Old Belton Railroad	Construct "rails to trails" multi-use path	IH 35	Leon River	Belton	Unfunded public suggested project
B00-15	Pearl St	Construct sidewalk	Avenue A	US 190 Westbound Service Rd	Belton	Unfunded public suggested project
B00-17	Belton Dam Trail	Construct multi-use trail	FM 2271	Miller Springs Park	Belton	Unfunded public suggested project
B00-6	Commerce St	Construct multi-use path	Sparta Rd	Industrial Park Rd	Belton	Unfunded public suggested project
B00-7	Industrial Park Rd	Construct multi-use path	Commerce St	SH 317/Main St	Belton	Unfunded public suggested project
B00-8	Waco Rd	Construct sidewalk	FM 93/6th Ave.	E 13th St.	Belton	Unfunded public suggested project
C00-58	Big Divide Rd	Construct multi-use path	FM 1113	US 190	Copperas Cove	Unfunded public suggested project
H00-36	Comanche Gap	Construct multi-use path	End of Shared-Use Path	Dana Peak Park	Harker Heights	Unfunded public suggested project
H00-37	FM 2410	Construct on-street bike lane	Simmons Rd	Stan Schlueter LP	Harker Heights	Unfunded public suggested project
H00-40	FM 3423 (Indian Trail)	Construct sidewalk	Veteran's Memorial Blvd	IH 14	Harker Heights	Unfunded public suggested project
H00-41	FM 3481 (Stillhouse Lake Rd)	Construct sidewalk	Knight's Way	Cedar Knob	Harker Heights	Unfunded public suggested project
H00-42	FM 3481 (Stillhouse Lake Rd)	Construct sidewalk	Knight's Way	Nevaeh Dr	Harker Heights	Unfunded public suggested project
H00-43	Verna Lee Blvd	Construct sidewalk	Indian Trail	Knight's Way	Harker Heights	Unfunded public suggested project
H00-44	FM 3481 (Stillhouse Lake Rd)	Construct on-street bike lane	Knight's Way	Stillhouse Hollow Lake	Harker Heights	Unfunded public suggested project
H00-47	W. US 190 Service Rd	Construct on-street bike lane	Paddy Hamilton Rd	Ft. Hood St.	Harker Heights	Unfunded public suggested project
K00-39	FM 439	Construct on-street bike lane	W.S. Young	Jackrabbit Flat Rd	Killeen	Unfunded public suggested project
K00-45	Mountain Lion Rd/Stagecoach Rd	Construct on-street bike lane	SH 195	Stillhouse Hollow Lake	Killeen	Unfunded public suggested project
K00-46	SH 195 (S. Ft. Hood St.)	Construct on-street bike lane	Stagecoach Rd to US 190/IH 14	Knight's Way	Killeen	Unfunded public suggested project
K00-49	MLK Blvd	Construct on-street bike lane	FM 2410	BUS 190	Killeen	Unfunded public suggested project
K00-50	Twin Creek Dr	Construct on-street bike lane	BUS 190	FM 439	Killeen	Unfunded public suggested project
K00-51	W.S. Young	Construct on-street bike lane	US 190	Rancier Ave	Killeen	Unfunded public suggested project
K00-52	Trimmier Rd	Construct sidewalk	Stan Schlueter LP	Stagecoach Rd	Killeen	Unfunded public suggested project
K00-54	Tiffany Circle	Construct sidewalk	SH 201	Clear Creek Rd	Killen	Unfunded public suggested project
K00-55	Lance Loop	Construct sidewalk	SH 201	Clear Creek Rd	Killen	Unfunded public suggested project
K00-56	SH 201 (Clear Creek Rd)	Construct sidewalk	Elms Rd	Mohawk Dr	Killeen	Unfunded public suggested project
K00-57	US 190	Construct multi-use path	Constitution Dr	Clear Creek Rd	Killen	Unfunded public suggested project
L00-19	FM 436	Upgrade existing trail to a multi-use path	SH 95	Lamar St	Little River-Acader	Unfunded public suggested project
N00-38	FM 439	Construct on-street bike lane	FM 93	Sparta Rd	Nolanville	Unfunded public suggested project
S00-21	College Hill Dr	Construct multi-use path	Main St	Main St	Salado	Unfunded public suggested project
S00-22	Table Rock Trail	Construct multi-use path	Table Rocks	FM 2268 (Main St.)	Salado	Unfunded public suggested project
S00-23	Center Circle	Construct multi-use path	Royal St	Royal St	Salado	Unfunded public suggested project
S00-24	Pace Park Rd	Construct multi-use path	FM 2268	Main St.	Salado	Unfunded public suggested project
S00-25	Pace Park Trail Connection	Construct multi-use path	Royal St	Pace Park	Salado	Unfunded public suggested project
S00-26	Art Fair Rd	Construct multi-use path	Pace Park Rd	Pace Park Rd	Salado	Unfunded public suggested project
S00-27	Van Bibber Rd	Construct multi-use path	FM 2268	Salado Plaza Dr	Salado	Unfunded public suggested project
S00-28	Salado Plaza Dr	Construct multi-use path	FM 2268	Van Bibber Rd	Salado	Unfunded public suggested project
S00-29	N IH 35 Service Rd	Construct multi-use path	FM 2268	Rose Lane	Salado	Unfunded public suggested project
S00-30	Rose Lane	Construct multi-use path	IH 35	Salado Youth Sports Field	Salado	Unfunded public suggested project
S00-31	FM 2484	Construct sidewalk	IH 35	Williams Rd	Salado	Unfunded public suggested project
S00-33	Williams Rd	Construct sidewalk	IH 35	FM 2484	Salado	Unfunded public suggested project
S00-34	Salado Schools Rd	Construct sidewalk	West Village Rd	Thomas Arnold Rd	Salado	Unfunded public suggested project
S00-35	Thomas Arnold Rd	Construct sidewalk	IH 35	West Creek Dr	Salado	Unfunded public suggested project
T00-1	Kegley Rd	Construct multi-use path	IH 35	FM 2305/Adams Ave	Temple	Unfunded public suggested project
T00-10	Midway Rd	Construct multi-use path	IH 35	Bonham Middle School	Temple	Unfunded public suggested project
T00-11	Shallowford Rd	Construct multi-use path	Shallowford Rd	Taylor's Valley Rd	Temple	Unfunded public suggested project
T00-12	West Shallowford Rd	Construct multi-use path	Midway Rd	Temple Lions Park	Temple	Unfunded public suggested project
T00-13	Taylor's Valley Rd	Construct on-street bike lane	IH 35	FM 93	Temple	Unfunded public suggested project
T00-18	FM 93	Construct bike lanes on shoulders	IH 35	BUS 190 in Heidenheimer	Temple	Unfunded public suggested project
T00-2	N. Pea Ridge Rd	Construct sidewalk	SH 317	Prairie View Rd	Temple	Unfunded public suggested project
T00-4	Apache Dr	Construct sidewalk	FM 2305	Arapaho Dr	Temple	Unfunded public suggested project
T00-5	Poison Oak Rd	Construct sidewalk	SH 317	Carriage House Dr	Temple	Unfunded public suggested project
T00-9	Charter Oak Rd	Construct multi-use path	E 13th St.	Kegley Rd	Temple	Unfunded public suggested project

Future Bicycle & Pedestrian Networks

The potential projects as listed in Table 7-2 through Table 7-4 have been included in the future network, as shown for the region in **Figure 7-5**. Insets to show better detail of projects are included as **Figure 7-6** for the western area and **Figure 7-7** for the eastern area. For clarity, the existing sidewalk network is not shown in these Figures.

All Figures show the existing 2017 facilities and the proposed projects for upgrades to existing facilities and for construction of new facilities. The alignments of new construction facilities are presented as approximations for planning purposes, and are not intended to represent the final alignments or to constrain KTMPO member jurisdictions in any way.

The key purpose of the Bicycle & Pedestrian Plan is to identify future projects so that right-of-way can be planned for. Supporting this purpose, the Plan is coded with all projects defined by KTMPO and by its member jurisdictions, not just the projects which have been identified as funded in the previous Mobility 2040 MTP. This listing has been developed as an input into the updated KTMPO MTP for the year 2045. One of the functions of the 2045 MTP will be to prioritize the listing of projects and to balance them against the anticipated available funding to derive funded and unfunded project listings.

Figure 7-5: Future Bicycle & Pedestrian Plan for the Region

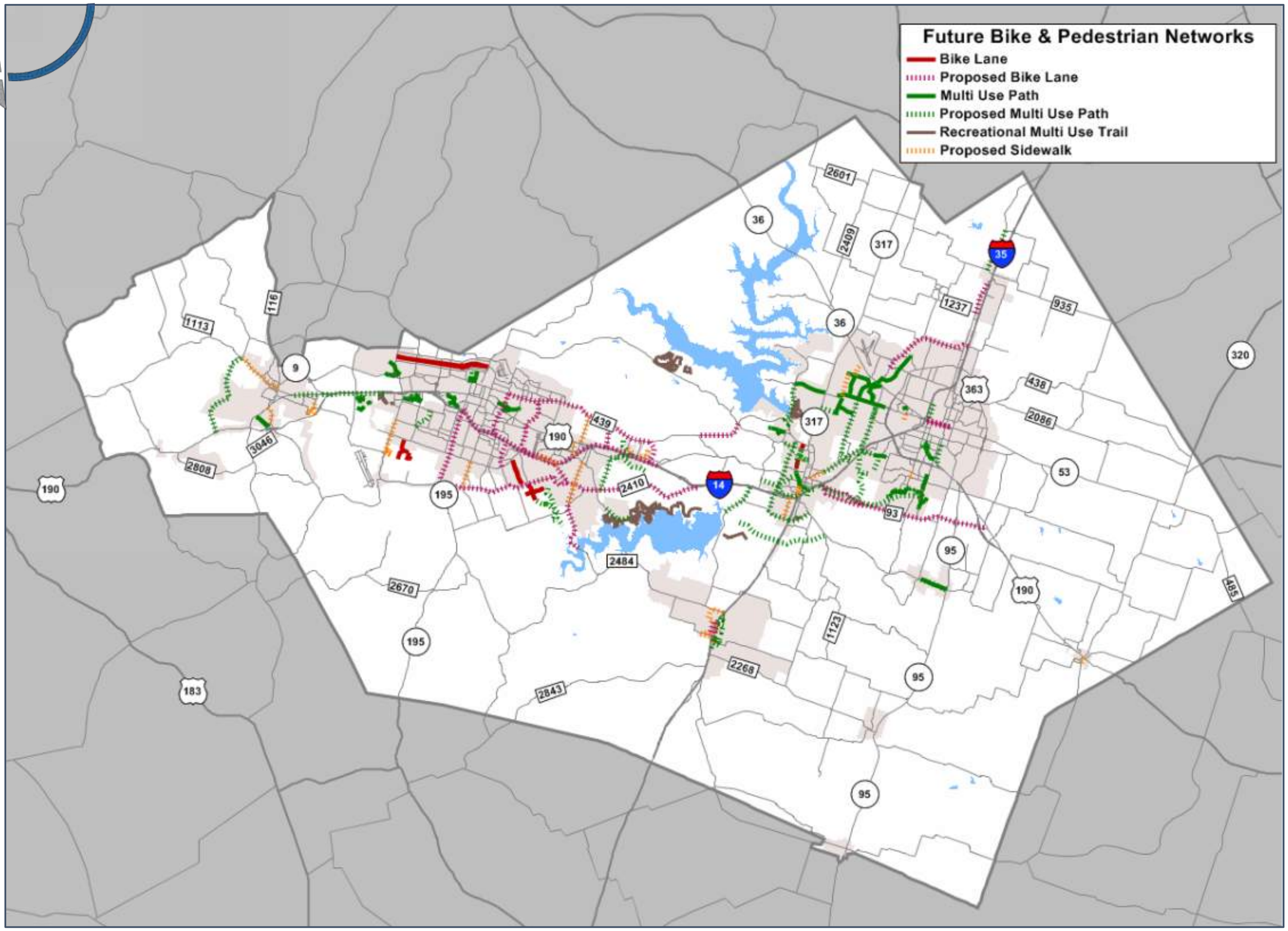


Figure 7-6: Future Bicycle & Pedestrian Plan for the Western Area

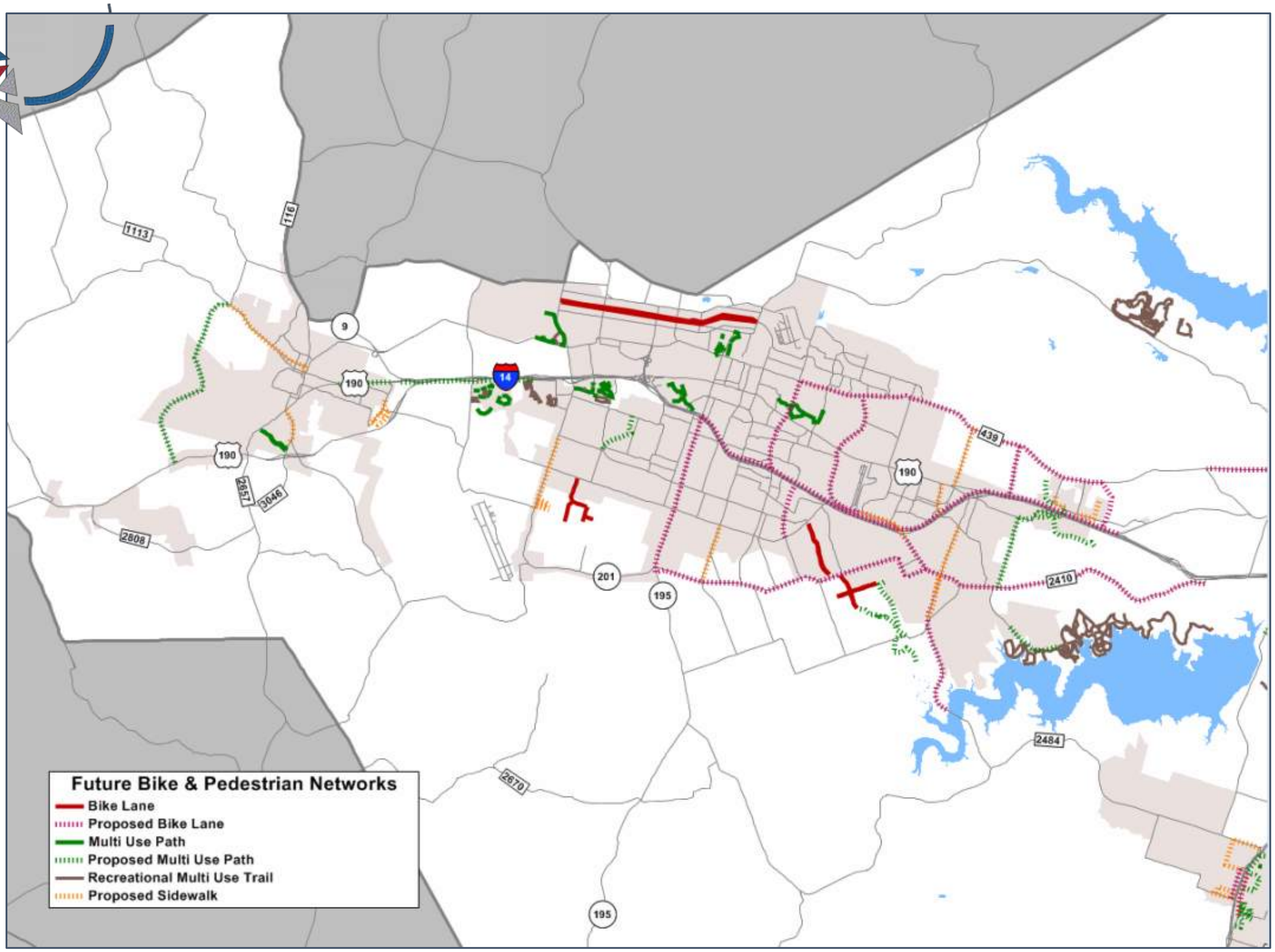
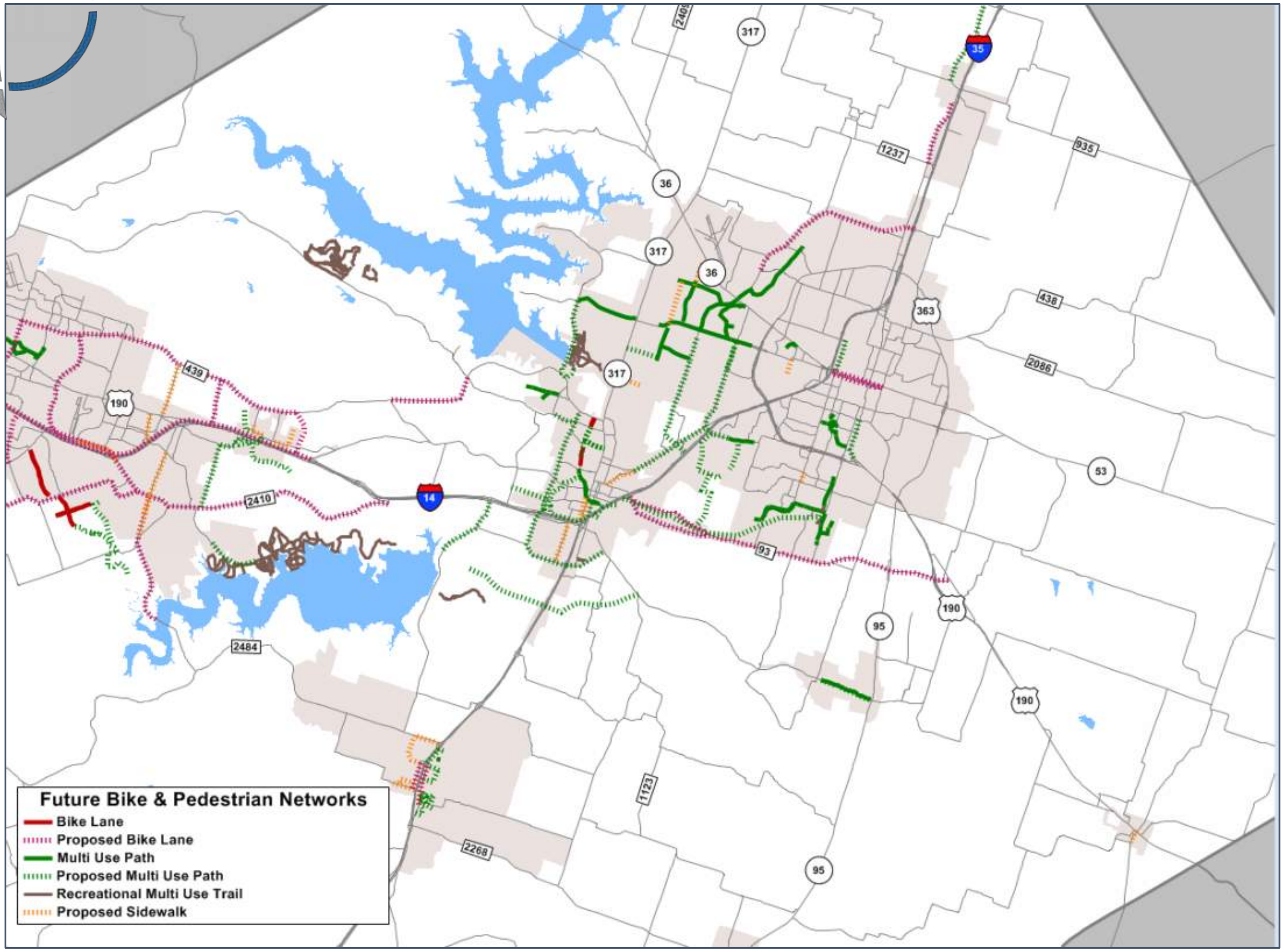


Figure 7-7: Future Bicycle & Pedestrian Plan for the Eastern Area



Summary

Based on the definitions of Functional Class for the bicycle and pedestrian networks, general design guidance for facilities and for other features such as intersection treatments, curbside treatments, bike parking, and pavement coloring was listed. Specific details depend on several factors, including the physical characteristics of the street, traffic volumes, mix of multimodal traffic, safety considerations, local standards and preferences, and funding. Therefore, the treatments presented in this Bicycle & Pedestrian Plan are meant as guidance for typical conditions, and should be refined as needed for each specific project.

Potential projects for this Bicycle & Pedestrian Plan are derived from the previous Mobility 2040 MTP and from public input received through the KTMPO website. At this stage of the planning process, the project list includes all projects, regardless of their source or of any designation as funded or unfunded in the previous MTP.

Typical construction costs for bicycle and pedestrian facilities are listed in **Table 7-5**. Construction costs can vary significantly based on site geologic conditions, drainage, subsurface utilities, and materials specifications. Environmental and social considerations can also have a significant impact on project costs.

Table 7-5: Typical Construction Costs for Bicycle & Pedestrian Projects

Typical Construction Costs for Bicycle & Pedestrian Project Types		
General Project Description	Typical Cost	Cost Units
Bicycle Facilities		
Widen street 4' for bike lane	300,000	per mile
Painted stripes for a conventional bike lane	15,000	per mile
Painted buffers for a conventional bike lane	20,000	per mile
Protected bike lane	100,000	per mile
Fixed bollard for protected bike lane	1,000	each
Off-street bike track	600,000	per mile
10' Off-street bike lane with 2' shoulders and signage	1,000,000	per mile
Signs for bike route	5,000	per mile
Bike lane signs, wayfinding signs, and pavement stencils	23,000	per mile
Bicycle Parking		
Inverted U bike rack, single	250	each
Multi-Use Trails & Paths		
12' multi use trail, concrete	200,000	per mile
12' multi use trail, ashphalt	100,000	per mile
6' multi use trail, gravel	55,000	per mile
Pedestrian Facilities		
5' sidewalk, both sides	250,000	per mile
Paved multi-use trail	100,000	per mile
Unpaved multi-use trail	50,000	per mile
Curbs, Medians, & Bridges		
Curb bulb-out	13,000	each
Pedestrian median island	13,000	each
ADA-compliant sidewalk ramp	2,000	each
Mid-block crossing with bulbouts and landscaping	60,000	each
100' wooden pedestrian bridge	100,000	each
Intersections		
Protected intersection	70,000	each
Painted crosswalk	3,000	each
Imprented decorative paved crosswalk	4,000	each

The costs for projects listed in Table 7-5 are sourced from the Pedestrian and Bicycle Information Center, which has compiled almost 2,000 observations of built projects referenced by the Robert Wood Johnson Foundation's Active Living Research Program and the Federal Highway Administration (FHWA). The costs are often reported with a wide range of values, with the high-end costs reaching ten to one hundred times the low-end cost. The exceptionally wide range in the estimates means that the resultant costs for projects listed in the table cannot be considered as reliable or appropriate for budget estimates, but can be valuable in comparing the relative costs of different types of projects. A general observation is that costs for bicycle and pedestrian infrastructure are consistently only a small fraction of the costs of street infrastructure.

Chapter 8: Group Transportation

CHAPTER HIGHLIGHTS

- **General Design Guidance**
- **Potential Projects**

Introduction

Group Transportation is defined as the bus, passenger rail, and passenger air modes. Of these three, only the transit mode is defined as having a network; the other modes gain access to the transportation network at specific points, which typically are intermodal stations. The three modes within Group Transportation category therefore define five distinct sub-modes:

- Bus, defined as The HOP's local bus network.
- Intercity bus, defined by the stations served by commercial long-distance bus.
- AMTRAK, defined by the station directly serving AMTRAK passenger rail.
- Bus-AMTRAK Connection, defined by the station linking the two services.
- Air, defined by the airports with regularly-scheduled commercial service.

The purpose of this regional Plan is to define the group transportation modes so that all potential projects may be displayed and reviewed together, and so that the appropriate right-of-way may be identified and planned for. A key component of this planning task is to define the Functional Class for each appropriate proposed project, and to define typical designs for each Functional Class. The concept of Functional Class is used as an organizing element for the bus network only; the other modes of intercity bus, AMTRAK, the bus-AMTRAK connection, and passenger air do not have associated networks or defined Functional Classes.

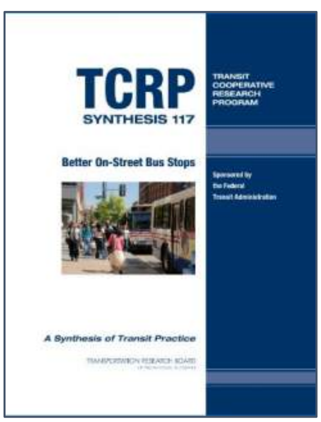
Typical designs are intended to illustrate the maximum right-of-way needed for each mode. It is recognized that the actual design needed for any specific project at a given time depends on several factors, including the needs of the bus stop, physical characteristics of the street, traffic volumes, ADA compliance and safety considerations, local standards and preferences, and funding. Therefore, the designs presented in this plan are meant as guidance for the typical conditions, and should be refined as needed for each specific project.

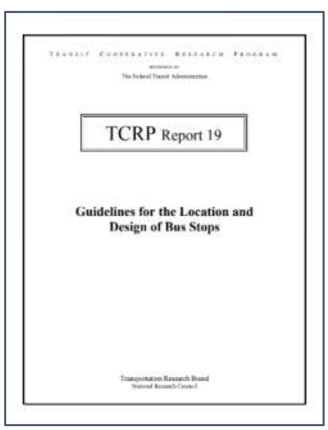
Group Transportation Systems General Design Guidance

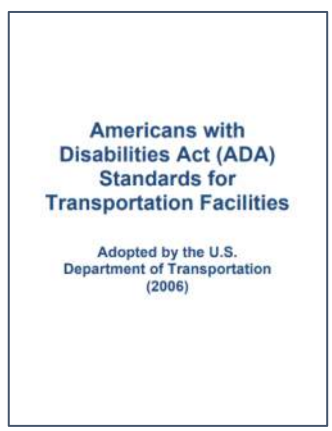
General Design Guidance for the Bus Network

Functional Classes for the bus network have been defined in terms of the amenities present at stops. The four bus Functional Classes include the ***Station Functional Class***, ***Shelter Functional Class***, ***Bench Functional Class***, and the ***Basic Bus Stop Functional Class***.

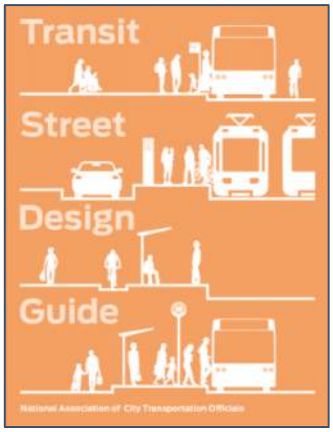
General design guidance for bus stops is provided at the national and state levels. Guidance includes national-level research studies such as *TCRP Synthesis 117: Better On-Street Bus Stops* and *TCRP Report 19: Guidelines for the Location and Design of Bus Stops*, and regulatory guidance such as the *USDOT's Americans with Disabilities Act (ADA) Standards for Transportation Facilities* and *FTA Circular FTA C 4710.1* providing ADA guidance.

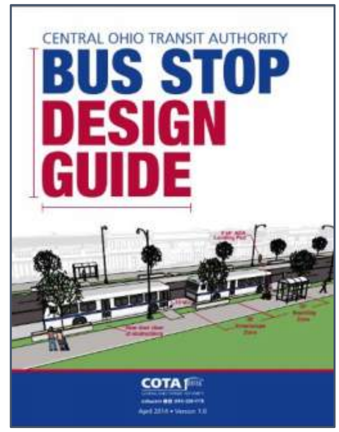






Optional and unofficial design guidance for transit stops and for transit operations on streets are provided by widely-recognized best practices from national organizations and from prominent transit agencies such as the *NACTO Transit Street Design Guide*, the *Enhanced Transit Corridors Plan Toolbox* from Tri-Met in Portland, Oregon, and the *Bus Stop Design Guide* from the Central Ohio Transit Authority in Columbus, Ohio. These types of publications provide guidance on state-of-the-practice facilities for bus stops.





ADA requirements pertain to surfaces, clearances from curbs and roadways, cross slopes, and accessible connections to streets, sidewalks, and pedestrian paths. The U.S. Access Board publishes *ADA Accessibility Guidelines* (ADAAG) and *ADA Standards for Transportation Facilities*. Pertinent sections of the ADA Standards are Section 810.2: Transportation Facilities, Bus Boarding & Alighting Areas and Section 402: Accessible Routes.

ADA standards are not "best practices" for the industry; they are the minimum requirements to comply with Federal legislation. Going beyond the ADA minimum requirements, a new concept of Universal Design (UD) has been developed. Universal Design is intended to provide improved access for people with disabilities while also going further to accommodate the needs of the whole population who may have no protected disabilities, but who do have special needs related to their need for ramps, slower walking speeds, or other issues. Targeted groups with special needs include children, parents pushing strollers, and older adults. General design guidance and background information on Universal Design is available through the Center for Inclusive Design and Environmental Access at the University of Buffalo at http://www. udeducation.org/.

There are three examples of the ***Station Functional Class*** in the region: the Southwestern Coaches intercity bus station on 4th Street in Killeen, which supports linking bus service to the AMTRAK station in Temple; the Greyhound intercity bus station on S 5th Street in Temple; and the AMTRAK station on W Avenue B in Temple. All three facilities are privately owned and operated, but all are served by the regional transit system and have public access. ADA compliance and Universal Design for the facilities and for access to the facilities are issues for consideration in station design.

General design guidelines for the ***Shelter Functional Class***, the ***Bench Functional Class***, and the ***Basic Bus Stop Functional Class*** all have a similar basis because of their physical and functional similarities.

In general, the overall design guidance for all Functional Classes of bus stops is that all stops must include a 5’ x 8’ pad for wheelchair loading at the bus door. If a shelter is present, a 2.5’ x 4’ wheelchair space for maneuvering must be provided within the shelter. Other bus stop attributes, including the adjacent sidewalk and sidewalk access, must comply with ADA standards.

Compliance to ADA requirements for every bus stop in the system is an expensive and complex task. Oftentimes, balancing passenger needs, physical constraints, and budget constraints in planning for full ADA compliance requires the development of a facility Capital Improvement Plan to inventory gaps, define and prioritize projects, and develop a project implementation plan and schedule.

Two general placements of the required ADA landing pad for wheelchairs are possible. **Figure 8-1** shows the landing pad placed partially within the shelter, combining the required maneuvering room with the pad. In **Figure 8-2**, the landing pad is placed fully outside the shelter and the maneuvering room is separate. This configuration affects the distance that the shelter must be placed from the curb.

Figure 8-1: Bus Stop With Shelter with Wheelchair Landing Pad at the Shelter

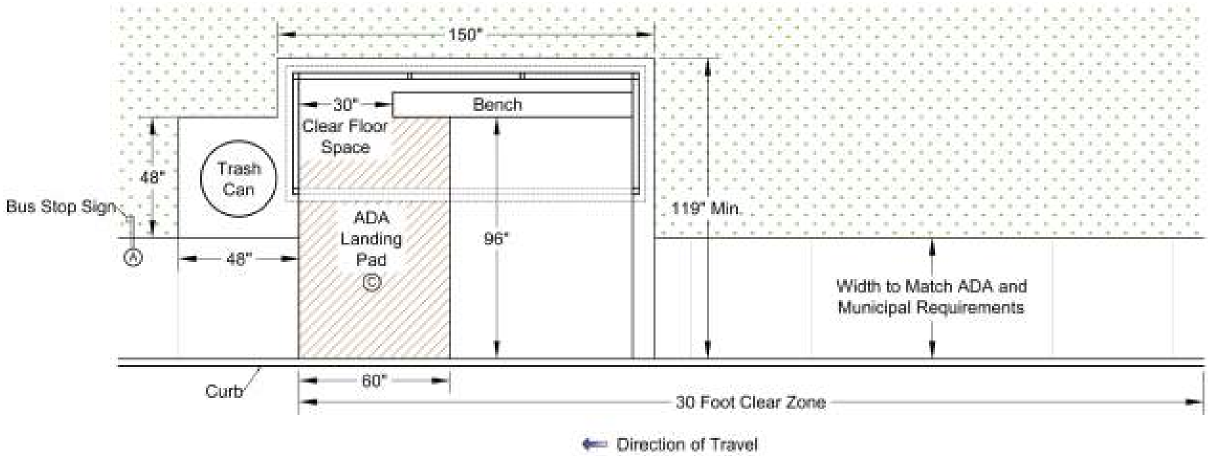


Figure 8-2: Bus Stop With Shelter with Wheelchair Landing Pad Outside the Shelter

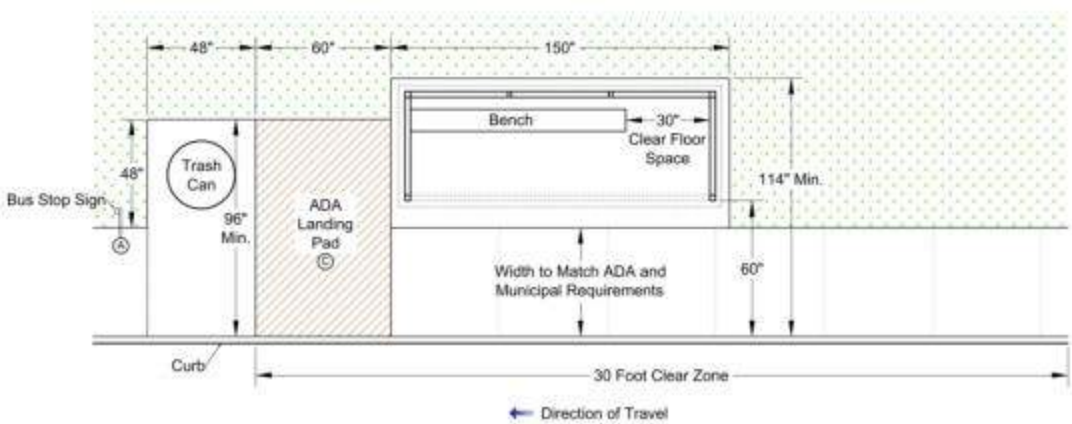


Figure 8-3: Sidewalk Placed Behind a Bus Stop

Figure 8-3 shows another configuration with just a bench, with the sidewalk placed on the back side of the pad rather than against the curb. The general design guidance for the bus stop is not affected; the same requirements for the ADA landing pad and maneuvering room must be met.

Figure 8-4: Bus Stop With Bench and Wheelchair Landing Pad

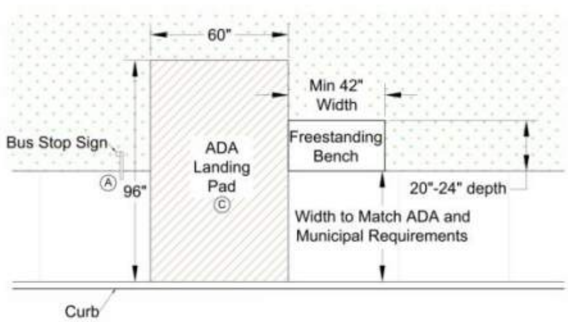


Figure 8-4 illustrates the general design criteria for a bench or a simple bus stop. Since the size of the 5’ x 8’ landing pad is deeper than the sidewalk, it extends further back than the sidewalk or the bench. This configuration also provides room for a wheelchair to be placed out of the walking path of the sidewalk.

In addition to the consideration of ADA compliance for the design of bus stops and the placement of stops in relation the street, the placement of stops in relation to adjacent buildings should also be considered as a general design guideline.

Figure 8-5: Bus Stop Separated from Building

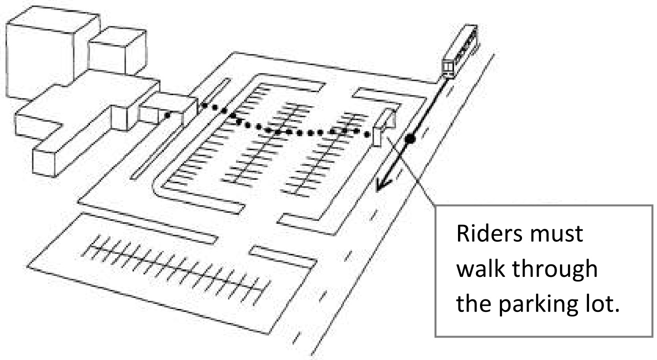


Figure 8-6: Bus Stop Adjacent to Building

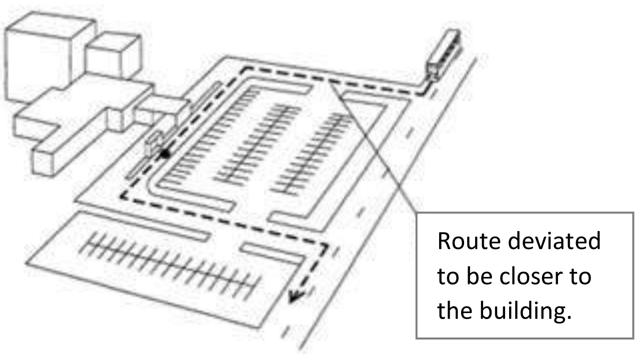


Figure 8-7: Bus Stop Connected with a Path

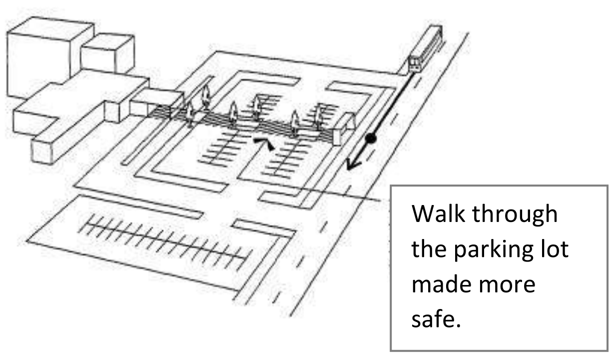


Figure 8-5 shows a configuration of a bus stop and an adjacent building that is typical for suburban areas. In this instance, a large parking lot is placed between the street and the building entrance. With the bus stop placed on the street on the periphery of the site, riders must walk through the parking lot in order to access the bus stop or the building. This configuration is present in the region at places such as the VA Hospital and the Scott & White Hospital in Temple, some entrances to the Temple Mall, Central Texas College in Killeen, and shopping destinations such as Wal-Mart, HEB, and strip malls throughout the region.

Figure 8-6 shows one way that this access, convenience, and safety issue can be addressed. This design has the bus route deviated into the parking lot, allowing the stop to be placed closer to the building. This placement eliminates the need for riders to walk through the parking lot, but it increases length of the bus route.

Figure 8-7 shows another alternative for increasing access and safety for a bus stop. This design provides a distinct pedestrian path between the bus stop and the building. While the riders still must walk through the parking lot to access the bus stop and the building, the path is designed for pedestrians to make the access more visible and thus safer. This design also has the advantage of not impacting the length of the bus route with any deviations.

Table 8-1 summarizes the recommendations for right-of-way applicable to all transit network Functional Classes. It includes ADA requirements for the landing pad, sidewalks, accessible ramps, surfaces, and cross slopes.

Table 8-1: Summary of Design Guidelines for Bus Network Functional Classes

Feature	Minimum Dimensions	Preferred Dimensions	Max Slope	Clearance	From	Notes
Bus Stop Sign on Pole				2.5'	Curb	
Landing Pad	5' x 8'	10' x 8'				5' wide parallel to road; 8' deep perpendicular to road
Bench	20" x 42"	24" x 42"		4'	Pedestrian Path	
Maneuvering Space	2.5' x 4'				Bench or Shelter	Clear space for wheelchair
Bus Shelter				11'	Curb	Must not block the pedestrian path
				5'	Sidewalk	
				2'	Curb	
				12'	Buildings or Walls	
Sidewalk Accessible Path	4'	5'				
Ramp Detectable Warnings						Truncated domes in aligned pattern, with color contrast
Ramp			1:12			Max ramp length 15'
Ramp Flared Sides			1:10			
Adjacent Road & Gutter			1:20			
Surface of Path	3'		1:20			
Cross Slope			1:48			

General Design Guidance for Other Group Transportation Modes

The remaining four group transportation modes of intercity bus, AMTRAK, the Bus-AMTRAK connection, and passenger air are all privately owned and operated and all relate to operations rather than

to infrastructure. Since the design standards for their facilities are both limited and are under the jurisdiction of the private sector, only the general requirements for ADA compliance that apply to all public facilities are relevant for these modes. ADA compliance must be applied to all public facilities that interface with these private group transportation modes.

Potential Group Transportation Mode Projects

In contrast to the road network which provides physical infrastructure, the bus network primarily provides transportation services through bus operations. The concepts of road projects and bus projects are therefore significantly different. Where the road network cites specific physical infrastructure projects such as new construction or adding lanes to existing roads, projects for the bus network are typically grouped projects. The 2019 – 2022 Transportation Improvement Program (TIP) listings for the bus network includes items for vehicle purchases, capital preventative maintenance, and operating funds. No physical infrastructure projects are listed.

For other group transportation modes, the 2040 Metropolitan Transportation Plan (MTP) lists two lighting projects for the Draughon-Miller Central Texas Regional Airport. MTP projects for group transportation are shown in Table 8-2.

Table 8-2: Group Transportation Projects from the 2040 MTP

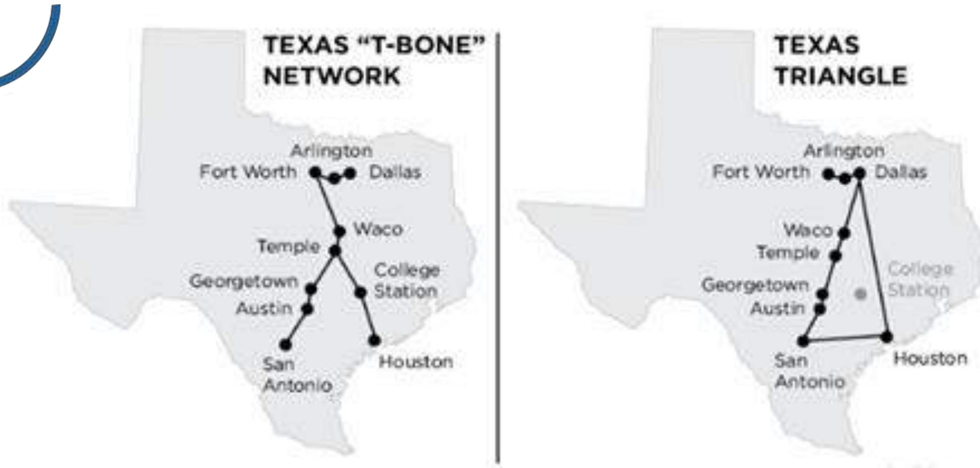
Mode	Project ID	Project	Project Description	City	Source	Year
Bus	A40-15	Fleet Replacement	Purchase new buses	N/A	Funded Cat 7	2020
Passenger Air		Draughon-Miller Central Texas Regional Airport	Engineering & lighting design	Temple	Aviation Capital Improvement Program	2019
Passenger Air		Draughon-Miller Central Texas Regional Airport	Lighting on runways and apron	Temple	Aviation Capital Improvement Program	2020

There is, therefore, not a set of specific group transportation projects which can be built into a network and plan which is equivalent to the Thoroughfare Plan for the road network.

Although there are no specific public sector projects for other group transportation modes, there are several private sector projects in planning stages related to passenger rail service through Temple.

The Federal Railroad Administration (FRA) has issued a Draft Environmental Impact Statement (DEIS) for the Texas Central bullet train between Houston and Dallas. This planning document sets the approval for the project's planning, design, and pre-construction phases. The preferred route as designated in the DEIS follows existing electrical transmission lines and has only one mid-point stop, so the route does not pass through the KTMPO region. However, Texas Central has reached an agreement with AMTRAK for through tickets and seamless connections between the services, which will link the high-speed rail service to AMTRAK the Texas Eagle route through Temple. The Texas Central service is distinct from both the related "Texas T-Bone" and the "Texas Triangle" high-speed rail alternatives shown in **Figure 8-8**, both of which feature routes directly through Temple.

Figure 8-8: Proposed High Speed Rail Routes in Texas



At the state level, TxDOT partnered with the Oklahoma DOT and FRA on the *Texas-Oklahoma Passenger Rail Study*, which was concluded in 2017 with a service-level Environmental Impact Statement, a Record of Decision, and a service development plan. This study examined various options for enhanced passenger rail service, but the three NEPA-preferred alternatives are all for high-speed service, with twelve to twenty daily round trips passing through Temple. The three preferred alternatives are identical from Hillsboro to San Antonio, as shown in **Figure 8-9**.

Figure 8-9: NEPA-Preferred Alternatives from the Texas-Oklahoma Passenger Rail DEIS

The TxDOT *2016 Texas Rail Plan Update* reviewed potential near-term improvements to current AMTRAK service. The report noted a strong connection between the Texas Eagle route through Temple and the Sunset Limited route running east-west through San Antonio. Its core recommendations were for projects to increase the current three-times-a-week service on both routes to daily service. While daily service was shown to be efficient and is a cost-effective project with a return on investment of 2.45, the plan noted that the project was not supported by the Union Pacific Railroad because of the need for double-tracking to address capacity issues. The 2016 estimate for the capital funding required to upgrade the tracks for daily service was $750 million.

Summary

Based on the definitions of Functional Class for the bus network, general design guidance for bus stops and for the placement of stops in relation to adjacent buildings was listed. Specific details depend on several factors, including the needs of the bus stop, physical characteristics of the street, traffic volumes, ADA compliance and safety considerations, local standards and preferences, and funding. Therefore, the treatments are presented as guidance for typical conditions, and should be refined as needed for each specific project.

Potential projects for group transportation modes typically relate to operations rather than infrastructure. Project listings in the 2017-2020 TIP and the Mobility 2040 MTP generally are grouped categories rather than specific physical projects. As a result, there can be no physical map or plan of group transportation projects equivalent to the Thoroughfare Plan. Conceptual specific and system-wide projects for group transportation are listed in Chapter 12.

Chapter 9: Freight Plan

CHAPTER HIGHLIGHTS

- **Freight General Design Guidance**
- **Potential Freight Projects**
- **Future Freight Network**

Introduction

Freight modes for the KTMPO region include truck, freight rail, and freight air. Because the freight rail and freight air modes access the network only at specific intermodal points, Functional Classes have been defined as an organizing element only for trucks. Truck Functional Classes are defined in Chapter 4 according to the differences in the desirability of the presence of trucks on the road network. They include the ***Truck Priority***, ***Truck Restricted***, ***Truck Hazardous Material***, and ***Truck Prohibited*** Functional Classes.

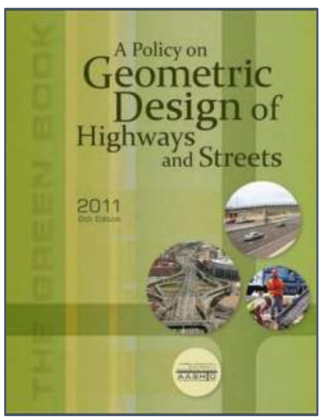
The purpose of this Plan is to define the freight transportation modes so that all potential projects may be displayed and reviewed together, and so that the appropriate right-of-way and the interaction between modes may be identified and planned for.

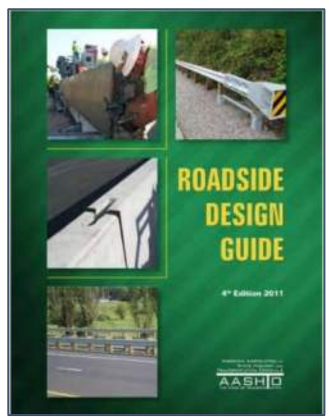
Freight General Design Guidance

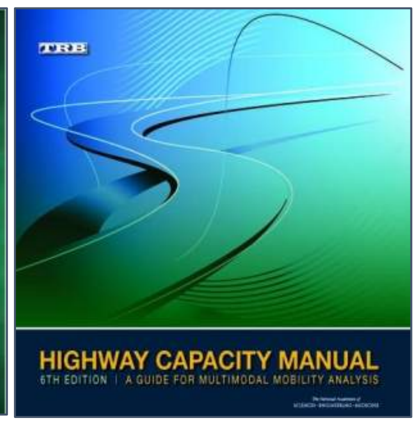
General Design Guidance for the Truck Network

Since the truck network corresponds to the road network, general design guidance follows the cross-sections by Functional Class as defined in the Thoroughfare Plan in Chapter 6. Truck Functional Classes are envisioned as being a complementary overlay on road Functional Classes.

General design guidance for on-system roads in Texas is provided by the *TxDOT Roadway Design Manual*. The manual includes general and basic design guidance, with additional guidance addressing the specific needs of urban streets, suburban streets, two-lane and multi-lane rural highways, and freeways. It references several other publications, such as the *AASHTO Policy on Geometric Design of Highways and Streets* (the green book), the *AASHTO Roadside Design Guide*, and the TRB *Highway Capacity Manual*.







The presence of trucks within any particular road Functional Class is accommodated through the concept of the "design vehicle." Larger vehicles such as trucks, emergency response vehicles, and buses have specific needs which must be addressed in road design; particularly turning radius, lane width, vertical clearance, and horizontal clearance. The specific design vehicle which is chosen for a particular road impacts the speed and safety of the road for all users. The *TxDOT Roadway Design Manual* does not define firm guidelines for the selection of the design vehicle for road design. It recognizes several factors which impact the selection of the design vehicle:

- Functional Class of the road and of intersection roads
- Frequency of use of the road by large vehicles (i.e., truck percentage of ADT)
- Types of large vehicles that use the road
- Available right-of-way

Templates defining the minimum turn radius and pavement edge geometries for turns for various types of large vehicles are provided, as shown in **Figure 9-1**.

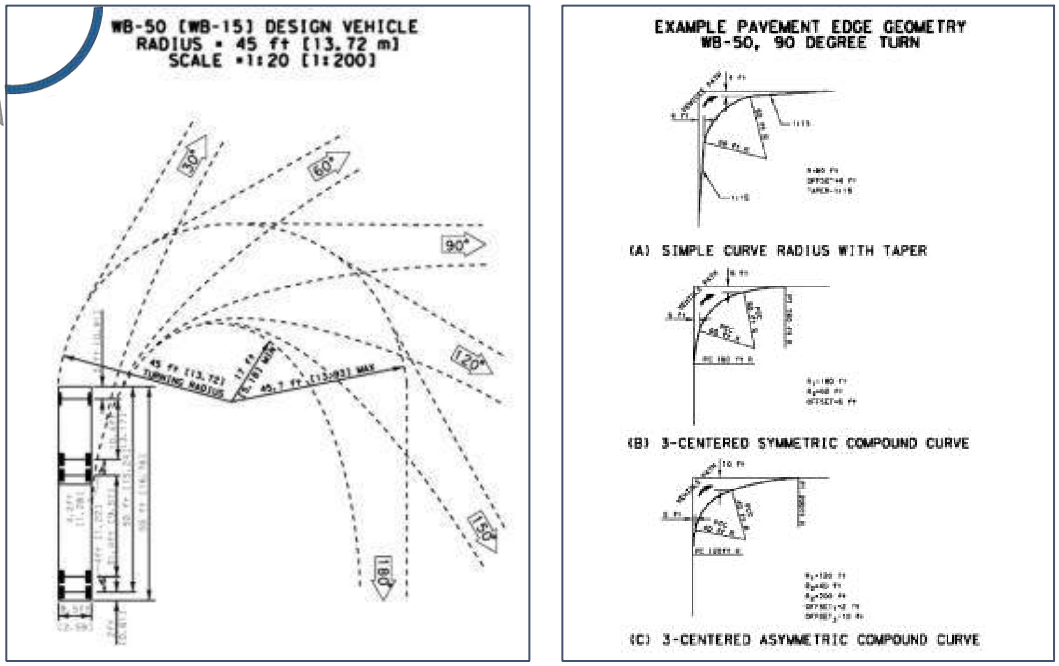
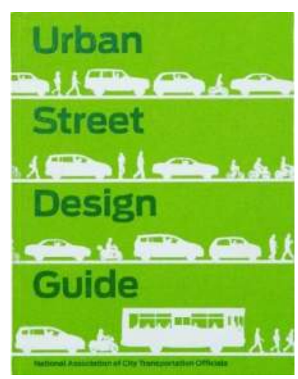


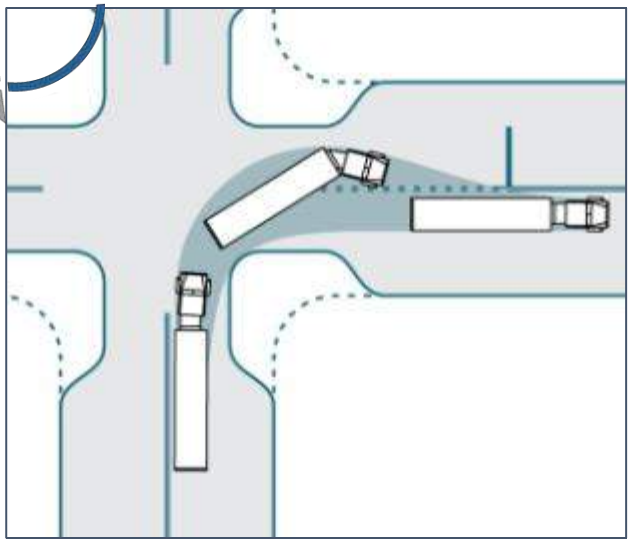
Figure 9-1: Sample TxDOT Templates for Design Vehicle Geometrics

The *TxDOT Roadway Design Manual* provides special design criteria for the Texas Highway Freight Network (THFN). TxDOT policy for roads designated as the THFN calls for a minimum 18.5' vertical clearance. Horizontal clearance is shown as dependent on the design speed of the roadway, with higher speeds requiring greater clearance. A horizontal clearance of 80' from the edge of the road to the closest vertical element of the roadside is required for design speeds up to 90 mph; higher design speeds require a 90' clearance.



The NACTO *Urban Street Design Guide* provides additional general guidance on the definition of the design vehicle. Rather than focusing road design on the needs of the largest vehicle, it brings an alternate viewpoint of designing for the most vulnerable user while providing reasonable accommodation for all vehicles within the full road network. This approach considers two vehicles: the "design vehicle," which is a frequent user of a particular road setting the minimum turning radius and other geometrics, and the "control vehicle," which is an infrequent user of the road but which still must be accommodated.

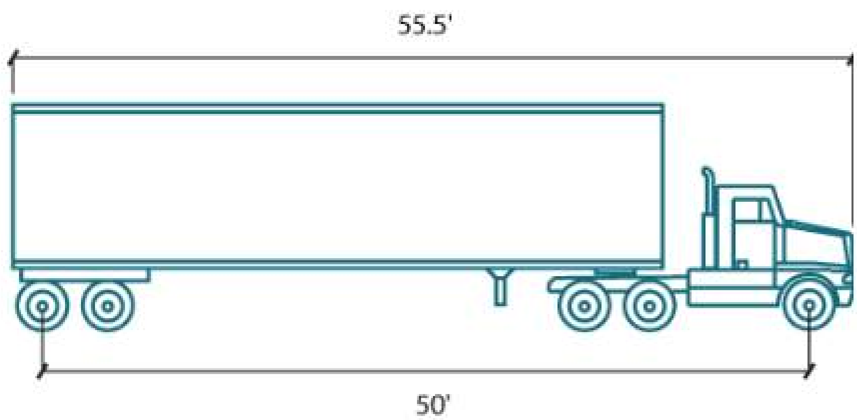
Figure 9-2: Control Vehicle Using Multiple Lanes for a Turn



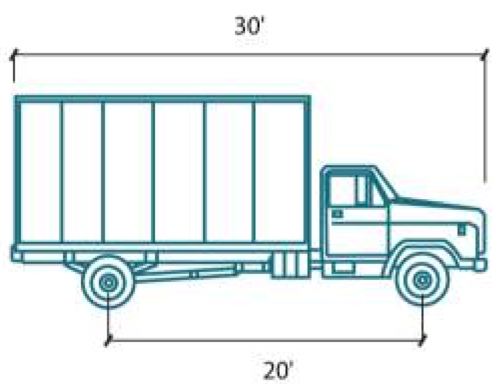
The NACTO guide recommends defining both a design vehicle and a control vehicle for each road based on its context. In reference to this Plan, road context is defined by the combination of road and truck Functional Classes. The NACTO guide posits that roads should be designed so that the design vehicle can make a turn using one turning lane. In contrast, the infrequent control vehicle is still accommodated, but its turns may use multiple lanes within an intersection. **Figure 9-2** shows how a setback stop line accommodates the larger turn radius of a control vehicle to allow it to encroach on the adjacent lane to make its turn. The intent of this design guidance is to reduce the width of the intersection and to slow traffic to improve road safety for all users.

The NACTO guide recommends the use of different design vehicles for different contexts, which correspond to road and truck Functional Classes.

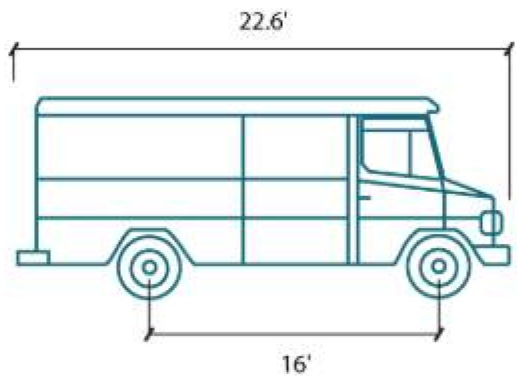
For designated truck routes, corresponding to the ***Truck Priority*** and ***Truck Hazardous Material*** Functional Classes, a WB-50 design vehicle is recommended. The standard WB-50 is an 18-wheeler with a 50' wheelbase and an overall length of 55.5'.



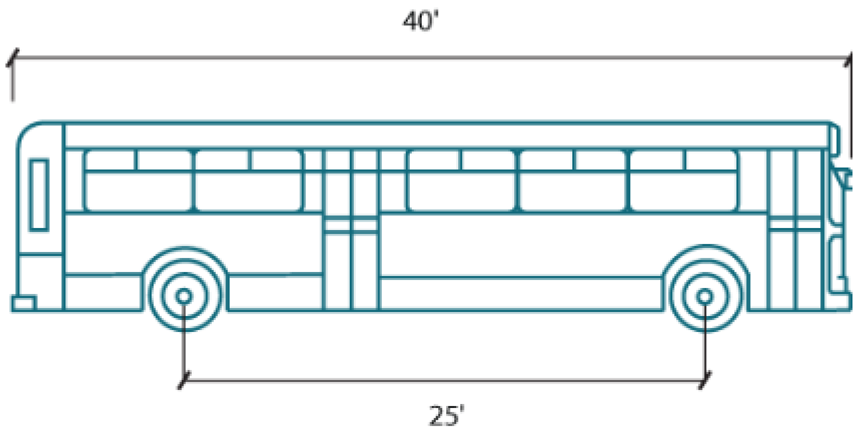
A smaller SU-30 design vehicle is recommended for downtown and commercial streets, which serve land uses requiring deliveries of goods. As a single unit vehicle with a smaller wheelbase, the SU-30 requires a smaller turning radius to stay within one lane on its turns. The larger WB-50 may be used as a control vehicle for these roads, with stop line setbacks accommodating turns which use the full intersection. The use of this class of design vehicle is appropriate for roads in the ***Truck Restricted*** Functional Class.



For the ***Truck Prohibited*** Functional Class on neighborhood and residential streets, the smaller single unit DL-23 delivery truck is an appropriate design vehicle. This choice allows the greatest flexibility to reduce lane widths, reduce the size of intersections, and slow traffic to design the road for the safety and convenience of all users.



Bus routes are defined independently of other design considerations, and may be present on any road Functional Class from Interstate Highway down to Local Streets. The needs of the BU-40 bus should be considered when selecting the design vehicle and control vehicle for all designated bus routes. When selecting the appropriate design vehicle based on truck access to land uses in a particular context, care should be taken that buses do not routinely have difficulty in managing turns on their routes.



The use of different design vehicles for each road and truck Functional Class is a concept that emphasizes the need for planning to define road rights-of-way. Roads built with a specific turning radius, lane width, vertical clearance, and horizontal clearance cannot easily be updated if land use changes create a need for accommodating larger vehicles. This makes the designation of truck routes and bus routes dependent on the design of the adjacent roads and their ability to accommodate larger vehicles. This is also a consideration in the development of industrial parks and intermodal areas. The size and characteristics of fire trucks should be considered when setting the design vehicle and control vehicle for all streets in order to ensure access.

General Design Guidance for Other Freight Modes

Freight railroads access the road network only at specific intermodal points and, in addition, are privately owned. Design standards and construction projects for railroad infrastructure are, therefore, largely defined by their private sector owners. TxDOT provides *Plans, Specifications, & Estimates Requirements on Projects with Railroads*, which provides guidance to road contractors when their projects interact with at-grade crossings. However, the TxDOT document does not specify standards for railroad infrastructure.

The exception on freight railroad design standards involves specific guidance from the Federal Railroad Administration (FRA) on infrastructure for railroad crossings for designated railroad quiet zones. A quiet zone is an exception to the FRA rules requiring trains to sound their horns when approaching at-grade crossings. To ensure safety, the quiet zone requires active warning devices, which typically include four-quadrant gates with warning lights, road channelization, and medians.

There are currently no designated railroad quiet zones in the KTMPO region.

Similar to rail freight, air freight accesses the road network only at specific intermodal points. Design guidance for roadside access to airports corresponds to the road design guidance by Functional Class as defined in the Thoroughfare Plan in Chapter 6.

Potential Freight Transportation Projects

The 2017 Texas Freight Mobility Plan provides insights into the scope of freight projects by detailing project evaluation criteria for freight transportation modes, as shown in **Table 9-1**. These criteria show that freight projects have multiple goals and, therefore, may also have multiple sources.

Table 9-1: Project Evaluation Criteria from the Texas Freight Mobility Plan

Texas Multimodal Freight Network (TMFN) Project Evaluation Criteria
On the Texas Multimodal Freight Network
Eliminates an at-grade rail crossing on the Texas Multimodal Freight Network
Improves structurally deficient or functionally obsolete facility
Improves access to a terminal or certified development site
Reduces travel time
Improves travel time reliability
Improves efficient movement
Encourages truck to rail diversion
Improves a safety hot spot
Improves safety on a high-volume hazmat route

To address this, potential future projects for freight modes have been derived from sources that address the range of the listed project evaluation criteria. They include:

- Routes defined by the KTMPO Freight Advisory Committee, as shown in **Table 9-2**.
- Load-restricted bridges, as shown in **Table 9-3**.
- Load-restricted roads, as shown in **Table 9-4**.
- Roads with geometric restrictions, as shown in **Table 9-5**.
- At-grade railroad crossings, shown in **Table 9-6**.

The listing of truck routes identified by the KTMPO Freight Advisory Committee in Table 9-2 also includes a proposed new intermodal site. The Civilian-Military Joint Use Rail-Truck Multimodal Facility is under study for a site on Fort Hood, located between the railroad tracks and IH-14 in an area bounded by Clarke Rd to the west and Clear Creek Rd to the east. While this site is not itself a rail or a road project, and has not been proposed by KTMPO, it is a proposed multimodal terminal which may generate the need for projects, and so should be considered.

Table 9-2: Truck Routes Identified by the KTMPO Freight Advisory Committee

Freight Advisory Committee Identified Truck Routes		
Road	Limits From	Limits To
FM 93	IH 35	US 190
FM 436	IH 35	US 190
FM 439	SH 195	SH 317
FM 1741	US 190	FM 93
LP 121	FM 436	FM 439
SH 36	Coryell Co line	Loop 363
SH 53	Loop 363	Falls Co line
SH 317	FM 439	McLennan Co line
Temple Outer Loop	IH 35 at Hart Rd	IH 35 S of Temple

Table 9-3: Load Restricted Bridges

Load Restricted Bridges		
Road	Crossing	Weight Limit
BIG ELM CREEK	#100	36,000
BIG ELM CREEK	#607	15,000
BIRD CREEK	#67	12,000
LEON RIREV	#62	36,000
LITTLE ELM CREEK	#507	21,000
LITTLE ELM CREEK	#618	21,000
LITTLE ELM CREEK	#95	12,000
LITTLE ELM CREEK	#98	12,000
NOLAN CREEK	#1	12,000
RUNNELLS CREEK		28,000
S DARRS CREEK	#52	21,000
SALADO CREEK	#60	24,000
WILLOW CREEK	#18	21,000

Table 9-4: Load Restricted Roads

Load Restricted Roads		
Road	**Limits From**	**Limits To**
FM 116	US 190	0.3 mi S of Abbot Ln
FM 436	Loop 121	US 190
FM 437	US 190	SH 53
FM 438	Loop 363	FM 935
FM 487	Williamson Co line east	Williamson Co line west
FM 487	SH 95	Milam Co line
FM 580	CR 3270	FM 116
FM 935	IH 35	Falls Co line
FM 940	FM 437	FM 485
FM 964	Farmers Rd	FM 485
FM 1113	FM 580	N 1st St
FM 1123	Holland Rd	SH 95
FM 1237	SH 317	IH 35
FM 2086	FM 438	SH 53
FM 2115	FM 487	IH 35
FM 2184 North	US 190	New Colony Rd
FM 2184 South	Reeds Cemetery Rd	US 190
FM 2268	FM 1123	IH 35
FM 2268	SH 95	Milam Co line
FM 2409	SH 36	FM 2601
FM 2410	Verna Lee Blvd	IH 14
FM 2483	FM 2271	SH 317
FM 2484	SH 195	IH 35
FM 2601	Moody Leon Rd	SH 317
FM 2670	Wolfridge Rd	FM 440
FM 2843	Cedar Valley Rd	IH 35
FM 2904	FM 2086	SH 320
FM 3046	Lampasas Co line	FM 116
FM 3117	US 190	SH 53
FM 3219	Bus 190	FM 439
FM 3369	FM 438	SH 320
LOOP 121	IH 14	IH 35
MARTIN LUTHER KING JR BLVD	Bus 190	IH 14
N FORT HOOD ST	Bus 190	Rancier Ave
SPUR 1237	FM 1237	Southerland Rd
SPUR 439	IH 14	FM 439

Table 9-5: Roads with Geometric Restrictions

Geometric Restricted Roads	
Road	**Restrictions**
Charter Oak Dr	RR underpass 13' 8", curve, narrow, hill
Levy Crossing Rd	At grade crossing with excessive crown
N 5th St	At grade crossing with excessive crown
Waco Rd	RR underpass 14' 5", curve, narrow, hill

Table 9-6 lists the 109 at-grade railroad crossings in the region. There are also 29 grade-separated crossings, which are not included in the table.

Table 9-6: At-Grade Railroad Crossings

Railroad	City	Crossing Street	Number of Tracks	Angle of Crossing
UP	Bartlett	E Bell St	1	90
BNSF	Belton	College St	2	60
BNSF	Belton	N Beal St	1	70
BNSF	Belton	N Penelope St	1	70
BNSF	Belton	N Wall St	1	70
UP	Belton	Hubbard Ln	2	70
BNSF	Copperas Cove	7th St	1	90
BNSF	Copperas Cove	Bradford Dr	1	90
BNSF	Copperas Cove	FM 116	1	90
BNSF	Copperas Cove	Grimes Crossing Rd	1	80
BNSF	Copperas Cove	Main St	1	90
BNSF	Copperas Cove	Unnamed Rd	1	90
BNSF	Copperas Cove	Wolf Rd	1	90
BNSF	Fort Hood	Ammo Rd	2	70
BNSF	Fort Hood	S 79th St	2	90
Fort Hood	Fort Hood	S 79th St	1	90
Fort Hood	Fort Hood	Santa Fe Ave	1	90
Fort Hood	Fort Hood	Spur Dr	1	90
Fort Hood	Fort Hood	Spur Dr	1	90
Fort Hood	Fort Hood	Warehouse Ave	1	90
BNSF	Harker Heights	FM 3219	1	90
UP	Holland	Fannin St	2	80
UP	Holland	FM 1123	1	90
BNSF	Kempner	FM 2313	1	90

Table 9-6: At-Grade Railroad Crossings (continued)

Railroad	City	Crossing Street	Number of Tracks	Angle of Crossing
BNSF	Killeen	2nd St	1	90
BNSF	Killeen	College St	1	90
BNSF	Killeen	Ft Hood St	1	85
BNSF	Killeen	Gilmer St	1	90
BNSF	Killeen	N 10th St	1	90
BNSF	Killeen	N 28th St	2	90
BNSF	Killeen	N 4th St	1	90
BNSF	Killeen	N 8th St	1	90
BNSF	Killeen	N Gray St	1	90
BNSF	Killeen	N Roy Reynolds Dr	1	85
BNSF	Killeen	Twin Creeks Dr	1	90
UP	Little River-Academy	Bill Money Rd	1	80
UP	Little River-Academy	FM 436	1	80
UP	Little River-Academy	W Church St	1	80
BNSF	Nolanville	Jack Rabbit Flat Rd	1	90
BNSF	Nolanville	Levy Crossing Rd	2	90
BNSF	Nolanville	N 5th St	2	90
BNSF	Nolanville	Old Nolanville Rd	3	90
BNSF	Nolanville	Pleasant Hill Cemetery Rd	1	90
Spur	Nolanville	E Ave H	1	90
Spur	Nolanville	FM 439	1	80
BNSF	Rogers	Benton Rd	2	90
BNSF	Rogers	FM 2184	3	90
BNSF	Rogers	FM 437	3	90
BNSF	Rural Bell Co	1237 Spur	3	60
BNSF	Rural Bell Co	Brewster Rd	1	70
BNSF	Rural Bell Co	FM 1237	1	60
BNSF	Rural Bell Co	FM 93	1	45
BNSF	Rural Bell Co	Franklin Rd	1	45
BNSF	Rural Bell Co	Guyton Rd	1	45
BNSF	Rural Bell Co	Heidenheimer Rd	3	90
BNSF	Rural Bell Co	Highland School Rd	2	90
BNSF	Rural Bell Co	Knob Creek Rd	2	45
BNSF	Rural Bell Co	Luther Curtis Rd	1	60
BNSF	Rural Bell Co	Neroc Rd	2	90
BNSF	Rural Bell Co	Pritchard Rd	2	45

Table 9-6: At-Grade Railroad Crossings (continued)

Railroad	City	Crossing Street	Number of Tracks	Angle of Crossing
BNSF	Rural Bell Co	Southerland Rd	2	60
BNSF	Rural Bell Co	Tem Bel Ln	1	70
BNSF	Rural Bell Co	Wheat Rd	1	90
BNSF	Rural Bell Co	Willow Grove Rd	1	45
Spur	Rural Bell Co	Levy Crossing Rd	1	50
UP	Rural Bell Co	E Big Elm Rd	1	90
UP	Rural Bell Co	Harber Rd	1	90
UP	Rural Bell Co	Hillyard Rd	1	90
UP	Rural Bell Co	Landfill Rd	1	80
UP	Rural Bell Co	Lindemann Rd	1	90
UP	Rural Bell Co	Mills Ln	1	90
UP	Rural Bell Co	Roberts Rd	1	90
UP	Rural Bell Co	Stag Rd	1	80
BNSF	Rural Lampasas Co	FM 1715	1	90
BNSF	Rural McLennan Co	Stampede Rd	1	45
BNSF	Temple	49th St	2	60
BNSF	Temple	Center St	1	90
BNSF	Temple	FM 3117	2	45
BNSF	Temple	Industrial Blvd	2	85
BNSF	Temple	Industrial Blvd	1	60
BNSF	Temple	Industrial Blvd	1	60
BNSF	Temple	Kegley Rd	1	70
BNSF	Temple	Lucius McCelvey Dr	2	90
BNSF	Temple	Martin Luther King Jr Dr	2	45
BNSF	Temple	Moore's Mill Rd	1	70
BNSF	Temple	S 25th St	2	70
BNSF	Temple	S Main St	2	70
BNSF	Temple	Unnamed Rd	1	70
UP	Temple	31st St	1	45
UP	Temple	Berger Rd	1	80
UP	Temple	Blackland Rd EB	1	90
UP	Temple	Blackland Rd WB	1	90
UP	Temple	E Ave C	1	80
UP	Temple	E Central Ave	1	90
UP	Temple	E Houston Ave	1	90
UP	Temple	E Munroe Ave	1	90

Table 9-6: At-Grade Railroad Crossings (continued)

Railroad	City	Crossing Street	Number of Tracks	Angle of Crossing
UP	Temple	E Shell Ave	1	80
UP	Temple	E Young Ave	1	90
UP	Temple	FM 93	1	80
UP	Temple	Hatrick Bluff Rd	1	45
UP	Temple	Martin Luther King Jr Dr	2	50
UP	Temple	S 5th St NB	1	75
UP	Temple	S 5th St SB	1	75
UP	Temple	Taylors Valley Rd	1	45
UP	Temple	Unnamed Rd	1	90
UP	Troy	Bottoms East Rd	1	90
UP	Troy	E Austin St	1	45
UP	Troy	Lely Dr	1	90
UP	Troy	Main St	1	70

Future Regional Freight Network

All the truck routes identified by the KTMPO Freight Advisory Committee and load restricted bridges, load restricted roads, and roads with geometric restrictions have been included in the future network, as shown for the region in **Figure 9-3**. Insets to show better detail of projects are included as **Figure 9-4** for the western area and as **Figure 9-5** for the eastern area.

The Figures show the existing 2017 streets and the proposed projects for upgrades to the freight network. There are three instances of overlaps among categories of projects where a load restricted road is also on an existing truck priority route or on a freight route identified by the KTMPO Freight Advisory Committee:

- Fort Hood Street from BUS 190 and Tank Destroyer Blvd in Killeen, which is an existing truck priority route. Fort Hood Street is also SH 195.
- Loop 121 from IH 14 to IH 35 in Belton. This is not on an existing truck priority route, but is an upgrade project proposed by the KTMPO Freight Advisory Committee.
- FM 436 from Loop 121 to US 190 south of Killeen. This is not on an existing truck priority route, but is an upgrade project proposed by the KTMPO Freight Advisory Committee.

The key purpose of the Freight Plan is to identify future projects so that right-of-way can be planned for. Supporting this purpose, the Plan is coded with all projects defined by KTMPO from relevant sources, as detailed in Table 9-2 through Table 9-5. This listing has been developed as an input into the updated KTMPO MTP for the year 2045. One of the functions of the 2045 MTP will be to prioritize the listing of projects and to balance them against the anticipated available funding to derive funded and unfunded project listings.

Figure 9-3: Regional Future Freight Network

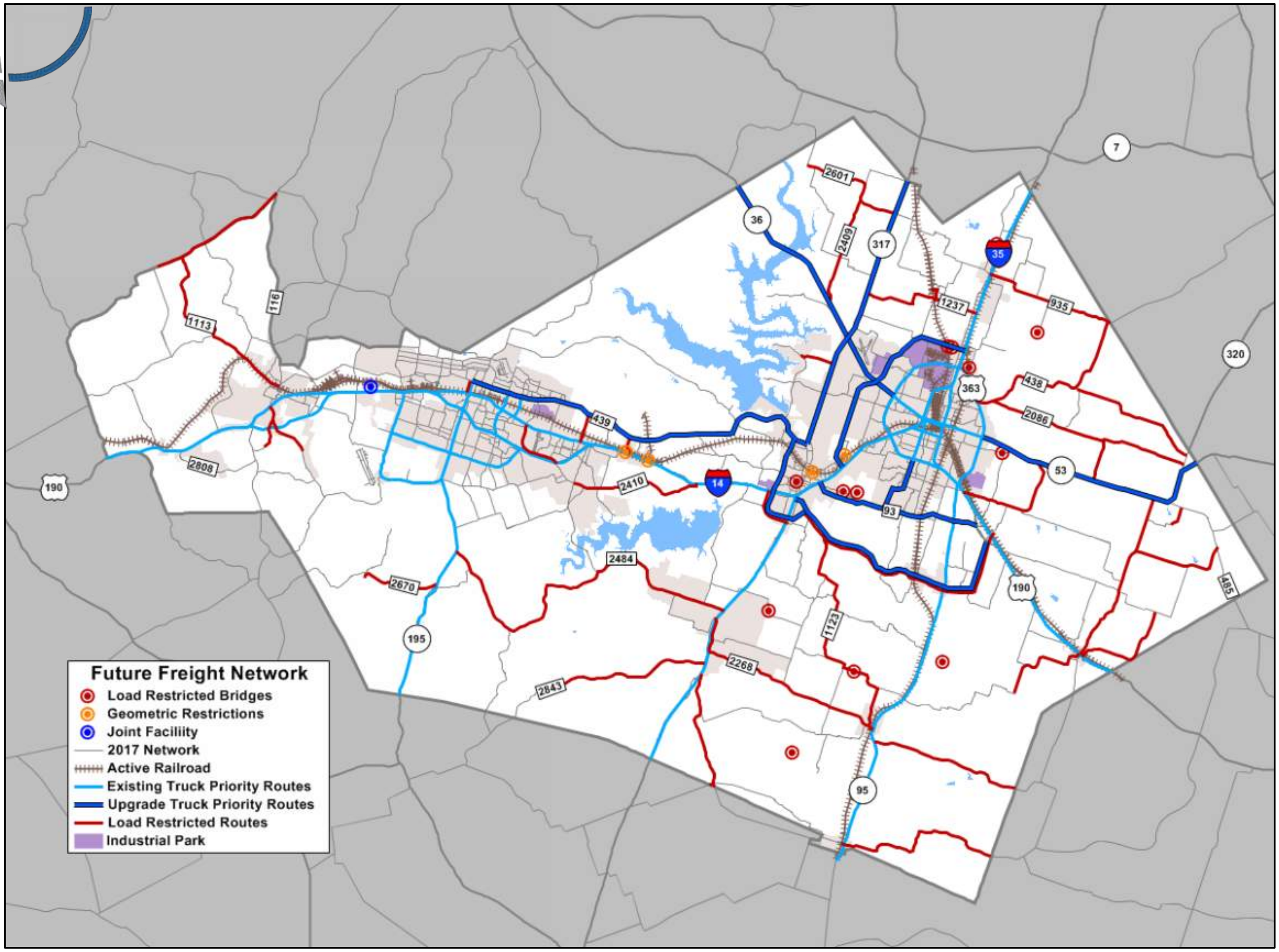


Figure 9-4: Future Freight Network in the Western Area

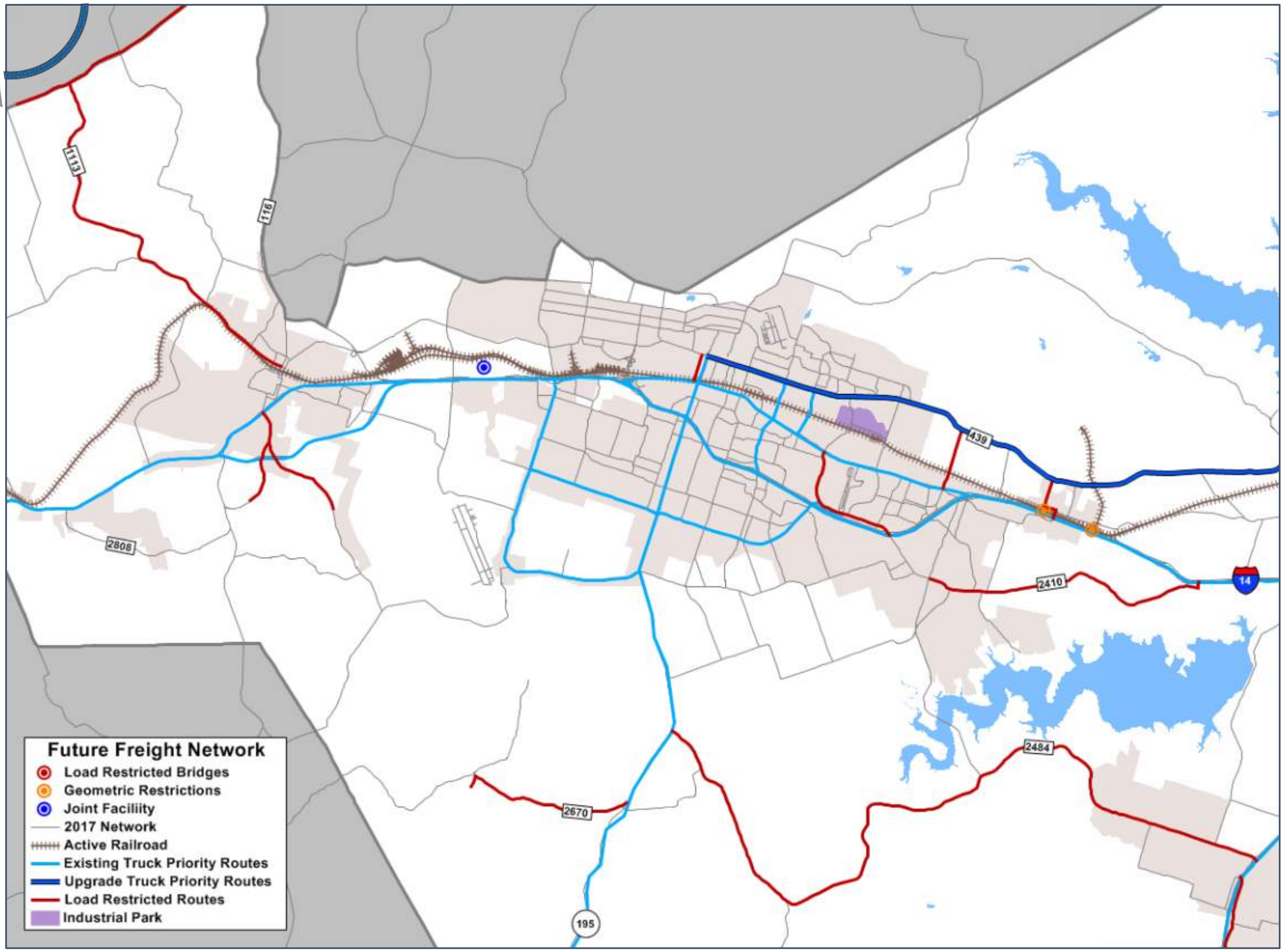
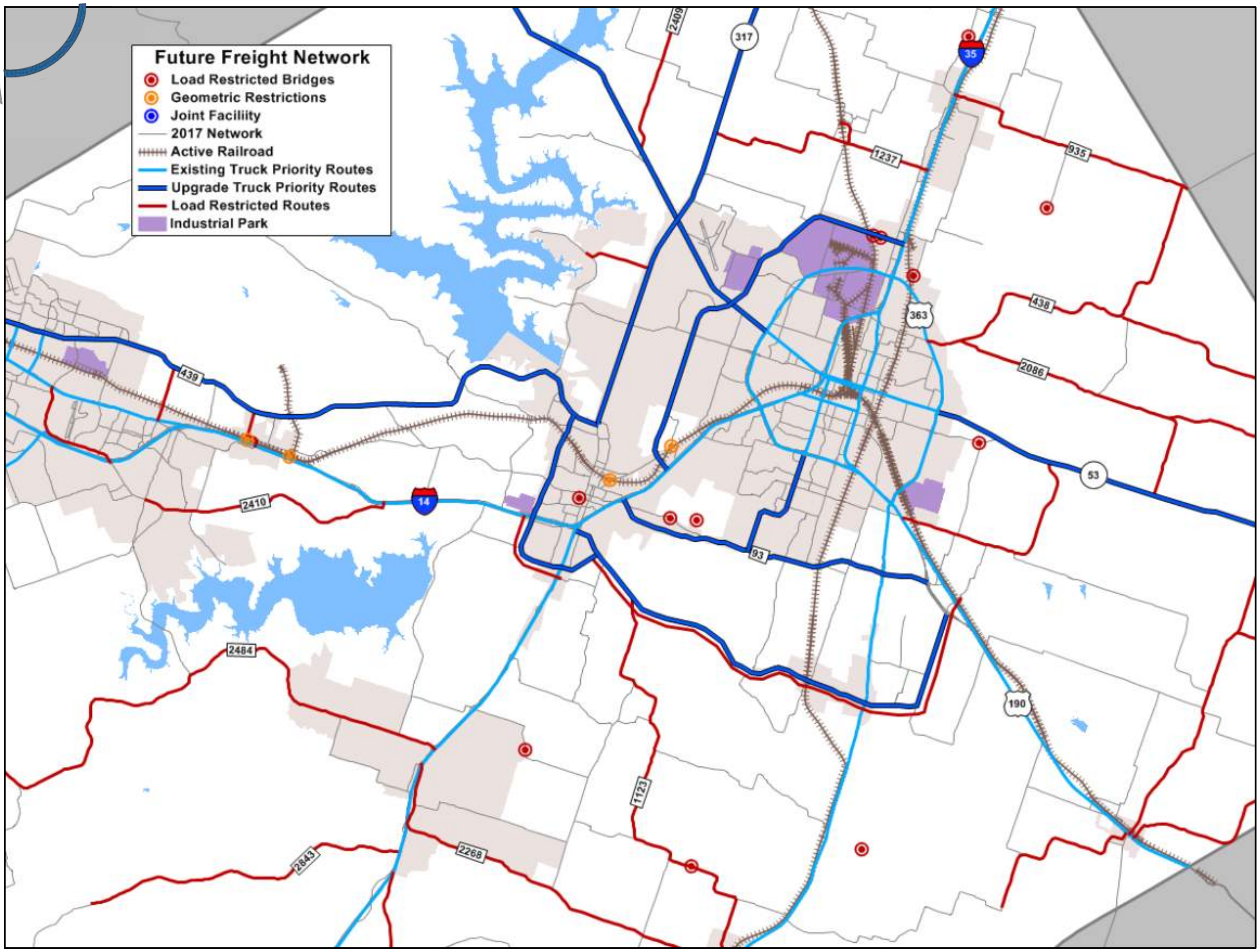


Figure 9-5: Future Freight Network in the Eastern Area



Summary

General design guidance for the truck network follows the auto network; the respective Functional Classes are designed to be complementary layers. National and TxDOT general design guidance relative to the truck network focuses on the definition of the design vehicle, which impacts the geometrics of the road for turning radius, lane width, vertical clearance, and horizontal clearance. These design criteria in turn affect vehicle speeds and the safety of the road for all users.

The *TxDOT Roadway Design Manual* does not define firm guidelines for the selection of the design vehicle for road design, but recognizes that various factors influence the appropriate choice. The NACTO *Urban Street Design Guide* considers two vehicles: the “design vehicle,” which is a frequent user of a particular road and which sets the minimum turning radius and other geometrics, and the “control vehicle,” which is an infrequent user of the road, but which still must be accommodated. It recommends defining both a design vehicle and a control vehicle for each road based on its context.

The use of different design vehicles for different road and truck Functional Classes is a concept that emphasizes the need for planning to define road rights-of-way. The size and characteristics of heavy trucks, fire trucks, and buses and their need for access should be considered when setting the design vehicle and control vehicle for all streets.

Since the rail freight and the air freight modes only interact with the road network at specific points, general design guidance on their infrastructure is not considered as a part of this Plan. However, guidance on the development of infrastructure for designated quiet zones for at-grade rail crossings is referenced. There are currently no designated railroad quiet zones in the KTMPO region.

Potential projects for the truck network are sourced to reflect the project evaluation criteria from the *Texas Freight Mobility Plan*. Sources include routes identified by the KTMPO Freight Advisory Committee and listings of load restricted bridges, load restricted roads, and geometric restricted roads.

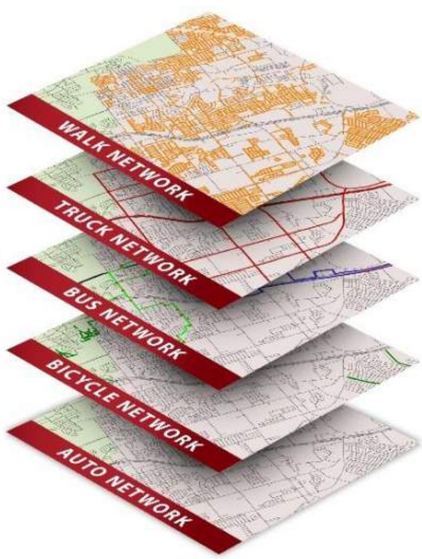
Chapter 10: Complete Streets

CHAPTER HIGHLIGHTS

- Context of the Region
- Context of the Street
- Complete Street Design Examples

Introduction

In chapter 3, the concept of Complete Streets was introduced to describe a shift from the traditional transportation engineering practice of optimizing streets for vehicle throughput towards a more multimodal approach that seeks to design streets that are usable, convenient, and safe for all users.



Chapters 6, 7, 8, and 9 have built on this by describing design guidance and potential projects for the full range of transportation modes which are available in the KTMPO region. In those chapters, each transportation mode has been treated separately and independently. This chapter on Complete Streets follows up by considering how each transportation mode can form integrated layers in a balanced regional multimodal network.

Complete Streets treatments are intended to bring the different layers of the multimodal system into a proper balance. This balance does not mean that every street must provide full accommodation for every transportation mode. It does mean that that every street should be designed with an appropriate consideration of all transportation modes to see how they can be balanced together.

> **…we could lay out an ideal street type, but in an existing city with constrained rights of way…not all streets can do all things at one time.**
>
> **David Gaspers**
> **Principal Planner**
> **City of Denver**

The definition of appropriate users for a street is a subjective judgement; not measurable in terms of its current uses. While Complete Streets treatments may not be immediately perceived as appropriate on specific streets that currently have low volumes of multimodal traffic, that perception is based on the use that has been driven by past street design where the street is optimized for automobiles. The inverse may be true; if a street is designed with all users in mind, then the convenience and the safety of the street will attract users. The goal is to build streets that will attract and serve new users for all modes, rather than merely accommodating existing users.

Implementing the desired Complete Streets design may be a challenge with the available right-of-way, funding constraints, and regulatory environment. Two general approaches are used:

The Complete Streets policy which has been adopted in Minneapolis is an example of an approach, where regulations aggressively call for Complete Streets treatments on every street. In this policy, top priority for every street is required to be given to pedestrians first, followed by bicycles & transit, with automobiles receiving the last priority. This is a deliberate decision to upend the traditional pyramid of placing automobiles as the first priority.

The other approach is illustrated by the Complete Streets policy being proposed in the Blueprint Denver Plan, which sets multimodal priorities in separate network layers. The pedestrian network is the first layer and is set as the highest priority for all streets. Each street is then evaluated individually for the appropriate modal priorities for the other layers of bicycling, transit, freight, and automobile. A particular street may therefore be optimized for automobiles, with a nearby parallel street prioritized for transit and bicycles. Conversely, another street may accommodate all modes. This approach is intended to implement a balanced system of modal layers rather than accommodating all networks ubiquitously.

With either approach, the very specific and objective design guidelines for each mode (as described in Chapters 4 through 9) are brought together and balanced under the very general and subjective concepts of Complete Streets (as described in this Chapter). Guidance for developing the proper balance of modes for Complete Streets therefore relies as much on imagination and judgement as it does on engineering.

> **Logic will take you from point A to point B. Imagination will take you anywhere.**
>
> **Albert Einstein**

Two contexts are important when considering the balance of modes for Complete Streets: the region and the street.

The context of the region considers variations of how Complete Streets principles can be applied with the transect of activity density, ranging from undeveloped rural areas to the high-density and high-activity urban cores.

The second context of Complete Streets is that of the street itself. The street may be considered as having various zones dedicated to different modes and uses, such as the sidewalk, the curbside, parking, travel lanes, and medians.

Complete Streets and the Context of the Region

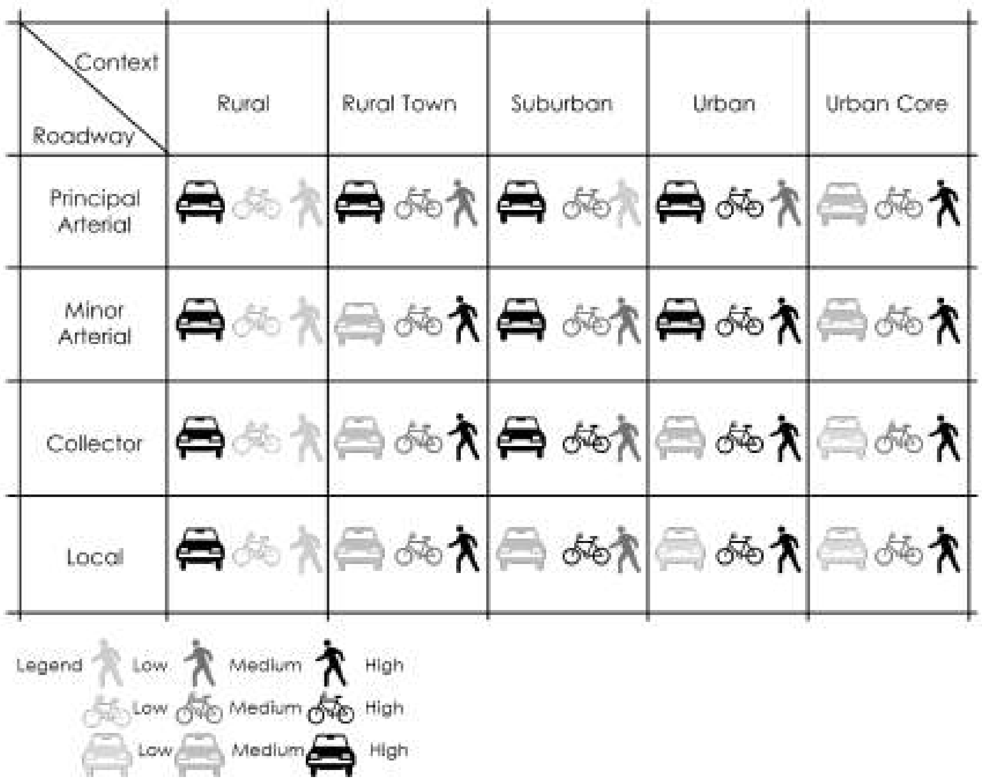
When considering the context of the region, street types are matched to land use characteristics. This context starts with defining a transect of land uses, ranging from undeveloped rural areas to the more intense activity zone in the urban core. **Figure 10-1** shows how activity density increases from rural areas to urban areas in a transect of regional context. This is designed to recognize how the differences in the regional context of density and activity affect street characteristics such as speed, capacity, and lane width.

Figure 10-1: Rural to Urban Transect in the Regional Context

The context of the region is employed in the approach taken by the *ITE Walkable Thoroughfares Manual*, which has been adopted by TxDOT and referenced for its Context-Sensitive Solution, and by the recently published *NCHRP Report 855: An Expanded Functional Classification System for Highways and Streets*. Both publications use the regional context and the type of street to set the appropriate balance and priorities of the street characteristics and the appropriate transportation modes accommodated.

The NCHRP report illustrates this concept with a matrix of street functional class versus regional context, as shown in **Figure 10-2**. It is based on the concept that street design cannot accommodate the best facilities for all modes and users on every street, every time. Street design must therefore consider conceptual priorities for all modes so that the appropriate priorities may be selected.

Figure 10-2: Matrix of Regional Context and Modal Appropriateness



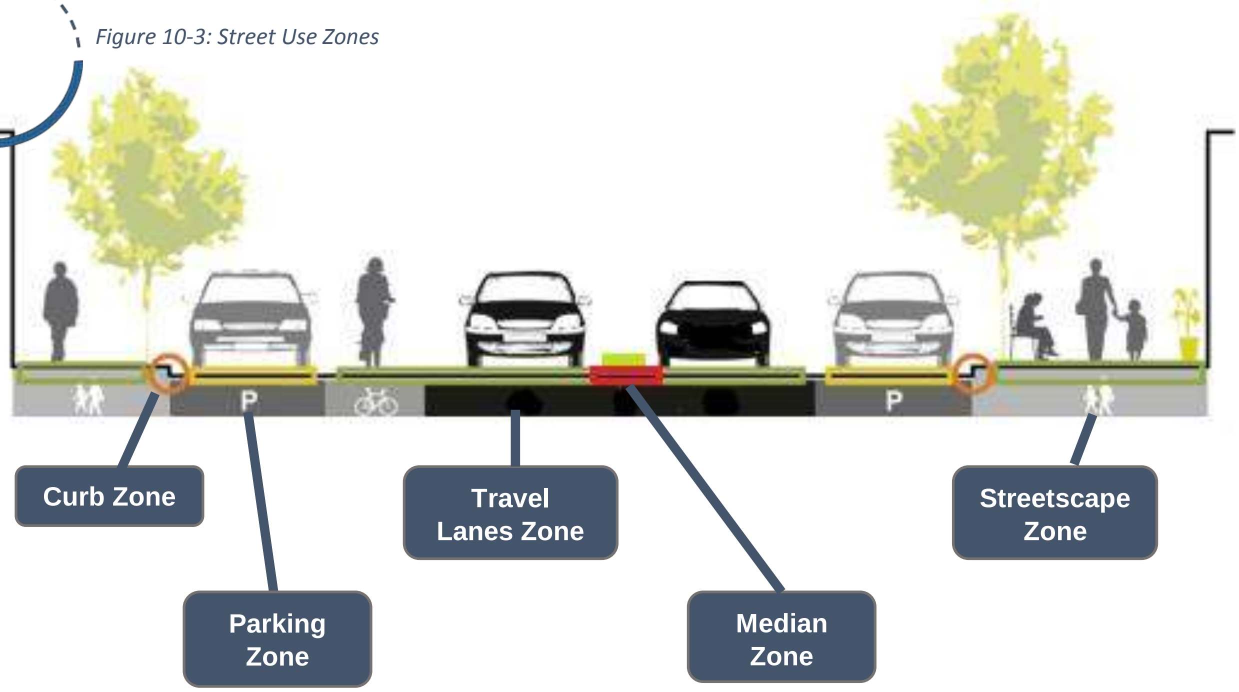
For example, on Principal Arterials, for most contexts the function of the street is to provide regional mobility, so high vehicle speeds are appropriate. The high speeds make Principal Arterials less appropriate for bicycles and pedestrians, and therefore they may be best accommodated with a parallel route whose function allows for lower speeds. Conversely, in the urban core, the functions to provide access and the greater density of sites means that speeds are lower and that pedestrians and bicycles have greater priorities. The presence of facilities such as bicycle lanes, which may reduce automobile speeds and capacity, is seen as appropriate in this context.

It should be noted that this approach defines the general appropriateness of the balance between transportation modes. Safety is an additional layer of consideration. Regardless of any other design parameters, every road should be safe for all its users. Dana Peak Park provides an example; the route for bicyclists to access the park requires traveling on rural streets, which are shown in the matrix as conceptual low-priority areas for bicycles. However, specific routes such as FM 2410 and Comanche Gap Rd should consider the safety of riders with specific bicycle facilities regardless of the conceptual balance of modes.

Complete Streets and the Context of the Street

The street cross section also provides context for Complete Streets treatments because of the different zones of use. **Figure 10-3** shows different zone uses which have typically been recognized.

Figure 10-3: Street Use Zones



The **Streetscape Zone** is the area dedicated to pedestrians. It can be further divided into the frontage zone along the building face, the walking zone, and the street furniture & landscaping zone. Streetscaping can improve the sense of place of a street and create pleasant environments.

The **Curb Zone** provides a clear distinction between the sidewalk and the street, and is important for the street's function and safety. Curb bulb-outs may be provided for safety and transit loading, and illustrate how the relationship between the zones can be malleable.

Strategies that impact the **Parking Zone** are often the most controversial element of Complete Streets design. Various orientations of the parking zone in relation to other zones can be developed to protect bike lanes. Bus turnouts and loading zones may be included with the parking zone.

The **Travel Lanes Zone** ranges from 9' to 12' feet wide. This zone may include dedicated bike lanes or bus lanes as well as general purpose automobile lanes.

Treatments in the **Median Zone** treatments include landscaped swales, raised and paved medians with intermittent turn bays, and continuous turn lanes. Pedestrian treatments in the median may be added to provide for safety islands to reduce the width of the street to be crossed.

Complete Streets General Design Examples

With the two approaches of either specifying full treatments for all streets or modal layers in a balanced network, and considering both the regional and the street contexts, the general and subjective guidance for Complete Streets design can be applied together with the very specific and objective design guidelines for each mode. Bringing all these concepts, approaches, contexts, and guidance together can be seen to require imagination as well as engineering.

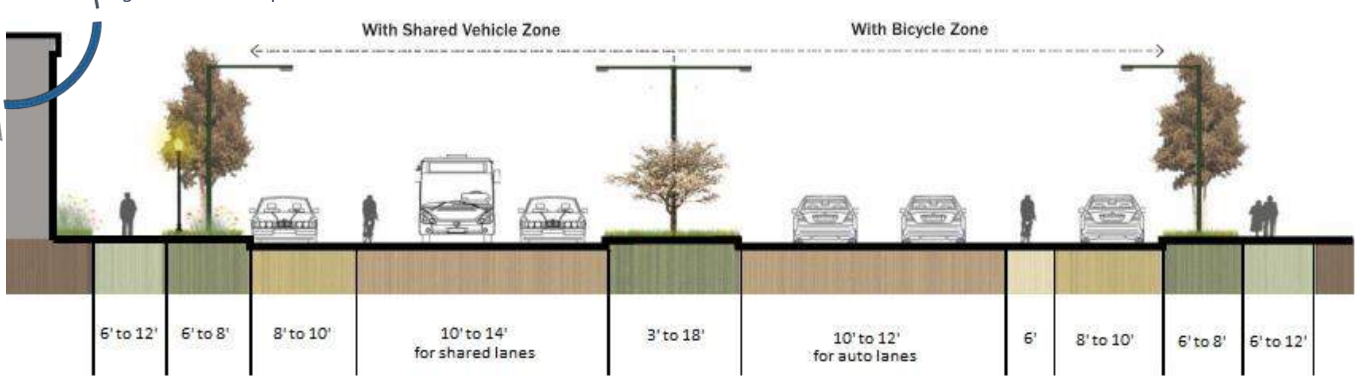
Whatever philosophy is used for Complete Streets design, the streets should address the regional goals as specified in the Metropolitan Transportation Plan (MTP) and in this Regional Multimodal Plan to ensure that the results are convenient and safe for all users and contribute to the development of a balanced regional multimodal system.

The options and artistry involved in implementing Complete Streets projects while conforming to the specific design guidance for the component transportation modes can be illustrated with several examples. **Figure 10-4** shows two examples of treatments on a multi-lane avenue. In the example on the left side, the outside lane is made wider to implement shared lanes. On the right side, the example shows the bicycle lane made separate and placed between the travel lanes and the parking zone.

These types of configurations are suitable for multi-lane streets with low to moderate speeds and traffic volumes to accommodate the shared streets strategy. The separate bicycle facilities as shown on the right side can be justified when traffic volumes or speeds are higher and bicyclist safety becomes more of an issue.

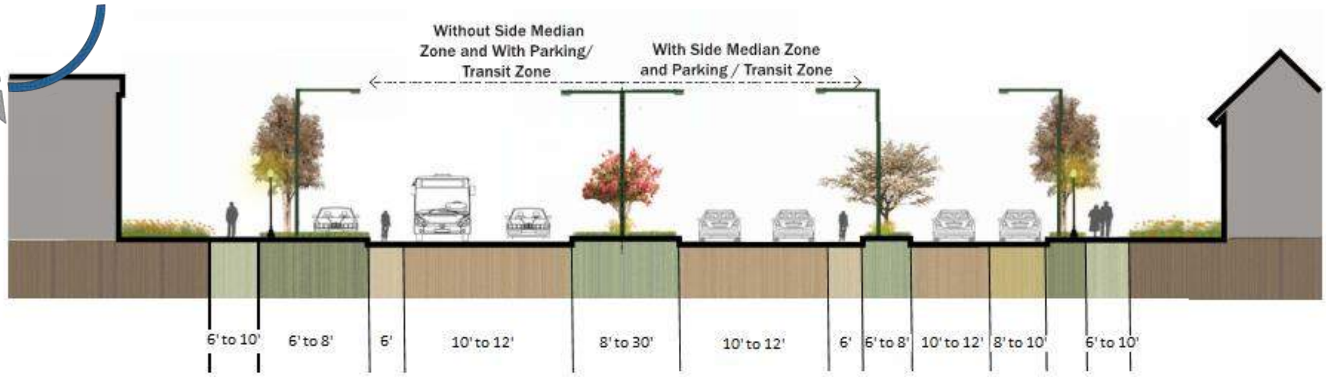
Either example may have a median with intermittent turn bays or a continuous center turn lane. Either treatment may include landscaping, islands, or pedestrian refuges.

Figure 10-4: Complete Streets Treatments on a Multi-Lane Avenue



Higher functional classed facilities with significant traffic volumes and high speeds are also amenable to Complete Streets treatments, as shown in **Figure 10-5**. In this example, the left side shows multiple travel lanes and a bicycle lane against the curb. Parking is accommodated with intermittent bays located in the curb and landscaping zone. On the right side, the example uses an intermediate median to separate the travel lanes from the parking and curb zones. This example includes a slower-speed travel lane along with the parking lane to provide access. This configuration separates slow-speed traffic and parking from the higher-speed main travel lanes, and features separate bicycle facilities in both examples.

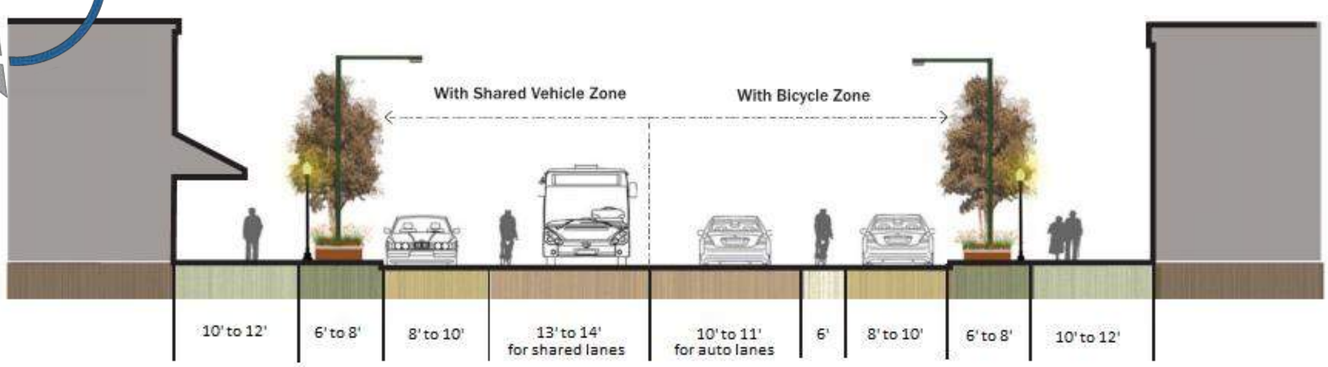
Figure 10-5: Complete Streets Treatments on a High Speed Multi-Lane Boulevard



Complete Streets treatments for a small urban core are shown in **Figure 10-6**. This kind of street is a destination, featuring more intense density and points of access in a smaller area. Traffic speeds are lower, but traffic volumes may be higher. Separate bicycle lanes are shown on the right, but the lower speeds in the area may make shared lanes a viable option, as shown on the left.

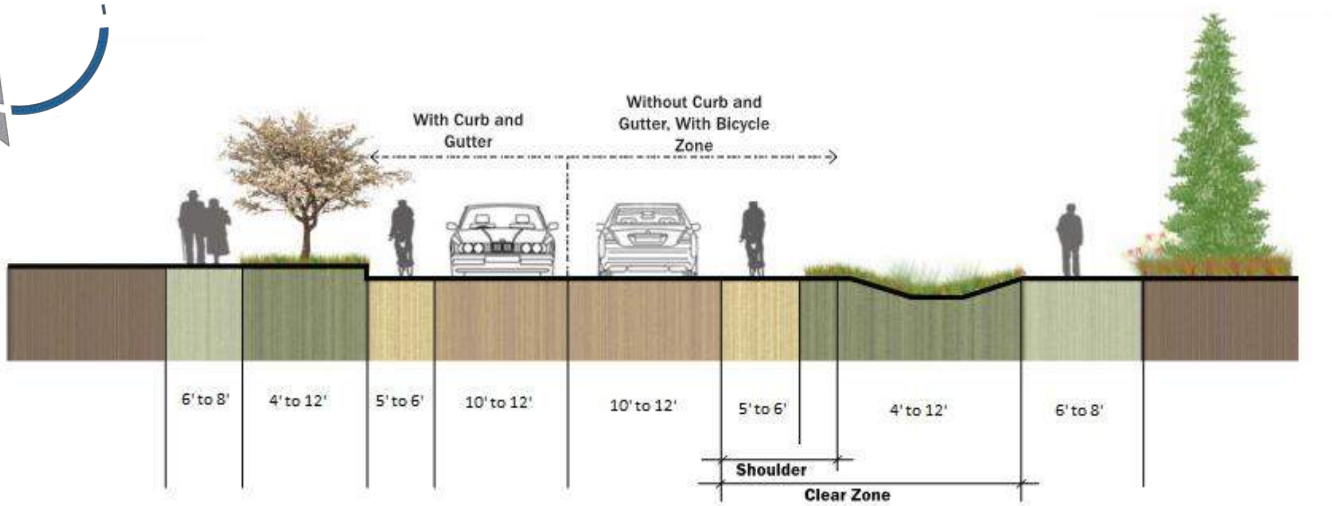
The sidewalk zones may be made wider to support pedestrian volumes and activities.

Figure 10-6: Complete Streets Treatments on a Small Urban Main Street



Complete Streets treatments for a suburban or rural two-lane road are shown in **Figure 10-7**. These street configurations are suitable for Local Streets, Collectors, and Minor Arterials with low to moderate traffic speeds and volumes. They may not include curbs & gutters or parking zones. In both examples, a separate bicycle lane is shown on the outside and the sidewalk zone is separated from the travel lanes with a generous landscaping zone.

Figure 10-7: Complete Streets Treatments on a Two-Lane Road



Complete Streets As-Built Examples

While Complete Streets is still a fairly recent concept, many examples have been completed to show the effects of the treatments. **Figure 10-8** shows a built example of a road diet on East Blvd in Charlotte, NC. The "before" configuration of a 4-lane undivided street through a residential area was under capacity and contributed to speeding and to safety issues for pedestrians and bicyclists. While the posted speed was 35 mph, cars were frequently observed traveling up to 50 mph. After the road diet was implemented to convert the street to 2 lanes with a center turn lane, pedestrian islands, and conventional bicycle lanes on the outside, the instances of speeding dropped measurably. Traffic data showed that the speed traveled by 85% of vehicles (the 85^{th} percentile speed, which is a traffic engineering measure) dropped from 43 mph to 40 mph, but the average travel time remained constant. These results show that speeding dropped but that the mobility of the corridor was not affected.

Figure 10-8: Road Diet Example from Charlotte, NC

An example on Lancaster St in Lancaster, CA shows an imaginative treatment of the median in a commercial area. As shown in **Figure 10-9**, the parallel parking zone along the curb was supplemented by angle-in parking in a landscaped median. The landscaping in the median includes pedestrian amenities at the crosswalks.

Figure 10-9: Median Treatment Example from Lancaster, CA

This example dropped the posted speed from 35 mph to 15 mph. The combination of fewer travel lanes, the median, and the change in posted speed reduced total crashes on the street by 50%, and reduced crashes with injuries by 86%. The corridor also saw extensive economic development with the Complete Streets treatment, with forty-nine new businesses totaling 116,000 square feet of commercial space being added to the 8-block long project.

The landscaped median also provides space for special events. Farmer's Market days, holidays, and special events take advantage of the space by restricting median parking and using the space to set up vendor's booths.

Ben Franklin Parkway in Philadelphia, PA illustrates another way to configure bicycle and pedestrian facilities with medians. **Figure 10-10** is an aerial photo, showing the paved central median on a 6-lane arterial. On both sides, a landscaped intermediate median separates flanking 2-lane streets with slower speeds and access to adjacent sites with curbside conventional bicycle lanes. **Figure 10-11** shows how the intermediate medians and the street edge both have multi-use lanes.

Figure 10-10: Multiple Medians Example in Philadelphia, PA

Figure 10-11: Multi-Use Paths in Medians in Philadelphia, PA

Octavia Blvd in San Francisco, CA shows a slightly different use of intermediate medians. In this example shown in **Figure 10-12**, the center median serves as a center turn bay in some locations. The intermediate medians separate the high speed traffic focused on mobility form the flanking streets serving lower-speed traffic focused on access. The flanking streets feature parking zones and sharrows.

Figure 10-12: Multiple Medians Example in San Francisco, CA

Summary

The KTMPO regional network consists of layers of interrelated networks for the auto, bicycle, bus, truck, and walk networks. Each of these networks has its own specific design standards specified by law or by professional practice. The Complete Streets concept is one tool that can help develop these individual networks into a balanced and integrated multimodal network.

Actually implementing the desired Complete Streets design may be a challenge with the available right-of-way, funding constraints, and regulatory environment. Two general approaches are used to define a policy: either applying Complete Streets treatments to every street, or defining layers of modal networks and determining the appropriate mix of treatments for each street.

Complete Streets treatments also depend upon the regional and the street contexts, which define the intensity and character of activities and where they take place on the street for each mode.

With either approach, the very specific and objective design guidelines for each mode are brought together and balanced under the very general and subjective concepts of Complete Streets. Guidance for developing the proper balance of modes for Complete Streets therefore relies as much on imagination and judgement as it does on engineering.

Chapter 11: Performance Measures

CHAPTER HIGHLIGHTS

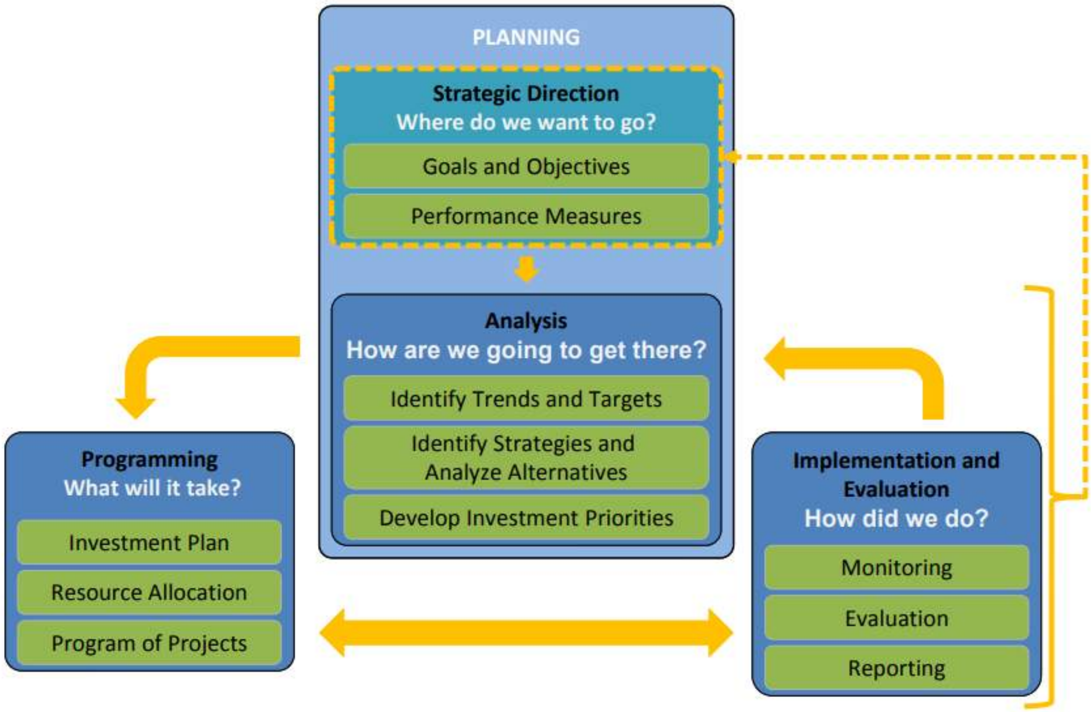
- Suggested Performance Measures by Mode
- Summary

Introduction

The concept of performance-based transportation planning is mandated by federal legislation, starting with its introduction in the Moving Ahead for Progress in the 21st Century (MAP-21) funding authorization in 2012, and continuing through the Fixing America's Surface Transportation Act (FAST Act) in 2015. Performance-based planning is a strategic approach that uses system data to guide decisions to progress towards goals. Defining performance measures and targets is a key component of the process to set objectives, define measurable targets, and monitor progress.

Figure 11-1 illustrates the role of performance measures in the planning process. Performance measures are grouped with goals & objectives defining the overall strategic direction. Together, they are the method for defining the "Where do we want to go?" portion of the planning process. The Implementation & Evaluation box defining the "How did we do?" portion of the process also relates to performance measures as the basis for monitoring, evaluation, and reporting progress.

Figure 11-1: Performance-Based Planning Process



The performance measures set at the national level by the Federal Highway Administration (FHWA) have been oriented towards motorized traffic, as shown in **Figure 11-2**. This is entirely appropriate given their geographic scope and the preponderance of motorized vehicles in the traffic mix.

Figure 11-2: National-Level Goals

Goal Area	National Goal
Safety	To achieve a significant reduction in traffic fatalities and serious injuries on all public roads
Infrastructure Condition	To maintain the highway infrastructure asset system in a state of good repair
Congestion Reduction	To achieve a significant reduction in congestion on the National Highway System
System Reliability	To improve the efficiency of the surface transportation system
Freight Movement and Economic Vitality	To improve the national freight network, strengthen the ability of rural communities to access national and international trade markets, and support regional economic development
Environmental Sustainability	To enhance the performance of the transportation system while protecting and enhancing the natural environment

Transportation planning in the KTMPO 2045 Metropolitan Transportation Plan (MTP) will address these performance targets and how they fit into federal requirements, the eleven Planning Factors, and regional transportation goals. This Regional Multimodal Plan complements that process at a finer level of detail with suggested performance measures for specific transportation modes. Following the performance-based transportation planning process as shown in Figure 11-1 and in accordance with federal regulations for public involvement, this Regional Multimodal Plan may only suggest performance measures for consideration. Adopting the performance measures and setting the specific targets must be a part of the larger planning process to ensure that they follow regional goals, are feasible and achievable, and that they have the support of all KTMPO member jurisdictions.

Suggested Performance Measures by Transportation Mode

Using this approach, the designation of regional performance measures can be used to complement and supplement those defined for the national and state levels. The full system can be used to help build, monitor, and evaluate a more balanced regional transportation system.

Performance measures for the ***Auto Network*** can closely follow the precedents set at the national and state levels. More specific performance measures can be defined to track performance towards integrating the auto network more closely into a balanced regional multimodal system.

Auto Network Performance Measure: Crashes Involving All Modes
Safety is one of the primary performance measures for the automobile network. Current performance measures include:

- Number of fatalities
- Fatality rate
- Number of serious injuries
- Serious injury rate

These performance measures treat all crashes as a single group. Additional safety-related measures are suggested to establish performance-based planning for the auto network within a balanced multimodal network.

This suggested performance measure would track the number of automobiles crashes with bicycles, buses, trucks, and pedestrians. It would be a gauge of how well the balance between modes is being implemented, which is particularly important as the use of other modes increase. This measures the safety of the balanced multimodal system.

Data for this performance measure would come from the Texas Crash Records Information System (CRIS) maintained by TxDOT. The system is based on reports from police responding to crashes, and so may contain some entry errors and omissions. It also misses the minor crashes which are not reported to police and incidents of near misses. However, the data is maintained by the state, is readily available, and is available for multiple years to allow comparisons to trends.

Auto Network Performance Measure: Speeding, Distracted Driving, and Driving Under the Influence

The TxDOT CRIS system reports a total of 6,753 crashes in Bell County for the year 2016. The data indicates that speeding is a factor in 525 crashes, distracted driving contributed to 1,206 crashes, and driving under the influence of alcohol or drugs was involved in 353 crashes. Taken together, these three factors account for almost 31% of all crashes in the county.

A performance measure to monitor one or more of these factors can complement the more general measures of the numbers and rates of fatalities and serious injuries caused by crashes. These suggested performance measures would focus more on the causes of crashes than on the results. For speeding in particular, the suggested measures would directly monitor the effects of Complete Streets treatments such as road diets, traffic calming, and lane narrowings that are intended improve safety by reducing vehicle speeds.

Data for these performance measures could be sourced from the CRIS crash records, as noted above. This would provide information on how these measures contribute to crashes. Alternately, data for any of the three suggested measures could come from police reports of tickets issued. This would have the advantage of capturing a broader base of data. However, it would require contacting the individual police departments in the KTMPO region for each year's data.

Auto Network Performance Measure: Mode Share

Mode shares for the journey-to-work trip as reported by the Census report that automobiles are used for 92.9% of all these trips in Bell County. Developing a more balanced regional multimodal network would increase the share of trips that use the bicycle, bus, and walk modes. A suggested performance measure to track the mode balance would monitor mode shares to track progress towards a more balanced network.

Journey to work data is collected by the American Community Survey (ACS) with annual updates. However, the sample size for Bell County is small, so an accurate capture of any change in mode shares may be difficult to obtain. Additionally, the journey to work trip is only about 30% of all daily trips, and so the ACS data would capture only a portion of the total. Proxy data for mode shares may include counted bus ridership and counts of bicycles and pedestrians at specific monitored sites.

Auto Network Performance Measure: Barriers, Bottlenecks, and Connectivity

Mobility and access depend on the network being configured to provide connections between origins and destinations. The connections may be interrupted by barriers or gaps in the network which force more circuitous routing, or bottlenecks which cause congestion. The suggested performance measure calls for an inventory of these undesirable network features, and measures their reduction.

The adopted KTMPO Project Selection Process has a category for scoring network connectivity. A project is scored for either closing a physical gap (in two categories for collector or arterial or higher streets), or for closing a gap in the number of lanes (in two categories for collector or arterial or higher streets).

While performance measures for the auto network focus on a mature system, those suggested for the ***Bicycle Network*** are geared towards the development of the network. Building the bicycle network as a convenient, safe, and pleasant system is a strategy to increase bicycle ridership.

Bicycle Network Performance Measure: Safety

The perceived lack of safety of riding in traffic is often cited as the primary reason why people do not ride bicycles as much as they would like. Improving the safety of the bicycle network therefore can have a significant impact on increasing ridership.

A suggested performance measure for safety would use TxDOT CRIS data to track the number of reported crashes involving bicycles. The system is based solely on reports from police responding to crashes, and therefore does not report incidents of near misses, which bicycles are particularly vulnerable to.

Bicycle Network Performance Measure: Barriers and Connectivity

Barriers and connectivity are particularly important to active transportation modes such as bicycles. Additionally, the barriers that are faced by bicycles are not the same as the barriers faced by automobiles in the general street network. The parameters for this suggested performance measure therefore focus on the connectivity of the dedicated network of conventional and protected bike lanes. A separate performance measure is suggested to track barriers and connectivity of bicycle boulevards.

A performance measure for reducing the number of barriers in the bicycle network is suggested to be based on an inventory of specific points and intersections impacting the full network, including shared-use streets.

Bicycle Network Performance Measure: Mileage of Bicycle Lanes

The existing bicycle network includes eighteen miles of bike lanes of all types and forty-three miles of multi-use paths. Monitoring progress in expanding the bicycle network mileage is a suggested performance measure. The suggested performance measure could refer to total mileage or to mileage by functional class to distinguish the characteristics of the bicycle network.

Data for this performance measure would come from direct observation of the network.

In developing the Functional Classification system for the ***Bus Network***, the primary concern was how the network addresses the comfort and convenience of its riders. Suggested performance measures for the bus network continue with this focus.

Operational performance measures such as passengers per mile and cost per mile are common in the transit industry, but are not listed in this plan. These types of measures are typically monitored by the transit agency for operational purposes, rather than the MPO, which plans more for capital project prioritization.

Bus Network Performance Measure: Connectivity

Connectivity for the bus network is a measure of rider convenience in that it measures how the system connects trip origins to destinations. Using origin-destination connectivity as a performance measure monitors how well the transit system serves the needs of its riders.

This performance measure could be modeled by defining origins and destinations as discrete points and evaluating how the system's fixed routes connect them. An alternate methodology would be to build ¼ mile buffers around all fixed routes and then calculating the population and employment that lie within the buffers. This methodology could also be considered as measuring system coverage.

Bus Network Performance Measure: Comfort

Functional Classes for bus stops have been defined as stations, shelters, benches, and simple stops. A performance measure for passenger comfort could measure the proportion of each functional class in the total mix of stops.

Data for this performance measure would be from the inventory of facilities at stops.

Bus Network Performance Measure: On-Time Performance & Travel Time Reliability

On-time performance as a performance measure monitors how well the buses adhere to their schedules for every stop. It is an operational measure, but it is also a planning measure because it is a proxy for the appropriate design of the routes. If a fixed route is not properly designed, drivers will have difficulty in meeting their schedules and time points.

On-time performance is also a proxy for the reliability of the transit system. Issues with on-time performance can lead to issues with transfers to other routes.

Data for this performance measure would have to come from The HOP.

Bus Network Performance Measure: Transit Asset Management and Safety Plan

Performance-based asset management is a new planning requirement mandated by the Federal Transit Administration (FTA). This separate Transit Asset Management Plan (TAMP) is intended to be coordinated with the regional 2045 MTP and with the Transportation Improvement Program (TIP). The plan sets performance targets for transit revenue vehicles, non-revenue vehicles, facilities, and equipment based on their Useful Life Benchmarks (ULB) or Transit Economic Requirements Model (TERM) scale. The HOP is required to develop a Transit Asset Management Plan, but as it has less than 100 vehicles, a Transit Safety Plan is not required.

The related performance measures are contained in the separate TAMP, and so are not detailed here.

The ***Truck Network*** shares its road system with the auto network. Special considerations for trucks are roads that are restricted due to geometric, weight, or regulatory considerations.

Truck Network Performance Measure: Load Restricted Bridges

Load restricted bridges are an issue not only in terms of safety, but also in routing. Trucks that must avoid load restricted bridges may have to travel more circuitous routes to go to their destinations. A suggested performance measure is to monitor the load restricted bridges in the region.

It should be recognized that some bridges on low volume rural roads would typically not serve truck trips. A modification of this performance measure can be to only inventory the load restricted bridges that lie on designated truck routes.

Data for this performance measure would come from the TxDOT load restricted bridge inventory. This inventory can form the primary database, but should be verified against local inventories from KTMPO member jurisdictions.

Truck Network Performance Measure: Barriers & Connectivity

This suggested performance measure would relate to two inventories: the designated truck high-priority network and the designated industrial parks and other freight origins and destinations. The performance measure would track the geometric, weight, or regulatory considerations that form barriers to trucks connecting the two inventories.

An alternate version of this performance measure would track designated hazardous materials routes and the local origins and destinations that serve them. This would require information on commercial sites in the region which are origins or destinations for hazardous materials. In order to make the measure practical, gasoline tanker trucks, which have destinations throughout the region, would have to be excluded.

While the ***Walk Network*** is robust and nearly ubiquitous throughout the KTMPO area, the sidewalk and trail inventories revealed gaps and barriers. However, the review of the inventories notes several geographic areas where the sidewalk inventory needs to be updated. Useful performance measures to gauge progress are dependent upon having a robust inventory of existing conditions.

Walk Network Performance Measure: Sidewalk Network

This suggested performance measure would monitor the linear feet of the sidewalk network.

Since the sidewalk network is nearly ubiquitous, monitoring the entire network for the region would not be useful; relatively small improvements in the network would not be revealed in the data. To address this, smaller geographies can be defined for measurement. This can cover either cities, defined neighborhoods, or a subset of regional TAZs with residential or commercial development where sidewalks are appropriate.

Another alternative for sidewalk inventory and performance measure would be to monitor sidewalks by their functional class.

In addition to a performance measure to simply monitor the inventory of sidewalks, another possible measure is to monitor their quality. Sidewalk attributes such as width and condition may also be inventoried and monitored with a performance measure.

Walk Network Performance Measure: ADA Compliance

Compliance with the requirements of the Americans with Disabilities Act (ADA) may be considered as a special performance measure. Compliance is required by law, so identifying the needs for projects and progress towards eliminating issues is vital.

Monitoring this suggested performance measure would require inventorying the locations of all non-ADA compliant facilities. This is a very specific and local-level task, so neither standard databases nor a review of aerial photos would provide sufficient information. As with the suggested sidewalk inventory, stratifying into smaller geographies is suggested so that network changes will show in the data. A performance measure for ADA compliance may also be stratified by category, such as sidewalk ramps, street crossings, and bus stops.

Walk Network Performance Measure: Barriers and Connectivity

Barriers in the walk network include missing sidewalks, gaps in sidewalks, and facilities which are in poor condition or obstructed. Streets crossing high-volume roads and limited access roads may also form barriers. Narrowed sidewalks on bridges are also an issue with the walk network.

The desire line functional class should also be included in the inventory, as they define paths where there is demand for a sidewalk network, but no infrastructure is in place.

Special connectivity paths may also be defined as an alternate performance measure. Connecting all the parks and schools within a defined neighborhood is one example of such a measure. Other connectivity paths may include sidewalk access to all bus stops, access to major employers, and access to defined government and social services sites.

Walk Network Performance Measure: Mileage of Trails

In addition to the sidewalk system, the walk network includes multi-use trails, recreational trails, and isolated trails within parks which do not form part of the transportation network, but are important components of the total walk network. A suggested performance measure would monitor these types of facilities separately.

As with most components of the walk network, actual field data is needed for the inventory. Developing the initial inventory and maintaining it up-to-date will be a significant task, and can only be accurately accomplished through field work.

The ***airport system*** and the ***rail system*** are special cases of transportation modes, since their networks do not directly impact the street network and they have access only as a very few specific points. In addition, these networks are largely privately owned and operated, so the KTMPO transportation planning process treats them for their effects on the street network, rather than as networks themselves. Therefore, no specific performance measures are suggested for these modes.

Summary

Federal legislation mandates performance-based planning, and defining performance measures is an integral part of the process. Legislation provides guidance for regional-level measures in areas such as safety, condition, and congestion.

To complement and supplement this process, additional performance measures are suggested at the modal level. The suggested performance measures are intended to help monitor progress towards a more balanced multimodal system for the KTMPO region.

To be useful within the planning process, performance measures should be objective, measurable, and feasible. To be appropriate, they should contribute to the regional vision and goals identified through the public involvement process. For these reasons, the performance measures outlined in this chapter can only be suggestions. Final measures and targets should be set as part of the overall planning process for the KTMPO 2045 Metropolitan Transportation Plan.

Chapter 12: Conceptual Projects

CHAPTER HIGHLIGHTS

- **Policy Projects**
- **Planning Projects**
- **Events Projects**
- **Auto Network Projects**
- **Bicycle Network Projects**
- **Bus Network Projects**
- **Truck Network Projects**
- **Walk Network Projects**
- **Rail System Projects**
- **Summary**

Introduction

Previous chapters of this plan have detailed specific physical network projects which are candidates for analysis and prioritization as part of the fiscally-constrained KTMPO 2045 Metropolitan Transportation Plan (MTP). These projects all have been proposed or reviewed by KTMPO member jurisdictions or committees, or have been received through a public outreach process. All fit under one or more of the funding categories defined for MTP projects. Therefore, all these previous project may be viewed as "official" candidate projects which are directly relevant to the KTMPO 2045 MTP.

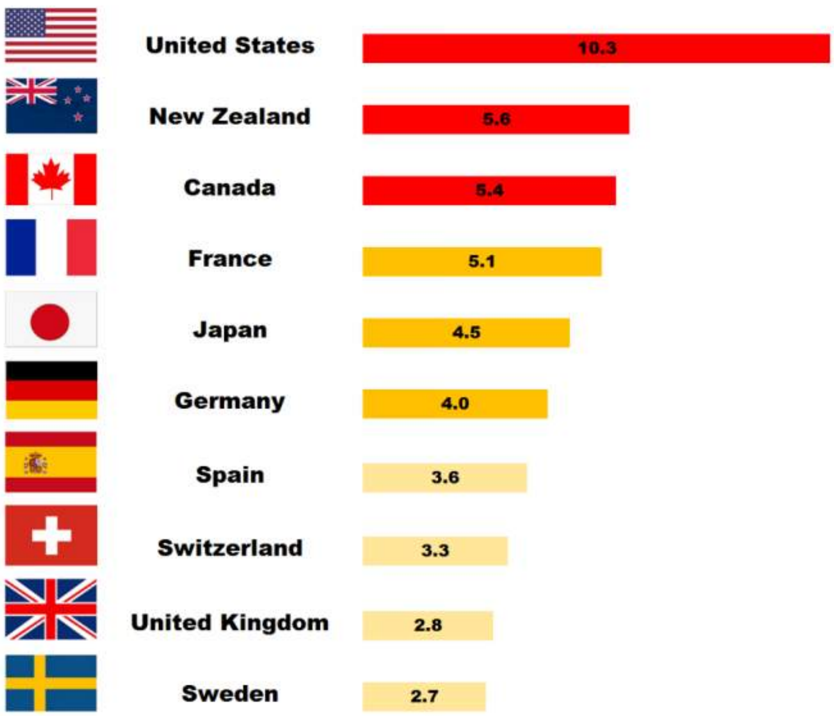
This chapter introduces a complementary set of projects that are "unofficial" in terms of their source, conceptual rather than specific, and may not fall into one of the MTP funding categories. These conceptual projects therefore may not be directly relevant to the KTMPO 2045 MTP. However, taken together with the MTP projects, these conceptual projects can contribute to developing a balanced regional multimodal network.

Policy Conceptual Projects

Project Py.1 The topic of safety is important in the KTMPO region and in its transportation planning. Safety is a specified performance measure, and many of the candidate projects from previous chapters focus on safety. This plan also defined a Functional Class system for the bicycle network that emphasized how infrastructure can contribute to safety.

In spite of this ongoing activity, traffic safety continues to be an issue in the United States as a whole. **Figure 12-1** shows the fatality rate per 100,000 persons for the United States and ten peer countries, with data taken from the World Health Organization Status Report on Road Safety.

Figure 12-1: Traffic Death Rates in Ten Comparison Countries



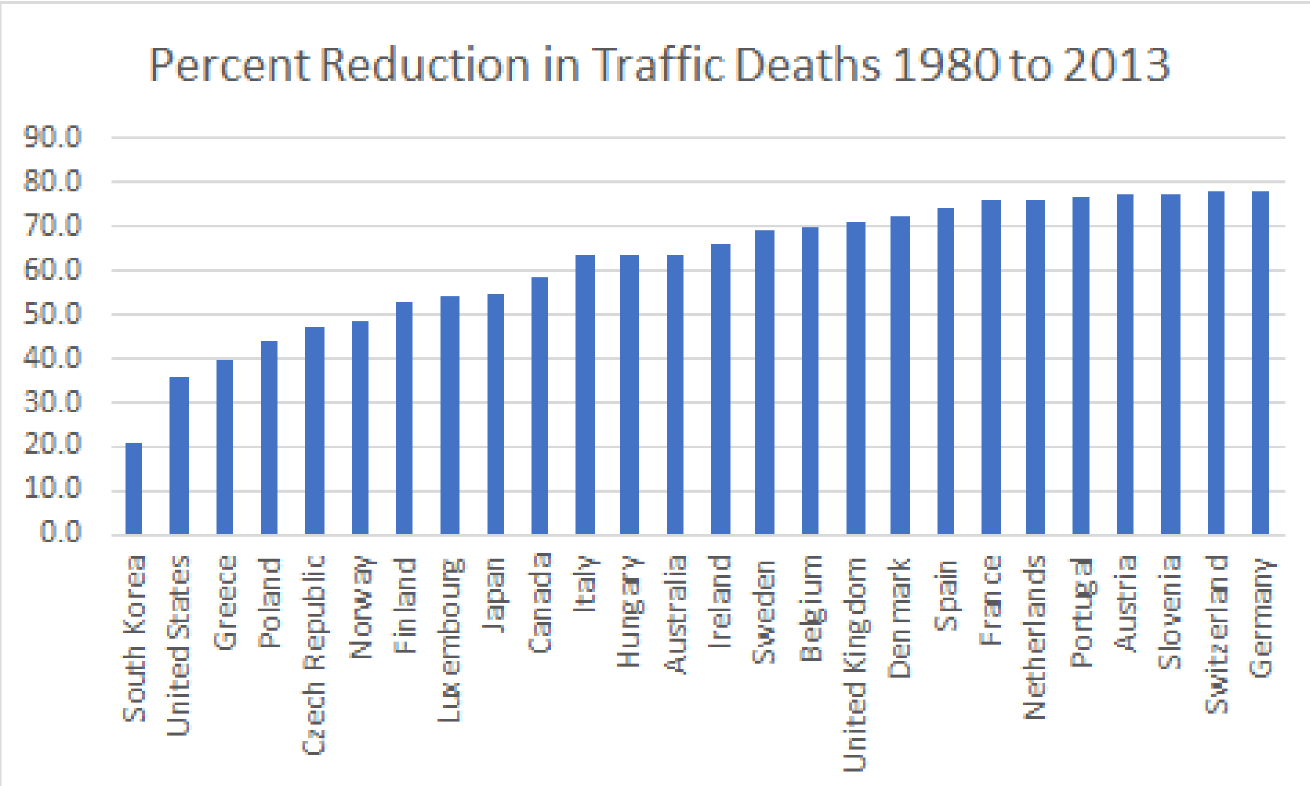
The data show a disturbing and undeniable trend of the United States leading its peer countries in Europe, Asia, and North America. Our traffic death rate is almost twice that of Canada's, with no significant difference in culture or quality of infrastructure to explain the difference. Compared to other peer countries like the United Kingdom and Sweden, our traffic death rate is almost four times as high.

The traffic death rate and general traffic safety can be addressed through specific safety projects, as has been done in the past. Another approach is to implement a specific **Vision Zero Policy** with the stated goal of developing infrastructure, policy, and behavioral changes to completely eliminate traffic deaths. Incidentally, the Vision Zero concept was developed in Sweden, which is shown with the lowest traffic death rate in Figure 12-1.

One of the core principles of Vision Zero is that road users share responsibility for traffic safety with road designers. Educational efforts to make drivers aware of safety issues are therefore an important component. Another core principle is that the road design should be forgiving; so that when crashes do occur, the risks of fatalities or serious injuries are lessened.

Since its inception in 1977, Vision Zero policies have been adopted in numerous countries worldwide and in numerous U. S. cities, with results that have been described as "outstanding". **Figure 12-2** shows the percentage reduction in traffic deaths from 1980 to 2013. The United States is near the bottom of the chart, but still has an impressive 36% reduction. Traffic deaths in the United States dropped from 51,100 in 1980 to 32,700 in 2013. However, the records of other countries show how significantly traffic deaths can be reduced with a more robust implementation of Vision Zero policies. Twenty countries showed a reduction of 50% or more, and seven countries showed over 75%.

Figure 12-2: Reduction In Traffic Deaths 1980 - 2013



The Federal Highway Administration (FHWA) has embraced Vision Zero as one of its policies supporting traffic safety and the development of a safety culture. Its website at https://safety.fhwa.dot.gov/zerodeaths/ highlights FHWA's commitment to the vision of implementing "zero deaths and serious injuries on the nation's highways." Likewise, the TxDOT Texas Strategic Highway Safety Plan 2017-2022 specifically lists a vision of "…a future with zero traffic fatalities and serious injuries," and includes sample MTPs from four Texas MPOs which have implemented Vision Zero initiatives. A Vision Zero policy is therefore a conceptual project suggested for consideration for the KTMPO region.

Project Py.2 To emphasize safety and help define, implement, and monitor safety projects, a separate **Safety Plan** is a suggested conceptual project. A separate plan is not a requirement, but has been implemented by some MPOs. The Houston-Galveston Area Council (H-GAC, the MPO for the Houston region) has developed a safety plan. It is featured as a link on the safety page of their website at http://h-gac.com/transportation-safety/default.aspx. H-GAC's safety program is guided by a Regional Safety Council. In addition to their safety plan, they monitor progress with an annual *State of Safety* report, which includes statistics, performance measures, and graphics showing locations with the highest number of crashes. Their safety planning shows how they have developed strategies for focus areas of impaired & distracted driving, bicycles & pedestrians, speeding, and intersections.

Project Py.3 Speeding is not only a leading contributor to crashes, it also makes crashes more severe and exponentially increases the risk of death for bicyclists and pedestrians struck by cars. **Slow Zones** are a suggested conceptual policy to improve safety. Slow Zones are small geographic areas of local streets with infrastructure designed to reduce vehicle speeds to 20 mph. In the implementation in London, a variety of traffic calming measures such as curb extensions, raised crosswalks, raised intersection, chicanes, pedestrian refuges, and mini-roundabouts were installed. Slow Zones have been implemented in 400 neighborhoods since 2009, with 880 more sites planned. The data show a 46% reduction in fatalities and serious injuries, with a spillover effect of an 8% reduction in the areas adjacent to the Zones. Results of the London implementation are discussed at https://nyc.streetsblog.org/2010/03/22/how-london-is-saving-lives-with-20-mph-zones/. In New York City, the 28 Slow Zones which have been implemented have not had the same level of positive results. Two reasons are cited for the difference: first, the London examples used a wider variety of traffic calming measures, and second, London implemented the measures more densely than New York City did. Overall, the more robust implementation in London had significantly better results.

Figure 12-3: Slow Zone in London

Although Slow Zones are intended only for local streets and include measures which may cause issues with transit buses and emergency vehicle access, they are a suggested safety conceptual project.

Project Py.4 Conventional project delivery follows the very understandable desire to "do the project right the first time", requiring extensive studies and a complex design process before implementation. The result is that implementation is relatively slow, which can be an issue with a safety project when the desire is for immediate action. A suggested conceptual policy is **Tactical Urbanism**, also known as **Rapid Prototyping** or **Iterative Development**. Rather than taking the conventional approach of fully implementing a perfect solution in a permanent construction, this approach emphasizes the speed of construction. It implements rapid, low-cost, temporary solutions, tests them for a limited period of time, modifies them if needed, and then implements the permanent solution after the optimal solution is determined. Tactical Urbanism is often used as a method for public involvement, as it readily allows for experimental treatments to be implemented. It is also used to very rapidly implement safety projects where the conditions are such that an immediate response is wanted.

The City of Burlington, Vermont has developed a Tactical Urbanism policy with an emphasis on community-led development of projects. The intent of the policy is to develop short-term, low-cost projects that can be implemented and tested, leading to longer-term permanent projects. Their guide to Tactical Urbanism is published by their Public Works Department website at https://www.burlingtonvt.gov/DPW/Tactical-Urbanism-and-Demonstration-Projects.

Planning Conceptual Projects

Project Pg.1 Chapter 4 of this plan defined new Functional Classification systems for the bicycle, bus, truck, and walk networks, followed by inventories in Chapter 5. Some of these new Functional Classifications defined new attributes for their respective networks that are not fully described in the existing inventories. A conceptual project for planning is suggested to **Update the Inventories** for all modes to capture any additional attributes which are detailed in the new systems.

Project Pg.2 The chapters also noted the need to update the sidewalk inventory to cover newly developed areas. Based on the proposed new inventory, **Inventories of Gaps and Barriers** for the bicycle and the walk networks is also a suggested conceptual project.

Figure 12-4: Gaps and Barriers in the Sidewalk Network

Figure 12-4 illustrates a gap and a barrier in the sidewalk network. An inventory to identify all the places and specifics of these types of issues is an important component of forming a plan to address them.

An inventory of gaps and barriers should be considered in the context of the severity of the issue, safety issues, any alternative routes, and the origin-to-destination paths which are served, particularly for sidewalks serving schools and activity centers. Being aware of this context will assist in setting priorities for addressing the gaps and barriers.

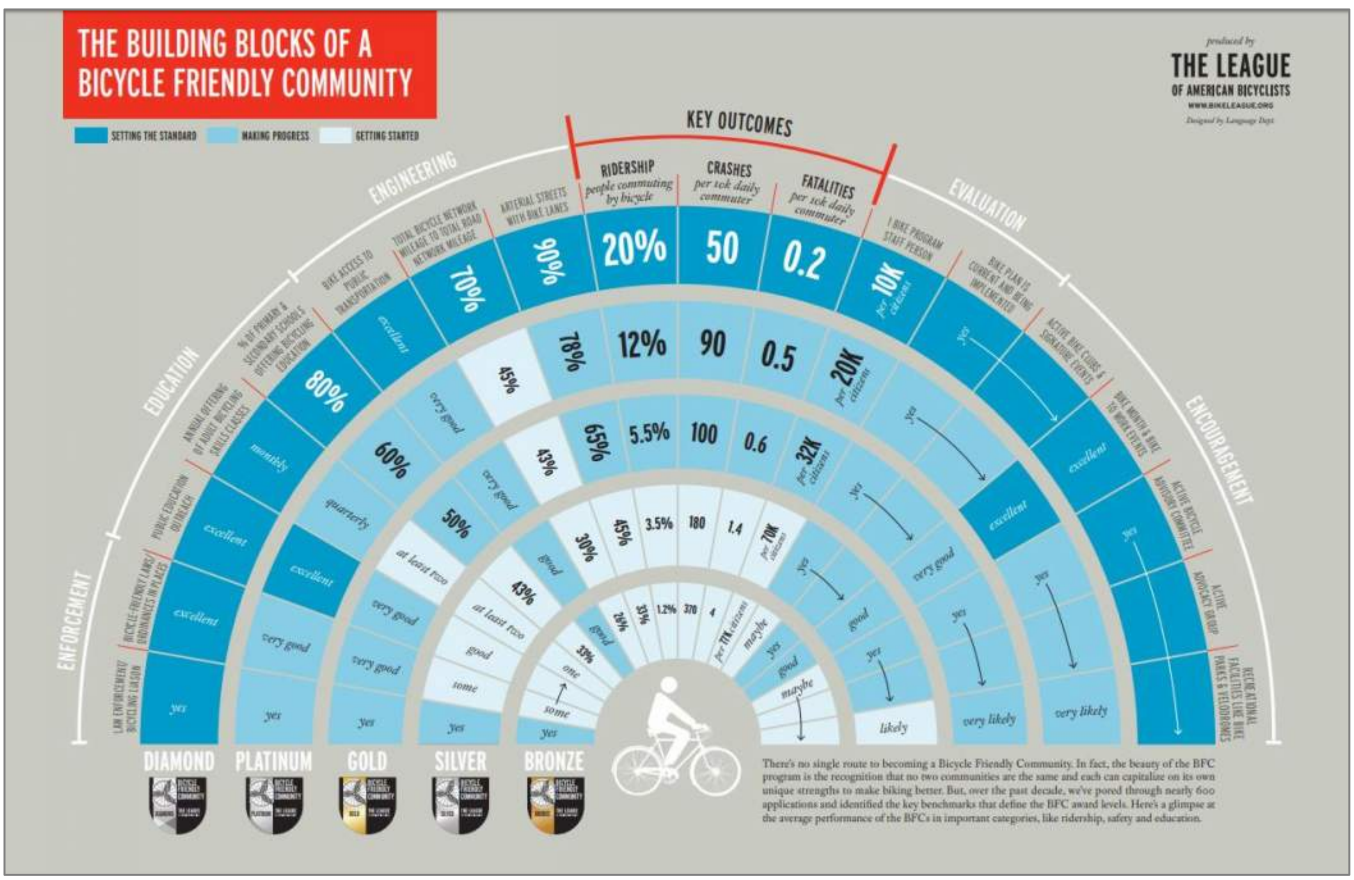
Project Pg.3 A **GIS Analysis of Priority Demographics Areas, Social Service Destinations, and Job Centers** is a conceptual project suggested to inform the process of evaluating walk, bike, and transit connectivity.

Project Pg.4 The GIS analysis can be supplemented by a related **Inventory of ADA Compliance** to describe paths between vital origins and destinations which have barriers for persons with disabilities. An additional layer of detail in the Inventory of ADA Compliance would specifically describe ADA compliance issues at bus stops and stations.

Project Pg.5 Plans for pursuing the **Bicycle Friendly Community Designation** is a conceptual project that has a well-organized path. The program was developed by the League of American Bicyclists in 1995, and currently has 450 designated communities. The designation follows a discrete chart with five attainment levels. Information is found on the League's website at www.bikeleague.org/community.

Figure 12-5 shows the chart of criteria and thresholds for qualification under the five levels of a Bicycle Friendly Community, ranging from Bronze Level to Diamond Level. The five categories include three items that are common to other implementation plans: Engineering, Enforcement, and Education.

Figure 12-5: Bicycle Friendly Community Chart



Events Conceptual Projects

Project E.1 Of the three criteria of Engineering, Enforcement, and Education which are designated as important for successfully implementing new projects and new modes in the region, Education to promote awareness and change drivers' attitudes can be seen as the most vital. Conceptual projects for various events are therefore suggested to highlight the possibilities to Educate the public.

One of the most prominent types of events promoting multimodal transportation is a **Ciclovía**. The event closes city street to motorized traffic and permits only active transportation. The original Ciclovía in Bogotá, Colombia, is held every Sunday on 75 miles of city streets. Other Ciclovía events, such as in San Antonio, are held once every two years on select streets in the downtown area.

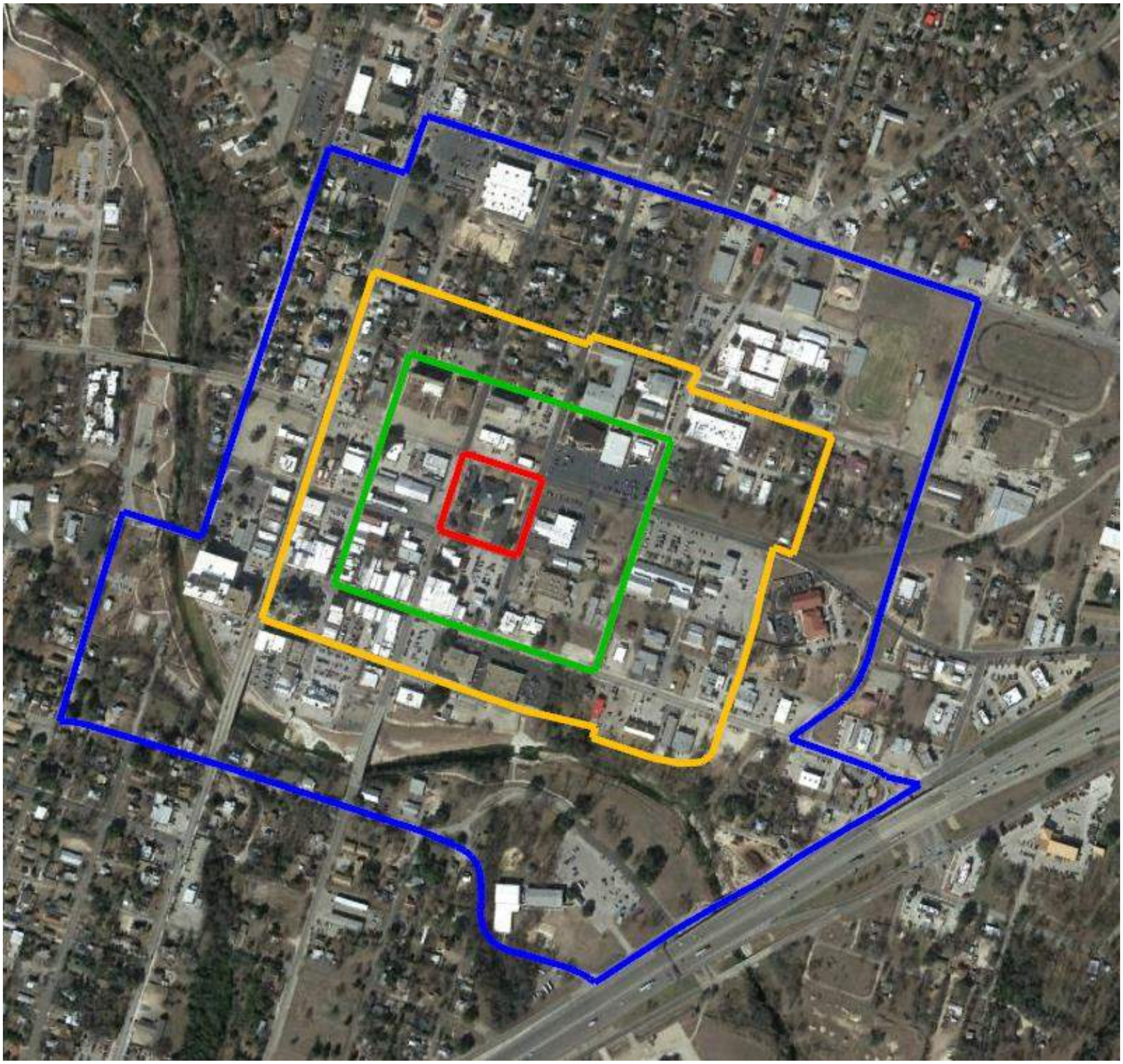
The power of the Ciclovía event is how vividly it demonstrates the wide range of activities that can take place in the streetscape once it is free of the danger of motorized traffic. The issue with implementing a Ciclovía is that motorized traffic comprises about 92% of all trips in the KTMPO region. Closing even a small portion of streets to 92% of traffic is a dramatic undertaking, which should be carefully planned.

The suggested conceptual project for holding a Ciclovía in the KTMPO region is to implement it at two different scales. If only a small portion of streets at the core area of the Ciclovía were closed to motorized traffic and a larger selection of streets were involved while remaining open, the event would simultaneously be large enough to make be noticeable, but small enough to not seriously impede traffic.

The configuration of downtown Belton supports this strategy with a central courthouse square and a surrounding series of rings on streets with relatively low traffic volumes and speeds. **Figure 12-6** illustrates the concept. To hold a Ciclovía event, the inner red ring immediately surrounding the courthouse could be closed to motorized traffic, with all street space opened to bicycle and pedestrian traffic and an intense variety of events. One or more of the surrounding green, yellow, and blue rings and cross streets connecting the rings could host less intense activities, while remaining open to all traffic. The ring-and-spoke system would also serve to orient specific activity sites on the rings. Ciclovía event signs throughout the area would alert motorists to drive with caution.

The San Antonio Ciclovía is predominantly themed to active transportation, and so captures only a limited interest group. A suggested conceptual project for the KTMPO region would layer wider-ranging themes onto the event to generate interest from a broader group of people, and to integrate and publicize active transportation modes within the greater theme.

Figure 12-6: Ciclovía Rings in Downtown Belton



The Ciclovía conceptual project would use different themes each year to present the public with new events, include a wider range of people and interests, and to keep the event fresh in the public's mind. Possible ring themes and approaches include:

- Class Rings – a theme with heavy involvement from local high schools. Specific events and booths may include sports, games, contests between schools, marching band events, and alumni events for different graduation years.
- Culinary Rings – focusing on different cooking styles. The theme may include food trucks and local restaurants.
- Tree Rings – extension courses and materials on gardening, landscaping, composting, and xeriscaping would bring in people who are not normally associated with transportation. The regularly-scheduled farmer's market could contribute to this theme.
- Bell Rings – local history, people, and events would be the theme. Contacts with local museums, including the Fort Hood museums, would broaden this theme.
- Birding Rings – the Texas Parks & Wildlife Department sponsors several bird watching events in Central Texas, and these could be integrated into a theme.
- Piston Rings – extending the theme of transportation would be an obvious choice, with the Rodchopperz Car Show already a regularly scheduled calendar event. Transportation-related events in the main ring could include basic car and bicycle mechanics' courses, and car washes. Driver's education seminars could be held for specific topics such as driving in congestion, driving in the presence of bicycles and pedestrians, safety tips, and avoiding distractions.
- Planetary Rings – local high schools could contribute to this theme emphasizing STEM education and fun events such as a scale model solar system, a physics circus, and competitive knowledge-based events.
- Der Nibelungen – Wagner's ring cycle of operas could introduce a general musical theme, with local bands as featured on the regularly-scheduled calendar of events. Local high schools could also compete in a "battle of the bands".
- Lord of the Rings – a fantasy & science fiction theme could include themed obstacle courses and costumed races.
- Book Rings – events could focus on authors, plots, or places from literature.

Regardless of the theme chosen for the Ciclovía, it could include core events such as a Safety City for children as shown in **Figure 12-7**, an obstacle course of unsafe infrastructure and practices, demonstration setups of bike lanes and protected intersections, scavenger hunts, contests, and other events designed to educate people on the balanced multimodal network.

Figure 12-7: Children's Safety City

Auto Network Conceptual Projects

Project A.1 Excessively wide streets in some locations, coupled with changing demographics trends, has sometimes resulted in roads that operate significantly under their design capacities. This presents an issue of costly maintenance for unneeded road surface, balanced with the opportunity for re-purposing the street right-of-way for other uses. The concept of a **Road Diet** takes advantage of this opportunity to "right size" a road. A typical Road Diet converts an underutilized 4-lane undivided road into a 2-lane road with a center turn lane and bicycle and pedestrian facilities. The turn lane often improves traffic flow, so Level of Service (LOS) can be better after the Road Diet. A conceptual project for Road Diet planning would inventory streets with an existing LOS lower than a defined threshold in both the base year and forecast year and a potential need for bicycle and pedestrian facilities. The project would then perform analyses to determine Road Diet candidates.

Project A.2 Resiliency planning prepares for natural disasters with designated evacuation routes and identified floodplains. An additional area of resiliency planning would **Identify Critical Infrastructure** that forms choke points. A threshold level of detour mileage or time would have to be defined in order to select infrastructure whose failure would have a significant impact on the network.

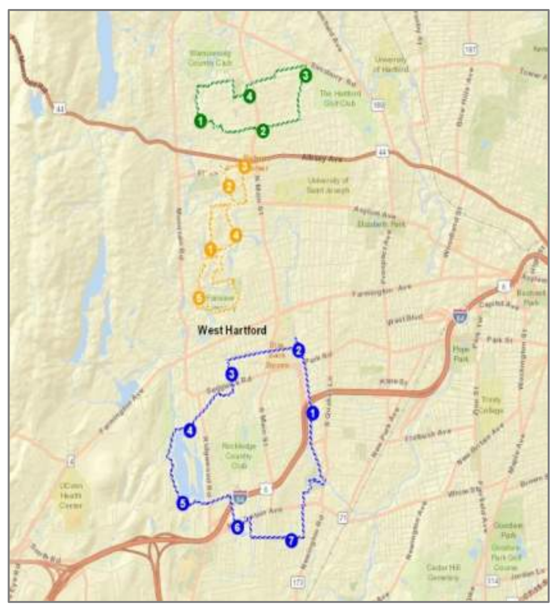
Project A.3 Complete Streets treatments, Slow Zones, and other safety and livability treatments draw from a range of design techniques that often result in narrower travel lanes and tighter turning radii at intersections. A conceptual project to **Define a Hierarchy of Emergency Access Routes** would identify a network for which emergency vehicle access would have priority. The planning may define preferred and prohibited traffic calming treatments for the hierarchy of routes.

Bicycle Network Conceptual Projects

Project By.1 The bicycle Functional Classification system defined the Bicycle Boulevard as a low speed, low volume, low stress route where bicycles would have priority over automobiles. A conceptual project for **Bicycle Boulevard Branding** would follow the precedent of routes implemented in Hartford, CT. As shown in **Figure 12-8**, the Hartford example brands three separate Bicycle Boulevards with colors, similar to the way that transit routes are coded. Wayfinding and route marking signs are also color-coded to heighten awareness of the routes.

These Bicycle Boulevards follow the recommendations to define routes on local streets within neighborhoods where a 25 mph speed limit is practical. They are less than optimum in that the three loops are totally separate, not connecting to each other or to other bicycle infrastructure for practical trip making. However, the precedent of high-profile branding with reference to higher-status transit systems is practical for raising awareness and identity of the Bicycle Boulevards. This is an important consideration for introducing a new Functional Class to the KTMPO region.

Figure 12-8: Bicycle Boulevards in Hartford, CT



Project By.2 The city of Seville, Spain increased its bicycle ridership to eleven times its previous levels in just a few years by a **Lightening Implementation of Protected Bike Lanes**. It is referenced as proof that any city can boost ridership significantly by building connected, safe bicycle infrastructure. The core of the implementation in Seville is that the infrastructure was built robustly and rapidly throughout the city. The implementation constructed forty miles of protected bike lanes in one year, with another forty-six miles added over the next six years. The bicycle mode share rose from 0.5% of all trips to 6% almost overnight, or from 6,000 daily trips to over 70,000. An study of Seville's new bike lanes found a direct correlation between the mileage of protected bike lanes and total ridership. Conversely, the connectivity of the protected bike lanes in a comprehensive system was found to be directly correlated to safety.

Following this successful precedent, a conceptual project would be to identify priority routes, right-of-way, and design elements for a full-fledged protected bike lane network for Lightening Implementation on a robust scale.

Project By.3 Even the most extensive public transit system fall shorts of providing door-to-door connectivity that covers the complex transportation needs of its riders. This first-mile, last-mile issue has been partially addressed in the KTMPO region. This concept may be extended further with a **Dockless Bike Share System**, similar to that already implemented on a limited scale on the Temple College Campus.

One recent option introduced in the industry is integrated fare cards with common payment for transit and bike share. This option eases the process of registering for the bike share system as well as the daily use of both systems.

Project By.4 Another conceptual project for bike share is to **Identify First-Mile, Last-Mile Opportunities**. Integrating bicycles with the transit system is largely complete with bike racks on all The HOP's buses, but the locations for shared ride stations and corrals needs to be determined. An analysis of the ultimate trip origins and destinations of transit riders will help in that placement. It can also provide insight on whether a docked or a dockless ride share system is most appropriate for a given area.

Project By.5 Parking for dockless bike share systems is a major concern. A new option couples the bikes' GPS with a Radio Frequency Identification (RFID) to define set areas for bike parking. Users simply scan the parking QR code in defined areas, as shown in **Figure 12-9** for a **Bike Corral** in Washington DC.

Figure 12-9: Bike Corral in Washington DC

Project By.6 The undeniable maintenance and clutter issues associated with the systems have been addressed in several areas with the conceptual project of **Dockless Bike Share Fees**, which are often supported by the bike share providers. The City of Seattle collects a $250,000 annual fee from each provider, while other systems such as Dallas charge per bike. The electric scooter company Bird has offered to pay $1 per scooter per day to fund dedicated bike lanes.

Project By.7 A conceptual project to **Identify Locations for Protected Intersections** would serve to help prioritize the locations where this important new infrastructure type can be introduced into the KTMPO region. Locations may be evaluated based on forecast ridership, safety need, and available right-of-way. In the Oakland, CA example illustrated in **Figure 12-10**, the treatment includes curb bulb-outs, protected bike lanes, pedestrian refuges, and permanent bollards.

Figure 12-10: Protected Intersection in Oakland, CA

An interesting aspect of the Oakland implementation is that they are constructing their protected intersections before their protected bike lanes. Crash data show that intersections are more dangerous for bicyclists than travel along the streets, so they see the safety treatments of the intersections first as more effective.

Project By.8 **Themed Bike Rides** are a conceptual project suggested to increase ridership with fun events and to promote awareness of bicycling by aggregating a larger and more visible group of riders. They may include intense races or training runs for the advanced and serious rider, or fun events for the more general rider.

Examples of Themed Bike Rides include the 15-mile tour of taco restaurants held in Chicago and the annual Bike Houston Moonlight Ramble. The Moonlight Ramble is held on the Saturday before Halloween and features costumes, music, and prizes. It has a 10-mile route and a 20-mile option, with rest stops along both routes that distribute water and snacks.

Project By.9 Additional conceptual projects for bicycles are **Previous Bicycle Network Projects** which were included in the previous *Regional Thoroughfare and Pedestrian/Bicycle Plan*, but which were not re-submitted in the latest call for projects or noted in other public outreach or city sources. While these projects are therefore "unofficial", they contain valuable information and demonstrate the desire for projects in specific locations. There projects are listed in Appendix A as conceptual projects.

Bus Network Conceptual Projects

Project Bu.1 The HOP has proportionally more stops with shelters than is typical, providing for passenger comfort and establishing the system's presence. This can be augmented with a conceptual project to **Develop Bus Shelters** with enhanced treatments. Corporate sponsors could be given the opportunity to customize their stops, and community groups could decorate stops and add their own amenities such as landscaping, bulletin boards, or lending libraries.

Project Bu.2 The transit system in Nashville, TN uses numbers and colors to identify their routes. A proposal for a conceptual project for that system has been to **Name Transit Routes** reflecting local features or history. Nashville proposed route names that are related to country music stars; KTMPO could name routes after local figures such as Captain Waskow, historic routes such as the M-K-T line, or local references such as the 1st Cavalry route.

Truck Network Conceptual Projects

Project T.1 A suggested conceptual project to expand an inventory for a transportation mode is a **Truck Barrier Inventory**. This is to identify areas where trucks are not legally excluded, but where local conditions such as rough roads, narrow clearances, and lines of sight make truck operations troublesome.

Project T.2 An **Inventory of Hazardous Materials Origins and Destinations** is a suggested conceptual project that would provide information to plan for truck operations and possible Hazmat Route designations.

Project T.3 A conceptual project for an **Inventory of Truck Parking Areas** would locate higher-volume truck locations that are independent of employment-based freight origins and destinations. Identifying these sites would help for planning street projects to accommodate trucks.

Project T.4 The regional truck network is generally identified by higher-Functional Class streets and local industrial parks. A conceptual project for a **Definition of the Regional Truck Network** would refine the truck network with more precise evaluations of truck movements based on actual truck counts. This project may identify truck movements and needs which have been overlooked.

Walk Network Conceptual Projects

Project W.1 To be practical, the walk network is dependent on direct routings. A suggested conceptual project to **Verify Efficient Paths** for the walk network would be to develop a general street connectivity policy, which could be based on a walkability index. Several indices are in popular use, such as the one developed by the Environmental Protection Agency at https://catalog.data.gov/dataset/walkability-index. A walkability program for KTMPO may identify areas with connectivity issues at the scale of the walk network, and identify priority locations for alleys and cut-throughs.

Project W.2 Many of the sidewalks in the KTMPO region are three to four feet wide. This is perfectly adequate for the occasional person walking a short distance, but is less fit for longer walks, for shared use with more people, for multi-use paths, or for a pleasant walking experience. It may also be inadequate for downtown areas where more intense activity make a wider sidewalk necessary. A conceptual project would review the sidewalk inventory with all its attributes, and determine the appropriate **Design of the Sidewalk** in specific locations. Sidewalk design may reference the area type in the transect from rural to urban core areas, the expected levels of activity, and the origins and destinations which are served. Design may include attributes of width, landscaping, shade, street furniture, lighting, and pavement.

Project W.3 Artistic designs on the pavement can be considered as part of this conceptual project for sidewalk design. **Figure 12-11** shows a sidewalk in Montreal, Canada. The simple painted decorations and maze attract activity to the sidewalk.

Figure 12-11: Sidewalk in Montreal

Figure 12-12 shows a sidewalk in Eindhoven, the Netherlands, which was inspired by Van Gogh's painting *Starry Night*. The half-mile long installation is powered by LED lights, but other similar installations use treated luminescent pebbles that glow in the dark. As with the painted sidewalk, this type of installation heightens awareness, increases livability, and promotes activity.

Figure 12-12: Glow-in-the-Dark Sidewalk

Project W.4 Prioritization of the walk network is an important issue. A conceptual project to **Connect Parks and Schools** with low stress, pleasant, and barrier-free paths that avoid circuitous routes would define a high priority network for planning.

Project W.5 Additional conceptual projects to stimulate activity include **Pocket Parks** in the place of one or two parking spaces. As shown in **Figure 12-13**, Pocket Parks repurpose one or two parking spaces on the edge of the street to extend the sidewalk and create small livable spaces. The concept is both an item of infrastructure and an event; there is an annual Park(ing) Day event held in cities throughout the nation to promote Pocket Parks by constructing temporary installations. The event is promoted by the American Society of Landscape Architects (ASLA). Information on the ASLA website at https://www.asla.org/contentdetail.aspx?id=46872 includes background, information on insurance and licensing, and an implementation manual.

Figure 12-13: Pocket Parks

Project W.6 Walkability increases when people have some pleasant path and destination where they would actually want to walk. A conceptual project to increase walkability would **Discover Hidden Places** in the KTMPO region that could be developed and publicized for walkability. **Figure 12-14** shows a Hidden Place at Buffalo Bayou in Houston. The area was previously described as a "trash-soaked eyesore under a near-impossible mess of freeways", but the potential of the Hidden Place was recognized. The Buffalo Bayou Promenade was developed as a path 1.2 miles long in twenty-three acres of park. It now connects the Buffalo Bayou Park to the downtown and the Theater District with a pleasant and walkable multi-use path. The development received the 2009 Professional Award of Excellence from the American Society of Landscape Architects.

Figure 12-14: Buffalo Bayou Hidden Place

Other potential Hidden Places which can be developed into walkable paths or destinations include historic structures, significant trees, and short alleyways connecting activity centers.

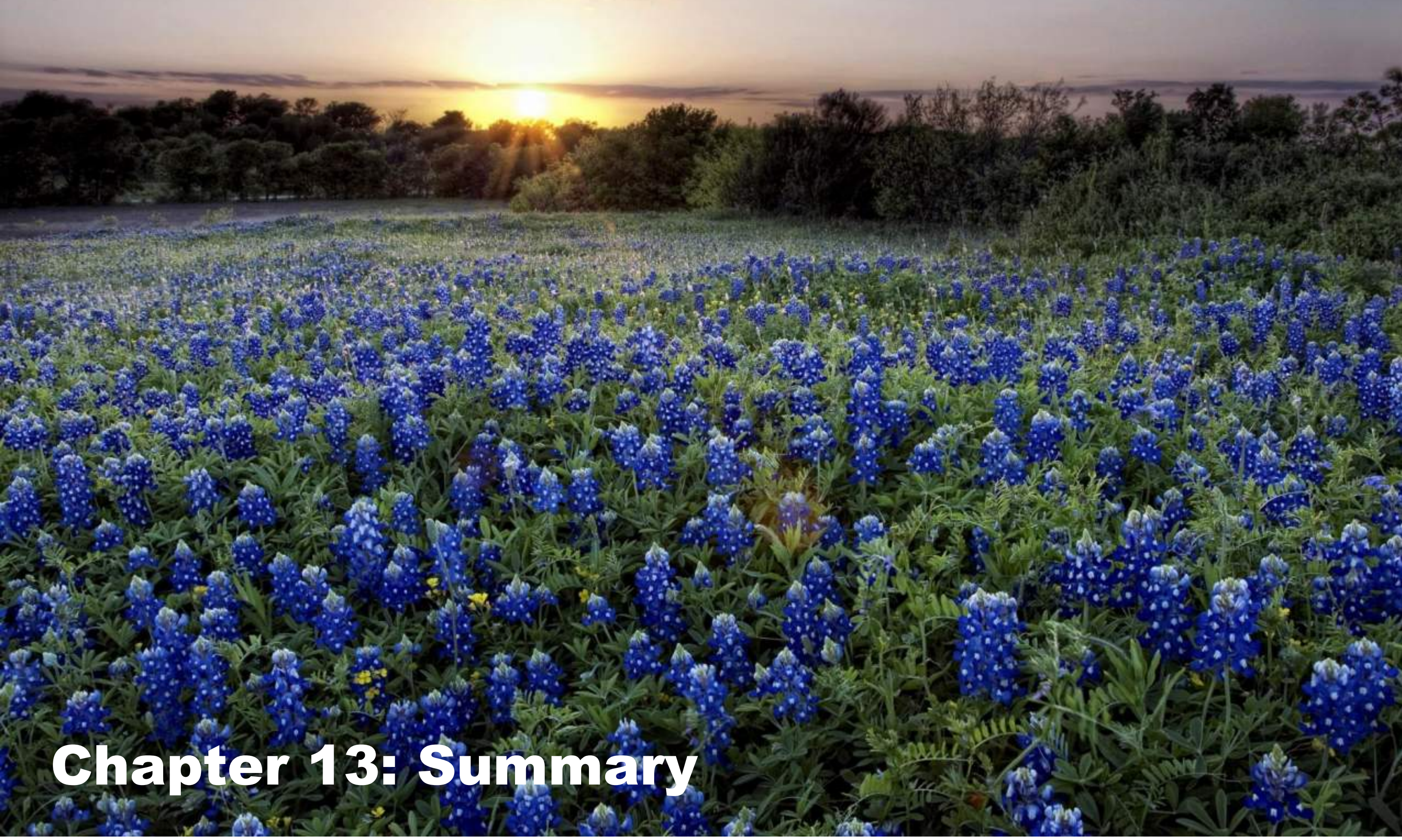
Rail System Conceptual Projects

Project R.1 The Federal Railroad Administration (FRA) promotes safety at all at-grade railroad crossings through their regulations requiring trains to sound their horns at least fifteen seconds before the crossing. Recognizing that this may be an annoyance in some residential areas, there is a provision for establishing **Rail Quiet Zones**. Designation requires the use of the FRA Quiet Zone Calculator, which calculates the risk of the crossing and the Supplemental Safety Measures (SSMs) which mitigate the risk. Development and designation of Rail Quiet Zones are overseen by FRA and monitored by the TxDOT Rail Division.

Supplemental Safety Measures for a Rail Quiet Zone most often include four-quadrant gates which block both sides of the road in both directions. Median barriers may also be implemented to help prevent cars from going around the gates.

Summary

The specific physical network projects which are candidates for analysis and prioritization as part of the fiscally-constrained KTMPO 2045 Metropolitan Transportation Plan (MTP), which are listed for the various transportation modes in Chapters 6 through 9, are complemented by the conceptual projects listed in this Chapter. These projects are "unofficial" in terms of their source, conceptual rather than specific, and may not fall into one of the MTP funding categories. These conceptual projects therefore may not be directly relevant to the KTMPO 2045 MTP. However, taken together with the MTP projects, these conceptual projects can contribute to developing a balanced regional multimodal network.



Chapter 13: Summary

CHAPTER HIGHLIGHTS

- The Transportation Planning Process
- Auto Network
- Bicycle Network
- Bus Network
- Truck Network
- Walk Network
- Complete Streets
- Summary

Introduction

Historically, the dominant mode of travel in the Killeen-Temple Metropolitan Planning Organization (KTMPO) region has been the personal automobile, and a transportation planning process that focused on automobile mobility was appropriate and adequate. However, people and industries are rethinking their transportation needs, preferences, and habits. It is now critical to consider multiple options for mobility and access, and the way we plan for transportation must progress to include all transportation modes for people and freight. Transportation planning must shift from its historic focus on the automobile mode and expand to consider all modes within an **integrated multimodal transportation system**.

The vehicle for accomplishing the transportation planning task is this **Regional Multimodal Plan**. The change in names from the previous Regional Thoroughfare Plan to this Regional Multimodal Plan reflects the greater emphasis that this update places on planning for all transportation modes.

The integrated multimodal transportation system can be considered as a series of layered networks with some links shared among transportation modes, some links exclusive to one modes, and some modes interfacing with the system as points rather than as links. Multimodal transportation planning must consider the features of each mode individually, and must also plan for how each mode interacts with the others. While each mode in theory can operate independently, in practice the interface between modes can be vital in establishing how well each mode performs.

The goal of a regional multimodal system is to develop complementary modal networks that interact to provide safe, convenient, and practical transportation options for all users. Within this balanced system, all transportation modes are not equal, nor are all modes equally used. The private automobile is the predominant mode of transportation in the KTMPO area. Transportation planning must recognize this fact, and take care to balance the needs and traditional accommodation of this mode while increasing the integration of all modes into the regional multimodal system.

The Transportation Planning Process

The regional multimodal transportation system operates within the context of regional goals, regional demographics, regional plans, and the travel demand model setup and definitions. The intensities and patterns of existing demographics and projected growth show that the road infrastructure is generally well patterned to serve transportation demand. A review of each of these contexts shows that the existing transportation planning process and transportation infrastructure in the region are robust and supportive of this Regional Multimodal Plan.

The task of updating the previous Regional Thoroughfare Plan into this Regional Multimodal Plan is to extend a robust regional automobile-oriented planning process to include planning for all transportation modes. This extension and update must also include the consideration of new planning concepts. The Complete Streets, Vision Zero, and Context-Sensitive Solutions movements contribute to planning for an integrated multimodal system with a compatible focus on supporting and protecting all transportation modes and users. Consideration of these new concepts is a valuable addition to the traditional concept of typical street cross sections which have historically been used.

The purpose of a plan is not to predict the future; it is to enable it.

The Auto Network

The **auto network** is the base layer for the Thoroughfare Plan, with Functional Classes defined as providing a balance of access and mobility.

The Functional Classes for the auto network are:

- Controlled Access
- Major Arterial
- Minor Arterial
- Collector
- Frontage Roads & Ramps
- Local Streets

Facility Types distinguish between different features that can be applied to any Functional Class street. The traditional auto network Facility Types are divided, undivided, and continuous center turn lane. This plan has extended the list of Facility Types to include Complete Streets and Green Streets as well.

The inventory of current conditions for the auto network reviewed the existing GIS files, previous Transportation Improvement Program (TIP) documents, and aerial photos to update the network to the year 2017. The network inventory is robust and aligns with the Functional Class system.

Design guidance for typical street cross sections have been provided for the auto network. The guidance is generalized to recognize that the implemented Functional Class and cross section for each project must consider the specific context of the project. Street cross sections provided in the Thoroughfare Plan are meant as guidance for typical conditions, and should be refined as needed for each specific project.

Table 13-1 summarizes the recommendations for right-of-way (ROW) considerations by street Functional Class.

Table 13-1: Summary of ROW Recommendations by Functional Class

Functional Class	Minimum ROW	Preferred ROW	Lane Width	Pavement Width	Median	Outside Buffer	Notes
Controlled Access	250'	Varies, up to 500'	Minimum 12'	Varies	Minimum 36' rural Minimum 10' urban	Varies	Inside shoulder minimum 4' Outside shoulder minimum 10' Vertical clearance minimum 14'
Major Arterial	130'	160'	Preferred 12'	82' to 106'	Preferred 18'	15'	ROW may be greater with parking, bicycle and pedestrian facilities, bus stops, and intersection treatments
Minor Arterial	80'	120'	Preferred 12'	47' to 75'	Center Turn Lane 14'	10'	
Collector	60'	80'	Minimum 11'	31' to 57'	Center Turn Lane 14'	5'	
Local	44'	50'	Minimum 10.5'	23' to 29'	None	5'	

The Thoroughfare Plan for the auto network includes:

- 22 projects from the KTMPO GIS layer of projects
- 24 funded projects from the 2040 MTP
- 28 unfunded projects from the 2040 MTP

Conceptual projects for the auto network include the ideas of inventorying candidates for road diets, identifying critical chokepoints in the network, and defining a hierarchy of access routes for emergency services.

To assist in project evaluation and planning, new performance measures were suggested to help balance the auto network within the integrated multimodal system. Suggested measures included evaluations of speeding, distracted driving, and driving under the influence (DUI) from crash data, measures of mode share from Census data, and inventories of network barriers, bottlenecks, and connectivity.

The Bicycle Network

While the basis for a Functional Classification system for the auto network is primarily that of balancing the purposes of access and mobility, in contrast, the basis for the **bicycle network** Functional Classification system can be seen primarily as addressing safety, which in turn directly affects convenience and building ridership volumes. Each of the bicycle Functional Classes therefore has multiple roles in developing a balanced regional multimodal network.

The Functional Classes for the bicycle network are:

- Protected Bike Lane
- Cycle Track
- Conventional Bike Lane
- Bicycle Boulevard
- Shared Road
- Off-Street Multi-Use Trail

The Facility Types applied to the bicycle network vary among the Functional Classes. They relate to the facilities' design, surface, and levels of protection.

The inventory of current conditions for the bicycle network reviewed the existing GIS files, previous Transportation Improvement Program (TIP) documents, and aerial photos to update the network. Not all the Functional Classes which were defined for the bicycle network are present in the 2017 inventory, but the inventory aligns with the Functional Class system.

Design guidance for the bicycle network included treatments for bicycle lanes, and was extended to discuss the design of intersections, curbsides, parking, and pavement color.

Projects for the bicycle network were sourced from the 2040 MTP and through public input through the KTMPO website. Since many projects are for multi-use trails which serve both the bicycle and the walk network, their projects were presented together. The combined list of projects includes 25 funded and 33 unfunded projects from the 2040 MTP and 52 suggested by the public.

Nine conceptual projects for the bicycle network included ideas for expanding the coverage and safety of the network and its connections to the transit mode. A separate listing of conceptual bicycle and pedestrian projects from the 2040 MTP is presented in Appendix A.

Suggested performance measures for the bicycle network included measures of safety, barriers and connectivity, and mileage of the bicycle network by Functional Class.

The Bus Network

The concept of Functional Classification for the **bus network** relates to the transit system infrastructure of bus stops. A consideration of passenger comfort and amenities is the primary driver in the definition of bus stop Functional Class.

The Functional Classes for the bus network are:

- Station
- Shelter
- Bench
- Basic Bus Stop

Facility Types for the bus network distinguish stops based on their relation with the street. ADA compliance is also established as a separate Facility Type that layers onto all other considerations.

The bus network inventory of current conditions was based on a GIS file of bus stops provided by The HOP and reconciled through field work. The inventory was updated for the recent route changes.

Design guidance for the bus network referenced the configuration of bus stops for ADA compliance and the placement of stops with relation to the street. Guidance for other group transportation modes recognized that they are controlled by the private sector, but stipulated the ADA compliance standards that is required of for all spaces serving the public.

Only three projects for group transportation were noted: one as a funded project from the 2040 MTP to purchase new buses, and two from the Aviation Capital Improvement Program for the Draughon-Miller Central Texas Regional Airport. Conceptual projects for high speed rail service and improvements to AMTRAK service were noted, but these are in the early planning stages and were therefore not listed.

Conceptual projects for the bus network were to develop bus shelters with enhanced treatments, and to improve the branding of transit routes.

Suggested performance measures for the bus network included measures of connectivity, comfort as rated by the presence of amenities at stops, on-time performance and reliability, and a measure of the completeness of the required Transit Asset Management Plan.

The Truck Network

The definition of Functional Classes for the **truck network** is intended to inform the street design process of the needs and impacts of trucks. This Functional Classification system is a tool to define a hierarchy of street facilities as used by trucks.

The Functional Classes for the bus network are:

- Truck Priority
- Truck Restricted
- Truck Hazardous Materials
- Truck Prohibited

The truck network inventory of current conditions was based on available GIS files and on designations of routes from planning sources such as the National Highway System (NHS) and the Texas Highway Freight Network. TxDOT designations such as the listings of load-restricted routes and load-restricted bridges were also referenced.

Design guidelines for the truck network are treated by referencing the concept of the “design vehicle.” Larger vehicles such as trucks, emergency response vehicles, and buses have specific needs which must be addressed in road design; particularly turning radius, lane width, vertical clearance, and horizontal clearance. Design guidance for the truck network is therefore similar to the auto network.

Truck network projects were derived from a variety of sources, including routes defined by the Freight Advisory Committee, inventories of routes with restrictions, and at-grade railroad crossings. Projects include:

- 9 routes identified by the Freight Advisory Committee
- 11 load-restricted bridges
- 34 load-restricted roads
- 4 roads with geometric restrictions
- 109 at-grade railroad crossings

Three conceptual projects were suggested for the truck network: inventorying hazardous materials origins and destinations, inventorying truck parking, and defining a more robust regional truck network.

Suggested performance measures for the truck network included evaluations of load restricted bridges and network barriers and connectivity. A conceptual project for railroad quiet zones was also included.

The Walk Network

The Functional Classes defined for the **walk network** set a hierarchy of facilities which can be implemented as appropriate when the walk network interacts with the other modal networks. This is considered in many contexts, supporting the primary purpose of promoting safety.

The Functional Classes for the walk network are:

- Off-Street Multi-Use Trail
- Sidewalk
- Desire Lines
- Crosswalk

Functional Classes for the walk network cover a wide range of infrastructure, so their associated Facility Types vary considerably.

The review of the inventories for the walk network revealed several topics and geographic area which need updates.

The definition of new Functional Classes for the walk network has established the need for new inventories in the topics of Desire Lines and Crosswalks. Additional attributes also need to be inventoried for some Functional Classes, including pavement width, surface, and ADA Compliance. To support the inventories, a more precise definition of the distinction between on-street multi-use trails and sidewalks is needed.

Geographically, there are new developments and older residential areas in Copperas Cove, south of Killeen and Harker Heights, north of Belton, Temple, and Troy where the sidewalk inventory is incomplete and needs to be extended.

Design guidance for the walk network generally reference the need for the provision of pedestrian facilities rather than their design. In general, design guidance for the pedestrian network relates to the sidewalk Functional Classes and ADA compliance.

Projects for the walk network were sourced from the 2040 MTP and through public input through the KTMPO website. Since many projects are for multi-use trails which serve both the bicycle and the walk network, their projects were presented together. The combined list of projects includes twenty-five funded and thirty-three unfunded projects from the 2040 MTP and fifty-two suggested by the public. A separate listing of conceptual bicycle and pedestrian projects is presented in Appendix A, and is not included in this count.

Six conceptual projects were suggested for the walk network, focusing on the efficiency and design of paths, connectivity, and the provision of livable spaces such as pocket parks and hidden places.

Suggested performance measures for the walk network included measures of the sidewalk network, ADA compliance, barriers and connectivity, and the mileage of trails.

Complete Streets

The KTMPO regional network consists of layers of interrelated networks for the auto, bicycle, bus, truck, and walk networks. Each of these networks has its own specific design standards specified by law or by professional practice. The **Complete Streets** concept is one tool that can help develop these individual networks into a balanced and integrated multimodal network. Complete Streets treatments are intended to bring the different layers of the multimodal system into a proper balance. This balance does not mean that every street must provide full accommodation for every transportation mode. It does mean that that every street should be designed with an appropriate consideration of all transportation modes to see how they can be balanced together.

> **…we could lay out an ideal street type, but in an existing city with constrained rights of way…not all streets can do all things at one time.**
>
> **David Gaspers**
> **Principal Planner**
> **City of Denver**

Implementing the desired Complete Streets design may be a challenge within the available right-of-way, funding constraints, and regulatory environment.

Complete Streets treatments and the balance of all the individual modes in the integrated multimodal network depends upon the regional and the street contexts, which define the intensity and character of activities and where they take place on the street for each mode.

Recognizing the contexts, the very specific and objective design guidelines for each mode are brought together and balanced under the very general and subjective concepts of Complete Streets. Guidance for developing the proper balance of modes for Complete Streets therefore relies as much on imagination and judgement as it does on engineering.

To support the planning of implementation of Complete Streets and bring the integrated multimodal network into a better balance, several conceptual projects were defined in the categories of policy, planning, and events. Conceptual projects include suggestions to adopt Vision Zero policies, safety strategies, rapid implementation of projects, updated inventories for transportation modes, and pursuing designations as

Bicycle Friendly Communities. A conceptual project for an annual Ciclovía was suggested as an education event to promote awareness of the balanced multimodal system and change drivers' attitudes towards other transportation modes.

Summary

The traditional transportation process and previous Regional Thoroughfare Plan supported a street network that is robust, well distributed, and well suited to serve the automobiles that serve over 92% of all trips in the region. However, a new vision for the region as expressed in the 2040 Metropolitan Transportation Plan (MTP) established the goal **to preserve and enhance the KTMPO area by developing a fully-integrated, multi-modal transportation system focusing on moving people and freight**. Accomplishing this vision calls for a shift in the way transportation planning is carried out in the region.

This Regional Multimodal Plan builds on the new vision to depart from the traditional automobile-oriented planning and pursue the development of a more balanced and integrated multimodal transportation system. The approach used in this Plan developed several new approaches to support the process:

If you always do what you always did, you'll always get what you always got.

- The transportation network was defined as several interrelated and interactive layers, with individual auto, bicycle, bus, truck, and walk networks. Transportation modes for passenger air and rail were also considered, but they interact with the regional network as discrete points rather than as networks, so planning for those modes was approached slightly differently.
- The existing Functional Class and Facility Type system as defined for the auto network was extended to cover all transportation networks. This approach supported more precision in modal inventories of current conditions and network issues.
- Projects for network improvements were compiled from various official and unofficial sources to develop potential future networks for planning. These lists of projects are not fiscally constrained or prioritized, and so form an input into the 2045 KTMPO MTP.
- Planning and projects are stimulated with conceptual projects suggested in the categories of policy, planning, and events, and for each transportation modal network. These projects are conceptual rather than specific, and may not fall into one of the MTP funding categories, and they therefore may not be directly relevant to the KTMPO 2045 MTP. However, taken together with the MTP projects, these conceptual projects can contribute to developing a balanced regional multimodal network.

Appendix A: Referenced Bicycle and Pedestrian Projects

The previous 2011 *Killeen-Temple MPO Regional Thoroughfare and Pedestrian/Bicycle Plan* presented a list of projects that were not all carried through into the 2040 Metropolitan Transportation Plan. Further, these projects were not carried forward into the KTMPO inventories and GIS files, and were not re-submitted. These projects may therefore be considered as “unofficial” or “conceptual”, even though they have been documented in the previous plan. However, they have been vetted by that planning process, and therefore represent real needs and potential solutions for the bicycle and pedestrian networks. These projects are therefore presented for reference.

The projects are shown for the region in **Figure A-1**. **Figure A-2** through **Figure A-6** are insets to show more detail for Copperas Cove, Killeen, Harker Heights, Belton – Salado, and Temple.

Each project is listed in **Table A-1** through **Table A-15**, with separate tables for the major jurisdictions in the KTMPO region as follows:

- **Table A-1** covers the City of Belton, with 70 projects
- **Table A-2** covers the City of Copperas Cove, with 44 projects
- **Table A-3** covers the City of Harker Heights, with 27 projects
- **Table A-4** covers the City of Kempner, with 3 projects
- **Table A-5** covers the City of Killeen, with 102 projects
- **Table A-6** covers the City of Little River / Academy, with 2 projects
- **Table A-7** covers the City of Morgan's Point Resort, with 2 projects
- **Table A-8** covers the City of Nolanville, with 6 projects
- **Table A-9** covers the City of Temple, with 147 projects
- **Table A-10** covers the Village of Salado, with 7 projects
- **Table A-11** covers Bell County, with 60 projects
- **Table A-12** covers Coryell County, with 13 projects
- **Table A-13** covers Lampasas County, with 17 projects
- **Table A-14** covers the Army Corps of Engineers, with 2 projects
- **Table A-15** covers Fort Hood, with 20 projects

Figure A-1: 2011 Reference Bicycle and Pedestrian Projects

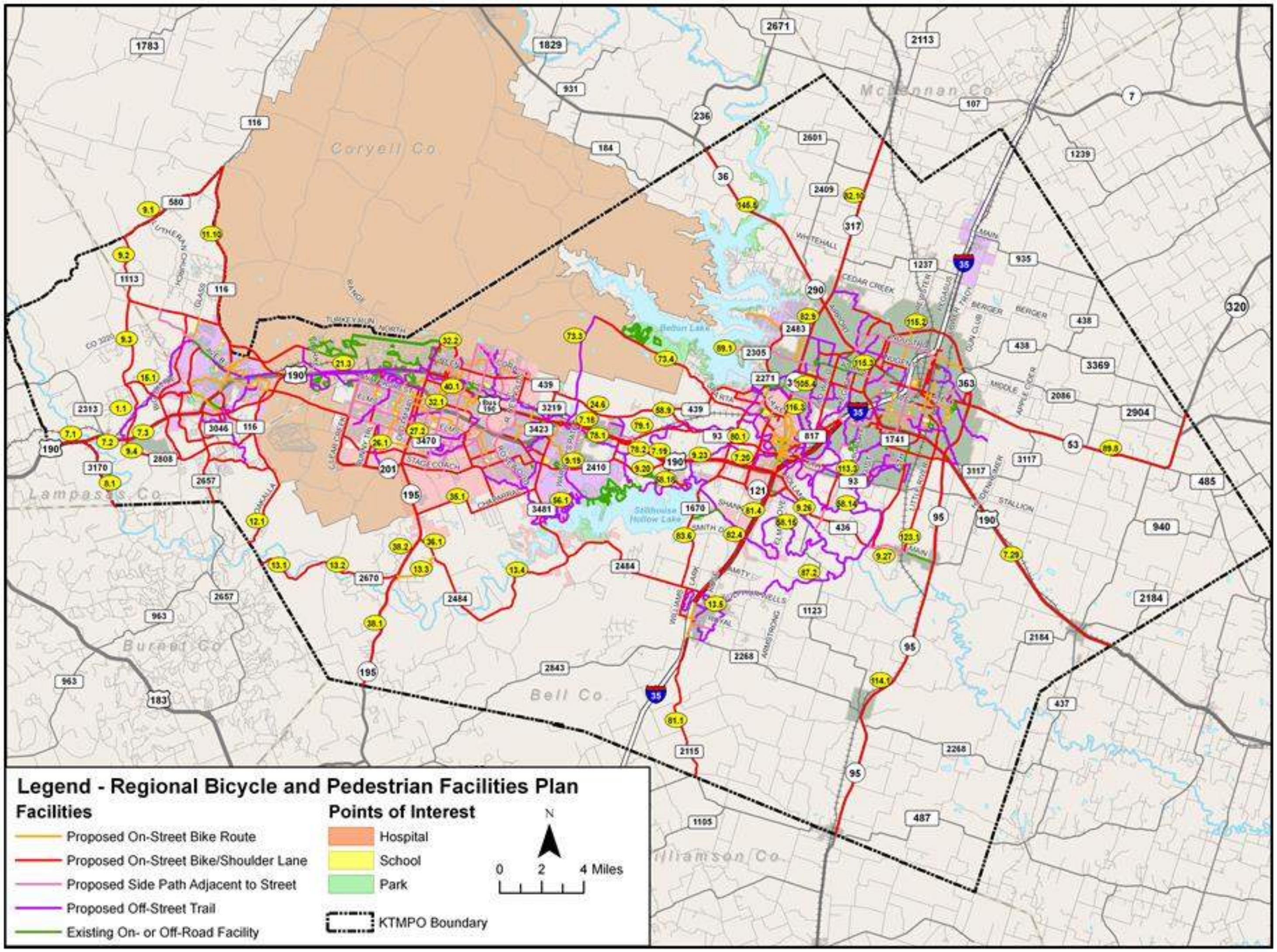


Figure A-2: 2011 Reference Bicycle and Pedestrian Projects Copperas Cove Inset

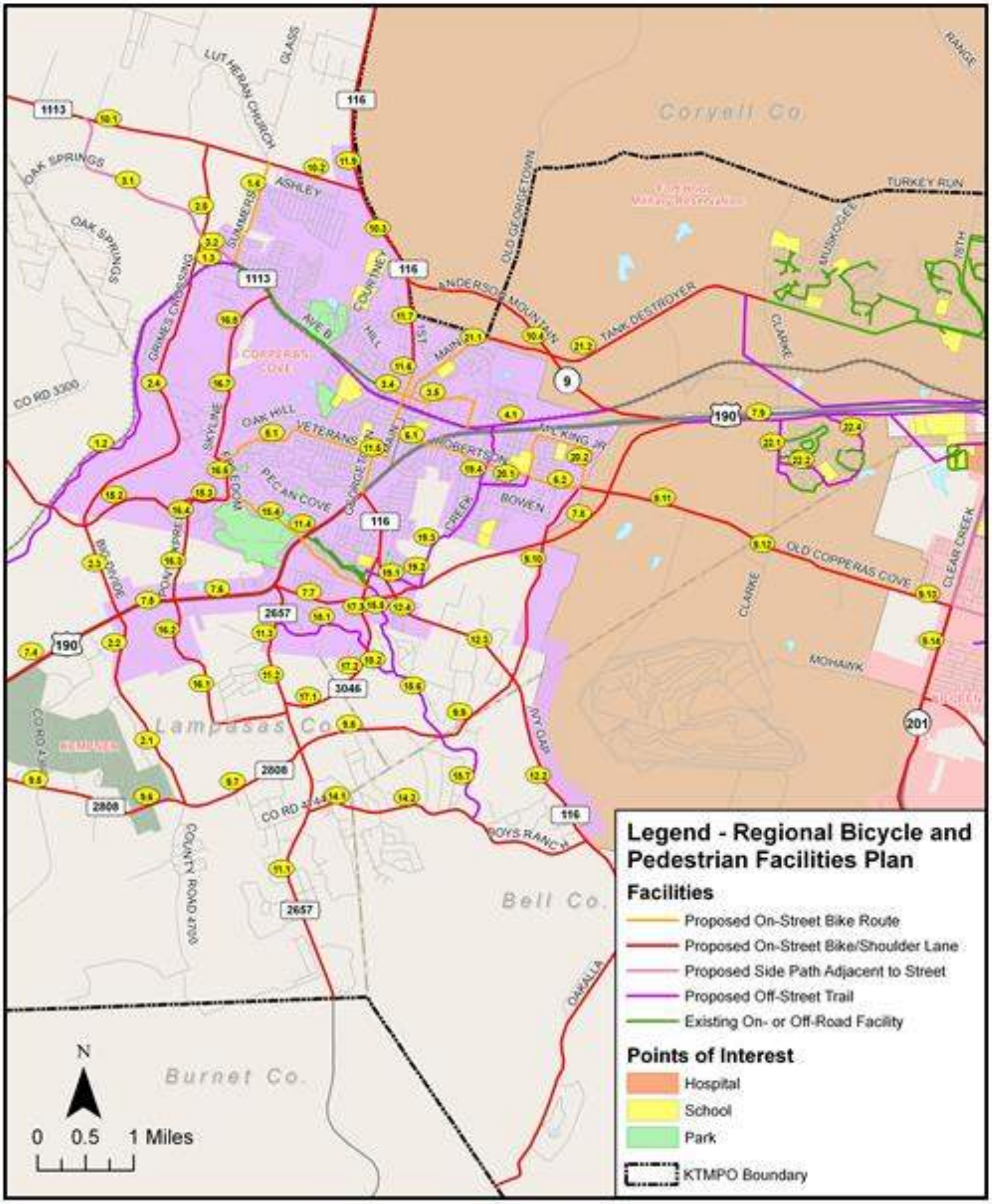


Figure A-3: 2011 Reference Bicycle and Pedestrian Projects Killeen Inset

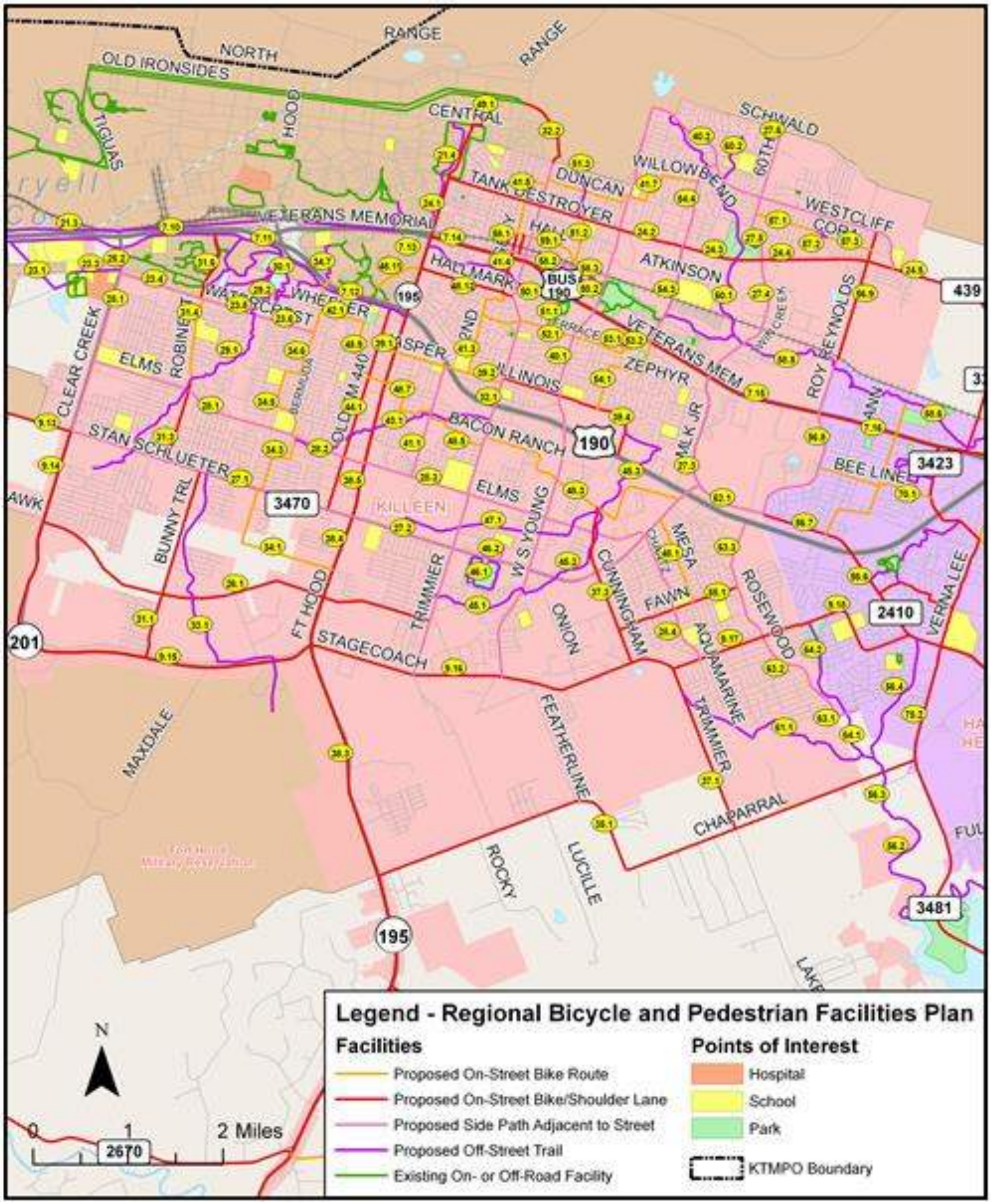


Figure A-4: 2011 Reference Bicycle and Pedestrian Projects Harker Heights Inset

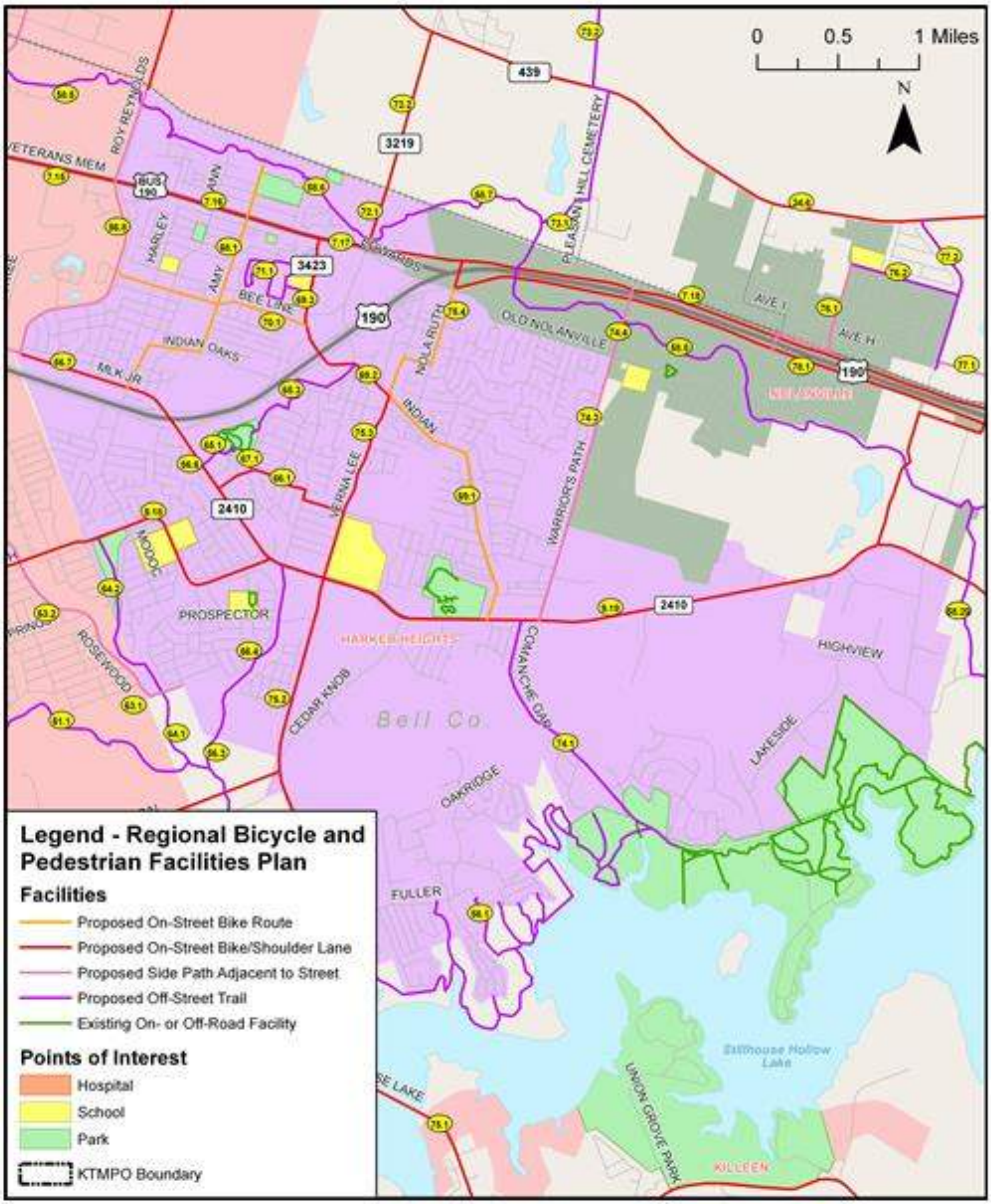


Figure A-5: 2011 Reference Bicycle and Pedestrian Projects Belton – Salado Inset

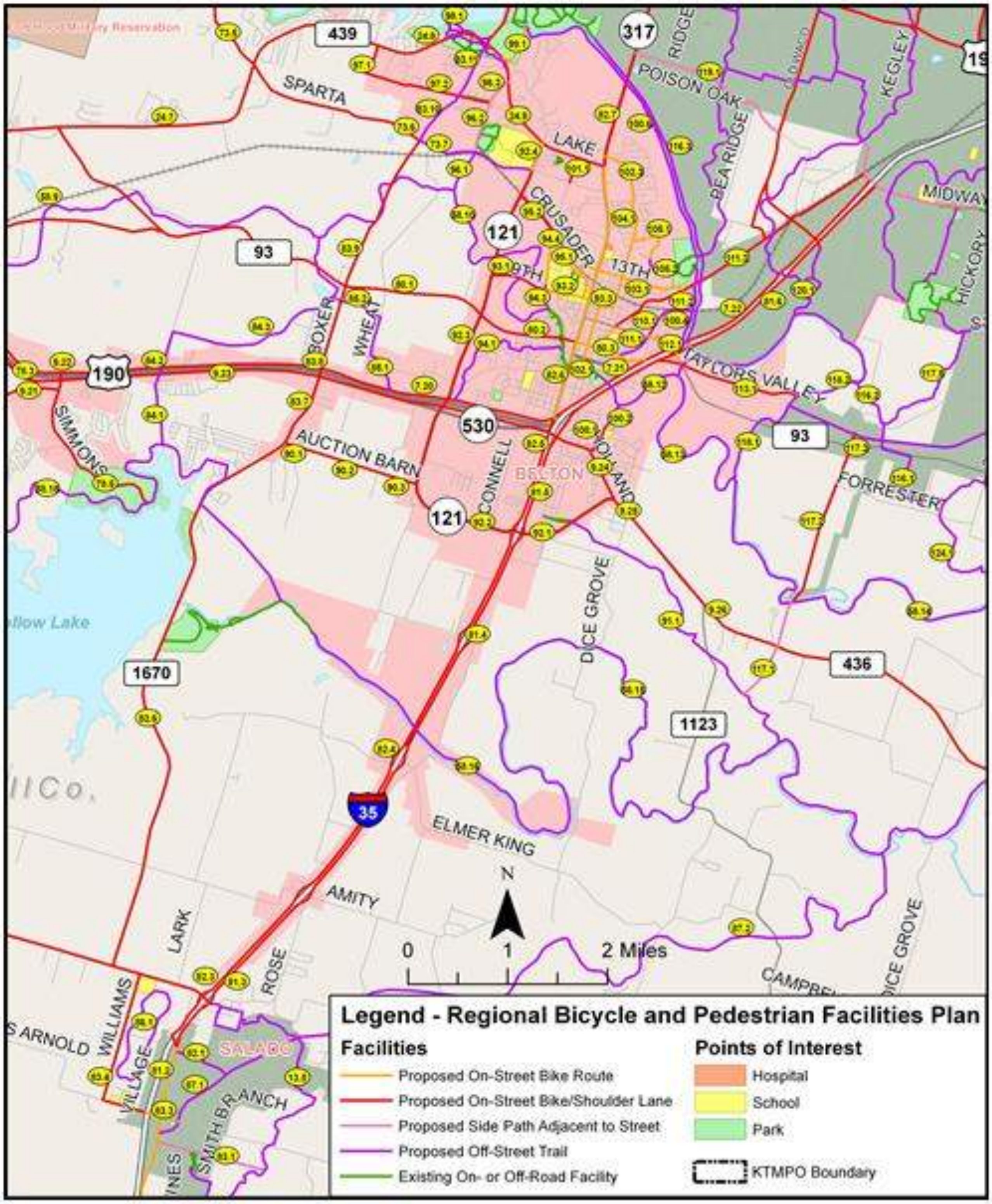


Figure A-6: 2011 Reference Bicycle and Pedestrian Projects Temple Inset

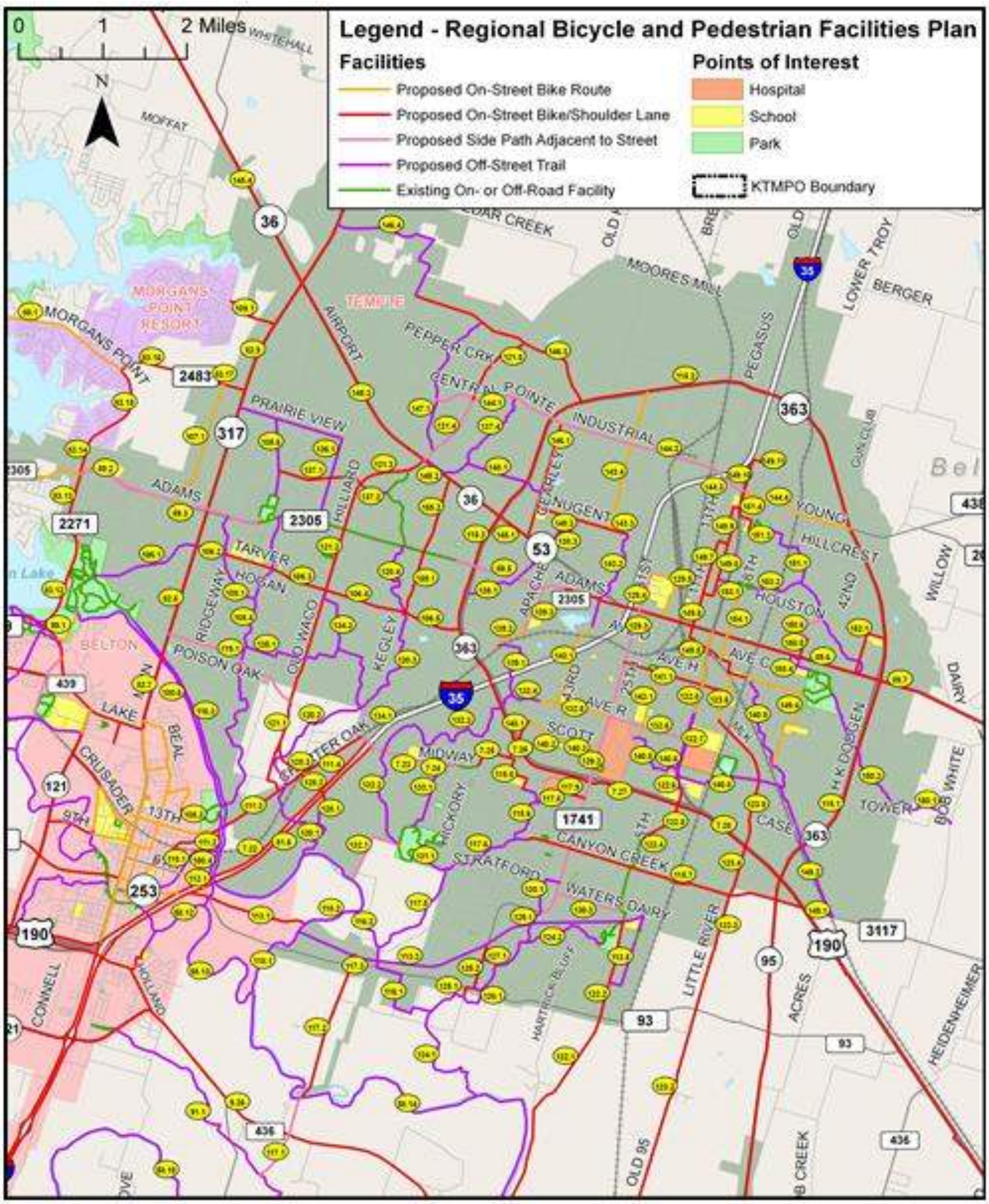


Table A-1: 2011 Reference Projects for the City of Belton

City of Belton									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
7.20	Shoulder Lane	Add signs and markings for shoulder lanes	On US190 WB FR	From western city limit easterly to Main Street	2 lane one-way roadway with shoulders	No	Yes	5.63	$225,200
7.21	Shoulder Lane	Include shoulder lane with future roadway improvement	On IH 35 SB FR	From US190 WB/Main St northerly to northern city limits	2 lane one-way roadway	No	Yes	1.52	$0
9.21	Shoulder Lane	Add shoulders, signs, and markings	On FM 2410	From western city limit easterly to Simmons Rd	2 lane roadway with narrow shoulders	No	Yes	0.51	$127,500
9.22	Shoulder Lane	Add shoulders, signs, and markings	On FM2410/Simmons Rd	From FM2410 northerly to US 190 WB FR	2 lane roadway	No	Yes	0.17	$42,500
9.23	Shoulder Lane	Add shoulders, signs, and markings	On US190 EB FR	From Simmons Rd easterly to IH 35 NB FR	2 lane one-way roadway	No	Yes	4.97	$1,242,500
9.24	Shoulder Lane	Add shoulders, signs, and markings	On FM 436	From IH 35 SB Service Rd easterly and southerly to Loop 121 at Shady Ln	4 lane roadway	Yes	Yes	0.99	$247,500
9.25	Shoulder Lane	Add shoulders, signs, and markings	On FM 436	From Loop 121 at Shady Ln easterly to eastern city limit	4 lane roadway	No	Yes	0.21	$52,500
24.8	Shoulder Lane	Add shoulders, signs, and markings	On FM 439	From Wild Wood Dr easterly to FM2271	4 lane roadway	No	Yes	1.15	$287,500
24.9	Shoulder Lane	Add shoulders, signs, and markings	On FM439/Lake Rd	From FM2271 easterly to Main St	5 lane roadway	Yes	Yes	1.86	$465,000
58.10	Trail	Add 10ft wide multi-use trail	Along Nolan Creek	From proposed trail at Belton western city limit southerly to existing trail in Lions/Harris Park	Creekside land	Yes	No	2.82	$846,000
58.12	Trail	Add 10ft wide multi-use trail	Along Nolan Creek	From existing trail in Confederate Park easterly to proposed trail south of FM93	Creekside land	Yes	No	1.10	$330,000
58.13	Trail	Add 10ft wide multi-use trail	Along Nolan Creek	From proposed trail south of FM93 easterly to proposed trail along Leon River	Creekside land	No	No	2.33	$699,000
58.16	Trail	Add 10ft wide multi-use trail	Along Lampasas River	From city limit west of Elm Grove Rd westerly to existing trail east of Chalk Ridge Falls Park	Riverside land	No	No	3.81	$1,143,000
73.6	Shoulder Lane	Add shoulders, signs, and markings	On Sparta Rd	From western city limit to proposed trail along proposed road west of Wheat Rd	2 lane roadway	No	No	0.28	$70,000
73.7	Trail	Add 10ft wide multi-use trail	Along Sparta Rd	From proposed trail west of Wheat Rd easterly to Loop 121	2 lane roadway	Yes	No	1.20	$360,000

Table A-1: 2011 Reference Projects for the City of Belton (continued)

City of Belton									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
78.3	Shoulder Lane	Add shoulders, signs, and markings	On US 190 EB FR	From western city limit west of FM2410 easterly to FM2410	2 lane one-way roadway with shoulders	No	Yes	0.60	$150,000
78.5	Shoulder Lane	Add shoulders, signs, and markings	On Simmons Rd	From FM2410 southerly to proposed trail in Stillhouse Park	2 lane roadway	No	No	1.72	$430,000
80.2	Bike Lane	Add signs and markings for bicycle lanes	On FM93/2nd Ave	From western city limit easterly to Main St	2 lane roadway with shoulders	Yes	Yes	1.17	$46,800
80.3	Bike Route	Add bike route signs	On 2nd Ave	From Main St easterly to IH35 SB FR	3 lanes roadway to the west of Penelope, 2 lanes to the east	Yes	No	0.73	$5,000
81.4	Shoulder Lane	Include shoulder lane with future roadway improvement	On IH 35 NB FR	From southern city limit north of FM2484 northerly to Loop 121	2 lane roadway	No	Yes	5.26	$0
81.5	Shoulder Lane	Include shoulder lane with future roadway improvement	On IH 35 NB FR	From Loop 121 northerly to northern city limit at Leon River	2 lane roadway	Yes	Yes	2.66	$0
82.4	Shoulder Lane	Include shoulder lane with future roadway improvement	On IH 35 SB FR	From southern city limit north of FM2484 northerly to Loop 121	2 lane roadway	No	Yes	5.29	$0
82.5	Shoulder Lane	Include shoulder lane with future roadway improvement	On IH 35 SB FR	From Loop 121 northerly to US 190 WB FR	2 lane roadway	Yes	Yes	1.21	$0
82.6	Bike Route	Add bike route signs	On SH317/Main St	From US 190 WB FR northerly to FM439	3-5 lane roadway	Yes	Yes	2.60	$15,000
82.7	Bike Lane	Add signs and markings for bicycle lanes	On SH 317/Main St	From FM439 northerly to northern city limit at Leon River	2 lane roadway with shoulders	Yes	Yes	0.90	$36,000
83.7	Shoulder Lane	Add signs and markings for shoulder lanes	On FM 1670	From southern city limit at Sunflower Ln northerly to US 190 EB FR	2 lane roadway with shoulders	No	Yes	1.03	$41,200
83.8	Shoulder Lane	Add shoulders, signs, and markings	On FM 1670	From US 190 EB FR northerly to northern city limits south of Springer St	2 lane roadway	No	Yes	0.16	$40,000
83.10	Trail	Add 10ft wide multi-use trail	Along proposed southern extension of FM 2271	From Sparta Rd northerly to Red Rock Dr	Future roadway	Yes	No	0.96	$288,000
83.11	Trail	Add 10ft wide multi-use trail	Along proposed southern extension of FM 2271	From Red Rock Dr northerly to FM439	Future roadway	No	No	0.23	$69,000

Table A-1: 2011 Reference Projects for the City of Belton (continued)

City of Belton									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
83.12	Shoulder Lane	Add signs and markings for shoulder lanes	On FM 2271 in Miller Spring Park	From FM439 northerly to north city limits east of Belton Lake	2 lane roadway with shoulders	Yes	Yes	0.98	$39,200
84.2	Trail	Add 10ft wide multi-use trail	Along George Wilson Rd	From city limit at Dogridge Rd northerly to city limit north of US190 WB FR	2 lane roadway	No	No	0.35	$105,000
85.1	Trail	Add 10ft wide multi-use trail	North of US190 and east of Wheat Rd	From US 190 WB FR northerly to northern city limit north of Digby Dr	Open land	No	No	0.52	$156,000
90.1	Shoulder Lane	Add shoulders, signs, and markings	On Auction Barn Rd	From FM 1670 easterly to city limit at Village Hill Rd	2 lane roadway	No	No	0.18	$45,000
90.3	Shoulder Lane	Add shoulders, signs, and markings	On Auction Barn Rd	From city limit west of Loop 121 easterly to Loop 121	2 lane roadway	No	No	0.15	$37,500
92.1	Shoulder Lane	Add shoulders, signs, and markings	On Loop 121	From FM436 westerly to IH35 NB FR	2 lane roadway	No	Yes	1.01	$252,500
92.2	Shoulder Lane	Add shoulders, signs, and markings	On Loop 121	From IH35 NB FR westerly to Auction Barn Rd	2 lane roadway with shoulders	Yes	Yes	1.26	$315,000
92.3	Bike Lane	Add signs and markings for bicycle lanes	On Loop 121	From Auction Barn Rd northerly to Sparta Rd	2-4 lane roadway with shoulders	Yes	Yes	3.38	$135,200
92.4	Bike Route	Add bike route signs	On Loop 121	From Sparta Rd northerly to FM439	4 lane roadway	Yes	Yes	0.29	$5,000
93.1	Bike Lane	Include bike lane in future roadway	On proposed western extension of and existing 9th Avenue	From Loop 121 easterly to University Drive	Future roadway and 2 lane roadway	Yes	No	0.56	$0
93.2	Bike Route	Add bike route signs	On 9th Avenue	From University Drive easterly to Main Street	2 lane roadway	No	No	0.46	$5,000
93.3	Bike Route	Add bike route signs	On 9th Avenue	From Main Street easterly to Beal Street	2 lanes local residential roadway	No	No	0.25	$5,000
94.1	Trail	Add 10ft wide multi-use trail	East of Loop 121 and south of 1st Ave	From US190 WB FR northerly to existing trail along Nolan Creek near Central and Davis	Wooded area	No	No	1.59	$477,000
94.3	Trail	Add 10ft wide multi-use trail	Northern extension of existing trail, east of Sparks St	From northern end of existing trail in Lions/Harris Park northerly to 10th Ave on UMHB campus	Wooded area	Yes	No	0.25	$75,000
94.4	Bike Route	Add bike route signs	On University Dr	From 10th St W northerly to Crusader Way	2 lane roadway	No	No	0.50	$5,000
95.1	Bike Route	Add bike route signs	On Pearl St and Crusader Way	From 9th Ave northerly to University Dr	2 lane roadways	No	No	0.76	$5,000
95.2	Bike Lane	Add signs and markings for bicycle lanes	On Crusader Way	From University Dr northerly to Loop 121	2 lane roadway	Yes	No	0.50	$20,000

Table A-1: 2011 Reference Projects for the City of Belton (continued)

City of Belton									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
96.1	Trail	Add 10ft wide multi-use trail	Southwest of Chisholm Trail Park and Belton Intermediate School	From proposed trail along Nolan Creek northerly to Sparta Rd	Open land	Yes	No	0.44	$132,000
96.2	Side Path	Add 8ft wide multi-use side path	Along Dunns Canyon Rd	From Sparta Rd northerly to Chisholm Trail Rd	3 lane roadway	Yes	No	0.51	$102,000
96.3	Side Path	Add 8ft wide multi-use side path	Along Dunns Canyon Rd	From Chisholm Trail Rd northerly to FM439	3 lane roadway	No	No	0.28	$56,000
97.1	Shoulder Lane	Include shoulder lane with future roadway improvement	On proposed western extension of Chisholm Trail Pkwy and other proposed road	From FM439 southerly and easterly to southern end of Spring Canyon Rd	Future roadways	No	No	0.69	$0
97.2	Shoulder Lane	Add shoulders, signs, and markings	On existing and proposed extension of Chisholm Trail Pkwy	From Spring Canyon Rd easterly to Dunns Canyon Rd	2 lane roadway and future roadway	Yes	No	0.88	$220,000
98.1	Trail	Add 10ft wide multi-use trail	In Miller Springs Park	Interconnected segments In Miller Spring Park southerly to Red Rock Dr	Park land	No	No	1.67	$501,000
99.1	Bike Route	Add bike route signs	On unnamed road In Miller Springs Park	From FM439 northerly to existing trail in Miller Springs Park	2 lane roadway	No	No	0.45	$5,000
100.1	Bike Lane	Add signs and markings for bicycle lanes	On Ave O, Ray St, Ave M, and Fairway Dr	From FM436 northerly to Avenue J at Miller Heights Elementary School	2 lane roadways	Yes	No	0.34	$13,600
100.2	Trail	Add 10ft wide multi-use trail	North of Griggs Park and Miller Heights Elementary School	From Miller Heights Elem northerly to proposed trail along Nolan Creek	Open land and wooded area	Yes	No	0.27	$81,000
100.4	Trail	Add 10ft wide multi-use trail	Along west side of Leon River	From proposed trail south of FM93 northerly to existing trail in Heritage Park	Open land and riverside land	Yes	No	1.20	$360,000
100.6	Trail	Add 10ft wide multi-use trail	Along west side of Leon River	From existing trail in Heritage Park northerly to existing trail in Miller Spring Park	Riverside land	Yes	No	3.28	$984,000
101.1	Bike Lane	Include bike lane in future roadway	On proposed northern extension of Commerce St	From Sparta Rd northerly to FM439	Future roadway	No	No	0.25	$0
102.1	Bike Route	Add bike route signs	On Beal St, Water St, and Penelope St	From existing trail in Confederate Park northerly to 9th Ave	2 lane roadways	Yes	No	0.78	$5,000
102.3	Bike Route	Add bike route signs	On Beal St	From 9th Ave southern jct w/ Beal northerly to Main St	2 lane roadway	No	No	1.75	$10,000
103.1	Bike Route	Add bike route signs	On College St and 13th Ave	From Crusader Way northerly and easterly to Waco Rd	2 lane roadways	Yes	No	1.16	$10,000

Table A-1: 2011 Reference Projects for the City of Belton (continued)

City of Belton									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
104.1	Bike Route	Add bike route signs	On 22nd Ave	From Main St easterly to Beal St	2 lane roadway	No	No	0.26	$5,000
105.1	Bike Route	Add bike route signs	On Hastings Rd and Landmark Dr	From Beal St easterly and southerly to southern end of Landmark Dr	2 lane roadways	No	No	0.53	$5,000
105.2	Trail	Add 10ft wide multi-use trail	West of Heritage Park	From southern end of Landmark Dr southerly and easterly to existing trail in Heritage Park	Wooded area	No	No	0.36	$108,000
110.1	Trail	Add 10ft wide multi-use trail	East of Birdwell St and west of Palmetto Dr	From 2nd Ave easterly to proposed trail along Leon River	Open land	No	No	0.95	$285,000
111.1	Bike Route	Add bike route signs	On Blair St	From 2nd Ave northerly to 6th Ave	2 lane roadway	No	No	0.25	$5,000
111.2	Shoulder Lane	Add shoulders, signs, and markings	On FM817/Old Waco Rd	From 6th St northerly to proposed trail at eastern city limit along Leon River at eastern city limit	2 lane roadway	No	Yes	0.94	$235,000
112.1	Bike Route	Add bike route signs	On FM93/6th Ave	From proposed trail west of Cori Dr easterly and southerly to Taylors Valley Rd	4-5 lane roadway	No	Yes	0.47	$5,000
113.1	Shoulder Lane	Add shoulders, signs, and markings	On Taylors Valley Rd	IH35 NB FR easterly to proposed trail along Leon River	2 lane roadway	Yes	No	1.46	$365,000
118.1	Trail	Add 10ft wide multi-use trail	Along Leon River	From proposed trail south of FM93 northerly to Taylors Valley Rd	Creekside land	No	No	1.18	$354,000
TOTAL								86.41	$12.79m

Table A-2: 2011 Reference Projects for the City of Copperas Cove

City of Copperas Cove

ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
1.2	Trail	Add 10ft wide multi-use trail	Along west side of Taylor Creek	From southern city limit northerly to Grimes Crossing Rd	Land between Taylor Creek and Railroad	No	No	3.07	$921,000
1.3	Trail	Add 10ft wide multi-use trail	Along north side of railroad	From Grimes Crossing Rd easterly to Avenue B	Land between Grimes Crossing Road and Railroad	No	No	0.52	$156,000
1.4	Bike Route	Add bike route signs	On Summers Rd	From Avenue B northerly to Lutheran Church Rd	2 lane roadway	No	No	1.11	$10,000
2.2	Shoulder Lane	Include shoulder lane with future roadway improvement	On proposed Big Divide Rd southern extension	From southern city limit northerly to US190	Future roadway	No	No	0.76	$0
2.3	Shoulder Lane	Include shoulder lane with future roadway improvement	On Big Divide Rd	From US190 northerly to proposed minor arterial	Narrow 2 lane roadway	No	No	0.98	$0
2.4	Shoulder Lane	Add shoulders, signs, and markings	On Big Divide Rd and Grimes Crossing Rd	From proposed minor arterial northerly to northern city limits	2 lane roadway	No	No	3.21	$802,500
3.2	Side Path	Add 8ft wide multi-use side path	Along FM 1113	From western city limit easterly to Summers Rd (west end of existing side path)	2 lane roadway	No	Yes	0.41	$82,000
3.4	Bike Route	Add bike route signs	On FM1113/Avenue B	From 7th St (east end of existing side path) easterly to FM116/1st St	2 lanes, 4 lanes between Main and 3rd St	No	Yes	0.21	$5,000
3.5	Bike Route	Add bike route signs	On Avenue B, North Dr, and Wolfe Rd	FM116/1st St easterly to Avenue D/Wolfe Rd	2 lanes, 4 lanes between Main and 3rd St	No	No	1.06	$10,000
4.1	Trail	Add 10ft wide multi-use trail	Along south side of railroad tracks	From proposed road just west of Myra Lou Ave easterly to proposed north bypass	Land between railroad and Avenue D	No	No	3.13	$939,000
5.1	Bike Route	Add bike route signs	On Veterans Ave	From Freedom Ln easterly to Georgetown Rd	Wide unmarked 2 lane road through neighborhoods	No	No	1.77	$10,000
6.1	Bike Route	Add bike route signs	On Robertson Ave	From Lee Rd/Veterans Dr easterly to proposed extension of Constitution just north of Virginia Ave	2 lanes, side walks along most of the road	No	No	1.77	$10,000
6.2	Bike Route	Add bike route signs	On future Constitution southern extension	From Robertson Rd easterly to southern end of existing Constitution Dr	Future roadway	No	No	0.24	$5,000

Table A-2: 2011 Reference Projects for the City of Copperas Cove (continued)

City of Copperas Cove									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
7.5	Shoulder Lane	Add signs and markings for shoulder lanes	On US 190	From western city limit easterly to proposed road west of Suja Ln	5 lanes with shoulders	No	Yes	0.70	$28,000
7.6	Bike Lane	Add signs and markings for bicycle lanes	On US 190	From proposed road west of Suja Ln easterly to proposed southern bypass	5 lanes with shoulders	No	Yes	1.07	$42,800
7.7	Shoulder Lane	Include shoulder lane in future roadway	On future southern bypass	From US190 easterly to FM116	Future roadway	No	Yes	1.29	$0
7.9	Trail	Add 10ft wide multi-use trail	Along US 190 EB FR	From proposed southern bypass easterly to Central Texas College at Bell Tower Dr	2 lane one-way road	No	Yes	2.87	$861,000
9.10	Shoulder Lane	Include shoulder lane with future roadway improvement	On proposed FM 2808 future eastern extension	From southern city limit near Abbott Ln northerly to Constitution Dr	Future roadway	No	No	1.84	$0
10.2	Shoulder Lane	Add signs and markings for shoulder lanes	On Lutheran Church Rd	From city limit east of Woodland Dr easterly to FM 116	Narrow 2 lane roadway	No	No	0.81	$32,400
10.3	Shoulder Lane	Add signs and markings for shoulder lanes	On FM116/1st St	From Lutheran Church Rd southerly to proposed north bypass	2 lane roadway with shoulders	No	Yes	1.06	$42,400
11.3	Shoulder Lane	Include shoulder lane with future roadway improvement	On FM 2657	From southern city limit northerly to US190	2 lane roadway	No	Yes	0.74	$0
11.4	Bike Lane	Add signs and markings for bicycle lanes	On US 190	From proposed southern bypass easterly to FM 116	5 lane roadway with shoulders	No	Yes	1.37	$54,800
11.5	Bike Route	Add bike route signs	On Georgetown Rd, Veterans Ave, Lee St, Meggs St, and 1st St	From US 190 northerly to Avenue F	2 lane roadway	No	No	1.04	$10,000
11.6	Bike Route	Add bike route signs	On FM116/1st St	From Avenue F northerly to Sherman Ave	2 lane roadway	No	Yes	0.56	$5,000
11.7	Bike Lane	Add signs and markings for bicycle lanes	On FM116/1st St	From Sherman Ave northerly to proposed northern bypass	2 lane roadway with shoulders	No	Yes	0.89	$35,600
11.9	Shoulder Lane	Add signs and markings for shoulder lanes	On FM116/1st St	From Lutheran Church Rd northerly to northern city limit	2 lane roadway with shoulders	No	Yes	0.49	$19,600
12.4	Shoulder Lane	Add shoulders, signs, and markings	On FM 116	From eastern city limit northerly to US 190	2 lane roadway south of Tyler Dr, 5 lanes to the north	No	Yes	1.68	$420,000

Table A-2: 2011 Reference Projects for the City of Copperas Cove (continued)

City of Copperas Cove									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
15.2	Bike Lane	Include bike lane with future roadway improvement	On future roadway and Winchester Dr, and Freedom Ln	From proposed road near CR 3340 easterly to Pony Express Ln	Future roadway and wide 2 lane roadway	No	No	1.93	$0
15.3	Bike Lane	Include bike lane with future roadway improvement	On Freedom Ln	From Pony Express Ln easterly to Ogletree Pass	2 lane roadway	No	No	0.38	$0
15.4	Bike Route	Add bike route signs	On Ogletree Pass and Walker Place	From Freedom Ln easterly to FM3046	2 lane roadway	No	No	1.85	$10,000
15.5	Trail	Add 10ft wide multi-use trail	Along Clark Creek	From FM3046 southerly to southern city limit	Creekside land	No	No	0.54	$162,000
16.2	Bike Lane	Include bike lane in future roadway	On future Pony Express southern extension	From southern city limit northerly to city limit north of US190	Future roadway	No	No	0.98	$0
16.4	Bike Lane	Include bike lane with future roadway improvement	On Pony Express Ln	From city limit south of Buckboard Trail northerly to Freedom Ln	Narrow 2 lane roadway	No	No	0.40	$0
16.6	Bike Lane	Add signs and restripe for bicycle lanes	On Freedom Ln	From Ogletree Pass northerly to Veterans Ave	Wide unmarked 2 lane roadway	No	No	0.42	$21,000
16.7	Bike Lane	Add signs and restripe for bicycle lanes	On Skyline Dr	From Veterans Ave northerly to northern end of Skyline Dr	Wide unmarked 2 lane roadway	No	No	0.97	$48,500
16.8	Bike Lane	Include bike lane in future roadway	On Skyline Dr proposed northern extension	From northern end of Skyline Dr northerly to Avenue B	Future roadway	No	No	0.95	$0
17.3	Bike Lane	Include bike lane with future roadway improvement	On FM 3046	From southern city limit northerly to FM116	2 lane roadway	No	Yes	1.20	$0
18.1	Trail	Add 10ft wide multi-use trail	Along Clark Creek	From FM 2657 easterly to FM 3046	Creekside land	No	No	1.20	$360,000
19.1	Trail	Add 10ft wide multi-use trail	South of Phyllis Dr	From existing trail in City Park South easterly to proposed southern bypass	Wooded area and open land south of subdivision	No	No	0.59	$177,000
19.2	Trail	Add 10ft wide multi-use trail	East of Phyllis Dr	From proposed southern bypass northerly to eastern city limit east of Phyllis Dr	Wooded area east of subdivision	No	No	0.29	$87,000
19.4	Trail	Add 10ft wide multi-use trail	Between Judy Ln and Creek St	From southern city limit south of Northern Dancer Dr northerly to US190	Partly concrete-lined channel through residential neighborhood	No	No	1.31	$393,000
20.1	Trail	Add 10ft wide multi-use trail	Between Virginia Ave and Amthor Ave	From proposed trail along Clear Creek easterly to Robertson Ave	Along power line corridor	No	No	0.56	$168,000

Table A-2: 2011 Reference Projects for the City of Copperas Cove (continued)

City of Copperas Cove									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
20.2	Bike Route	Add bike route signs	On Williams St, MLK Dr, and Constitution Dr	From Robertson Ave at Williams St clockwise to existing end of Constitution Dr	2 lane roadways (Williams and MLK) and 4 lane roadway (Constitution)	No	No	1.44	$10,000
21.1	Bike Route	Add bike route signs	On Main St	From Avenue B northerly to Old Georgetown Rd	2 lane roadway	No	No	1.04	$10,000
TOTAL								50.70	$5.95m

Table A-3: 2011 Reference Projects for the City of Harker Heights

City of Harker Heights									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
7.16	Shoulder Lane	Add shoulders, signs, and markings	On BU190/Veterans Memorial Blvd	From Roy Reynolds Dr easterly to Indian Trail	5 lane roadway with 1-2 ft shoulders	No	Yes	1.28	$320,000
7.17	Shoulder Lane	Add signs and markings for shoulder lanes	On BU190/Veterans Memorial Blvd	From Indian Trail easterly to eastern city limits	5 lane roadway with shoulders	No	Yes	0.72	$28,800
9.18	Bike Lane	Add signs and restripe for bicycle lanes	On Mountain Lion Rd	From western city limit at Sun Dance Dr easterly to FM 2410	3-4 lane roadway	No	No	1.44	$72,000
9.19	Shoulder Lane	Add shoulders, signs, and markings	On FM 2410	From Mountain Lion Rd easterly to eastern city limit east of High Oak Dr	5 lane roadway west of Cedar Knob Rd, 2 lanes to the east	No	Yes	4.43	$1,107,500
56.4	Trail	Add 10ft wide multi-use trail	Between Mustang Trl and Snowbird Ave	From southern city limit northerly to FM2410	Creekside land	No	No	1.22	$366,000
56.6	Shoulder Lane	Add shoulders, signs, and markings	On FM 2410	From Mountain Lion Rd northerly to US190 EB FR	5 lane roadway	No	Yes	0.98	$245,000
56.7	Bike Lane	Include bike lane with future roadway improvement	On FM 2410	From US 190 EB FR westerly to Roy Reynolds Rd	2 lane roadway	No	Yes	1.11	$0
58.6	Trail	Add 10ft wide multi-use trail	Along South Nolan Creek north of Summit Soccer Complex	From Roy Reynolds Dr easterly to easterly city limits near railroad	Creekside land	No	No	2.41	$723,000
63.1	Side Path	Add 8ft wide multi-use side path	Along proposed southern extension of Rosewood Dr and proposed connection to Deer Trail	From Deer Trail westerly and northerly to Siltstone Loop	Future roadway	No	No	0.45	$90,000

Table A-3: 2011 Reference Projects for the City of Harker Heights (continued)

City of Harker Heights									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
64.1	Trail	Add 10ft wide multi-use trail	Along creek east of Rosewood Dr	From proposed trail west of FM3481 northerly to proposed trail west of southern end of Iowa Dr	Creekside land	No	No	1.01	$303,000
64.2	Trail	Add 10ft wide multi-use trail	Through park east of Nickelback/Rosewood Dr	From proposed trail west of southern end of Iowa Dr northerly to Mountain Lion Rd	Creekside land	No	No	0.75	$225,000
65.1	Trail	Add 10ft wide multi-use trail	Southwest of Carl Levin Park near City Hall	From FM2410 easterly to existing trail in Carl Levin Park	Open land	No	No	0.27	$81,000
65.3	Trail	Add 10ft wide multi-use trail	Northeast of Carl Levin Park	From existing trail in Carl Levin Park easterly to Indian Trail	Around residential development	No	No	1.00	$300,000
66.1	Bike Lane	Add signs and restripe for bicycle lanes	On Pioneer Trl, Wildewood Dr, and Ramblewood Dr	From FM2410 easterly to Verna Lee Blvd	2 lane roadways	No	No	0.92	$46,000
67.1	Trail	Add 10ft wide multi-use trail	Between Grizzly Trl and Caribou Trl	From Pioneer Trail northerly to existing trail in Carl Levin Park	Drainage channel	No	No	0.12	$36,000
68.1	Bike Route	Add bike route signs	On Ann Blvd, Indian Oaks Dr, and Amy Ln	From FM 2410 northerly to proposed trail along South Nolan Creek	2 lane roadways	No	No	1.86	$10,000
69.1	Bike Route	Add bike route signs	On Indian Trail	From FM 2410 northerly to Verna Lee Blvd	2 lane roadway	No	No	1.67	$10,000
69.2	Bike Lane	Add signs and markings for bicycle lanes	On Indian Trail	From Verna Lee Blvd northerly to US190 EB FR	2-4 lane roadway	No	No	0.50	$20,000
69.3	Bike Lane	Add signs and markings for bicycle lanes	On FM3423/Indian Trail	From US190 EB FR northerly to Veterans Memorial Blvd	2-4 lane roadway	No	Yes	0.78	$31,200
70.1	Bike Route	Add bike route signs	On Bee Line Ln	From Roy Reynolds Dr easterly to Indian Trail	2 lane roadway	No	No	1.20	$10,000
71.1	Trail	Add 10ft wide multi-use trail	West of Eastern Hills Middle School	From Indian Trail westerly to from loop trail west of Eastern Hills Middle School	Open land	No	No	1.49	$447,000
72.1	Shoulder Lane	Add signs and markings for shoulder lanes	On FM 3219	From Veterans Memorial Blvd northerly to northern city limits	2 lane roadway with shoulders	No	Yes	0.36	$14,400
74.1	Trail	Add 10ft wide multi-use trail	Along Comanche Gap Rd	From existing trail in Dana Peak Park northerly to FM2410	2 lane roadway	Yes	No	1.85	$555,000
74.3	Side Path	Add 8ft wide multi-use side path	Along Warrior's Path	From FM 2410 northerly to Old Nolanville Rd	2 lane roadway	No	No	1.69	$338,000

Table A-3: 2011 Reference Projects for the City of Harker Heights (continued)

City of Harker Heights									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
75.2	Shoulder Lane	Add shoulders, signs, and markings	On FM3481/Stillhouse Lake Rd	From southern city limit south of Del Rey Dr northerly to FM2410	2 lane and 4 lane roadways	No	Yes	2.51	$627,500
75.3	Shoulder Lane	Add shoulders, signs, and markings	On Verna Lee Blvd	From FM2410 northerly to Indian Trail	2 lane and 4 lane roadways	No	No	1.19	$297,500
75.4	Bike Route	Add bike route signs	On Verna Lee Blvd, Shine Ln, and Nola Ruth Blvd	From Indian Trail northerly to Old Nolanville Rd	2 lane roadways	No	No	0.92	$5,000
TOTAL								34.13	$6.31m

Table A-4: 2011 Reference Projects for the City of Kempner

City of Kempner									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
7.2	Shoulder Lane	Add signs and markings for shoulder lanes	On US 190	From western city limits easterly to FM2808	5 lanes with shoulders	No	Yes	1.21	$48,400
7.3	Shoulder Lane	Add signs and markings for shoulder lanes	On US 190	From FM2808 easterly to eastern city limit	5 lanes with shoulders	No	Yes	1.13	$45,200
9.4	Shoulder Lane	Add shoulders, signs, and markings	On FM 2808	From US190 southerly to southern city limit	2 lane roadway	No	Yes	0.57	$142,500
TOTAL								2.91	$236.1k

Table A-5: 2011 Reference Projects for the City of Killeen

City of Killeen									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
7.11	Trail	Add 10ft wide multi-use trail	Along US 190 EB FR, south of interchange at Fort Hood main gate	From proposed trail on south side of US190 easterly to proposed trail just west of Willow Springs Rd	2 lane one-way road	Yes	Yes	1.02	$306,000
7.12	Trail	Add 10ft wide multi-use trail	Along US 190 EB FR	From proposed trail west of Willow Springs Rd easterly to Fort Hood St	2 lane one-way road	No	Yes	0.98	$294,000
7.13	Shoulder Lane	Add signs and markings for shoulder lanes	On SH195/Fort Hood St	From US190 EB FR northerly to Veterans Memorial Blvd	7 lane roadway	Yes	Yes	0.89	$35,600
7.14	Bike Lane	Add signs and markings for bicycle lanes	On Veterans Memorial Blvd	From Fort Hood St easterly to 28th St	5 lane roadway	Yes	Yes	1.57	$62,800
7.15	Bike Lane	Add signs and markings for bicycle lanes	On BU190/Veterans Memorial Blvd	From 28th St easterly to Roy Reynolds Dr	5 lane roadway with shoulders	No	Yes	3.00	$120,000
9.13	Shoulder Lane	Add shoulders, signs, and markings	On Old Copperas Cove Rd	From western city limit easterly to Clear Creek Rd	2 lane roadway	Yes	No	0.36	$90,000
9.14	Shoulder Lane	Add shoulders, signs, and markings	On SH201/Clear Creek Rd	From Stan Schlueter Loop southerly and easterly to Bunny Trail	4 lane divided roadway	Yes	Yes	3.61	$902,500
9.15	Shoulder Lane	Add shoulders, signs, and markings	On SH201	From Bunny Trail easterly to SH195	2 lane roadway	Yes	Yes	1.80	$450,000
9.16	Shoulder Lane	Add shoulders, signs, and markings	On Stagecoach Rd	From SH195 easterly to Stagecoach/Trimmier	2 lane roadway	Yes	No	3.95	$987,500
9.17	Bike Lane	Add signs and markings for bicycle lanes	On Stagecoach Rd	From Trimmier Rd easterly to eastern city limit at Nickelback Rd	2 lane roadway west of Rosewood, 3 lanes to the east	Yes	No	1.43	$57,200
23.4	Side Path	Add 8ft wide multi-use side path	Along Water Crest Rd	From Clear Creek Rd easterly to Robinett Rd	Roadway under construction	Yes	No	0.92	$184,000
23.5	Side Path	Add 8ft wide multi-use side path	Along Water Crest Rd	From Robinett Rd easterly to Cody Poe Rd	2 lane roadway	No	No	0.72	$144,000
23.6	Side Path	Add 8ft wide multi-use side path	Along Water Crest Rd	From Cody Poe Rd easterly to Willow Springs Rd	Along north side of 2 lane road	Yes	No	0.49	$98,000
24.1	Shoulder Lane	Add signs and markings for shoulder lanes	On SH195	From Veterans Memorial Blvd northerly to FM439	4 lane roadway	Yes	Yes	0.64	$25,600
24.2	Bike Lane	Add signs and markings for bicycle lanes	On Rancier Ave	From Fort Hood St easterly to 38th St/FM439	4-5 lane roadway	Yes	No	2.56	$102,400

Table A-5: 2011 Reference Projects for the City of Killeen (continued)

City of Killeen									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
24.3	Bike Lane	Add signs and markings for bicycle lanes	On FM439/Rancier Ave	From 38th St easterly to Twin Creek Dr	4-5 lane roadway	Yes	Yes	0.86	$34,400
24.4	Shoulder Lane	Add signs and markings for shoulder lanes	On FM 439/Rancier Ave	From Twin Creek Dr easterly to Roy Reynolds Dr	5 lane roadway	Yes	Yes	1.12	$44,800
24.5	Shoulder Lane	Add signs and markings for shoulder lanes	On FM 439/Rancier Ave	From Roy Reynolds Dr easterly to eastern city limit	4 lane roadway to the west of Glover, 2 lanes to the east	Yes	Yes	0.89	$35,600
25.1	Side Path	Add 8ft wide multi-use side path	Along SH201/Clear Creek Rd	From Stan Schlueter Loop northerly to Watercrest Rd	5 lane roadway	Yes	Yes	1.73	$346,000
26.1	Shoulder Lane	Include shoulder lane with future roadway improvement	On Atlas Rd western extension	From SH 201/Clear Creek Rd easterly to Trimmier Rd	Future roadway and existing 2 lane roadway	No	No	4.44	$0
27.1	Side Path	Add 8ft wide multi-use side path	Along Stan Schlueter Loop	From SH201/Clear Creek Rd easterly to SH195/Fort Hood St	5 lane roadway	Yes	Yes	3.09	$618,000
27.2	Side Path	Add 8ft wide multi-use side path	Along Stan Schlueter Loop	From SH195/Fort Hood St easterly to FM2410/MLK Blvd	5 lane roadway	Yes	Yes	4.12	$824,000
27.3	Side Path	Add 8ft wide multi-use side path	Along FM2410/MLK Blvd	From FM2410/MLK Blvd northerly to BU190	5 lane roadway	Yes	Yes	1.18	$236,000
27.4	Side Path	Add 8ft wide multi-use side path	Along Twin Creek Dr	From BU190 northerly to FM439	5 lane roadway	Yes	No	1.50	$300,000
27.5	Side Path	Add 8ft wide multi-use side path	Along proposed Twin Creek northerly extension	From FM439 northerly to Lake Rd	Future roadway	Yes	No	0.38	$76,000
27.6	Side Path	Add 8ft wide multi-use side path	Along 60th St	From Lake Rd northerly to northern city limits at Schwald Rd	2 lane roadway	Yes	No	1.05	$210,000
28.1	Side Path	Add 8ft wide multi-use side path	Along Elms Rd	From SH201/Clear Creek Rd easterly to Carpet Ln	3-5 lane roadway	Yes	No	2.31	$462,000
28.2	Side Path	Add 8ft wide multi-use side path	Along proposed Elms Rd extension	From Carpet Ln easterly to SH195/Fort Hood St	Future roadway	No	No	0.77	$154,000
28.3	Side Path	Add 8ft wide multi-use side path	Along Elms Rd	From SH195/Fort Hood St easterly to Stan Schlueter Loop	3-5 lane roadway	Yes	No	3.09	$618,000
28.4	Side Path	Add 8ft wide multi-use side path	Along Chantz Dr	From Stan Schlueter Loop southerly to Stagecoach Rd	2 lane roadway	Yes	No	1.45	$290,000
29.1	Trail	Add 10ft wide multi-use trail	Along South Nolan Creek	From eastern end of Rimes Ranch Rd northerly to Watercrest Rd	Creekside land between subdivisions	Yes	No	2.74	$822,000
29.2	Trail	Add 10ft wide multi-use trail	Southwest of US190 interchange at Ft Hood main gate	From Watercrest Rd northerly to proposed trail along US190 EB FR	Open land near ponds	Yes	No	2.43	$729,000

Table A-5: 2011 Reference Projects for the City of Killeen (continued)

City of Killeen									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
30.1	Trail	Add 10ft wide multi-use trail	Southeast of US190 interchange at Ft Hood main gate	From proposed trail east of Roberts Rd easterly to proposed trail west of Willow Springs Rd	Open land near ponds	Yes	No	2.06	$618,000
31.1	Bike Lane	Include bike lane in future roadway	On Bunny Trail	From SH201 northerly to Stan Schlueter Loop	Narrow 2 lane roadway and future roadway	Yes	No	2.04	$0
31.3	Bike Lane	Include bike lane with future roadway improvement	On Robinett Rd	From Stan Schlueter Loop northerly to Edgefield Rd	2 lane roadway	Yes	No	0.86	$0
31.4	Bike Route	Add bike route signs	On Robinett Rd	From Edgefield Rd northerly to Watercrest Rd	3 lane roadway	Yes	No	0.90	$5,000
32.1	Side Path	Add 8ft wide multi-use side path	Along Trimmier Rd and 10th St	From Stagecoach Rd northerly to northern city limit south of Warrior Way	2-5 lane roadway	Yes	No	5.65	$1,130,000
33.1	Trail	Add 10ft wide multi-use trail	East of Bunny Trail and south of Reese Creek Rd	From proposed Texas A&M campus south of SH201 northerly to Stan Schlueter Loop	Open land	Yes	No	3.38	$1,014,000
34.1	Bike Route	Add bike route signs	On Omar Dr western extension and Littlerock Dr southern extension	From SH195 westerly and northerly to Stan Schlueter Loop	Future roadway	No	No	1.58	$10,000
34.3	Bike Route	Add bike route signs	On Littlerock Dr, Ledgestone Dr, and Carpet Ln	From Stan Schlueter Loop northerly to Elms Rd	2 lane roadways	No	No	0.84	$5,000
34.5	Bike Route	Add bike route signs	On Tallwood Dr, Edgefield St, South Hill Dr, and Westwood Dr	From Elms Rd northerly to Willow Spring Rd	2 lane roadways	No	No	1.03	$10,000
34.6	Bike Route	Add bike route signs	On Willow Springs Rd	From Westwood Dr northerly to US190 WB FR	2 lane roadway	Yes	No	1.07	$10,000
37.1	Shoulder Lane	Add shoulders, signs, and markings	On East Trimmier Rd	From Chaparral Rd northerly to Stagecoach Rd	2 lane roadway	No	No	1.81	$452,500
37.3	Bike Lane	Include bike lane with future roadway improvement	On Cunningham Road	From Stagecoach Rd northerly to Little Nolan Rd	2 lane roadway	Yes	No	1.71	$0
38.2	Shoulder Lane	Add signs and markings for shoulder lanes	On SH 195	From FM 2670 northerly to Chaparral Rd	4 lane divided highway with shoulders	No	Yes	3.25	$130,000
38.3	Shoulder Lane	Add signs and markings for shoulder lanes	On SH 195	From Chaparral Rd northerly to SH201	4 lane divided highway with shoulders	No	Yes	2.54	$101,600

Table A-5: 2011 Reference Projects for the City of Killeen (continued)

City of Killeen									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
38.4	Shoulder Lane	Add signs and markings for shoulder lanes	On SH 195	From SH201 northerly to Stan Schlueter Loop	4 lane divided highway with shoulders	Yes	Yes	1.43	$57,200
38.5	Shoulder Lane	Add signs and markings for shoulder lanes	On SH 195	From Stan Schlueter Loop northerly to US190 EB FR	5 lane roadway	Yes	Yes	2.17	$86,800
39.1	Bike Route	Add bike route signs	On Jasper Dr	From Old FM 440 easterly to Fort Hood St	2 lane roadway	No	No	0.18	$5,000
39.2	Bike Route	Add bike route signs	On Jasper Dr	From Fort Hood St easterly to Trimmier Rd	4 lane roadway	Yes	No	1.16	$10,000
39.4	Bike Lane	Add signs and markings for bicycle lanes	On Illinois Avenue	From Trimmier Rd easterly to US 190 WB FR	2-3 lane roadway	Yes	No	1.72	$68,800
40.1	Side Path	Add 8ft wide multi-use side path	Along WS Young Dr	From Stagecoach Rd northerly to Westcliff Rd	2-5 lane roadway	Yes	No	6.38	$1,276,000
40.2	Side Path	Add 8ft wide multi-use side path	Along Westcliff Rd	From WS Young Dr easterly to FM439	2 land roadway	Yes	No	3.34	$668,000
41.1	Side Path	Add 8ft wide multi-use side path	Along Florence Rd	From Elms Rd northerly to Jasper Dr	2 lane roadway	Yes	No	1.21	$242,000
41.3	Bike Route	Add bike route signs	On 2nd St, Bryce Ave, and Gray St	From Jasper Dr northerly to Hallmark Ave	2 lane roadways	No	No	1.09	$10,000
41.4	Bike Lane	Add signs and markings for bicycle lanes	On Gray St	From Hallmark Ave northerly to Avenue C	2 lane roadway with angled parking	No	No	0.64	$25,600
41.5	Bike Route	Add bike route signs	On Gray St and Dean Ave	From Avenue C at Gray northerly to 10th St at Dean	2 lane roadways	No	No	0.74	$5,000
41.7	Bike Route	Add bike route signs	On Duncan Ave, Massey St, Poage Ave, Ruiz Dr, and Willowbend Dr	From 10th St easterly to 38th St	2 lane roadways	No	No	1.86	$10,000
42.1	Bike Route	Add bike route signs	On Wheeler Ave	From Willow Springs Rd easterly to Alta Vista Dr	2 lane roadway with on-street parking	No	No	0.48	$5,000
43.1	Trail	Add 10ft wide multi-use trail	Along creek between residential subdivisions	From Carpet Ln easterly to Trimmier Rd	Creekside land	Yes	No	2.31	$693,000
44.1	Bike Lane	Add signs and markings for bicycle lanes	On Old FM 440	From Stan Schlueter Loop northerly to US190 EB FR	2 lane roadway	No	No	2.22	$88,800
45.1	Trail	Add 10ft wide multi-use trail	North of Saegert Ranch Rd and Schorn Dr	From Constellation Dr easterly to Onion Rd	Creekside land	Yes	No	1.42	$426,000

Table A-5: 2011 Reference Projects for the City of Killeen (continued)

City of Killeen									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
45.2	Trail	Add 10ft wide multi-use trail	East of Sunflower Dr and east of Cunningham Rd	From Onion Rd northerly to Cunningham Rd	Creekside land	No	No	1.18	$354,000
45.3	Trail	Add 10ft wide multi-use trail	East of proposed Cunningham Rd extension and on east and north side of shopping plaza	From Cunningham Rd northerly to Illinois Ave	Creekside land and drainage channel	No	No	1.44	$432,000
46.1	Trail	Add 10ft wide multi-use trail	In Lions Club Park	Series of trails inside Lions Club Park	Park land	Yes	No	1.58	$474,000
46.2	Side Path	Add 8ft wide multi-use side path	Along Dartmouth Dr	From proposed trails in Lions Club Park northerly to Granex Dr (Trimmier Elementary)	2 lane roadway	No	No	0.21	$42,000
47.1	Trail	Add 10ft wide multi-use trail	Between Stan Schlueter Loop and Elms Rd	From Old Florence Rd easterly to Cunningham Rd	Creekside land	Yes	No	2.20	$660,000
48.1	Bike Route	Add bike route signs	On Mesa Dr	From Fawn Dr northerly to Stan Schlueter Loop	2 lane roadway	No	No	0.93	$5,000
48.3	Bike Route	Add bike route signs	On Bacon Ranch, Little Nolan, and Bacon Ranch	From Stan Schlueter Loop westerly to Trimmier Rd	2 lane road	No	No	2.67	$15,000
48.5	Bike Route	Add bike route signs	On Turtle Bend Dr, Tortoise Ln, Pondview Dr, Minthorn Dr, Cobblestone Dr, and Turtle Creek Dr	From Trimmier Rd westerly to Florence Rd	2 lane roadways	No	No	0.86	$5,000
48.7	Bike Route	Add bike route signs	On Daffodil Dr, Andover Dr, and Kathey Dr	From Florence Rd westerly to Old FM440	2 lane roadways	No	No	1.01	$10,000
48.9	Bike Route	Add bike route signs	On Leader Dr, Meadow Dr, and Alta Vista Dr	From Old FM440 westerly and northerly to US 190 EB FR	2 lane roadways	No	No	0.84	$5,000
48.12	Bike Lane	Add signs and markings for bicycle lanes	On Hallmark Ave	From Fort Hood St easterly to 10th St/Trimmier Rd	2 lane roadway	Yes	No	1.01	$40,400
50.1	Trail	Add 10ft wide multi-use trail	Along South Nolan Creek	From Fort Hood St easterly to 28th St	Creekside land	Yes	No	1.68	$504,000
50.2	Trail	Add 10ft wide multi-use trail	Along South Nolan Creek, west of Community Center park	From 28th St easterly to existing trail in Community Center Park west of WS Young Dr	Creekside land	Yes	No	0.32	$96,000

Table A-5: 2011 Reference Projects for the City of Killeen (continued)

City of Killeen									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
51.1	Bike Route	Add bike route signs	On Conder St, 28th St, and Greenwood Ave	From Terrace Dr northerly to Alexander St	2 lane roadways	No	No	0.87	$5,000
51.2	Bike Route	Add bike route signs	On Alexander St	From Greenwood Ave northerly to Rancier Ave	2 lane roadway	No	No	0.47	$5,000
51.3	Trail	Add 10ft wide multi-use trail	West of Stewart St and east of 24th St	From Alexander St northerly to northern city limits south of Warrior Way	4 lane roadway and drainage channel	Yes	No	0.61	$183,000
52.1	Bike Route	Add bike route signs	On Fowler Ave, Terrace Dr, and Rev Abercrombie Dr	From 2nd St easterly to Veterans Memorial Blvd	2 lane roadways	No	No	1.83	$10,000
53.1	Bike Route	Add bike route signs	On Highland Ave	From Rev Abercrombie Dr northerly to Marlboro Park	2 lane roadway	No	No	0.06	$5,000
53.2	Trail	Add 10ft wide multi-use trail	Within Marlboro Park	Within Marlboro Park	Park land	Yes	No	0.39	$117,000
54.1	Bike Route	Add bike route signs	On Becker Dr, Zephyr Rd, and Jeffries Ave	From Illinois Ave northerly to Veterans Memorial Blvd	2 lane roadways	No	No	1.18	$10,000
54.3	Side Path	Add 8ft wide multi-use side path	Along FM439/38th St	From Veterans Memorial Blvd northerly to Rancier Ave	4-5 lane roadway with shoulders	Yes	Yes	1.07	$214,000
54.4	Side Path	Add 8ft wide multi-use side path	Along 38th St	From Rancier Ave northerly to Westcliff Rd	4-5 lane roadway with shoulders	Yes	No	0.98	$196,000
55.1	Bike Lane	Add signs and markings for bicycle lanes	On Fawn Dr	From Cunningham Rd easterly to Rosewood Dr	Wide unmarked 2 lane road with on-street parking and sidewalks	No	No	1.33	$53,200
56.2	Trail	Add 10ft wide multi-use trail	Along Trimmier Creek	From FM3481 west of Stillhouse Lake northerly to city limit east of FM3481	Creekside land	No	No	1.96	$588,000
56.8	Side Path	Add 8ft wide multi-use side path	Along Roy Reynolds Dr	From MLK Dr northerly to city limits at railroad	2 lane roadway	No	No	2.06	$412,000
56.9	Bike Lane	Add signs and markings for bicycle lanes	On Roy Reynolds Dr	From city limits at railroad northerly to Westcliff Rd	4 lane roadway	No	No	1.39	$55,600
57.1	Bike Route	Add bike route signs	On Cora Ave	From 60th St easterly to Windward Dr	2 lane roadway	No	No	0.67	$5,000
57.2	Trail	Add 10ft wide multi-use trail	Connecting Cora Ave to Greengate Dr	From Windward Dr easterly to Cedarhill Dr	Open land between neighborhoods	No	No	0.13	$39,000
57.3	Bike Route	Add bike route signs	On Greengate Dr	From Cedarhill Dr easterly to Roy Reynolds Dr	2 lane roadway	No	No	0.48	$5,000

Table A-5: 2011 Reference Projects for the City of Killeen (continued)

City of Killeen									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
58.1	Bike Lane	Add signs and markings for bicycle lanes	On 4th and 8th Sts	From Ave C southerly to Ave G	2 lane roadways	Yes	No	0.40	$16,000
58.2	Side Path	Add 8ft wide multi-use side path	Along Ave G	From 4th St easterly to 28th St	2 lane roadway	Yes	No	0.76	$152,000
58.3	Trail	Add 10ft wide multi-use trail	Northwest of Community Center Park	From 28th St easterly to existing trail in Community Center Park	Wooded area	Yes	No	0.31	$93,000
58.5	Trail	Add 10ft wide multi-use trail	Along South Nolan Creek	From 38th St easterly to Roy Reynolds Dr	Creekside land	Yes	No	2.12	$636,000
59.1	Bike Route	Add bike route signs	On Ave C, Hall Ave, and Greenwood Ave	From Gray St easterly to Alexander St	2 lane roadway	No	No	0.71	$5,000
60.1	Trail	Add 10ft wide multi-use trail	Along creek east of Killeen High School, west of Wright Way	From proposed trail along South Nolan Creek west of Twin Creek Dr northerly to Westcliff Rd	Creekside land	Yes	No	2.87	$861,000
60.2	Trail	Add 10ft wide multi-use trail	Between Beretta Dr and Kilgore Dr and through Brookhaven Elementary campus	From proposed trail east of Brookbend Dr eastern end northerly to Traverse Dr	Creekside land	Yes	No	0.73	$219,000
61.1	Trail	Add 10ft wide multi-use trail	Along Trimmier Creek	From Trimmier Rd easterly to proposed trail east of Rosewood Dr proposed extension	Creekside land	Yes	No	2.34	$702,000
62.1	Side Path	Add 8ft wide multi-use side path	Along FM2410/MLK Blvd	From Stan Schlueter Loop easterly to Roy Reynolds Rd	2 lane roadway	No	Yes	0.75	$150,000
63.2	Side Path	Add 8ft wide multi-use side path	Along Rosewood Dr	From Siltstone Loop northerly to Fawn Dr	Wide unmarked roadway	Yes	No	1.58	$316,000
63.3	Side Path	Add 8ft wide multi-use side path	Along proposed northern extension of Rosewood Dr	From Fawn Dr northerly to US190 EB FR	Future roadway	Yes	No	0.70	$140,000
TOTAL								158.84	$24.66m

Table A-6: 2011 Reference Projects for the City of Little River/Academy

City of Little River/Academy									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
9.27	Side Path	Add 8ft wide multi-use side path	Along FM436	From proposed trail along Leon River easterly to Lamar St (west end of existing side path)	Along 2 lane road	No	Yes	1.96	$392,000
123.1	Shoulder Lane	Add shoulders, signs, and markings	On Kings Trl	From Main St northerly to northern city limit	2 lane roadway	No	No	0.33	$82,500
TOTAL								2.29	$474.5k

Table A-7: 2011 Reference Projects for the City of Morgan's Point Resort

City of Morgan's Point Resort									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
83.15	Shoulder Lane	Add signs and markings for shoulder lanes	On Morgan's Point Rd	From southern city limit at Bonnie Ln northerly to FM2483	2 lane roadway	No	No	1.16	$46,400
88.1	Bike Route	Add bike route signs	On Morgan's Point Rd	From FM 2483 westerly to Camp Kachina Rd near west city limit	2 lane roadway	No	No	1.77	$10,000
TOTAL								2.93	$56.4k

Table A-8: 2011 Reference Projects for the City of Nolanville

City of Nolanville									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
7.18	Shoulder Lane	Add signs and markings for shoulder lanes	On US190 WB FR	From western city limit easterly to eastern city limit	2 lane one-way roadway	No	Yes	4.03	$161,200
58.8	Trail	Add 10ft wide multi-use trail	Along South Nolan Creek	From northern city limits west of Pleasant Hill Cemetery Rd easterly to eastern city limit	Creekside land	No	No	3.15	$945,000
74.4	Side Path	Add 8ft wide multi-use side path	Along proposed northern extension of Warrior's Path	From Old Nolanville Rd northerly to US190 WB FR	Future roadway	No	No	0.43	$86,000
76.1	Side Path	Add 8ft wide multi-use side path	Along Main St, railroad, and 10th St	From US190 EB FR northerly to proposed trail north of Nolan Ridge Dr	2 lane roadways and open land	No	No	1.01	$202,000
76.2	Trail	Add 10ft wide multi-use trail	Between Nolan Ridge Dr and Wyatt Earp Ln	From 10th St easterly to proposed trail along private road	Open land	No	No	0.69	$207,000
78.1	Shoulder Lane	Add signs and markings for shoulder lanes	On US 190 EB FR	From US190 WB FR easterly to eastern city limits	2 lane one-way roadway	No	Yes	4.07	$162,800
TOTAL								13. 38	$1.76m

Table A-9: 2011 Reference Projects for the City of Temple

City of Temple									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
7.22	Shoulder Lane	Add signs and markings for shoulder lanes	On IH 35 SB FR	From southern city limit northerly to Kegley Rd	2 lanes one-way roadway with shoulders	No	Yes	2.49	$99,600
7.23	Side Path	Add 8ft wide multi-use side path	Along Kegley Rd and Midway Dr	From IH35 SB FR easterly to Camelot Ln	4 lane roadway	Yes	No	0.62	$124,000
7.24	Side Path	Add 8ft wide multi-use side path	Along Midway Dr	From Camelot Ln easterly to Las Moras Dr	4 lane roadway	Yes	No	0.51	$102,000
7.25	Bike Lane	Add signs and markings for bicycle lanes	On Hickory Rd and Thornton Lane	From Midway Dr at Hickory Rd easterly to Oakdale Dr	4 lane roadway	Yes	No	0.48	$19,200
7.26	Bike Lane	Add signs and restripe for bicycle lanes	On Oakdale Dr	From Thorton Ln northerly to Dodgen Loop	4 lane roadway	No	No	0.18	$9,000
7.27	Shoulder Lane	Include shoulder lane with future roadway improvement	On H K Dodgen Loop EB FR	From Oakdale Dr easterly to 1st St	2 lane one-way roadway	No	Yes	2.25	$0
7.28	Shoulder Lane	Include shoulder lane with future roadway improvement	On SH36/US190	From 1st St southerly to southern city limit at Barnhardt Rd	4 lane divided roadway	No	Yes	1.81	$0
81.6	Shoulder Lane	Add signs and markings for shoulder lanes	On IH 35 NB FR	From southern city limit at Leon River northerly to Midway Dr	2 lane roadway with shoulders	No	Yes	2.50	$100,000
82.8	Shoulder Lane	Add signs and markings for shoulder lanes	On SH 317/Main St	From southern city limit at Leon River northerly to Adams Ave	2 lane roadway with shoulders	Yes	Yes	1.84	$73,600
82.9	Shoulder Lane	Add signs and markings for shoulder lanes	On SH 317/Main St	From Adams Ave northerly to northern city limit north of Triple Heart Ln	2 lane roadway with shoulders	Yes	Yes	4.88	$195,200
83.13	Shoulder Lane	Add signs and markings for shoulder lanes	On FM 2271	From southern city limit east of Belton Lake northerly to FM2305/Adams Ave	3 lanes with shoulders	Yes	Yes	0.96	$38,400
83.14	Shoulder Lane	Add signs and markings for shoulder lanes	On Morgan's Point Rd	From FM2305/Adams Ave northerly to northern city limit at Bonnie Ln	3 lanes with shoulders	Yes	No	0.37	$14,800
83.17	Shoulder Lane	Add signs and markings for shoulder lanes	On FM 2483	From western city limit easterly to SH 317	2 lane roadway	Yes	Yes	0.61	$24,400

Table A-9: 2011 Reference Projects for the City of Temple (continued)

City of Temple									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
89.1	Bike Route	Add bike route signs	On FM 2305	From Temple Lake Park easterly to FM 2271	2 lane roadway with shoulders	Yes	Yes	1.55	$10,000
89.2	Side Path	Add 8ft wide multi-use side path	Along FM2305/Adams Ave (both sides)	From FM 2271 easterly to St. Andrews Place	2 lane roadway	Yes	Yes	1.59	$318,000
89.3	Side Path	Add 8ft wide multi-use side path	Along FM2305Adams Ave	From St. Andrews Place easterly to western end of existing side path at Montpark Rd	4 lane roadway	Yes	Yes	1.46	$292,000
89.5	Side Path	Add 8ft wide multi-use side path	Along FM2305/Adams Ave	From eastern end of existing trail west of Dodgen Loop easterly to West Gate Dr	5 lane roadway	Yes	Yes	1.35	$270,000
89.6	Bike Lane	Add signs and markings for bicycle lanes	On FM2305 and SH53/Adams Ave	From West Gate Dr easterly to Dodgen Loop east	4 lane roadway	Yes	Yes	3.90	$156,000
89.7	Shoulder Lane	Add signs and markings for shoulder lanes	On SH 53	From Dodgen Loop east easterly to eastern city limit	2 lane roadway with shoulders	Yes	Yes	0.42	$16,800
105.4	Trail	Add 10ft wide multi-use trail	Along creek and west of Pea Ridge Rd	From existing trail in Heritage Park northerly to existing side path along Adams Ave	Creekside and open land	Yes	No	4.17	$1,251,000
105.6	Trail	Add 10ft wide multi-use trail	East of SH317	From existing trail in West Temple Community Park northerly and westerly to SH317	Open land	Yes	No	1.38	$414,000
106.1	Trail	Add 10ft wide multi-use trail	East of Miller Spring Park	From existing trail in Miller Springs Park easterly to SH 317 at Tarver Dr	Wooded area and open land	Yes	No	1.34	$402,000
106.2	Bike Lane	Add signs and restripe for bicycle lanes	On Tarver Dr	From SH 317 easterly to Pirtle Elementary	4 lane roadway	Yes	No	0.72	$36,000
106.3	Bike Lane	Add signs and restripe for bicycle lanes	On existing and proposed eastern extension of Tarver Dr	From Pirtle Elementary easterly to Old Waco Rd	2 lane roadway and future roadway	No	No	0.90	$45,000
106.4	Bike Lane	Add signs and restripe for bicycle lanes	On existing and proposed eastern extension of Jupiter Dr	From Old Waco Rd easterly to Kegley Rd at Wildflower Ln	2 lane roadway and future roadway	Yes	No	0.98	$49,000
106.5	Bike Lane	Add signs and restripe for bicycle lanes	On Wildflower Ln	From Kegley Rd easterly to Dodgen Loop	2 lane roadway	No	No	0.68	$34,000
107.1	Bike Route	Add bike route signs	On existing and proposed northern extension of Starlight Dr	From Adams Ave northerly to FM2483	2 lane roadway and future roadway	Yes	No	1.57	$10,000

Table A-9: 2011 Reference Projects for the City of Temple (continued)

City of Temple									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
108.1	Trail	Add 10ft wide multi-use trail	Along creek west of Tarver Intermediate School	From proposed trail south of Pea Ridge/Hogan northerly to Adams Ave	Creekside land	Yes	No	1.20	$360,000
109.1	Shoulder Lane	Add shoulders, signs, and markings	On North Point Rd	From Armadillo Circle easterly to SH317	2 lane roadway	Yes	No	0.62	$155,000
111.3	Shoulder Lane	Add shoulders, signs, and markings	On FM817/Charter Oak Dr	From proposed trail at western city limit along Leon River northerly to Pea Ridge Rd	2 lane roadway	Yes	Yes	0.83	$207,500
111.4	Shoulder Lane	Add shoulders, signs, and markings	On FM817/Charter Oak Dr	From Pea Ridge Rd northerly to Kegley Rd	2 lane roadway	No	Yes	1.20	$300,000
113.3	Trail	Add 10ft wide multi-use trail	Along Abandoned RR and east of Ray Allen Elementary	From proposed trail along Leon River easterly to existing trail at Ray Allen Elementary	Abandoned railroad	Yes	No	4.50	$1,350,000
113.5	Trail	Add 10ft wide multi-use trail	East of Southern Crossing Dr	From southern end of existing trail at Pullman Place Blvd southerly to 5th St	Open land	Yes	No	0.68	$204,000
115.1	Shoulder Lane	Include shoulder lane with future roadway improvement	On H K Dodgen Loop	From Barnhardt Rd northerly to Adams Ave (east)	2 lane roadway	No	Yes	2.98	$0
115.2	Shoulder Lane	Include shoulder lane with future roadway improvement	On H K Dodgen Loop and proposed FRs	From Adams Ave (east) northerly to McLane Pkwy	2 lane roadway	Yes	Yes	6.18	$0
115.3	Shoulder Lane	Include shoulder lane with future roadway improvement	On H K Dodgen Loop proposed FRs	From McLane Pkwy southerly to Oakdale Dr	2 lane undivided, 4 lane divided roadway	No	Yes	4.76	$0
115.5	Bike Lane	Add signs and markings for bicycle lanes	On Thorton Ln, Oaklawn Dr, Cottonwood Ln, and Oakview Dr	From Oakdale Dr southerly to Pin Oak Dr	2 lane roadways	Yes	No	0.60	$24,000
115.6	Trail	Add 10ft wide multi-use trail	West and south of Oak Creek Park	From Oakview Dr southerly to proposed trail south of Canyon Creek Dr	Wooden area	Yes	No	1.00	$300,000
115.7	Bike Lane	Add signs and markings for bicycle lanes	On Canyon Creek Dr, Blackland Rd, and Barnhardt Rd	From Canyon Creek Dr easterly to US190 just north of FM3117	2 lane roadways	Yes	No	3.40	$136,000
116.1	Trail	Add 10ft wide multi-use trail	Along Dubose Rd and FM 93	From prop. trail along creek north of Forrester northerly to prop. trail along Bird Creek	Open land	Yes	No	1.46	$438,000
116.3	Trail	Add 10ft wide multi-use trail	Along Leon River	From Shallow Ford Rd westerly and northerly to existing trail in Miller Springs Park	Riverside land	Yes	No	5.49	$1,647,000

Table A-9: 2011 Reference Projects for the City of Temple (continued)

City of Temple									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
117.3	Shoulder Lane	Include shoulder lane with future roadway improvement	On Witter Ln	From southern city limit northerly to Taylor's Valley Rd	2 lane roadway	No	No	0.26	$0
117.6	Trail	Add 10ft wide multi-use trail	East of Ramblewood Park	From proposed Hickory Rd extension easterly to proposed trail south of Canyon Cliff Dr	Wooded area	Yes	No	0.96	$288,000
117.8	Trail	Add 10ft wide multi-use trail	East of Oak Creek Park and south of King's Daughters Hospital	From proposed trail north of Forest Trail easterly to Market Loop	Park and open land	Yes	No	0.55	$165,000
117.9	Bike Lane	Add signs and restripe for bicycle lanes	On Market Loop	From proposed trail on south side of Cottonwood Dr easterly to 31st St	2 lane roadway	Yes	No	0.19	$9,500
119.1	Side Path	Add 8ft wide multi-use side path	Along existing and proposed easterly extension of Poison Oak Rd	From SH 317 easterly to Old Waco Rd	2 lane roadway and future roadway	No	No	1.71	$342,000
120.1	Trail	Add 10ft wide multi-use trail	Along Pepper Creek	From proposed trail along Leon River northerly to city limit at Charter Oak Dr	Creekside land	Yes	No	1.64	$492,000
120.3	Trail	Add 10ft wide multi-use trail	Along Pepper Creek	From proposed trail west of Kegley Rd northerly to proposed trail just south of Wildflower Ln	Creekside land	Yes	No	1.46	$438,000
120.4	Trail	Add 10ft wide multi-use trail	Along Pepper Creek	From proposed trail west of Kegley Rd northerly to Adams Ave	Creekside land	Yes	No	1.18	$354,000
121.2	Shoulder Lane	Add shoulders, signs, and markings	On Old Waco Rd	From Riverside Trail at Old Waco Rd northerly to Adams Ave	2 lane roadway	Yes	No	2.16	$540,000
121.3	Bike Lane	Add signs and restripe for bicycle lanes	On Hilliard Rd and Research Pkwy	From Adams Ave northerly to SH36/Airport Rd	4 lane divided roadway	Yes	No	1.42	$71,000
121.4	Side Path	Add 8ft wide multi-use side path	Along Old Howard Rd	From SH36/Airport Rd northerly to Central Pointe Pkwy	4 lane divided roadway	Yes	No	0.94	$188,000
121.5	Bike Lane	Add signs and restripe for bicycle lanes	On Old Howard Rd	From Central Pointe Pkwy northerly to McLane Pkwy	2 lane roadway	Yes	No	0.94	$47,000
122.2	Bike Lane	Add signs and restripe for bicycle lanes	On 5th Street	From FM 93 northerly to proposed trail along abandoned railroad	4 lane divided roadway	No	No	1.18	$59,000
122.4	Trail	Add 10ft wide multi-use trail	At northern end of existing trail west of 5th St	From north end of existing trail west of 5th St to 5th St	Wooded area	Yes	No	0.10	$30,000
122.5	Shoulder Lane	Include shoulder lane in future roadway	On proposed southern extension of 1st St	From proposed trail at 5th St northerly to Temple College Pedestrian overpass	Future roadway	Yes	No	0.67	$0

Table A-9: 2011 Reference Projects for the City of Temple (continued)

City of Temple									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
122.6	Trail	Add 10ft wide multi-use trail	Along SS290/1st St (both sides)	From Temple College Pedestrian overpass northerly to proposed trail north of Felder Dr (both sides)	5 lane roadway	Yes	Yes	0.52	$156,000
122.7	Trail	Add 10ft wide multi-use trail	Along SS290/1st St (both sides)	From proposed trail north of Felder Dr northerly to Avenue M	4 lane roadway	Yes	Yes	1.40	$420,000
122.8	Bike Route	Add bike route signs	On SS290/1st St and 3rd St	From Avenue M northerly to Adams Ave	4 lane roadway	Yes	Yes	1.00	$10,000
123.3	Shoulder Lane	Add shoulders, signs, and markings	On Little River Rd	From southern city limit northerly to Blackland Rd	2 lane roadway	No	No	0.65	$162,500
123.4	Shoulder Lane	Add shoulders, signs, and markings	On Little River Rd	From Blackland Rd northerly to Dodgen Loop	2 lane roadway	Yes	No	0.60	$150,000
123.5	Bike Lane	Add signs and markings for bicycle lanes	On Martin Luther King Jr Dr	From Dodgen Loop northerly to 8th St	4 lane roadway	Yes	No	1.71	$68,400
123.6	Bike Route	Add bike route signs	On Martin Luther King Jr Dr	From Avenue M northerly to Avenue E	4 lane roadway	Yes	No	0.58	$5,000
124.2	Trail	Add 10ft wide multi-use trail	Along Creek	From FM 93 northerly to existing trail in South Temple Community Park	Creekside land	Yes	No	1.90	$570,000
125.1	Shoulder Lane	Add signs and markings for shoulder lanes	On Boutwell Rd	From proposed trail south of FM93 at Boutwell Rd northerly to FM93	2 lane and 5 lane roadways	Yes	No	0.10	$4,000
125.2	Shoulder Lane	Add signs and markings for shoulder lanes	On FM93, and FM1741/31st St	From FM93 northerly to proposed trail along abandoned railroad	2 lane and 5 lane roadways	Yes	Yes	0.65	$26,000
126.1	Trail	Add 10ft wide multi-use trail	Along FM93	From FM1741/31st easterly to proposed trail along creek	4 lane roadway	Yes	Yes	0.11	$33,000
127.1	Trail	Add 10ft wide multi-use trail	South of Fox Glen Ln	From FM1741/31st easterly to proposed trail along creek	Open land	Yes	No	0.21	$63,000
128.1	Trail	Add 10ft wide multi-use trail	East of IH35	From proposed trail along Pepper Creek northerly to proposed road just east of IH35	Wooded area	Yes	No	0.31	$93,000
128.2	Shoulder Lane	Include shoulder lane with future roadway improvement	On proposed road connecting Old Waco Rd and Taylors Valley Rd	From proposed road just east of IH35 northerly to city limit west of Charter Oak Dr	Future roadway	Yes	No	0.46	$0
129.1	Trail	Add 10ft wide multi-use trail	South of bend in 31st St	From proposed trail south of abandoned railroad northerly to 31st	Open land	Yes	No	0.43	$129,000
129.2	Side Path	Add 8ft wide multi-use side path	Along FM1741/31st Street	From proposed trail east of Warwicke Dr northerly to Avenue D	5 lane roadway	Yes	Yes	3.47	$694,000

Table A-9: 2011 Reference Projects for the City of Temple (continued)

City of Temple									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
129.3	Side Path	Add 8ft wide multi-use side path	Along 31st Street	Avenue D northerly to SH53/Adams Ave	5 lane roadway	Yes	Yes	0.36	$72,000
129.4	Side Path	Add 8ft wide multi-use side path	Along 31st Street	SH53/Adams Ave northerly to just north of Bray St	5 lane roadway	Yes	No	0.47	$94,000
129.5	Bike Route	Add bike route signs	On north side of Temple High School and 23rd St	From 31st St easterly and southerly to Adams Dr	2 lane roadway	Yes	No	0.75	$5,000
130.1	Trail	Add 10ft wide multi-use trail	Along drainage channel and Winchester Dr	From 31st east of Warwicke to 31st at Winchester Dr	Drainage channel and 2 lane roadway	Yes	No	0.57	$171,000
130.3	Side Path	Add 8ft wide multi-use side path	Along Waters Dairy Rd	From 31st St easterly to existing trail just west of 5th St	3 lane roadway	Yes	No	0.78	$156,000
131.1	Trail	Add 10ft wide multi-use trail	North of Bird Creek	From existing trail in Temple Lions Park easterly to proposed Hickory Rd	Open land	Yes	No	0.39	$117,000
132.1	Side Path	Add 8ft wide multi-use side path	Along Shallow Ford Rd	From proposed trail along Leon River northerly to existing trail in Temple Lions Park	Narrow 2 lane roadway	No	No	0.88	$176,000
132.2	Trail	Add 10ft wide multi-use trail	Along Bird Creek	From existing trail in Temple Lions Park northerly to Battle Dr	Creekside land	Yes	No	1.92	$576,000
132.3	Trail	Add 10ft wide multi-use trail	Along Bird Creek and into Hodge Park	From Battle Drive easterly to proposed trail between Avenues R and T	Creekside land	No	No	1.72	$516,000
132.4	Trail	Add 10ft wide multi-use trail	Through Hodge Park and between Ave R and Ave S	From proposed trail along Bird Creek easterly to 57th St	Wooded area between houses	Yes	No	0.34	$102,000
132.5	Bike Route	Add bike route signs	On Ave R	From 57th St easterly to 31st St	2 lane roadway	Yes	No	0.88	$5,000
132.6	Side Path	Add 8ft wide multi-use side path	Along Avenue R	From 31st St easterly to 1st St	4 lane roadway	Yes	No	0.95	$190,000
133.1	Trail	Add 10ft wide multi-use trail	North of Temple Lions Park west of Valley View Dr	From existing trail in Temple Lions Park northerly to Midway Dr	Wooded area	Yes	No	0.86	$258,000
134.1	Side Path	Add 8ft wide multi-use side path	Along Midway Dr and Kegley Rd	From IH35 SB FR northerly to proposed trail along Pepper Creek	2 lane roadway	Yes	No	0.44	$88,000
134.2	Trail	Add 10ft wide multi-use trail	West of Kegley Rd and east of Old Waco Rd	From proposed trail along Pepper Creek northerly to Jupiter Dr	Open land	Yes	No	1.77	$531,000
135.1	Trail	Add 10ft wide multi-use trail	North of Wind Chime Rd	From proposed trail north of Poison Oak Rd easterly to proposed trail east of Old Waco Rd	Open land	Yes	No	1.30	$390,000

Table A-9: 2011 Reference Projects for the City of Temple (continued)

City of Temple									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
136.1	Trail	Add 10ft wide multi-use trail	Along Prairie View Rd and west of Hilliard Rd	From Dewberry Ln easterly-southerly to existing side path along Adams Ave	2 lane roadway and open land	Yes	No	1.84	$552,000
137.1	Bike Lane	Add signs and markings for bicycle lanes	On existing and proposed easterly extension of Stonehollow Dr	From proposed trail west of Pea Ridge Rd to Hilliard Rd at Research Loop	2 lane roadway and future roadway	Yes	No	1.02	$40,800
137.2	Trail	Add 10ft wide multi-use trail	Along Research Loop	From Hilliard Rd easterly to existing Pepper Creek Trail	2 lane roadway and open land	Yes	No	0.34	$102,000
137.4	Trail	Add 10ft wide multi-use trail	Along SH36/Airport Rd and Pepper Creek	From Old Howard Rd easterly and northerly to Central Pointe Pkwy	5 lane roadway and creekside land	Yes	No	1.69	$507,000
138.1	Trail	Add 10ft wide multi-use trail	Southwest of Woodbridge Park and north of Antelope Trl	From Dodgen Loop NB FR easterly to existing trail in Woodbridge Park	Greenbelt	Yes	No	0.92	$276,000
138.3	Trail	Add 10ft wide multi-use trail	West of John Paul Jones Dr	From existing trail in Woodbridge Park northerly to Nugent Ave	Open land	Yes	No	0.62	$186,000
139.1	Trail	Add 10ft wide multi-use trail	North of Hodge Park and between shopping center and Sammons Golf Course	From proposed trail between Avenues R and T northerly to western end of Keller Rd	Wooded area east and 2 lane roadway	Yes	No	0.98	$294,000
139.2	Bike Route	Add bike route signs	On Keller Rd	From western end of Keller easterly to Apache Dr	2 lane roadway	Yes	No	0.38	$5,000
139.3	Side Path	Add 8ft wide multi-use side path	Along Apache Dr	From Keller Rd northerly to Adams Ave	2 roadway	Yes	No	0.61	$122,000
140.1	Bike Lane	Add signs and restripe for bicycle lanes	On 57th St	From Dodgen Loop SB FR northerly to Scott Blvd	4 lane roadway	No	No	0.31	$15,500
140.2	Bike Route	Add bike route signs	On Scott Boulevard	From 57th St easterly to 43rd St	2 lane roadway	No	No	0.50	$5,000
140.3	Bike Route	Add bike route signs	On Scott Boulevard	From 43rd St easterly St to 31st St	2 lane roadway	Yes	No	0.42	$5,000
140.5	Trail	Add 10ft wide multi-use trail	East of Scott and White Hospital and west and south of Avenue V	From Scott and White Blvd easterly and southerly to 5th St	Drainage channel	Yes	No	0.67	$201,000
140.6	Trail	Add 10ft wide multi-use trail	North of Felder Dr	From proposed trail connecting to Scott & White Hospital northerly and easterly to 1st St	4 lane roadway and to-be-redeveloped land	Yes	No	0.16	$48,000
140.8	Trail	Add 10ft wide multi-use trail	Through Temple College, south of Tarrant Park, and along Knob Creek	From 1st St easterly to current southern end of 30th St (crossing railroad)	2 lane roadway, open land, future roadway, and creekside land	Yes	No	1.75	$525,000

Table A-9: 2011 Reference Projects for the City of Temple (continued)

City of Temple									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
140.9	Trail	Add 10ft wide multi-use trail	Along Knob Creek and east of railroad	From southern end of 30th St northerly to Avenue E at Jeff Hamilton Park	Creekside land and drainage channel	Yes	No	1.24	$372,000
141.1	Bike Lane	Add signs and restripe for bicycle lanes	On Avenue H	From 31st St easterly to MLK Blvd	4 lane roadway	Yes	No	1.26	$63,000
142.1	Bike Route	Add bike route signs	On 19th Street	From proposed trail along Avenue T northerly to Avenue H	2 lane roadway	Yes	No	0.81	$5,000
143.1	Bike Route	Add bike route signs	On 49th St	From Avenue R northerly to Avenue D	2 lane roadway	Yes	No	1.05	$10,000
143.2	Trail	Add 10ft wide multi-use trail	Along Bird Creek and east of Sammons Golf Course	From Avenue D/49th St northerly to Nugent Ave	Creekside land	Yes	No	1.31	$393,000
143.3	Bike Lane	Add signs and markings for bicycle lanes	On Nugent Ave	From Allegiance Dr westerly to Eberhardt Rd	2 lane roadway	Yes	No	0.21	$8,400
143.4	Bike Route	Add bike route signs	On Eberhardt Road	From Nugent Ave northerly to Dodgen Loop	4 lane roadway	Yes	No	1.70	$10,000
144.1	Side Path	Add 8ft wide multi-use side path	Along Central Pointe Rd	From proposed trail west of Entrepreneur Way easterly to Dodgen Loop	4 lane roadway	Yes	No	1.49	$298,000
144.2	Side Path	Add 8ft wide multi-use side path	Along Industrial Blvd	From Dodgen Loop easterly to just west of IH35 ramps at FM1143	4 lane roadway	Yes	No	1.99	$398,000
144.3	Side Path	Add 8ft wide multi-use side path	Along FM1143/Industrial Blvd	From just west of IH35 ramps at FM1143 easterly to 3rd St	4 lane roadway	Yes	Yes	0.46	$92,000
144.4	Bike Route	Add bike route signs	On Zenith St and Young Ave	From 3rd Ave easterly to Dodgen Loop	2 lane roadway	No	No	1.36	$10,000
145.1	Shoulder Lane	Add signs and markings for shoulder lanes	On SH53/SH36/Airport Rd	From existing trail in Woodbridge Park northerly to Kegley Rd	5 lane roadway with shoulders	No	Yes	1.42	$56,800
145.2	Shoulder Lane	Add signs and markings for shoulder lanes	On SH36/Airport Rd	From Kegley Rd northerly to Old Howard Rd	5 lane roadway with shoulders	Yes	Yes	0.37	$14,800
145.3	Shoulder Lane	Add signs and markings for shoulder lanes	On SH36/Airport Rd	From Old Howard Rd northerly to SH317	5 lane roadway with shoulders	No	Yes	2.60	$104,000
145.4	Shoulder Lane	Add signs and markings for shoulder lanes	On SH36/Airport Rd	From SH317 northerly to northern city limits at Clear Ridge Park Dr	2 lane roadway with shoulders	No	Yes	2.00	$80,000
146.1	Shoulder Lane	Add shoulders, signs, and markings	On Cearley Rd	From SH36/Airport Rd northerly to Industrial Blvd	2 lane roadway	Yes	No	1.40	$350,000

Table A-9: 2011 Reference Projects for the City of Temple (continued)

City of Temple									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
146.3	Shoulder Lane	Add shoulders, signs, and markings	On Mouser Rd and McLane Parkway	From Dodgen Loop westerly to Airport Trail	2 lane roadway	Yes	No	2.51	$627,500
146.4	Trail	Add 10ft wide multi-use trail	Along Airport Trail and creek	From Mouser Rd northerly and westerly to SH317	2 lane roadway, and creekside land	Yes	No	2.05	$615,000
147.1	Trail	Add 10ft wide multi-use trail	West of Old Howard Rd and east of Central Texas Regional Airport	From Old Howard Rd northerly to Mouser Rd	Open land	Yes	No	1.84	$552,000
148.1	Trail	Add 10ft wide multi-use trail	North of SH36/Airport Rd	From proposed trail east of Old Howard Rd easterly to Cearley Rd	Open land	Yes	No	0.96	$288,000
148.3	Bike Lane	Add signs and markings for bicycle lanes	On Nugent Ave	From Cearley Rd easterly to Eberhardt Rd	2 lane roadway	Yes	No	0.89	$35,600
149.1	Trail	Add 10ft wide multi-use trail	Along FM3117	From US190 at FM 3117 easterly to railroad	2 lane roadway and railroadside land	Yes	Yes	0.33	$99,000
149.2	Trail	Add 10ft wide multi-use trail	Along railroad	From FM 3117 northerly to proposed trail along proposed western extension of Tower Rd	2 lane roadway and railroadside land	Yes	No	1.69	$507,000
149.4	Bike Route	Add bike route signs	On 30th St, Avenue J, 34th St, and Avenue E	From southern end of 30th St south of Ave N northerly and westerly to 14th St	2 lane roadways	Yes	No	1.70	$10,000
149.5	Bike Lane	Add signs and markings for bicycle lanes	On Avenue E, 6th St, Avenue C, Avenue B, and Avenue A	From 14th St westerly to 11th St	2 lane roadways	Yes	No	0.95	$38,000
149.6	Bike Lane	Add signs and markings for bicycle lanes	On 11th St	From Avenue A northerly to Garfield Ave	2 lane roadway	Yes	No	0.56	$22,400
149.7	Bike Lane	Add signs and markings for bicycle lanes	On 11th St and Park Ave	From Garfield Ave northerly to 7th St at Park Ave	2 lane roadways	Yes	No	0.77	$30,800
149.8	Bike Lane	Add signs and markings for bicycle lanes	On Garfield Ave and 7th St	From 11th St easterly and northerly to Park Ave	2 lane roadways	Yes	No	0.77	$30,800
149.9	Bike Lane	Add signs and markings for bicycle lanes	On 7th St, Mayborn Dr, 8th St, and Walker Ave	From Park Ave northerly to 3rd St	2 lane roadways	Yes	No	0.55	$22,000
149.10	Bike Lane	Add signs and markings for bicycle lanes	On SS290/3rd St	From Walker Ave northerly to Bellaire North	2 lane roadways	Yes	Yes	0.60	$24,000
149.11	Bike Lane	Add signs and markings for bicycle lanes	On Bellaire North	From 3rd St easterly to eastern end of Bellaire North at Visitors Center	2 lane roadways	Yes	No	0.20	$8,000

Table A-9: 2011 Reference Projects for the City of Temple (continued)

City of Temple									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
150.2	Trail	Add 10ft wide multi-use trail	Along creek, southeast of James Wilson Park	From eastern city limit northerly to existing trail in James Wilson Park	Creekside land and open land	Yes	No	1.85	$555,000
150.4	Trail	Add 10ft wide multi-use trail	North of Emerson Elementary and in Ferguson Park	From existing trail in James Wilson Park westerly to Ferguson Park	Park land	Yes	No	0.53	$159,000
150.5	Bike Lane	Add signs and markings for bicycle lanes	On Fowler Rd	From proposed trail in Ferguson Park northerly to proposed trail north of Downs Ave	2 lane roadway	Yes	No	0.29	$11,600
150.6	Side Path	Add 8ft wide multi-use side path	Along proposed northern extension of Fowler Rd and French Ave	From current northern end of Fowler Rd northerly-easterly to proposed trail along Williamson Branch	Future roadway and 2 lane roadway	Yes	No	0.44	$88,000
151.1	Trail	Add 10ft wide multi-use trail	Along Williamson Branch Creek and Shell Ave	From Adams Ave northerly to existing trail in Miller Park	Creekside land and 2 lane roadway	Yes	No	2.49	$747,000
151.3	Bike Lane	Add signs and markings for bicycle lanes	On 1st St and Virginia Ave	From existing trail in Miller Park northerly and westerly to 3rd St	2 lane and 4 lane divided roadways	Yes	No	0.26	$10,400
151.4	Bike Lane	Add signs and markings for bicycle lanes	On SS290/3rd St	From Virginia Ave northerly to Walker Ave	2 lane and 4 lane divided roadways	Yes	Yes	0.09	$3,600
152.1	Bike Lane	Add signs and markings for bicycle lanes	On 50th St and Lavendusky Dr	From Adams Ave northerly and easterly to Dodgen Loop	2 lane roadways	Yes	No	0.72	$28,800
153.1	Trail	Add 10ft wide multi-use trail	West of Jackson Park	From 7th St easterly to existing trail in Jackson Park	Drainage channel	Yes	No	0.24	$72,000
153.3	Trail	Add 10ft wide multi-use trail	South of King Cir and through King Circle Park	From existing trail in Jackson Park easterly to proposed trail west of Dodgen Loop	Wooded area	Yes	No	0.62	$186,000
154.1	Bike Route	Add bike route signs	On 2nd St	From Avenue C northerly to existing trail in Jackson Park	2 lane roadway	No	No	0.93	$5,000
155.1	Bike Lane	Include bike lane with future roadway improvement	On South Kegley Rd	From proposed trail just south of Wildflower Ln northerly to Adams Ave	2 lane roadway	Yes	No	0.81	$0
155.2	Bike Lane	Add signs and restripe for bicycle lanes	On Kegley Road	From Adams Ave northerly to SH36/Airport Rd	4 lane roadway	Yes	No	0.93	$46,500
TOTAL								179.70	$28.25m

Table A-10: 2011 Reference Projects for the Village of Salado

Village of Salado									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
13.5	Trail	Add 10ft wide multi-use trail	Along Mill Creek Golf Course, Smith Branch Creek, and Salado Cemetery	From IH35 NB FR easterly-southerly-northerly existing trail in Tablerock Ampitheatre	Parkland, wooded area, and creekside land	No	No	5.36	$1,608,000
81.2	Bike Route	Add bike route signs	On FM2268	From FM2268 northerly to Mill Creek Dr	2 lane roadway	No	Yes	1.62	$10,000
82.1	Trail	Add 10ft wide multi-use trail	South of Southridge Rd and along Salado Plaza and	From proposed trail along Salado Creek westerly to Main St	Open land and 2 lane roadway	No	No	0.59	$177,000
83.1	Side Path	Add 8ft wide multi-use side path	Along proposed eastern extension of and existing Royal St	From proposed Trail along Smith Branch Creek westerly to Main St	Future roadway and 2 lane roadway	No	No	1.11	$222,000
83.3	Bike Route	Add bike route signs	On Pace Park Rd and Thomas Arnold Rd	From proposed trail along Salado Creek westerly to IH 35 SB FR	2 lane roadway	No	No	0.33	$5,000
86.1	Trail	Add 10ft wide multi-use trail	South of Salado High School	Loop within area bounded by FM2484, Village Rd, Salado School Rd and Williams Rd	Open land	No	No	2.27	$681,000
87.1	Trail	Add 10ft wide multi-use trail	Along Salado Creek	From Main St easterly to northern city limit at Chisholm Trail	Creekside land	No	No	1.79	$537,000
TOTAL								13. 07	$3.24m

Table A-11: 2011 Reference Projects for Bell County

Bell County									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
7.19	Shoulder Lane	Add signs and markings for shoulder lanes	On US190 WB FR	From Nolanville eastern city limit easterly to Belton western city limit	2 lane one-way roadway with shoulders	No	Yes	1.20	$48,000
7.29	Shoulder Lane	Add signs and markings for shoulder lanes	On US190 and Old US190	From Temple southern city limit at Barnhardt Rd southerly to Milam County Line	2 lane road with shoulders	No	Yes	11.92	$476,800
9.20	Shoulder Lane	Add shoulders, signs, and markings	On FM 2410	From Harker Heights city limit easterly to Belton eastern city limit	2 lane roadway with narrow shoulders	No	Yes	2.00	$500,000
9.26	Shoulder Lane	Add signs and markings for shoulder lanes	On FM 436	From Belton eastern city limit easterly to proposed trail along Leon River	2 lane roadway with shoulders	No	Yes	4.71	$188,400
12.1	Shoulder Lane	Add shoulders, signs, and markings	On Oakalla Rd	From Burnet County Line northerly to FM 116	2 lane roadway	No	No	3.24	$810,000
12.2	Shoulder Lane	Add shoulders, signs, and markings	On FM 116	From Oakalla Rd northerly to Coryell County Line	2 lane roadway	No	Yes	2.80	$700,000
13.1	Shoulder Lane	Add shoulders, signs, and markings	On Maxdale Rd	From Burnet County Line easterly to Wolfridge Rd	2 lane roadway	No	No	3.44	$860,000
13.2	Shoulder Lane	Add shoulders, signs, and markings	On FM 2670	From Wolfridge Rd easterly to SH 195	2 lane roadway	No	Yes	4.03	$1,007,500
13.3	Bike Route	Add bike route signs	On Triple 7 Dr, Fire Ln, and Tally Ho Rd	From SH 195 easterly to FM 2484	2 lane roadways	No	No	2.51	$15,000
13.4	Shoulder Lane	Add shoulders, signs, and markings	On FM 2484	From Tally Ho Rd easterly to IH35 NB FR	2 lane roadway	No	Yes	17.80	$4,450,000
14.2	Shoulder Lane	Add shoulders, signs, and markings	On Boys Ranch Rd	From Lampasas County Line easterly to FM 116	2 lane roadway	No	No	2.69	$672,500
15.7	Trail	Add 10ft wide multi-use trail	Along Clark Creek	From Coryell County Line southerly to Boys Ranch Rd	Creekside land	No	No	1.25	$375,000
24.6	Shoulder Lane	Add signs and markings for shoulder lanes	On FM 439	From Killeen eastern city limit easterly to FM93	2 lane roadway with shoulders	No	Yes	6.56	$262,400
24.7	Shoulder Lane	Add signs and markings for shoulder lanes	On FM 439	From FM93 easterly to western Belton city limit	2 lane roadway with shoulders	No	Yes	3.80	$152,000
35.1	Shoulder Lane	Add shoulders, signs, and markings	On Chaparral Rd	From SH 195 easterly to FM 3481	2 lane roadway and future roadway east of future Rosewood southern extension	No	No	6.47	$1,617,500

Table A-11: 2011 Reference Projects for Bell County (continued)

Bell County									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
36.1	Shoulder Lane	Add shoulders, signs, and markings	On FM 2484	From Tally Ho Rd northerly to SH195	2 lane roadway	No	Yes	1.13	$282,500
38.1	Shoulder Lane	Add signs and markings for shoulder lanes	On SH 195	From Williamson County Line northerly to FM2670	2 lane roadway with shoulders	No	Yes	5.69	$227,600
56.3	Trail	Add 10ft wide multi-use trail	Along Trimmier Creek	From Killeen city limit east of FM3481 northerly to Harker Heights southern city limit	Creekside land	No	No	1.15	$345,000
58.7	Trail	Add 10ft wide multi-use trail	Along South Nolan Creek	From Nolanville city limit east of FM3219 easterly to city limit west of Pleasant Hill Cemetery Rd	Creekside land	No	No	0.93	$279,000
58.9	Trail	Add 10ft wide multi-use trail	Along South Nolan Creek and Nolan Creek	From Nolanville eastern city limit easterly to proposed trail at Belton western city limit	Creekside land	No	No	9.67	$2,901,000
58.14	Trail	Add 10ft wide multi-use trail	Along Leon River and Lampasas River	From proposed trail along Leon River clockwise to Mitchell Branch Creek- SE of Belton	Riverside land	No	No	10.82	$3,246,000
58.15	Trail	Add 10ft wide multi-use trail	Along Lampasas River	From Mitchell Branch Creek- SE of Belton westerly to Belton city limit west of Elm Grove Rd	Riverside land	No	No	7.98	$2,394,000
58.20	Trail	Add 10ft wide multi-use trail	East of High Oak Dr	From existing trail at Stillhouse Hollow Lake northerly to proposed trail north of FM2410	Wooded area and open land	No	No	1.75	$525,000
72.2	Shoulder Lane	Add signs and markings for shoulder lanes	On FM 3219	From Harker Heights northern city limit northerly to FM439	2 lane roadway with shoulders	No	Yes	1.02	$40,800
73.1	Trail	Add 10ft wide multi-use trail	Along creek and west Pleasant Hill Cemetery	From proposed trail along South Nolan Creek north of railroad easterly to Pleasant Hill Cemetery Rd	Creekside land and wooded area	No	No	0.38	$114,000
73.2	Trail	Add 10ft wide multi-use trail	Along Pleasant Hill Cemetery Rd and Quarry Rd	From proposed trail east of South Nolan Creek northerly to Fort Hood boundary	2 lane roadway and gravel roadway	No	No	2.10	$630,000
73.5	Shoulder Lane	Add shoulders, signs, and markings	On Sparta Rd	From Fort Hood east boundary easterly to Belton western city limits	2 lane roadway	No	No	3.66	$915,000
75.1	Shoulder Lane	Add signs and markings for shoulder lanes	On FM 3481	From FM 2484 northerly to southern Harker Heights city limit south of Del Rey Dr	2 lane roadway with shoulders, except on bridge	No	Yes	2.66	$106,400
77.1	Side Path	Add 8ft wide multi-use side path	West of Shaw Branch Creek and along Jackrabbit Rd	From proposed trail along South Nolan Creek westerly to proposed trail along private road	Open land and 2 lane roadway	No	No	0.99	$198,000

Table A-11: 2011 Reference Projects for Bell County (continued)

Bell County									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
77.2	Trail	Add 10ft wide multi-use trail	Along private road between Wyatt Earp Ln and Shaw Branch Creek	From Jackrabbit Rd northerly to FM439	Open land	No	No	1.02	$306,000
78.2	Shoulder Lane	Add signs and markings for shoulder lanes	On US 190 EB FR	From Nolanville eastern city limit to Belton western city limit	2 lane one-way roadway with shoulders	No	Yes	1.23	$49,200
79.1	Shoulder Lane	Add shoulders, signs, and markings	On Levy Crossing Rd and Paddy Hamilton Rd	From FM 2410 northerly and easterly to FM93	2 lane roadways	No	No	4.62	$1,155,000
80.1	Bike Lane	Add signs and markings for bicycle lanes	On FM 93	From FM 439 easterly to Belton western city limit	2 lane roadway with shoulders	No	Yes	4.86	$194,400
81.1	Shoulder Lane	Add signs and markings for shoulder lanes	On FM2115 and IH35 NB FR	From Williamson County line northerly to FM2268	2 lane roadway with shoulder	No	Yes	7.19	$287,600
81.3	Shoulder Lane	Include shoulder lane with future roadway improvement	On IH 35 NB FR	From Mill Creek Dr northerly to Belton south city limit	2 lane roadway	No	Yes	1.06	$0
82.3	Shoulder Lane	Include shoulder lane with future roadway improvement	On FM2268 and IH 35 SB FR	From Main St at Mill Creek Dr northerly to Belton southern city limit	2 lane roadway	No	Yes	1.07	$0
82.10	Shoulder Lane	Add signs and markings for shoulder lanes	On SH 317	From northern city limit northerly to McLennan County Line	2 lane roadway with shoulders	No	Yes	6.45	$258,000
83.4	Shoulder Lane	Add shoulders, signs, and markings	On Thomas Arnold Rd, Williams St, and proposed extension of Williams St	From IH 35 SB FR westerly and northerly to FM 2484	2 lane roadway and future roadway	No	No	1.76	$440,000
83.6	Shoulder Lane	Add signs and markings for shoulder lanes	On FM 1670	From FM 2484 northerly to southern Belton city limit at Sunflower Ln	2 lane roadway with shoulders	No	Yes	5.70	$228,000
83.9	Bike Lane	Include bike lane in future roadway	On Boxer Rd and proposed southern extension of FM2271	From Belton northern city limit near US 190 northerly to Sparta Rd	Future roadway	No	No	2.43	$0
83.16	Shoulder Lane	Add signs and markings for shoulder lanes	On FM 2483	From Morgan's Point Rd easterly to Temple western city limit west of SH317	2 lane roadway	No	Yes	0.92	$36,800
84.1	Trail	Add 10ft wide multi-use trail	North of Stillhouse Hollow Lake and east of Vista Trl	From proposed trail along Stillhouse Lake northerly to Belton city limit at Dogridge Rd	Wooded area	No	No	0.60	$180,000

Table A-11: 2011 Reference Projects for Bell County (continued)

Bell County									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
84.3	Trail	Add 10ft wide multi-use trail	North of US190 and wet of Boxer Rd	From Belton city limit north of US190 WB FR easterly-northerly to proposed trail along Nolan Creek	Wooded area	No	No	2.74	$822,000
85.2	Trail	Add 10ft wide multi-use trail	South of FM93	From Belton northern city limit north of Digby Dr northerly to proposed trail north of Airdale Dr	Open land	No	No	0.83	$249,000
87.2	Trail	Add 10ft wide multi-use trail	Along Salado Creek	From Salado northern city limit at Chisholm Trail easterly to proposed trail along Lampasas River	Creekside land	No	No	8.19	$2,457,000
89.8	Shoulder Lane	Add signs and markings for shoulder lanes	On SH 53 and SH320	From eastern Temple city limit easterly to Falls County Line	2 lane roadway with shoulders	No	Yes	12.26	$490,400
90.2	Shoulder Lane	Add shoulders, signs, and markings	On Auction Barn Rd	From Belton city limit at Village Hill Rd easterly to Belton city limit west of Loop 121	2 lane roadway	No	No	1.05	$262,500
91.1	Trail	Add 10ft wide multi-use trail	Along Mitchell Branch Creek	From proposed trail along Lampasas River northerly to Loop 121	Creekside land	No	No	3.50	$1,050,000
114.1	Shoulder Lane	Add signs and markings for shoulder lanes	On SH95	From Williamson County line northerly to southern Temple city limit	2 lane roadway with shoulders	No	Yes	19.19	$767,600
116.2	Trail	Add 10ft wide multi-use trail	Along Bird Creek and Leon River	From proposed trail along Leon River N of Burton northerly to Shallow Ford Rd	Creekside and riverside land	Yes	No	1.15	$345,000
117.1	Side Path	Add 8ft wide multi-use side path	Along proposed southern extension of Witter Ln	From proposed trail along Mitchell Branch Creek northerly to proposed trail along Leon River	Future roadway	No	No	1.07	$214,000
117.2	Shoulder Lane	Include shoulder lane with future roadway improvement	On proposed southern extension and existing Witter Ln	From proposed trail along Leon River northerly to Temple south city limit	Future and 2 lane roadway	No	No	1.57	$0
117.5	Trail	Add 10ft wide multi-use trail	Along Bird Creek	From proposed trail north of Burton Ln northerly to proposed Hickory Rd extension	Creekside land	Yes	No	1.36	$408,000
118.2	Trail	Add 10ft wide multi-use trail	Along Leon River	From Taylors Valley Rd easterly to proposed trail west of Shallow Ford Rd	Riverside land	Yes	No	0.60	$180,000
120.2	Trail	Add 10ft wide multi-use trail	Along Pepper Creek	From Temple city limit at Charter Oak Dr northerly to proposed trail west of Kegley Rd	Creekside land	Yes	No	1.68	$504,000

Table A-11: 2011 Reference Projects for Bell County (continued)

Bell County									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
121.1	Bike Lane	Include bike lane with future roadway improvement	On Pea Ridge Rd and Old Waco Rd	From Charter Oak Dr northerly to Riverside Trail at Old Waco Rd	2 lane roadway	Yes	No	1.17	$0
122.1	Shoulder Lane	Include shoulder lane with future roadway improvement	On Hartrick Bluff Rd and proposed southern extension of 5th St	From FM436 northerly to FM93	2 lane roadway and future roadway	No	No	3.19	$0
123.2	Shoulder Lane	Add shoulders, signs, and markings	On Old TX-95	From northerly Little River City Limit northerly to southern Temple city limit	2 lane roadway	No	No	3.65	$912,500
124.1	Trail	Add 10ft wide multi-use trail	Along Creek	From proposed trail along Leon River northerly to FM 93	Creekside land	Yes	No	2.42	$726,000
128.3	Shoulder Lane	Include shoulder lane with future roadway improvement	On proposed road connecting Old Waco Rd and Taylors Valley Rd	From Temple city limit west of Charter Oak Dr northerly to Old Waco Rd	Future roadway	Yes	No	0.44	$0
145.5	Shoulder Lane	Add signs and markings for shoulder lanes	On SH36	From northern Temple city limits at Clear Ridge Park Dr northerly to Coryell County line	2 lane roadway with shoulders	No	Yes	7.57	$302,800
150.1	Trail	Add 10ft wide multi-use trail	Along creek, north of Tower Road	From Bob White Rd westerly to eastern Temple city limit	Creekside land	Yes	No	0.60	$180,000
TOTAL								237.49	$37.35m

Table A-12: 2011 Reference Projects for Coryell County

Coryell County									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
2.5	Shoulder Lane	Include shoulder lane with future roadway improvement	On future Grimes Crossing Rd northern extension	From northern Copperas Cove city limit northerly to proposed road east of Lawson Ln	Future roadway	No	No	1.43	$0
3.1	Side Path	Add 8ft wide multi-use side path	Along FM 1113	From proposed minor arterial easterly to Copperas Cove west limit	2 lane roadway	No	Yes	2.02	$404,000
7.8	Shoulder Lane	Include shoulder lane in future roadway	On future southern bypass	From FM116 easterly to US190	Future roadway	No	Yes	3.70	$0
9.1	Shoulder Lane	Add shoulders, signs, and markings	On FM 580	From FM 1113 easterly to FM 116	2 lane roadway	No	Yes	5.88	$1,470,000
9.2	Shoulder Lane	Add shoulders, signs, and markings	On FM1113	From FM580 southerly to CR3295	2 lane roadway	No	Yes	3.27	$817,500
9.9	Shoulder Lane	Include shoulder lane with future roadway improvement	On proposed FM 2808 future eastern extension	From Lampasas County line easterly and northerly to Copperas Cove city limit near Abbott Ln	Future roadway	No	No	2.14	$0
10.1	Shoulder Lane	Add shoulders, signs, and markings	On FM 1113 and future roadway	From proposed major arterial at CR3295 easterly to Copperas Cove city limit east of Woodland Dr	Narrow 2 lane roadway, future roadway	No	Yes	3.65	$912,500
11.10	Shoulder Lane	Add signs and markings for shoulder lanes	On FM 116	From Copperas Cove northern city limit northerly to FM 580	2 lane roadway with shoulders	No	Yes	7.26	$290,400
12.3	Shoulder Lane	Add shoulders, signs, and markings	On FM 116	From Bell County Line northerly to Copperas Cove eastern city limit	2 lane roadway	No	Yes	1.16	$290,000
15.6	Trail	Add 10ft wide multi-use trail	Along Clark Creek	From Copperas Cove southern city limits southerly to Bell County Line	Creekside land	No	No	1.41	$423,000
17.2	Bike Lane	Include bike lane with future roadway improvement	On FM 3046	From Lampasas County line northerly to Copperas Cove southern city limit	2 lane roadway	No	Yes	0.33	$0
18.2	Trail	Add 10ft wide multi-use trail	Along Clark Creek	From FM 3046 easterly to proposed trail along Clear Creek	Creekside land	No	No	0.44	$132,000
19.3	Trail	Add 10ft wide multi-use trail	Southwest of Northern Dancer Dr	From Copperas Cove eastern city limit northerly to city limit south of Northern Dancer Dr	Wooded area	No	No	0.38	$114,000
TOTAL								33. 07	$4.85m

Table A-13: 2011 Reference Projects for Lampasas County

Lampasas County									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
1.1	Trail	Add 10ft wide multi-use trail	Along west side of Taylor Creek	From US190 northerly to Copperas Cove City limit	Land between Taylor Creek and Railroad	No	No	3.02	$906,000
2.1	Shoulder Lane	Include shoulder lane with future roadway improvement	On proposed Big Divide Rd southern extension	From FM 2808 northerly to Copperas Cove southern city limit	Future roadway	No	No	1.44	$0
7.1	Shoulder Lane	Add signs and markings for shoulder lanes	On US 190	From CR4450 (western MPO boundary) easterly to western Kempner city limit	5 lanes with shoulders	No	Yes	2.55	$102,000
7.4	Shoulder Lane	Add signs and markings for shoulder lanes	On US 190	From Kempner east city limit easterly to Copperas Cove western city limit	5 lanes with shoulders	No	Yes	0.91	$36,400
8.1	Shoulder Lane	Add shoulders, signs, and markings	On FM3170	From Burnet County Line northerly to US190	2 lane roadway	No	Yes	3.59	$897,500
9.3	Shoulder Lane	Include shoulder lane with future roadway improvement	On Proposed Major Arterial	From FM1113 southerly to US 190	Future roadway	No	No	7.22	$0
9.5	Shoulder Lane	Add shoulders, signs, and markings	On FM 2808	From Kempner city limit at Cherokee easterly to Kempner city limit near Eagle Ln	2 lane roadway	No	Yes	1.88	$470,000
9.6	Shoulder Lane	Add shoulders, signs, and markings	On FM 2808	From city limit near Eagle Ln to city limit near CR4818	2 lane roadway	No	Yes	0.39	$97,500
9.7	Shoulder Lane	Add shoulders, signs, and markings	On FM 2808	From Kempner city limit near CR4818 to FM 2657	2 lane roadway	No	Yes	1.60	$400,000
9.8	Shoulder Lane	Include shoulder lane with future roadway improvement	On proposed FM 2808 future eastern extension	From FM 2657 easterly to Coryell County Line	Future roadway	No	No	0.71	$0
11.1	Shoulder Lane	Add shoulders, signs, and markings	On FM 2657	From Burnet County Line northerly to FM2808	2 lane roadway	No	Yes	2.74	$685,000
11.2	Shoulder Lane	Add shoulders, signs, and markings	On FM 2657	From FM 2808 northerly to Copperas Cove southern city limit	2 lane roadway	No	Yes	1.07	$267,500
14.1	Shoulder Lane	Add shoulders, signs, and markings	On CR 4931	From FM 2657 easterly to Bell County Line	2 lane roadway	No	No	0.48	$120,000
15.1	Shoulder Lane	Include shoulder lane in future roadway	On CR 3300 and Future roadway	From proposed road near CR 3300 easterly and southerly to proposed road near CR 3340	Narrow 2 lane roadway and future roadway	No	No	1.38	$0

Table A-13: 2011 Reference Projects for Lampasas County (continued)

Lampasas County									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
16.1	Bike Lane	Include bike lane in future roadway	On future Pony Express southern extension	From FM2657 westerly and northerly to Copperas Cove southern city limit	Future roadway	No	No	1.46	$0
16.3	Bike Lane	Include bike lane with future roadway improvement	On future Pony Express southern extension	From Copperas Cove city limit north of US190 northerly to south of Buckboard Trail	Future roadway	No	No	0.51	$0
17.1	Bike Lane	Include bike lane with future roadway improvement	On FM 3046	From FM2657 easterly to Coryell County Line	2 lane roadway	No	Yes	0.61	$0
TOTAL								31. 56	$3.98m

Table A-14: 2011 Reference Projects for the US Army Corps of Engineers

U.S. Army Corps of Engineers									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
56.1	Trail	Add 10ft wide multi-use trail	Along north shore of Stillhouse Hollow Lake	From Comanche Gap Rd westerly to FM3481 (with several spurs and loops)	Through wooded area around lake	No	No	8.82	$2,646,000
58.18	Trail	Add 10ft wide multi-use trail	Along north of Stillhouse Lake	From existing trail east of Chalk Ridge Falls westerly to existing trail near Elf Trail	Wooded area	No	No	7.54	$2,262,000
TOTAL								16.36	$4.91m

Table A-15: 2011 Reference Projects for Fort Hood

Fort Hood									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
7.10	Trail	Add 10ft wide multi-use trail	Along US 190 EB FR	From Central Texas College at Bell Tower Dr easterly to proposed trail on south side of US190	2 lane one-way road	No	Yes	1.78	$534,000
9.11	Shoulder Lane	Add shoulders, signs, and markings	On Old Copperas Cove Rd	From Constitution Dr easterly to Coryell-Bell County Line	2 lane roadway with unpaved shoulders	No	No	1.94	$485,000
9.12	Shoulder Lane	Add shoulders, signs, and markings	On Old Copperas Cove Rd	From Coryell-Bell County Line easterly to Killeen west city limit	2 lane roadway	No	No	1.78	$445,000
10.4	Shoulder Lane	Include shoulder lane in future roadway	On proposed northern bypass	From FM116 easterly to US190	Future roadway	No	Yes	3.15	$0
21.2	Shoulder Lane	Include shoulder lane with future roadway improvement	On Tank Destroyer Blvd	From Old Georgetown Rd easterly to Clarke Rd	2 lane roadway	No	No	3.14	$0
21.3	Trail	Add 10ft wide multi-use trail	Along US190 WB FR and open land	From Tank Destroyer Blvd easterly to proposed trail near Coleman Rd	Open land and 2 lane one-way roadway	No	Yes	6.60	$1,980,000
21.4	Trail	Add 10ft wide multi-use trail	Along west side of Fort Hood St around New Patton Park and New Wainwright Housing Division	From existing trail near Coleman Rd easterly and northerly to existing trail along Central Dr	Through open land along back side of housing divisions	No	No	1.72	$516,000
22.1	Trail	Add 10ft wide multi-use trail	Along Clarke Rd	From US 190 EB FR southerly to existing trail at south end of Red Oak	2 lane roadway	No	No	0.71	$213,000

Table A-15: 2011 Reference Projects for Fort Hood (continued)

Fort Hood									
ID	Type	Action	Location	Limits	Existing Condition	In Local Plan	State Highway	Length (mi.)	Cost ($)
22.2	Trail	Add 10ft wide multi-use trail	Along Clement Rd, Live Oak, and south of Montague Village Elementary School	From Clarke Rd easterly to existing trail south of Main Ct	2 lane roadways and Open land	No	No	1.00	$300,000
22.4	Trail	Add 10ft wide multi-use trail	East of Rusk Circle and west of creek	From existing trail north of Fuentes Ct northerly to US 190 EB FR	Open land	No	No	0.62	$186,000
23.1	Trail	Add 10ft wide multi-use trail	Southwest of Central Texas College	From proposed trail along US 190 EB FR easterly to existing trails in Central Texas College	Open land	No	No	0.84	$252,000
23.3	Trail	Add 10ft wide multi-use trail	Along north side of University Dr	From existing trails in Central Texas College easterly to Clear Creek Rd	Open land	No	No	0.50	$150,000
25.2	Side Path	Add 8ft wide multi-use side path	Along SH201/Clear Creek Rd	From Watercrest Rd northerly to US 190 EB FR	5 lane roadway	No	Yes	0.28	$56,000
32.2	Bike Lane	Add signs and markings for bicycle lanes	On 10th St and Warrior Way	From Killeen city limit at gate northwesterly to Martin Dr	2 lane roadway	Yes	No	0.81	$32,400
31.6	Bike Lane	Add signs and markings for bicycle lanes	On Roberts Rd	From Watercrest Rd northerly to proposed trail along US 190 EB FR	2 lane roadway	No	No	0.73	$29,200
34.7	Trail	Add 10ft wide multi-use trail	South of Venable Village Elementary	From US190 WB FR northerly to existing trail near Venable Village Elementary	Open land	No	No	0.44	$132,000
48.11	Bike Route	Add bike route signs	On Hoover Hill Rd	From existing trail along Hoover Hill St northerly to Fort Hood St	2 lane roadway	No	No	0.52	$5,000
49.1	Bike Lane	Add signs and restripe for bicycle lanes	On Fort Hood St, Central Dr, and 16th St	From Tank Destroyer Rd northerly to Hell on Wheels Ave	2-4 lane roadway	No	No	1.06	$53,000
73.3	Trail	Add 10ft wide multi-use trail	Along Quarry Rd	From Fort Hood boundary northerly to Nolan Rd	Gravel roadway	No	No	2.85	$855,000
73.4	Shoulder Lane	Add shoulders, signs, and markings	On Nolan Rd	From Quarry Rd easterly to Fort Hood boundary	2 lane roadway	No	No	4.92	$1,230,000
TOTAL								34. 58	$7.45m

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