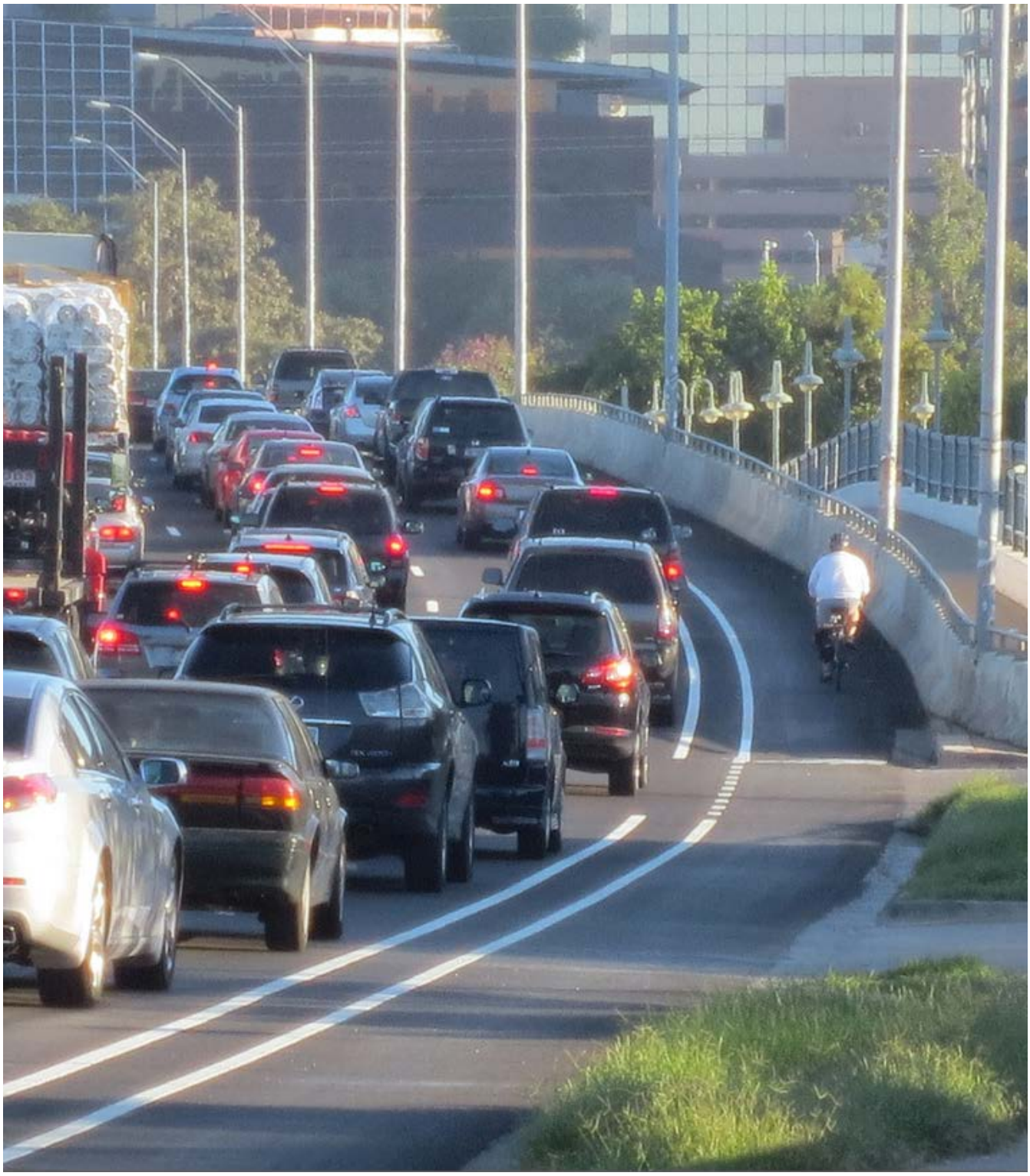
Bicycle System



Caption: New buffered bicycle lanes on the South 1st Street Bridge provide a safe and refreshing alternative to the frustrations of congested roadways.

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Providing a bicycle system that serves people of all ages and abilities is the most fundamental element to increase bicycle use. The facilities that create this system include an integrated on-street and off-street bicycle network, as well as support facilities such as parking, showers and wayfinding.

This Plan identifies five elements of a strong, comprehensive bicycle system:

The Bicycle Network — Objective 2.1: Create an All Ages and Abilities Bicycle Network

Providing a network of safe and comfortable bicycle facilities for people of all ages and abilities is the first step toward encouraging bicycle use. This Plan outlines how the bicycle network and the various facility treatments should be identified, prioritized, designed and ultimately built. The three primary focus areas for the bicycle network are: 1)Creating an all ages and abilities bicycle network, 2)removing barriers in the existing bicycle lane network, and 3)resolving issues with parking in bicycle lanes.

End-of-Trip Facilities — Objective 2.2: Provide Comprehensive End-of-Trip Facilities

Support facilities, such as secure bicycle parking or storage and shower facilities at the end of the trip are tools to better integrate bicycling into our transportation system. Other supporting facilities include wayfinding and signage along the route to help guide bicyclists to their destination.

Providing these items promotes bicycling as easy and convenient for transportation and recreation.

Integration of Cycling with Transit — Objective 2.3: Fully Integrate Cycling with Transit Services

Bicycling has the potential to significantly improve transit service by providing a solution for the first and last mile. The 2 to 3 mile range of a reasonable bicycle trip, compared to a half-mile walk will significantly increase the potential market for transit. Safe and secure high capacity bicycle parking at key transit stops for regular transit, rapid bus, and rail should be coordinated and implemented. Additionally, bicycle accommodation on all bus, rail transit and van pool vehicles should be provided.

Bike Share System — Objective 2.4: Maintain and Expand the Bike Share System

Modern bike share systems are one of the most catalytic tools cities have to significantly increase bike trips. Bike share systems also add value to the mobility market by providing low cost, on demand, non-ownership based transportation. Because bike share is a non-ownership based it broadens the audience for bicycling. Bike share is a great solution to meet short trip mobility demand within the operating area of the system.

Bicycle Facility Maintenance — Objective 2.5: Provide Superior Bicycle Facility Maintenance

Maintenance of the bicycle network and supporting facilities will ensure a comfortable and predictable bicycle trip. Bicycles are more sensitive to pavement irregularities and road debris than vehicles due to thin tires and lack of suspension. Roadway features that cause minor discomfort to motorists, such as potholes and improper drain grates, can cause serious problems for cyclists. New equipment, such as narrow street sweepers, is necessary to effectively maintain the physically protected bicycle network.

Evaluation of Existing Bicycle Infrastructure

Since the adoption of the 2009 Plan, the Austin region has seen a significant expansion of the bicycle network. The network currently consists of a variety of facilities, including protected bicycle lanes, bicycle lanes, shoulders, wide curb lanes, signed bicycle routes and multi-use paths. As of April 2014, the Austin region had a total 57.6 miles of urban trails (shared-use paths), 2.6 miles of protected bicycle lanes, 17.8 miles of buffered bicycle lanes and 210 miles of bicycle lanes. Even with a shift in focus to protected bicycle facilities, only 36 percent of Austin's arterial streets have traditional painted bicycle lanes.

The first step in identifying the needs and goals for the bicycle system is to evaluate the existing system. This analysis, which includes public input as well as detailed field research, identifies the barriers in the system and guides recommendations for new facilities throughout the city.

A key issue raised during the planning process involved barriers along existing routes throughout the city. This includes concern through the public input process that bicycle lanes often end suddenly and that areas outside the center of the city are often disconnected from the existing bicycle network.

The following are major themes that evolved from the public input regarding the existing network:

- There is a great demand for more bike lanes throughout the city. Central Austin seems to be

well connected by bike lanes, although gaps in the network remain in the outlying areas.
- The most requested corridors for improved bicycle facilities were on Lamar Boulevard, MoPac Expressway, HW 183, Congress Avenue, IH35, HW360, Burnet Road, East Riverside, South 1st Street, Airport Boulevard and 45th Street.
- There are gaps in the network that need to be connected. It was often noted that bike lanes on major roads such as South Lamar and South Congress finish abruptly.
- There is a desire for connections to Central Austin, across major highways, to urban trails, schools, and work.

These barriers often make routes unattractive to most people. Through the process of drafting the Plan, City staff conducted a comprehensive review of prominent barriers in the existing bicycle lane network, updating the work done by the Street Smarts Task Force (SSTF) for the 2009 Plan. This barrier analysis identified 95 top physical barriers in the bicycle network discussed more in the section below.

The 2009 Plan was largely focused on bicycle lanes and barriers in the bicycle network. Over the last three years, there has been a national and local movement to look beyond bicycle lanes and create more comfortable and protected facilities. Austin currently has 20 miles of buffered bicycle lanes and 3 miles of protected lanes. An additional 30 miles of buffered or protected lanes is in the planning, design or construction stage.

Support for protected bicycle lanes was another significant theme found through the public input process.

- In general, input shows the public is more interested in the installation of protected bicycle lanes than conventional bike lanes.
- There is a desire for protected bicycle lanes throughout the city. There was also a strong support for protected bicycle lanes to schools, often referencing the success of the Bluebonnet protected lanes serving Zilker Elementary School.
- Protected bicycle lanes are seen as a way to allow families to bike together to destinations including: shopping areas, libraries, parks and schools.

The latest bicycle infrastructure development has been the implementation of a bike share system. Bike share is an on-demand point to point mobility solution available at a very low cost to users. Bike share systems have been shown as one of the most significant catalysts to increased bicycling. By removing the barrier of bicycle ownership, bike share systems significantly expand the audience for bicycling and allow casual spontaneous use. Bike sharing is also a powerful tool to bolster transit by expanding the typical “first and last mile” and making transfers between lines more flexible. A local non-profit organization handles the day-to-day operations of Austin’s bike sharing system, including maintenance of the bicycles, marketing the system, and securing station sponsorships (For more information on Bike Share System see Objective 2.4).

The Bicycle Network

Objective 2.1a: Create an All Ages and Abilities Bicycle Network
Objective 2.1b: Remove Barriers in the Bicycle Network

The lack of streets that safely and comfortably accommodate people on bikes of all ages and abilities is frequently cited as the top barrier to bicycling in Austin. If Austin is going to embrace the full potential of bicycles as a mode of transportation, serious efforts to implement a robust bicycle network will be

necessary.

Best Practice Bicycle Network Planning

Cities and countries that have more than 20 percent bicycle mode share have one thing in common: complete bicycle networks that accommodate people on bikes of all ages and abilities. One of the primary tools to create this network is the use of protected bicycle facilities on streets with high motor vehicle traffic levels. Where networks of these facilities are implemented and where there are high levels of short trips, significant mode shift will result. The following is an overview of the planning principles behind the current state of the practice for high quality bicycle networks targeted to achieve significant ridership.

Attracting the 'Interested but Concerned' Bicyclist and Implementing Protected Bicycle Lanes

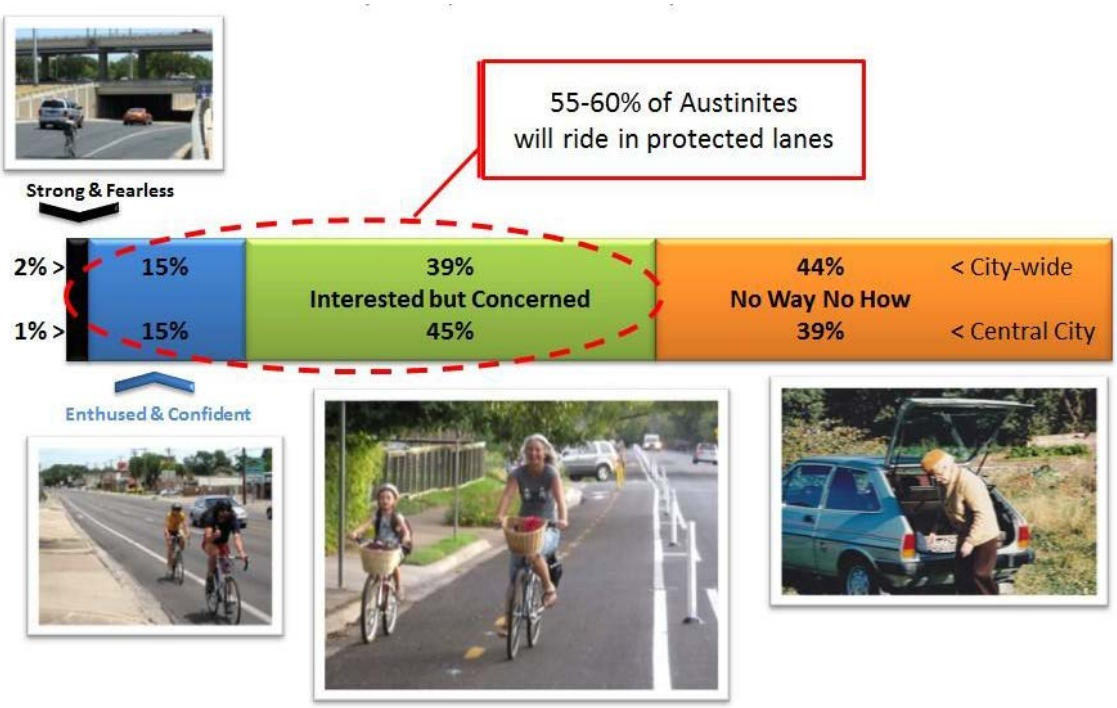
A framework developed by the City of Portland's bicycle coordinator, Roger Geller, classifies four types of bicyclists in any given population to help us better understand who is served by different types of bicycle facilities [paraphrased citation].

1. The "Strong and the Fearless" will ride regardless of roadway conditions. They are 'bicyclists;' riding is a strong part of their identity and they are generally undeterred by roadway conditions. In Austin, this group accounts for 1 to 2 percent of the population.
2. The "Enthused and Confident" are comfortable sharing the roadway with automotive traffic, but they prefer to do so operating on their own facilities. They are attracted to riding on streets that have been redesigned to make them work well for bicycling. They appreciate bicycle lanes on busy streets. In Austin this group accounts for 15 percent of the population, among which compose most of the cyclists who are supported by Austin's current bicycle network.
3. The "Interested but Concerned." is the largest demographic and are those who are curious about bicycling but concerned about their safety due to motor vehicle traffic on busy streets. They like riding a bicycle, remembering back to their youth, or a recent ride, and they would like to ride more. But, they are afraid to ride. They don't like the cars speeding down their streets. They get nervous thinking about what would happen to them on a bicycle when a driver runs a red light, or guns their cars around them, or passes too closely and too fast. Very few of these people regularly ride bicycles, perhaps through their neighborhoods to the local park or coffee shop, but will not venture out onto the arterial to the major commercial and employment destinations they frequent. They would ride if they felt safer on the roadways—if cars were slower and less frequent, and if there were more quiet streets with few cars and paths without any cars at all. In Austin, this group represents 39 to 45 percent of the population.
4. The "No Way, No How" group is not interested in bicycling at all, for reasons of topography, inability, or simply a complete and utter lack of interest. In Austin, this accounts for 39 to 44 percent of the population. It is unlikely that this group will convert a substantial portion of their trips to bicycle trips and this is okay. Even this group receives substantial societal benefits from bicycle trips made by the other three groups.

Geller notes the separation between these four broad groups is not generally as clear-cut as described here. There is likely quite a bit of blurring between the "enthused," the "interested," and those not at all interested, but this has proven to be a reasonable way to understand the city's existing and potential cyclists.

Geller's framework was later studied by Portland State University researcher Jennifer Dill, whose work ultimately supported Geller's findings. As part of this plan update, the City of Austin conducted a statistically significant and demographically representative phone survey to determine the portion of Austin's residents that falls into each category. Portions of the population that fall into each of these four categories are summarized for citywide as well as Central Austin. The population of Central Austin, defined as the area bounded by Oltorf Street to the south, Hwy. 2222 to the north, MoPac to the west and US 183 to the east, is slightly more inclined to ride a bicycle.

Four Types of Transportation Cyclists in Austin - by Proportion of Population



Source: City of Austin 2013 Statistically Valid Telephone Survey

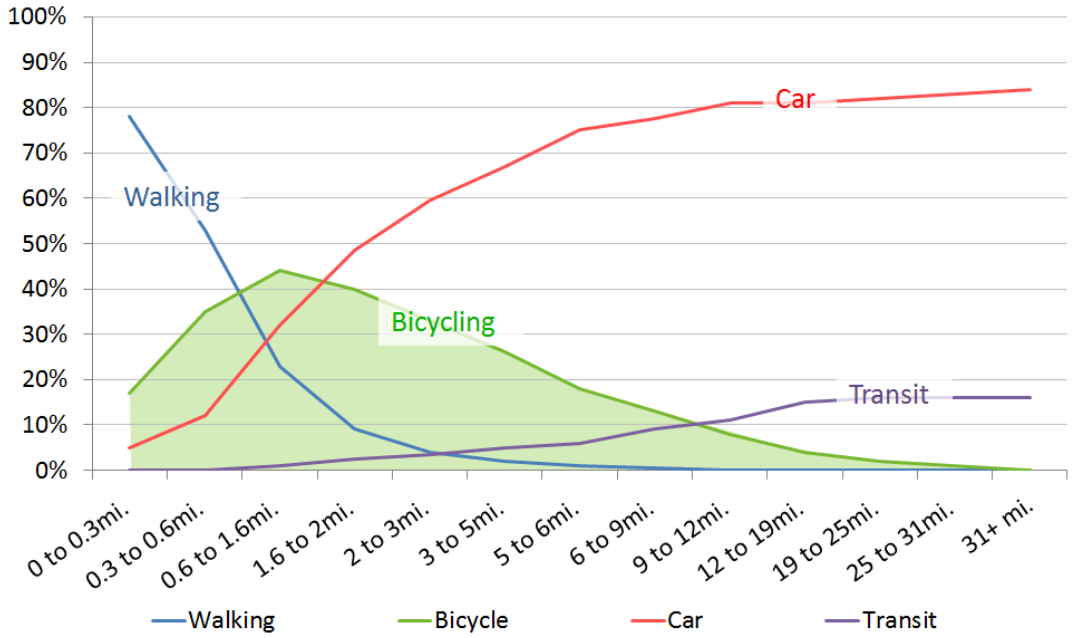
The data strongly suggests that if Austin continues to build a network using primarily painted bicycle lanes on busy roadways, about 17 percent of the population would feel safe bicycling on our roadways. Other barriers such as long-trip distances and lack of end-of-use facilities will further limit our ability to reach even this portion of the population.

The data also demonstrates that if were able to implement an all ages and abilities bicycle network, using tools such as protected bicycle lanes and urban trails, then 55 to 60 percent of the population would feel safe enough to bicycle on our roadways. Therefore, an all ages and abilities approach represents a nearly four times potential to increase bicycling compared to our existing bicycle network approach.

Capturing Short Trips

Because bicycling, like walking, is a human-powered form of transportation, it is inherent that there is a finite amount of energy that a person can expend to make a trip. The primary result of this fact is a practical limit on typical bicycle trip lengths. The figure below shows mode splits between walking, bicycling, transit and vehicle use at a range of trip distances.

Mode Share by Trip Length Where Safe Facilities for All Modes Are Present

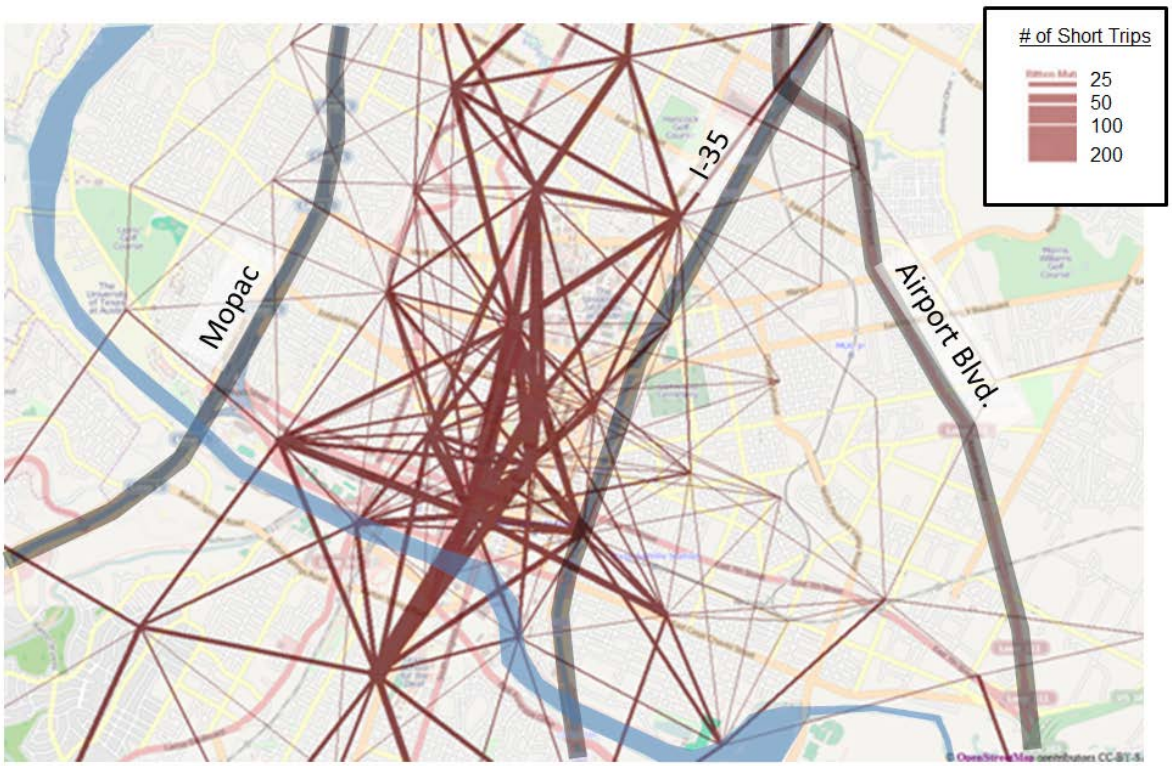


Source: Nationwide Dutch travel data 2005, RWS/AVV/MON

The vast majority of very short trips are made by walking, while longer trips are made by vehicle or transit. One very important note about this data is that the trends shown can only be obtained from a place where there are very safe walking, bicycling, transit and automobile networks. If this data were collected in a place with an unsafe bicycle and walking network (no sidewalks or bicycle lanes), you would see very a different trend that reflects a bias towards motor vehicle trips across all trip lengths. In many U.S. cities, it is common that even short trips are taken by automobile for this very reason. Data shown above is nationwide Dutch travel data including both urban and rural areas. There is range of trip distances where the bicycle is the preferred mode of travel because it has a greater range than walking and is faster and more flexible than car or transit for many shorter trips.

During Austin's Think Bike event, where Dutch design and policy experts conducted a 3-day workshop and audit of Austin's bicycle planning, Dutch experts stressed the importance of capturing short trips. First, they showed the data above regarding mode selection by distance. Then they stressed that to achieve a maximum increase in bicycle mode shift, a network of all ages and abilities bicycle facilities should be targeted in areas with the highest concentrations of short trips. They also demonstrated how to use Austin's regional origin and destination data from the Capital Area Metropolitan Planning Organization air quality model to map out short trips. Not surprisingly, short trips are concentrated around the central city as seen in the map below.

Concentration of Short Trips in Central Austin



Source: Capital Area Metropolitan Planning Organization Origin and Destination Data, 2010

Dutch experts also stressed the importance of capturing short trips around high-capacity transit stations such as those on Austin's MetroRail line. This provides an opportunity to serve longer trips through linking transit trips with a bicycle trips.

In some areas hilly terrain may also be a significant factor towards energy limits of the rider. Whether to overcome adverse terrain or to increase trip distances, electric-assisted bicycles are increasingly seen as a supplementary tool to increasing bicycle mode share.

Building a Complete Bicycle Network

One of the most important focus areas is the creation of a network of bicycle facilities, not just isolated facilities. Recent research by Mekuria, Furth, and Nixon classified streets by their level of traffic stress. The research analyzed streets in San Jose, California found that while most streets on the network were suitable for most adult cyclists (defined as Level of Traffic Stress 2-LTS2), this network was fragmented by busy, high-stress streets. The research showed that if the right streets could be improved, the islands of low stress streets could form a robust and connected network (Mekuria, Furth, and Nixon 2012, Low Stress Bicycling and Network Connectivity).

To demonstrate the power of creating an all ages and abilities bicycle network targeted where short trips exist, we can look at the lessons learned from two well know cities that have made significant advances in bicycle infrastructure: Portland, Oregon and Seville, Spain.

Portland, the leading large bicycle friendly city in the US, has a bicycle mode share at just over 6 percent as of the 2013 American Community Survey. Portland has been working to create a bicycle network in earnest since the mid-1990's when their bicycle mode share was around 1 percent. The primary tools used over this time period were bicycle lanes on busy streets and bicycle boulevards on

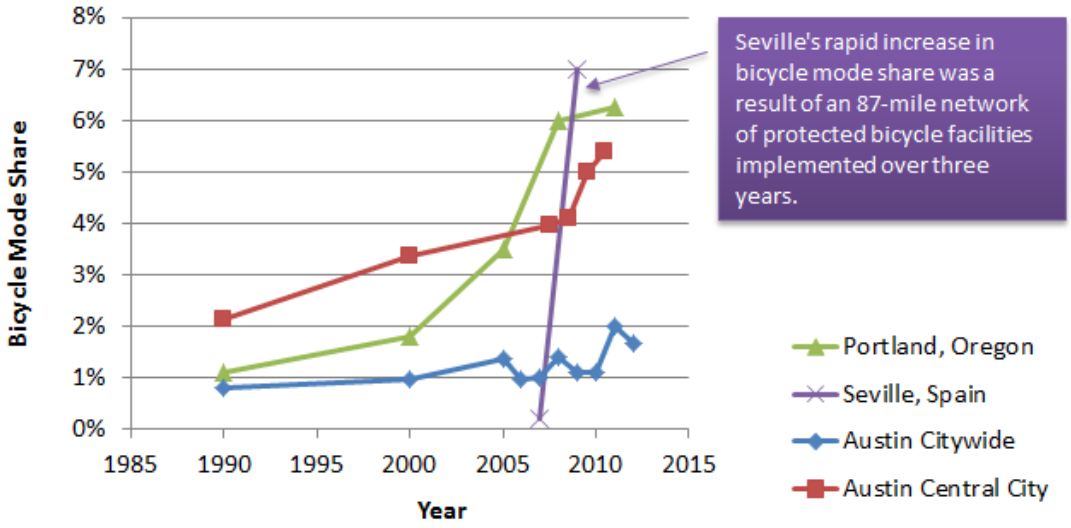
underutilized streets in their grid. Only very recently have they started to implement protected bicycle facilities on busy streets. In almost 20 years, Portland has increased their citywide bicycle mode share from 1 percent to 7 percent.

Seville, Spain on the other hand began making improvements to their bicycle network decades later and took a very different approach. Between 2007 and 2009 they implemented an 87-mile network of Dutch inspired protected facilities for $43 million, coupled with a moderate-sized bike share system. The network was designed to be cohesive and ensure that users are clearly and safely guided through intersections. Their design target was a 65-year-old woman with groceries. Instead of taking 20 years to reach the 7 percent mode share mark, Seville accomplished this in only four years. Unlike Holland, Spain had no legacy of bicycle transportation, with Seville having only a 0.2 percent mode share in the year 2000.

Caption: Protected bicycle facilities in Seville, Spain (Photo courtesy of the Green Lane Project)

The chart below shows both Austin citywide and our Central City mode share change over time since 1990. Due to the recent expansion of the Austin's bicycle network, the Central City bicycle mode share is on an upward trend much like that of Portland in the mid-2000s. The chart suggests that by shifting to a new approach in Austin, that implementing a strategically focused all ages and abilities bicycle network, a dramatic increase in bicycling and related benefits is possible in a very short time.

Rise of Cycling Over Time in Portland, Seville, and Austin



Source: City of Austin

Bicycle Facility Toolbox

Many types of bicycle facilities will be used throughout Austin to create a robust bicycle network. The bicycle facilities described below are grouped into two categories: tools to create an all ages and abilities network and other supporting bicycle facilities.

All Ages and Abilities Bicycle Network Toolbox

In order to provide a safe, all ages and abilities bicycle network, the following bicycle facility types must be connected to complete a cohesive network: protected bicycle lanes on major streets, urban trails, bicycle boulevards on calmed or quiet streets. Nearly all cities will use a combination of these facility types to retrofit streets with a robust, low-stress network, though the weight given to each element will vary, as each will have unique constraints and opportunities. The following descriptions provide an overview of these tools.

Protected Bicycle Lanes

A protected bicycle lane is an exclusive bike facility that combines the user experience of a separated path with the on-street infrastructure of a conventional bike lane. A protected bicycle lane is physically separated from motor vehicle traffic and distinct from the sidewalk. Protected bicycle lanes have different forms, but all share common elements—they provide space that is intended to be exclusively or primarily used for bicycles and are separated from motor vehicle travel lanes, parking lanes, and sidewalks. In situations where on-street parking is allowed protected bicycle lanes are located to the curb-side of the parking (in contrast to bike lanes).

Caption: One-way and two-way protected bicycle lanes as shown in the NACTO Urban Bikeway Design guide (Graphic courtesy of NACTO, Urban Bikeway Design Guide)

Protected bicycle lanes may be one-way or two-way, and may be at street level, at sidewalk level, or at an intermediate height. If at sidewalk level, a curb or median separates these lanes from motor vehicle traffic, while different pavement color/texture separates the protected bicycle lane from the sidewalk. If at street level, they can be separated from motor traffic by raised medians, on-street parking, bollards, or other physical barriers. By separating cyclists from motor vehicle traffic, protected bicycle lanes can offer a higher level of security than bike lanes and are attractive to a wider spectrum of the public (NACTO Urban Bikeway Design Guide, 2014).

On-street protected bicycle lanes often require more on street or right-of-way (ROW) width than painted bicycle lanes to provide the barrier and sufficient width for passing. Opportunities for protected bicycle lanes will exist where streets or rights of ways are wide enough to accommodate protected bicycle lanes among the other competing interests for the space.

Urban Trails and Dedicated Bikeways

Caption: Urban trail with separate paths for bicycles and pedestrians

Urban trails and dedicated bikeways are paths physically separated from motorized vehicular traffic by an open space or barrier and are located either within the road right-of-way, within an independent right-of-way, or accommodated in another way, such as parkland. Urban trails are shared by multiple

users including, but not limited to, pedestrians, skaters, wheelchair users and bicyclists, while dedicated bikeways are designated for exclusive use by bicycles. For all weather operation, most trails will have a smooth hard surface.

Quiet Streets

Caption: A quiet street, or neighborhood greenway, in Portland Oregon (Photo courtesy of NACTO, Urban Bikeway Design Guide)

Quiet streets, otherwise known as bicycle boulevards or neighborhood greenways, are streets with low motorized traffic volumes and speeds that are designated and designed to give bicycle travel priority. Bicycle boulevards use signs, pavement markings, and speed and volume management measures to discourage through trips by motor vehicles and create safe, convenient bicycle crossings of busy arterial streets (NACTO Urban Bikeway Design Guide, 2014).

Traffic calming elements of quiet streets are also excellent opportunities to integrate green infrastructure to meet several community goals in one project.

Intersection Treatments

For the crossing of major street barriers in the low-stress network, intersection treatments can be used to make the crossings safer and more comfortable. Tools include, but are not limited to bicycle signals, hybrid beacons that give indication to cyclists, median refuge islands, two-way protected bicycle lane connections at offset intersections, and intersection crossing markings.

Other Supporting Bicycle Facilities

The following bicycle facility types are not the primary tools used to create an all ages and abilities network, but will be used to enhance the bicycle network and address barriers in the system.

Bicycle Lane, Buffered Bicycle Lane

A bicycle lane, or a bike lane, is defined as a portion of the roadway that has been designated by striping, signage, and pavement markings for the preferential or exclusive use by bicyclists. Bike lanes enable bicyclists to ride at their preferred speed without interference from prevailing traffic conditions and facilitate predictable behavior and interactions between bicyclists and motorists. A bike lane is distinguished from a protected bicycle lane in that it has no physical barrier (bollards, medians, raised curbs, etc.) that restrict the encroachment of motorized traffic. Conventional bike lanes are located curbside when no parking is present and between parking and motor vehicle traffic when it is present. Bike lanes are traditionally located on the right-hand side of the street but can be located on the left-hand side of the street in specific situations. Bike lanes typically run in the same direction as traffic, though they may be configured in the contra-flow direction on low-traffic corridors necessary for the connectivity of a particular bicycle route.

The configuration of a bike lane requires a thorough consideration of existing traffic volumes and behaviors, adequate safety buffers to protect bicyclists from parked and moving vehicles, and enforcement to prohibit motorized vehicle encroachment and double-parking. Bike Lanes may be distinguished using color, lane markings, signage, and intersection treatments (NACTO Urban Bikeway Design Guide, 2014).

Shoulder

A shoulder is defined by the American Association of State Highway and Transportation Officials (AASHTO) as “the portion of the roadway contiguous with the traveled way for accommodation of stopped vehicles, for emergency use, and for lateral support of the sub-base, and surface courses” (AASHTO, 2011). A shoulder can accommodate bicyclists if it is adequate in width and pavement surface and has few driveways or other crossings. Minimum width shoulders are not preferred even on lower speed roadways. Shoulders on higher speed roadways should be even wider to provide adequate separation. Texas legal code allows continuous use of the shoulder only by bicycles, emergency vehicles and maintenance crews. At conflict areas and intersections, shoulders should be transitioned to bicycle lanes so explicit guidance can be given to roadway users. On roadways with shoulders, as with all bicycle facilities, continuity is critical for the safety and comfort of cyclists. Shoulders that end abruptly, just like bicycle lanes are often a significant hazard and deterrent for people on bicycles.

Traffic Calming

Traffic calming devices are used to reduce motorized vehicle speeds or volumes and thus improve the real and perceived safety for roadway users, especially non-motorized users of a roadway. The City of Austin utilizes a variety of traffic calming devices including: speed cushions, traffic circles, chicanes, semi-diverters, roundabouts, bulb-outs, center islands and median barriers.

According to the Pedestrian and Bicycle Information Center, bicyclists are concerned that some traditional traffic calming techniques (narrowing streets and speed cushions) have a negative impact on bicyclists. However, a report written by Andrew Clarke and Michael Dornfeld in 1994 as part of the National Bicycling and Walking Study, concluded that “the experience from Europe clearly shows that bicycle use has been encouraged by traffic calming” (PBIC, Traffic Calming). If designed and implemented properly, with consideration for the impacts on bicyclists, traffic calming devices can have beneficial impacts for bicyclists and pedestrians.

Traffic calming infrastructure is an excellent opportunity to integrate green infrastructure and meet

multiple goals in one project.

Bicycle Network Design Principles, Network Performance Criteria, and Facility Criteria

To achieve the goal of creating an all ages and abilities network, the following design principles, network performance criteria, and facility criteria should be applied.

Bicycle Network Design Principles

Five design principles have been identified by Dutch bicycle experts as the primary requirements for a successful, high-quality bicycle network. If any one of these five elements is not adequately addressed the street or bicycle facility should be reevaluated for improvement.

1. Cohesion

   The bicycle network will be a cohesive whole with complete routes that are easily understandable. Wayfinding, intersection markings, coloring and other treatments will be used to provide intuitive guidance to cyclists. The need for cohesion led to the feasibility analysis of a network of seamless connected, low-stress bicycle facilities that could be implemented in the short term.
2. Directness (and Travel Efficiency)

   As mode choice is primarily made on a time-competitive basis, every effort will be taken to minimize delay for bicyclists in the network. Safe bicycle facilities on direct routes will be prioritized. Travel efficiencies to minimize time delay are encouraged, including tactics such as green signal waves timed to bicycle speeds and orientation of traffic controls that reduce the number of full stops cyclists have to make.
3. Safety

   Safe conditions are the single largest barrier that keeps people from bicycling. Austin streets should be made safe for people on bicycles of all ages and abilities.
4. Attractiveness

   Effort will be made to provide an enjoyable trip that allows users to ride socially (side-by-side), separated from the stress of traffic, and in built environments that are human-scaled and hospitable.
5. Comfort

   The comfort of the user experience will be maximized by providing adequate separation from traffic, minimizing flow interruptions, and providing smooth surfaces, shade and comprehensibility, along routes.

Network Performance Criteria

To create a high-quality bicycle network, the following performance criteria will be adhered to accomplish this goal.

<u>Network Density</u>

The goal will be to provide a bicycle network density with routes spaced every half to quarter of a mile.

This will provide acceptable access to residences, businesses and employment. This spacing provides a distance to the nearest bicycle route that provides convenient access without long detours.

For the short term, all ages and abilities network, this density was applied in Central Austin in an approximately gridded pattern. Around major transit stations, transit-oriented developments and Imagine Austin centers, network density is applied radially to provide access to surrounding areas.

Austin is dominated by suburban development patterns with separated uses and a largely disconnected street network that is dependent on arterial roadways. The Imagine Austin Plan calls for compact and connected development patterns including complete streets with smaller interconnected blocks. Where roadway connections are not possible, bicycle and pedestrian connections should be made at a minimum.

Safety Performance Target

Both streets and bicycle networks will be held to the "8-80" test, aimed at creating a network in which both 8-year-olds and 80-year-olds can move about safely and enjoyably. This is the level of quality the Plan aspires to for the all ages and abilities bicycle network and more generally our efforts to create complete streets.

Austin's low-stress network will be designed to perform at a level that accommodates the "Interested but Concerned" portion of the population that tolerates a Level of Traffic Stress 2 (LTS2) (See Chapter 2, Best Practices in Bicycle Network Planning, Building a Complete Bicycle Network to read more about low stress bicycle networks and LTS categories). Where possible, the network will be enhanced to accommodate children by providing a Level of Traffic Stress 1 (LTS1).

Design Cyclist

Bicycle planning and design must be done from the cyclist point of view. Designs must account for differences in age, gender, physical abilities, bicycle types, and reasons for cycling. The following are the parameters that will be used in the design of Austin's bicycle network:

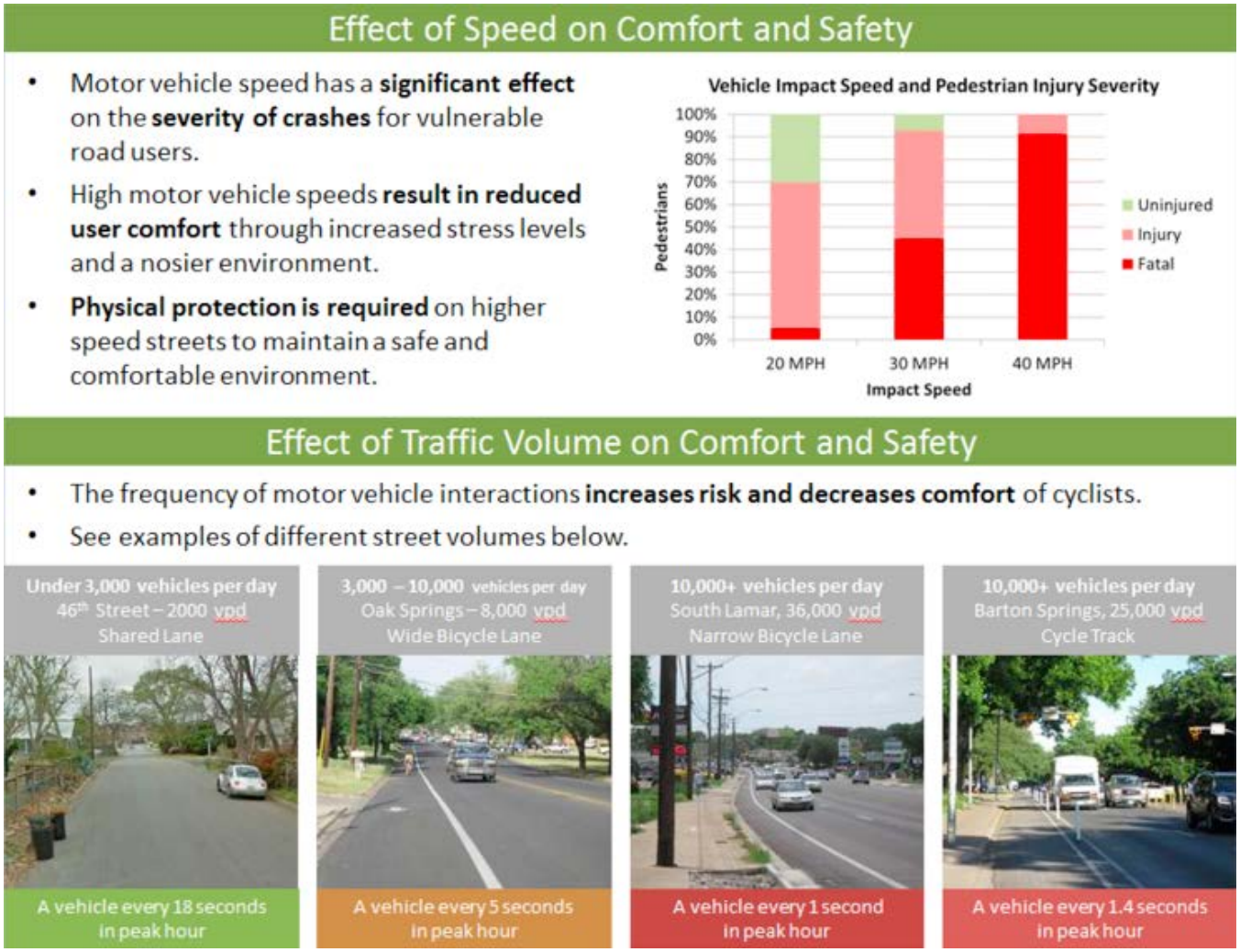
- **Design Person:** Austin's bicycle network will be designed for people of all ages and all abilities.
- **Design Speed:** The design speed of the network will generally be optimized for a commuter cyclist traveling 10 to 15 mph. In certain contexts, design speeds of 5 to 20 mph will be used.
- **Design Width:** The width of bicycle facilities is important for the safety, comfort, operation and maintenance of bicycle facilities. Bicycle facilities should be designed to allow passing, side-by-side riding where possible. Bicycle facilities should also be wide enough to be swept by Austin's street sweeping fleet. The acquisition of narrower sweepers could allow narrower bicycle facilities in constrained locations. Additionally, extra width provides additional capacity for the facility as bicycle traffic does not necessarily flow in a single file like a motor vehicle lane. Therefore, the minimum recommended width for one-way protected facilities is 8 feet. The minimum recommended width for two-way facility is 10 feet. If high bicycle volumes are anticipated, even in a decade-long horizon, serious consideration should be given to wider facilities.
- **Crossing Time:** Crossing timings will account for children and the elderly.
- **Design Bicycle:** Designs will accommodate trail-a-bikes, trailers, tandems and cargo bikes.

On-Street Bicycle Facility Criteria

The following are the criteria used for facility selection and design to create all ages and abilities bicycle facilities.

Criteria for Physical Protection

Streets with high speed and volume should have physically protected bicycle facilities: protected bicycle lanes or urban trails. Higher motor vehicle speeds have a significant negative safety impact on the safety of all roadway users. Higher motor vehicle volume along streets significantly increases the risk and decrease comfort for people on bicycles.



Source: Graphic by City of Austin, Speed vs Pedestrian Severity Data from Pasanen, 1992

At higher speeds and volumes, physical separation is necessary to achieve conditions that are safe for people of all ages and abilities. The follow table shows the criteria used to develop the recommended bicycle facility at various combinations of speed and volume.

Bicycle Facility Recommendations by Speed and Volume

The following is contextual guidance for the selection of appropriate bicycle facilities developed by the

City of Austin. The guidance replaces recommendations based on the 1992 Federal Highway Administration document "Selecting Roadway Design Treatments to Accommodate Bicycles" that did not recommend facilities with greater physical protection than a bicycle lane, even on high speed and volume multilane roadways. The Plan's recommendations developed by City of Austin correct this shortcoming and provide recommendations based on the speed volume that range from shared lanes on low speed and volume streets to protected bicycle lanes on higher speed and volume roadways.

		Average Annual Daily Traffic (vehicle per day)		
		Less than 3,000	3,000-9,999	10,000+
85th Percentile Speed (MPH) Meaured or Projected	< or =30	Shared*	Bike Lane	Buffered
	31-40	Bike Lane	Buffered	Protected
	41-50	Buffered	Protected	Protected
	> 50	Protected	Protected	Protected

*Local streets that are important for the all ages and abilities network with less than 3,000 vpd and 30 MPH should be treated as necessary to meet the performance guidelines for Quiet Streets.

Source: City of Austin

In addition to speed and volume criteria for physical protection, special consideration will be given to other factors including but not limited to curbside activity, on-street double parking pressures, parking frequency, delivery activity, multiple travel lanes, transit service, and route continuity such as completing gaps in off-street urban trails.

The City of Austin developed bicycle facility section contextual guidance was created as an interim measure until contextual guidance by NACTO is released. The NACTO guidance is expected to be the first U.S. based contextual guidance to include protected bicycle lanes and will set the new national best practice. The Plan recommends adopting NACTO recommendations for bicycle facilities as soon this new guidance is available.

Performance Criteria for Quiet Streets (Bicycle Boulevards) in the Low-Stress Network

Quiet Streets in the low-stress bikeway network should adhere to the most current guidance in the NACTO Urban Bikeway Design Guide for Bicycle Boulevards. At the time of adoption the following are the recommended speed and volume targets (2014):

> **Speeds:** The 85th percentile speed should be managed to be at 25 mph or less, with 20 mph as the preferred speed.
>
> **Volumes:** Motor vehicle volumes should be managed to be fewer than 1,500 vehicles per day, with up to 3,000 vehicles per day allowed in limited sections of the corridor.

Planning Austin's Bicycle Network

The long-term goal of this plan is to ensure all streets in Austin are accessible by bicycle for people of all ages and abilities. Physically protected bicycle lanes will be necessary on busy streets before this goal is met. Even after decades of working toward a complete bicycle lane network only 36 percent of arterial streets have a bicycle lane so the full build-out of our city streets will be a long term pursuit. This plan documents a complete set of bicycle facility recommendations for all streets in the bicycle network.

While all of the complete set of recommendations are not of the same priority, they provide guidance that complies with this Plan and Austin's Complete Streets policy at the time that there is an opportunity to reconfigure the roadway.

The only way to create an all ages and abilities bicycle network in Austin within a short-term time frame is to use a combination of bicycle facility types where opportunities exist to form a cohesive network. The Plan recommends a priority short-term all ages and abilities bicycle network that will capture the benefits that bicycling can bring to Austin. The short-term network was strategically cost optimized to deliver the highest public value for the investment.

The planning recommendations for the creation of a bicycle network suitable for people on bicycles of all ages and abilities are thus twofold:

1. **Short-Term, All Ages and Abilities Network Recommendations:** Analysis was conducted to develop an all ages and abilities network that could be achieved in the short term, defined as the next five years, within the context of existing traffic volumes, on-street parking demands and construction/feasibility.
2. **Complete Bicycle Facility Recommendations:** Recommendations for all streets in the plan not filtered by near term feasibility and may take many decades to realize. Recommendations are based on speed, volume criteria and other contextual factors.

Additional sections address other important aspects of creating a complete bicycle network. These include addressing barriers in the existing bicycle lane network, removing on-street parking in bicycle lanes, and how to handle the unique opportunities presented by TxDOT-managed roadways.

Planning for a Short-Term All Ages and Abilities Network

As cities throughout the United States and abroad work toward all ages and abilities networks, differences between opportunities and constraints will determine the best approach to create these networks. The following examples illustrate differences between approaches in several U.S. cities.

- Portland, Oregon has been able to implement a robust and high-quality network of bicycle boulevards due to redundancies in their largely complete street grid network. This network has been a significant factor in achieving the highest bicycle mode share of a large city.
- Davis, California has integrated off-street trail into their developments since the 1970s and as a result has created a robust network of off-street facilities. Bicycle mode share in Davis is one of the highest of any city in the U.S.
- New York City, New York is retrofitting wide, one-way avenues to have protected bicycle lanes without affecting and often improving motor vehicle level of service and safety. The transformations of NYC's major streets have resulted in incredible increases in bicycle use in the last five years.

Because Austin does not have the same opportunities as the example cities listed above, the approach here will have to be different. Austin will have to create a low-stress network using a combination of protected bicycle lanes, urban trails, and quiet streets where opportunities exist. The following section gives more details about Austin's approach in using each of the following bicycle facility types to form a cohesive all ages and abilities network.

Opportunities to Create a Short Term All Ages and Abilities Network

<u>Protected Bicycle Lanes</u>

In Austin, some streets will be able to be converted to protected bicycle lanes within existing curb lines or in the right of way without major reconstruction in the short-term. In the long-term, protected bicycle lanes could be created with large capital projects or by upgrading existing bicycle lanes as private development occurs. The following are strategies to use this tool in Austin to create a low stress network:

- Provide protected bicycle lanes where current street space allows on streets that meet speed and volume criteria and other contextual factors.
- Use protected bicycle lanes to connect urban trails and bicycle boulevards to form a cohesive all ages and abilities bicycle network. Where these connections are not possible due to constraints, the connection should be made with bicycle lanes or other appropriate facilities so the network remains cohesive.
- Leverage private development and capital projects to implement recommended protected bicycle lanes.

Caption: The Pedernales protected bicycle lane connects the Boggy Creek Trail to the Butler Trail (Rendering courtesy of McCann Adams Studio).

Urban Trails

Austin has a number of opportunities for urban trails, though potential corridors are often fragmented and do not follow travel desire lines. One of the most significant urban trail assets is the Butler trail system around Lady Bird Lake that is an ideal central hub for the all ages and abilities network. There are also a number of spoke trails off this backbone that connect to adjacent neighborhoods, though in some cases private property limits their reach. Outside of the existing hub and spoke system there are some additional potential corridors for urban trails, though many of these opportunities are limited and will need on-street connections to create a network. Opportunities and existing assets include the Mueller Trail system, Boggy Creek Trail, utility/rail corridors and TxDOT ROWs along controlled access highways.

An Urban Trail Master Plan is being created in parallel with the 2014 Bicycle Master Plan Update. The Urban Trails Master Plan will include recommendations for a comprehensive network of urban trails and

develop prioritization for potential trails. This plan looks at urban trails as a tool to supplement on-street connections. Potential urban trails are acknowledged in the long-term recommendations in this plan. The prioritized short-term recommendations in this plan include urban trails that are an integral part of the all ages and abilities bicycle network.

The following are strategies to use urban trails in Austin to create an all ages and abilities network:

- Find opportunities to extend the existing Butler Trail system, extending routes up Shoal Creek, Waller Creek, Johnson Creek, Robert E. Lee/Bluebonnet and other corridor opportunities.

Caption: The Boardwalk Trail completed in 2014 and pictured on opening day, completes the Butler Trail loop and provides bicycle access to East Riverside area.

- Build urban trails to bridge significant gaps in the on-street bicycle network.
- Connect urban trails using protected bicycle lanes and bicycle boulevards to create a cohesive low-stress network.
- Improve cohesion of on-street and off-street networks by making transitions between on-street and off-street urban trails seamless. This includes design that brings urban trails to intersect directly with streets and makes street crossings safe; provides trail-head treatments that are highly visible, consistent, easily recognizable; and includes wayfinding signage along the urban trails.
- Design trails with transportation cyclists in mind as recommended in the Urban Trails Master Plan. This includes providing hard, smooth surfaces and separate trails for pedestrians and wheeled users (bicyclists, rollerbladers, skateboarders, mobility impaired, etc.) where space allows. This will create a safer and more accessible trail system for all users.

Quiet Streets

Much of Austin lacks the comprehensive grid street network that creates ideal conditions for quiet streets, also known also as bicycle boulevards or neighborhood greenways among bicycle planning professionals. In Austin, based on predominately suburban era development patterns, collector streets are often the lowest street classification that has significant connectivity. These streets are not appropriate for volume diversion due to their importance to the motor vehicle network. Given Austin's street typology, the use of quiet streets will largely be limited to making connections between other low-

stress facility types on streets that are not critical to the motor vehicle network. Often times, these quiet street routes are obstructed by major street crossings and physical barriers such as creeks. These barriers will have to be overcome for quiet streets to provide useful connections to the all ages and abilities network. The following are strategies to use this tool in Austin:

- Evaluate opportunities for quiet streets where there is a street grid that offers redundancy and best practice speed and volume performance targets can be achieved.
- Use quiet streets to provide connections to urban trails and protected bicycle lanes to form an all ages and abilities network.
- Connect quiet streets across barriers to create contiguous routes.

The City of Austin Watershed Protection Department is always searching for opportunities to reduce impervious cover and add green infrastructure, while increasing comfort and safety for pedestrians and bicyclists. This is an excellent opportunity to combine multi-department City objectives to save money and deliver higher value to the public.

The Traffic Calming Program will work closely with the Bicycle Program regarding the application of traffic calming devices on bicycle routes in this Plan to ensure that goals of the bicycle plan are being met.

Intersection Treatments

Intersection treatments should be used to cross barriers created by busy streets to bring the previous three facility types into a network.

Focus Areas for Short-term All Ages and Abilities Network

One of the most important shifts in focus for this update is to provide a safe bicycle network where short trips can be shifted from motor vehicle to bicycle trips, as discussed previously. The following locations in the City are those that have the highest potential for short trips and where this plan recommends the strategic implementation of all ages and abilities bicycle facilities

Central City

The central city has the highest concentration of short trips because there are high density, mixed-use properties that are in close proximity to the region's primary employment center. The short trips in the central city present the most significant opportunity to reduce drive alone trips by substituting them with bicycle trips. As regional traffic issues are concentrated in the central city, the conversion trips to bicycle in this area represent a significant opportunity to address regional congestion while offering mode choice to those interested in traveling by bicycle.

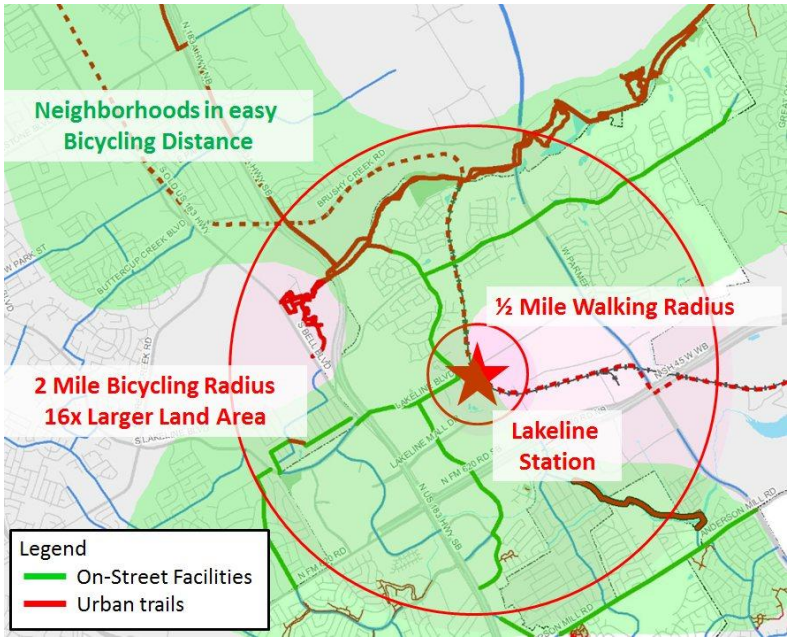
Major Transit Stations and Transit Oriented Development Areas

Generally, longer trips originating from outlying areas are less likely to attract a significant number of people riding bicycles. So the prioritization of an all ages and abilities bicycle network in these areas can divert resources from areas that would have more impact. An exception to this rule is in areas around major transit stations that provide an opportunity to link a transit trip with a bicycle trip to cover greater distances and increase the flexibility of transit. If all ages and abilities bicycle facilities are provided, radiating from major transit stations to nearby destinations, bicycle trips less than 5 miles to and from the station are reasonable and have the potential to significantly increase transit ridership and

decrease parking requirements around stations.

A perfect example of this is neighborhoods near Capital Metro Red Line stations that are within convenient bicycling distance of the stations. Currently these neighborhoods do not have all ages and abilities bicycle facilities connecting to the stations, but once they do, people could take a short bicycle trip to the station where they can take a high-speed transit to the downtown employment center. Combining transit and bicycle trips makes it possible for those who have even relatively long trips or commutes to benefit from an active bicycle commute linked with a high quality transit experience free from the stresses of driving in traffic.

Proposed All Ages and Abilities Network Feeding the Lakeline Station



Source: City of Austin

The map looks at the proposed all ages and abilities bicycle network to get people to the Capital Metro Red Line Lakeline Station. Compared to the typical half-mile walking radius, a 2-mile bicycling radius reaches a 16 times greater land area.

The City of Austin, Capital Metro and other regional partners have developed a regional high capacity transit framework called Project Connect. This transit framework plans for many significant transit stations in outlying areas and is an excellent opportunity to significantly increase the market for transit and convert drive alone trips to transit/bicycle trips, generating regional traffic improvements.

<u>Bike Share Operating Area</u>

Bike Share systems also play a significant role in extending the reach and viability of transit trips. Access to first and last mile connections or flexible transfers between transit lines can be made without requiring a private bicycle. Providing an all ages and abilities network within the operating area of bike share will significantly expand the number of people comfortable using the system. Austin's bicycle share system is currently located in the downtown area and for the foreseeable future will be contained within central Austin. Areas where bike share system is expanded should be analyzed for the potential for all ages and abilities bicycle facilities and become a focus area of the short-term bicycle network.

Imagine Austin Centers and Corridors

Another focus area for the all ages and abilities bicycle network is in and around Imagine Austin Centers. The Imagine Austin plan designated regional centers, town centers, neighborhood centers, activity corridors and activity centers as places where there is a desire to create a dense mix of uses to encourage walkable, bikeable, and transit friendly areas. There is a potential for a significant concentration of short trips around these centers. These centers are a focus area of the all ages and abilities bicycle network, both within the center and providing connections to surrounding areas. By providing safe bicycle connections to and through the centers, trips by bicycle will help to support the creation and viability of centers as envisioned in Imagine Austin.

Key Feeder Routes to Central City

While the most significant opportunity to catch short trips is in the 0-3 mile range, there is also potential to catch slightly longer trips in the 3-9 mile range. Input received during the planning process supports connecting outlying areas to the central city with protected bicycle facilities. The all ages and abilities bicycle network includes routes in all directions from the center of the city

- Northwest: Shoal Creek / HW 183
- North: North Lamar
- Northeast:
    - Berkman / Cameron
    - 290 Toll
    - Southern Walnut Creek and Austin to Manor Trail
- East: FM 969
- Southeast:
    - Bergstrom Expressway / HW71
    - Pleasant Valley
- South: South Congress
- Southwest: South MoPac, Violet Crown, and YBC
- West: HW 360 and connections to core

Access to Schools

Focusing all ages and abilities bicycle facilities around schools provides an opportunity to encourage bicycling to school and physical activity for students.

One of the significant barriers to bicycling to school is traffic generated by the high volume of families that drive their children to school. The challenge is that traffic is heaviest immediately surrounding the school making these locations the most important to have all ages and abilities bicycle and walking infrastructure. The traffic volumes and driving habits create a vicious cycle that causes more and more families to feel uncomfortable letting their kids walk or bicycle to school.

Caption: Protected bicycle lanes on Bluebonnet Lane, serving Zilker Elementary

One way to reverse this cycle is to provide safe places to walk and bicycle to school. Safe routes to school have been a focus for many years including receiving federal funding to build sidewalks. Unfortunately sidewalks often do not result in safe and comfortable places to ride to school due to inadequate sight distance for bicyclists and crowding near schools. In the last two years the City of Austin has been approached by principals at several schools to help provide protected bicycle facilities to the front door of the school. Protected bicycle lanes on Bluebonnet Lane installed in 2012 resulted in an increase from single digit to 40 children riding to Zilker Elementary after only one year. Another new protected bicycle lane and bridge serving Hart Elementary, in coordination with a kids earn a bicycle program resulted in an increase from nearly zero to over 80 children riding to school after only one month. Protected bicycle lanes to several other schools are currently planned and will be implemented over the next year and are an exciting opportunity to get more children and their parents riding.

The Plan does not include detailed recommendations for all ages and abilities bicycle facilities to schools. Recommendations are instead handled on a broad policy level, due to the complex management of pick-up and drop-off operations, governed by both the school administration and Campus Advisory Groups. Streets surrounding schools have the added complication of having high traffic volumes during pick-up and drop-off times only, likely less than an hour a day for the 180 school days a year. Justifying a bicycle facility on such a limited basis will have to be a community conversation that best balances getting kids safely to school in an active and healthy way as well as other community needs such as on-street parking.

This plan recommends working with stakeholders from schools and the surrounding community to assess the feasibility of all ages and abilities facilities to provide students with safe access to campus. This includes the potential for new bicycle facilities, changes to existing on-street parking, and operational changes, such as conversion to one-way streets. All streets around a particular school should be holistically addressed including streets that are not specifically named in the Plan due to the fact that the plan typically only makes explicit bicycle facility recommendations on streets that serve citywide commuter routes. The bicycle facilities implemented should ideally be protected bicycle facilities, separate from both motor vehicle and pedestrian traffic. To provide the highest level of service possible, the bicycle facility should continue directly to the bicycle parking which should be located as close as possible to the main entrances to the schools.

Access to Parks

All Ages and Abilities bicycle facilities to and through parks provide a great way for people to both access and experience these special public spaces. Often times the primary form of access to an within parks is by motor vehicle which degrades park lands both by requiring large areas for the movement and storage of these vehicles and by the nuisance of noise created. Safe protected bicycle facilities allow people to experience our parks in a much less invasive way, preserving more of park land for its intended purpose. High quality non-motorized connectivity, in the forms of protected bicycle lanes and urban trails, serves not only people on bicycles but people of all ages on razor scooters, roller blades, roller skates, skate boards and wheelchairs. Because these facilities serve such a wide audience and can access areas where motor vehicle access is undesired or infeasible, they have the potential to activate areas deep within parks that are currently underutilized, bring our parks to life.

Neighborhood Feeder Routes and Destinations

In some neighborhoods improved bicycle facilities may be necessary to provide safe access from neighborhood areas to the all ages and abilities bicycle network or other local destinations. Improved bicycle facilities and traffic calming techniques should be evaluated in partnership with local residents or neighborhood association to remove barriers to bicycle travel even if the streets is not designated as part of the city-wide bicycle network.

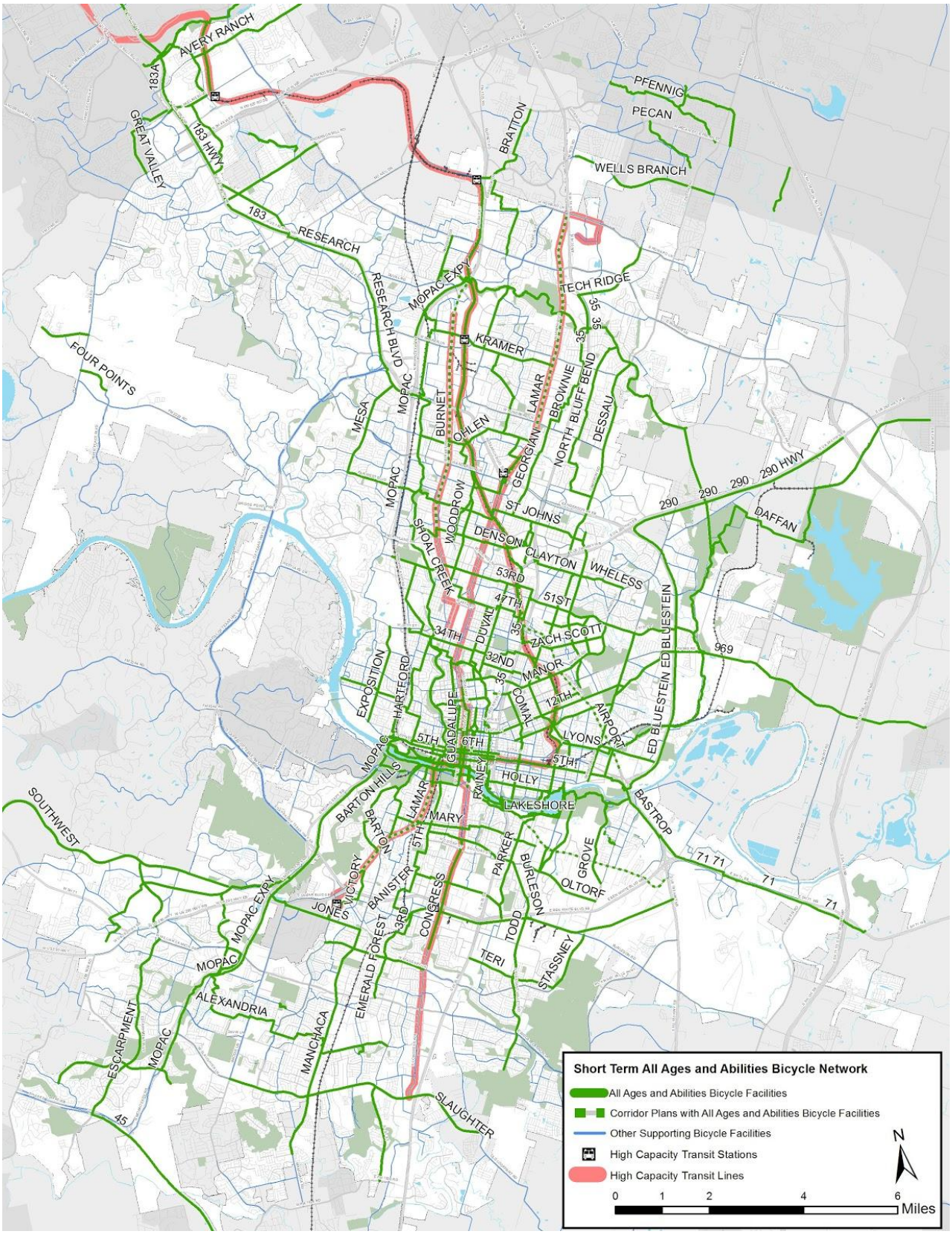
All Ages and Abilities Bicycle Network Recommendations

The all ages and abilities bicycle network is a set of facility recommendations developed to deliver the highest cost/benefit on the investment. The network would result in a significant increase in bicycle use and help the City meet its goals as set out in the Imagine Austin Plan. The recommendations are such that they would be feasible to be implemented in a short time frame, the next five years, if the investment was funded. Near-term feasibility accounted for existing parking demand and traffic volumes, and the ability to implement without costly street reconstructions. Most of these facility recommendations would be achieved by optimizing the existing street space to improve conditions for bicycling while still meeting the other needs of the street.

The following maps show the recommended all ages and abilities bicycle network.

NOTES ABOUT THE PLACEHOLDER MAPS FOR THE SHORT TERM ALL AGES AND ABILITIES BICYCLE NETWORK SHOWN ON THE FOLLOWING PAGES: Upon Council adoption, the map placeholders on the following pages will be created for the final print version of this document from the data shown in the map included in “Appendix A: Short Term All Ages and Abilities Bicycle Network”. Appendix A will also be replaced with a table of streets and trails by from and to limits recommended in the short-term all ages and abilities bicycle network including the recommended bicycle facility.

Citywide All Ages and Abilities Bicycle Network



North Austin All Ages and Abilities Bicycle Network

DRAFT PLACEHOLDER - Detailed map to be included in final print document. Map data is included on map in Appendix A: Short Term All Ages and Abilities Bicycle Network.

South Austin All Ages and Abilities Bicycle Network

DRAFT PLACEHOLDER - Detailed map to be included in final print document. Map data is included on map in Appendix A: Short Term All Ages and Abilities Bicycle Network.

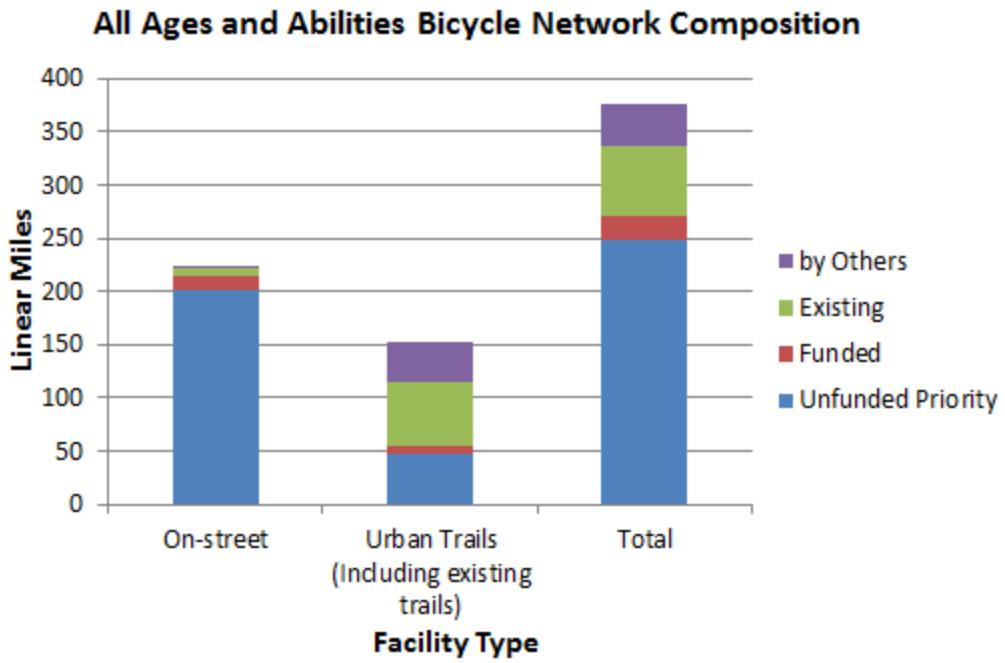
Cost of the All Ages and Abilities Bicycle Network

The planning level cost estimate for the all ages and abilities bicycle network is $151 million, and leverages many existing and already funded bicycle facilities. The cost of priority unfunded investments include 200 new miles of on-street facilities for $58 million, at an average cost of $290,000 per mile. The cost per mile for on-street facilities varies greatly upon the type of treatment. The estimate also includes 47 new miles of Urban Trails at $93 million at an average cost of $2 million per mile. As funding for portions of the network become available, an implementation plan would be developed, detailing the most strategic facility investments that would be pursued at that time.

It is important to note that the Tier 1 trails recommended in the Urban Trails Master Plan, adopted by City Council in September of 2014, are identical to the recommended urban trails in the Bicycle Plan's all ages and abilities bicycle network. Costs for these Tier 1 trails are included in the Bicycle Plan as

these urban trails are critical links in the bicycle network, and without them the all ages and abilities bicycle network would be fragmented. In terms of cost of the all ages and abilities bicycle network, urban trails account for the majority of the cost at $93 million of the total $151 million. The network planning and cost-benefit analysis assumes that the investment in the on-street and off-street (urban trail) networks are made in parallel to create one seamless all ages and abilities bicycle network.

All Ages and Abilities Bicycle Network Composition



Source: City of Austin

The chart shows the composition of the 370 total miles of facilities that make up the all ages and abilities bicycle network. On-street facilities account for 220 miles of the network and off-street facilities, largely urban trails and existing unpaved trails, account for 150 miles. The chart shows the composition of the complete network including priority investments, existing facilities, and those already funded by the City of Austin or partner agencies. The sections below will look at the community wide benefits we can expect from this investment through increased bicycle and decreased motor vehicle use.

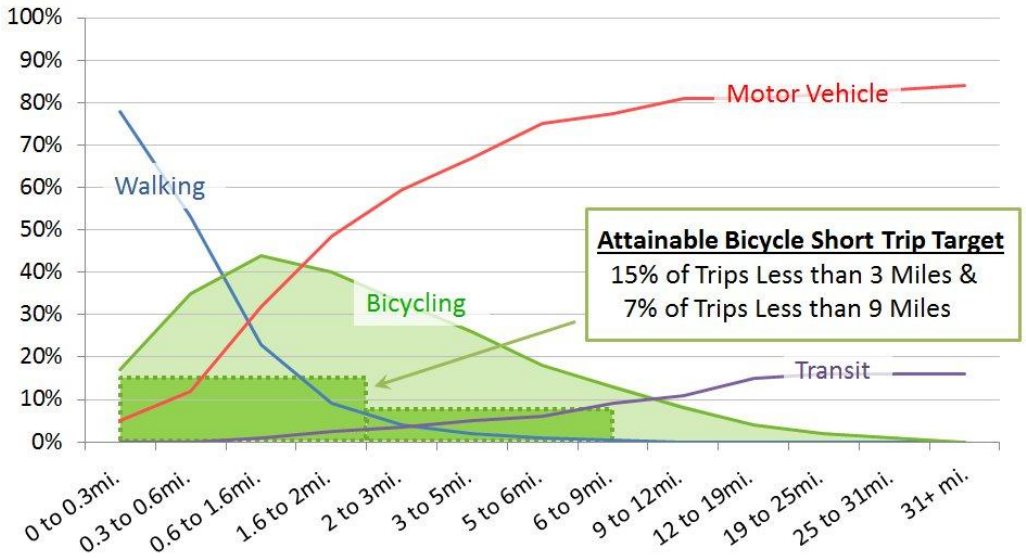
Quantifying Increase in Bicycle Use

The first step in quantifying benefits of bicycling to the City and region is to estimate the increase in bicycle use. This plan update represents a significant step forward in our abilities to quantity both the magnitude and areas where this behavior change is likely to occur. As discussed in the best practices section, existing short trips are the most likely candidates to be converted to bicycle trips and network investments should be targeted in these areas.

This plan update sets the following attainable short trips capture targets for areas where existing travel demand is served by the all-ages and abilities network investment. The following estimated reduction in number of motor vehicle trips and miles are based on the full build-out of the all ages and abilities

bicycle network.

Austin's Bicycle Short Trip Capture Targets Compared with Dutch National Trends



Source: City of Austin and Nationwide Dutch travel data 2005, RWS/AVV/MON

Bicycle Short Trip Capture Targets by Length of Trip

Trip Type	Bicycle Trip Capture Targets by Length of Trip	
Bicycle Only Trips		
Trip distance	0-3 Miles	3-9 Miles
Bicycle trip capture target	15% of All Trips	7% of All Trips
Bicycle and Transit Combo Trips		
Trip distance to station	0-2 Miles	2-5 Miles
Bicycle + transit trip capture target	15% of All Trips	7% of All Trips

Source: City of Austin

The bicycle trip capture targets were then applied to the Metropolitan Planning Organization's origin and destination matrix used for the air quality model. The origin and destination data describes the mobility demand from 1,400 traffic analysis zones to each of the other 1,400 traffic analysis zones by the number of trips between each zone. With this data travel demand that is served by the all ages and abilities network can be determined. Where this demand is served by the network, the trip capture targets are applied to calculate the resulting increase in bicycle trips and corollary reduction in motor vehicle trips.

The trip capture targets are well below known possible limits obtained from Dutch national data shown in the graph above. The trip capture targets for Austin's urbanized area were set at approximately one-third of the level of bicycle use found across the entire Dutch nation including both their urban and non-urban areas. The origin and destination travel data used for Austin is from 2010. Future increased infill in the central Austin and around transit stations should result in the availability of more short trips. Additionally, the move to more mixed use development patterns should also result in shorter trip length patterns.

Cost/Benefits of Short Term Network

One of the significant advances of this plan is the application of trip capture targets for the purposes of quantifying the benefits of the full build-out of the recommended all ages and abilities bicycle network investment to the City of Austin. The proceeding section describes the methods used to forecast increased bicycle use, and the corollary reduction in motor vehicle use. The estimated changes in mode from motor vehicle to bicycle were then applied to estimate the benefits of other measurable outcomes.

As demonstrated below, the recommended all ages and abilities bicycle network investment should be considered an investment of regional reach and scale as the benefits are on the order of magnitude of other regional investments being made to address the issues, and directly forward the goals of Imagine Austin.

Benefit to Congestion and Mobility

A significant portion of our regional congestion is caused by local trips on our region's roadways. These trips are concentrated in the central city, to get into the central business district, the Capital Complex, and University of Texas campus. The boundary for this area has been locally termed the "ring of congestion" as the roadway network has a limited ability to allow additional motor vehicle access during peak periods.

Caption: Austin's "Ring of Congestion" - The Central Business District, Capital Complex, and University Area.

A recent and nationally published study of the notoriously congested I-35 corridor by the Texas Transportation Institute found that of all possible improvements to the corridor, including widening and tolling, the only solution that would significantly improve operations along the corridor included a necessary 40% reduction in local traffic demand. The study suggests that teleworking, transit, bicycling, and walking are all strategies to meet this target reduction.

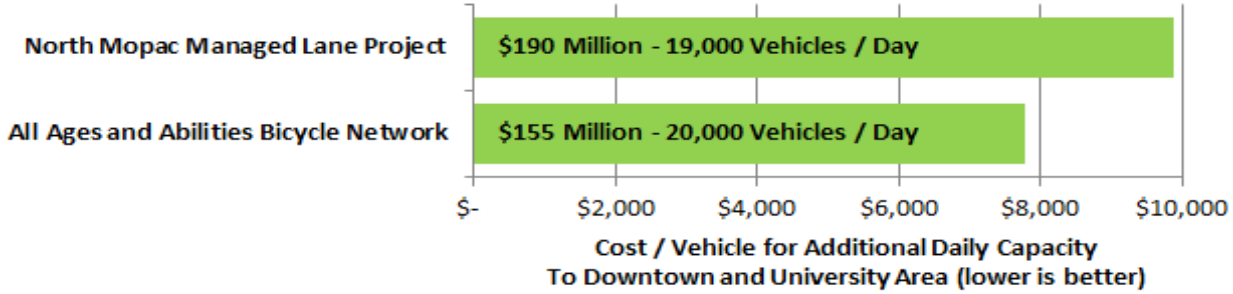
The following are highlights of the benefits of the network investment to congestion and mobility:

- **Reduced car trips to downtown.** This investment is anticipated to convert 7 percent of the 300,000 daily passenger vehicle trips to the central business district and university area in Austin to bicycle trips.
- **Reduced city-wide motor vehicle trips.** Citywide, a reduction of 170,000 daily driving trips,

equating to 460,000 daily miles traveled is projected if the all ages and abilities bicycle network is constructed.

- **Regional mobility and congestion management.** The 20,000 additional bicycle trips to central Austin as a result of the $151 million all ages and abilities bicycle network results in the same increased motor vehicle capacity as the MoPac Improvement Project, a $190 million 11-mile urban freeway project adding a single managed lane in each direction. This demonstrates that the investment in the all ages and abilities bicycle network is on par with other large mobility projects in managing regional congestion.

Comparison of Regional Mobility Projects



Source: City of Austin

Boost Affordability

By offering people a viable low-cost transportation option, the bicycle network can help families significantly cut the household expense of owning and operating a vehicle. Due to decreased vehicle miles traveled, individuals can save $170 million in direct driving costs annually.

Public Health Benefits

Increasing the percentage of travelers who regularly bicycle for transportation directly correlates to improved public health. The increased physical activity associated with shifting short trips to bicycle trips would equate to 130,000 people or 15 percent of Austinites meeting their daily minimum physical activity. Savings from avoidance of disease associated with sedentary lifestyle per person is estimated at $128 per person, for a total benefit of $16.6 million per year.

Environmental Benefits

By reducing vehicle trips, bicycling reduces the pollution from motor vehicles. This, in turn, reduces the costs to mitigate environmental damage and public health impacts from air pollution that vehicles create. For example, the estimated reduction in miles traveled would result in a reduction of 84,000 metric tons of carbon per year, the equivalent of the carbon generated by the driving habits of Austinites over 11 days.

Barrier Removal

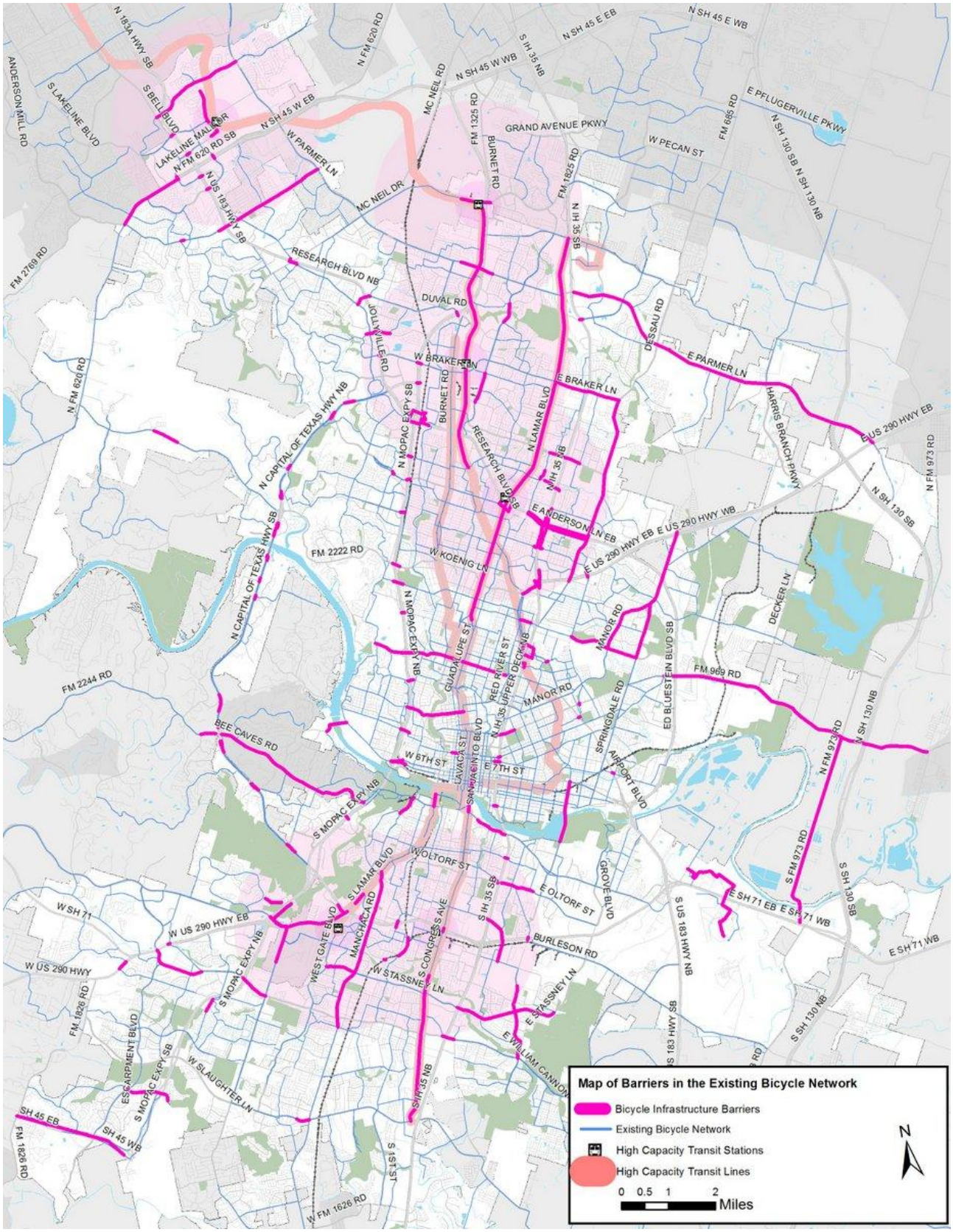
Another strategic focus to complement the all ages and abilities network is to plan for and prioritize the

removal of barriers in the supporting bicycle network largely composed of bicycle lanes. Barriers exist where bicycle lanes end or geographic barriers prevent connectivity. If possible, resolving a barrier with an all ages and abilities facility is ideal though there is still significant value to providing the connection with only striped bicycle lanes where this is not possible. Removing these barriers will provide a spectrum of options for people on bikes, providing both an all ages and abilities network backbone for those "interested but concerned" and a more pervasive accessibility for those that are "enthused and confident" (for more information on the 4 types of cyclists see Ch. 2 section Attracting the 'Interested but Concerned' Bicyclist and Protected Bicycle Lanes).

Barriers include gaps in the bicycle lane network, controlled access highways with few crossing streets, low angle railroad track crossings, and intersections without guidance for people on bikes. The 2009 plan identified 101 gaps in the bicycle network and many of these have now been or are in the process of being resolved. Bicycle program staff has completed a comprehensive survey of barriers to bicycling as our network has changed significantly over the last 5 years. This plan identifies 95 barriers that are recommended as a high priority to be resolved. The following map shows these barriers along with the location of existing facilities.

Roughly 70 percent of these barriers will be resolved through minor re-striping or construction work at an estimated cost of $10 million. The other 30 percent of the barriers will need further study and likely capital work to resolve. Costs and potential solutions for addressing the barriers were performed by the City's Bicycle Program staff and will be used to create future project packages for funding opportunities. Implementation phasing of this list will depend on opportunity, such as street resurfacing, public interest, or acute need. Addressing the barriers throughout the city is one of the highest infrastructure actions of the Plan.

Top Physical Barriers in the Existing Bicycle Network



Parking and Bicycle Lanes

A roadway's primary functions are to provide for the mobility and to serve as great public places, storing stationary vehicles is tertiary. While on-street parking is an often desired and useful component on urban roadways, it can be dangerous to bicyclists. When an on-street vehicle parks in a bicycle lane, it creates a dangerous situation requiring people on bicycles to merge into a traffic lane to get around the vehicle. Therefore parking should not be permitted in bicycle lanes.

The Transportation Department will evaluate existing and proposed bike lanes, to determine, with stakeholder input, if parking or bicycle facilities has greatest priority. To the extent possible, the evaluation of parking in bicycle lanes should be considered on a corridor basis and not block-by-block.

Since the 2009 Plan, 27 miles of parking within bicycle lanes has been addressed. Currently 27 miles, or 13 percent, of existing bicycle lanes with unrestricted motor-vehicle parking remain, compared to 54 miles, or 35 percent, in 2009. In the next five years, it is expect the work to remove parking from bicycle lanes will be substantially complete.

In 2008, the City of Austin Bicycle Program established guidelines to address removing parking from within bicycle lanes. This document, *On-Street Parking Modification Guidelines*, discusses research, the evaluation of and process for modifying on-street parking resulting in several possible outcomes. Since 2008, this process has been used successfully on 39 miles of projects of new and existing bicycle lanes. The On-Street Parking Modification Guidelines are kept within the City of Austin Bicycle Program.

Bicycle Lanes and Diagonal Parking

Vehicular movement in and out of head-in diagonal parking presents a danger to bicyclists and therefore bicycle lanes are not advisable where this condition exists. Where diagonal parking is necessary, back-in angle parking should be used. This requires motorists to pull in front of a parking space and reverse into it, as is done with parallel parking. Back-in angle parking provides motorists clear visibility behind them where a person on a bicycle might be approaching before crossing the bicycle lane. It also improves the motorists' visibility of oncoming bicycle and motor traffic when exiting the parking space.

City of Austin Recommendations for TxDOT Roadways

Texas Department of Transportation (TxDOT) roadways play a critical role in the bicycle network as they are often high speed and volume roadways that are barriers to people on bikes. TxDOT roadways include, highways, urban arterials, and controlled access freeways with limited crossings. For the purposes of this document, they will all be referred to as TxDOT roadways whether they are operated by TxDOT or by others, such as the Central Texas Regional Mobility Authority (CTRMA). One of the fundamental goals of this Plan is to implement bicycle facilities that are accessible to people on bicycles of all ages and abilities. For Austin's bicycle network to be whole this approach will have to be extended to TxDOT roadways and crossings as there are many destinations and mobility demands both along and across the TxDOT corridors. Many TxDOT owned and operated roadways within this plan are within the City of Austin extraterritorial jurisdiction.

Recommendations for TxDOT roadways will require special consideration.

- TxDOT roadways are often relatively high speed environments and necessitate physical

separation from motor vehicle traffic. Travel speeds on frontage roads, highways, and suburban arterials are often in the 45-60 mph range, making even confident cyclists very uncomfortable to be in an on-street unprotected environment. Along with the high speeds are heavy traffic volumes that also suggest that a protected environment is best.

- Controlled access freeways allow only limited crossings. This results in each crossing potentially spaced at a half-mile to 2 miles apart, critical to being a safe all ages and abilities network so people on bicycles have a seamless experience crossing the TxDOT roadway. The other effect of limited access combined with one-way frontage roads is the potential to generate significant route delay if two-way facilities are not provided on each side of the street.

Special Considerations for TxDOT Roadways

Recommendations in this plan on TxDOT roadways warrant special consideration. While many of these roadways are within the City of Austin or the extraterritorial jurisdiction and in the jurisdiction of this plan, the roadways are owned and operated by TxDOT or partner agencies. It is important to clearly state how this plan affects the planning, scope and delivery of TxDOT projects.

The intentions of the recommendations in this plan are as follows:

- To document best practice in accommodating people on bicycles of all ages and abilities on Austin's roadway network, including TxDOT roadways.
- For the recommendations to be a resource during the development of projects along TxDOT roadways while not mandating a particular outcome.
- The Plan acknowledges that TxDOT and City of Austin have different design standards, internal processes and public processes. This plan recommends working together to achieve the highest quality bicycle network to the extent practicable.
- The Plan acknowledges that each project on a TxDOT roadway will have different context, constraints, scopes, available funding, timeline and public process and recommends the City of Austin and TxDOT work together to achieve the highest quality bicycle facility on each project to the extent practicable.

Recommended Approach for 2014 Bicycle Plan

Over the last five years, there has been a significant evolution in thought related to providing bicycle accommodations among TxDOT staff, bicycle program staff and bicycle stakeholders groups. The most significant change has been an awareness that we have a responsibility to make our roadways accessible for all modes and people of all ages and abilities. This includes travel along, across, and to and from destinations along the corridor. In special cases, parallel facilities may be a solution where rights of way are constrained, and where nearby high-quality, parallel facilities exist. The subsequent question becomes what types of facilities can meet this goal on TxDOT roadways. Feedback over the last five years shows wide curb lanes are not a safe or comfortable accommodation on high-speed roadways even for experienced people on bicycles. Additionally, a much stronger collaborative relationship and strategic partnership between TxDOT and the City of Austin on a range of issues including regional mobility and improved pedestrian and bicycle accommodations now exists. This Plan represents a significant opportunity to find common ground with TxDOT as an agency partner to better align our approach to bicycle facilities, conforming to national best practice.

This Plan recommends four different approaches for bicycle facility types on TxDOT roadways, dependent on the context of the roadway. Streets with higher speeds and volumes should include

protected bicycle facilities. Shared-use paths recommendations appear in the Urban Trails Master Plan. This Plan recommends the following bicycle facilities along each TxDOT roadway type:

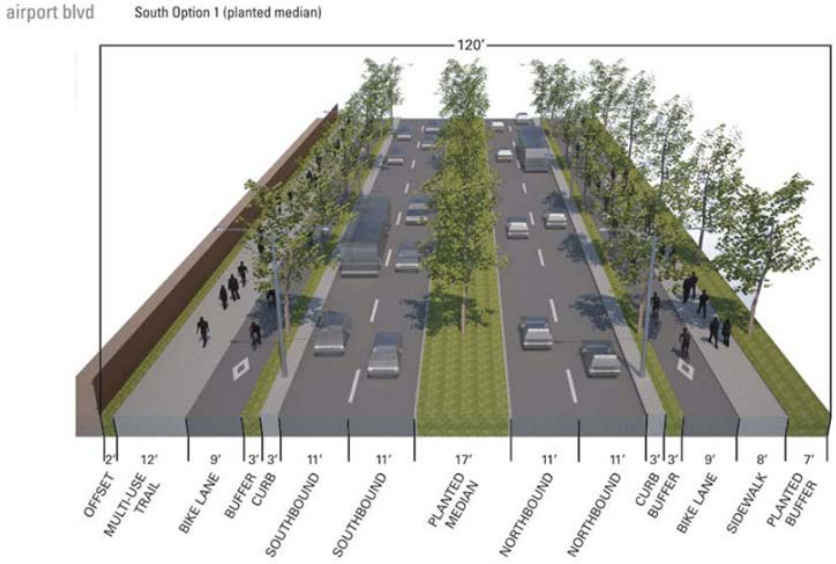
1. **Controlled Access Freeways and Frontage Roads with Limited Access:** As noted, because of the limited crossing opportunities, the one-way nature of frontage roads and main lanes, and the presence of destinations on both sides of the facility, it is important to provide two-way access to pedestrians and cyclists on both sides of the corridor due to their high sensitivity to longer trip distances. Due to high speeds and volumes of these roadways protected bicycle facilities are recommended. These roadways often have a low to medium density of driveways and intersections that reduce conflict points and improve the safety and operations of bidirectional off-street bicycle facilities. Pedestrian densities along these corridors are typically low to medium except for roadways in the central city, which result in acceptable operations along shared use paths where people walking and bicycling share the space. Along controlled access freeways with limited access this plan recommends two-way shared use paths along both sides of the roadway. When this is not possible, a sidewalk on one side can provide two-way local access to destinations on one side complimented by a high quality shared use path that provides a high level of service for travel along the corridor on the other side. The photo on the left shows a shared-use path along the 183 A toll road in Northwest Austin. Examples are shared use paths that are proposed in the scope of both the Bergstrom Expressway and 71 Expressway projects.

Caption: A shared use path along 183A Toll Road in northwest Austin

2. **Major Highways:** While highways are also high speed and high volume roadways that should have protected bicycle facilities, intersection and crossing opportunities are generally more closely spaced. These roadways often have moderate number of driveway, intersection, and pedestrian densities making protected off-street bicycle facilities preferable to on-street protected facilities. Since these roadways offer more frequent crossing opportunities this plan recommends two-way shared use path along one side of the roadway and either a sidewalk or shared use path on the other side of the roadway to provide local access to destinations. The photo on the right shows a shared use path along a multilane highway. Examples are recommended for shared use paths in the plan along FM 969 and Parmer Lane.

Caption: *A shared use path along the undivided highway 89 in Grand Teton Park (Photo courtesy of U.S. DOT).*

3. **Urban Arterials and Frontage Roads Without Limited Access:** The Plan recommends almost all city arterials have protected bicycle lanes in urban areas. These high speed and volume roadways warrant physical protection but have moderate to high numbers of driveways, intersections, and pedestrian levels that increase complexity and risk of an off-street bidirectional shared use path. The Plan recommends providing one-way protected bicycle lanes on each side of the street, in addition to adjacent sidewalks. This recommendation also applies to frontage roads with a high number of driveways, intersections, or is expected to have substantial pedestrian volumes. Examples include the sections of the I-35 frontage road in the central city and Airport Boulevard, a TxDOT maintained urban arterial. The photo to the left shows proposed protected bicycle lanes in the City of Austin's Airport Boulevard Corridor Plan, currently a TxDOT roadway.



Caption: Recommended cross section of Airport Boulevard that includes protected bicycle lanes from the Airport Boulevard Corridor Plan.

4. **Minor / Rural Highways:** In outlying areas, there are a number of TxDOT roadways that have moderate to low speeds and volumes or have limited short trip travel demand. While it is important to provide bicycle accessibility on all roadways, in these cases a shoulder can be a

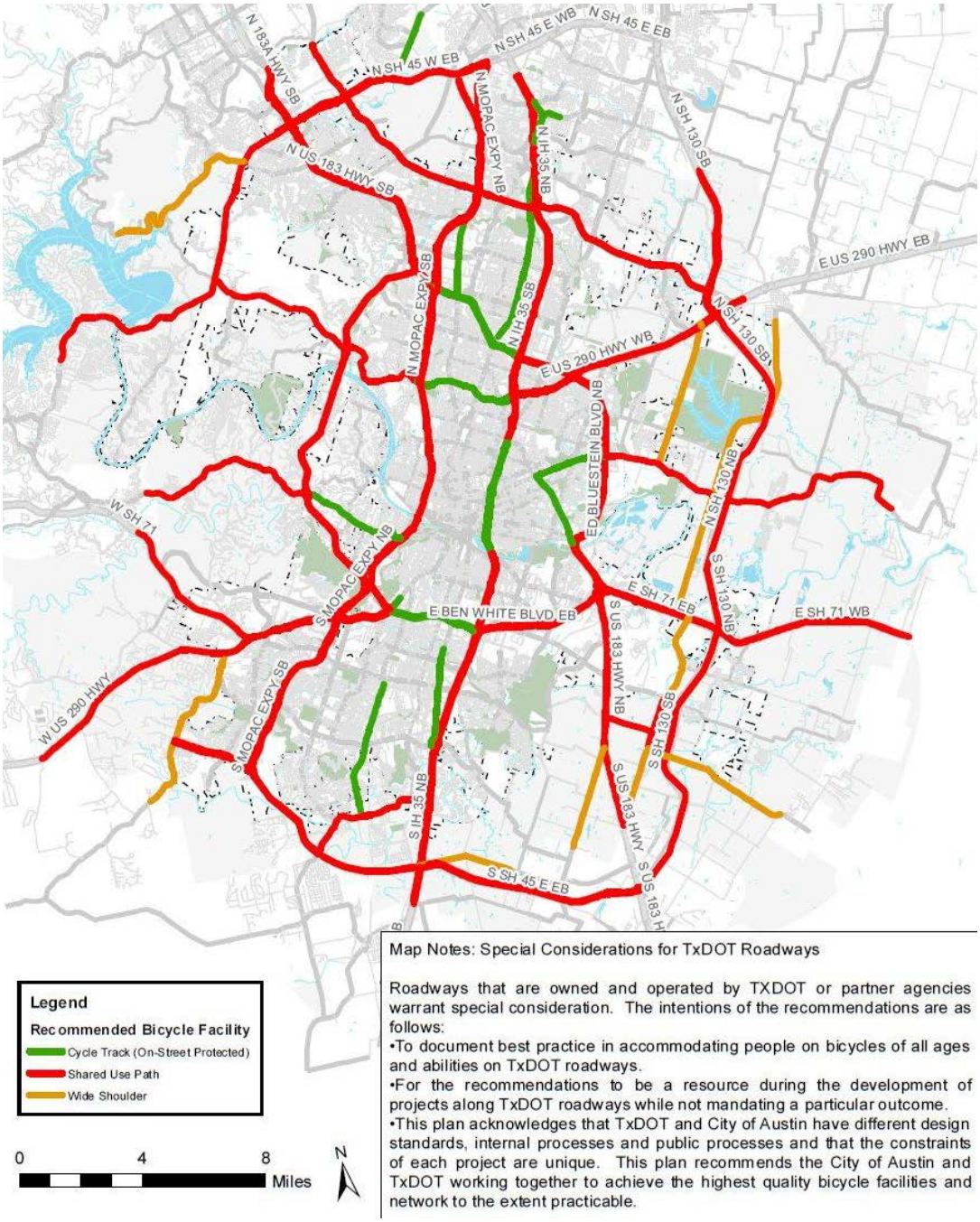
safe and comfortable bicycle facility. This Plan recommends providing bicycle lanes or shoulders of an adequate width based on the speed and volume of the roadway. At higher speeds and volumes minimum, AASHTO shoulder dimensions are not desired. The photo to the right shows a context in which a shoulder is an appropriate bicycle facility. FM 973 is an example of this type of roadway.

Caption: Bike tourists on Highway 90 in west Texas with a comfortably wide shoulder given low traffic volumes (Photo courtesy of Doug Williams).

Recommended Facilities on TxDOT Roadways

The following map shows the roadways where shared use paths (urban trails), protected bicycle lanes (protected), and bicycle lanes/shoulders are recommended.

City of Austin Bicycle Facility Recommendations for TxDOT Roadways

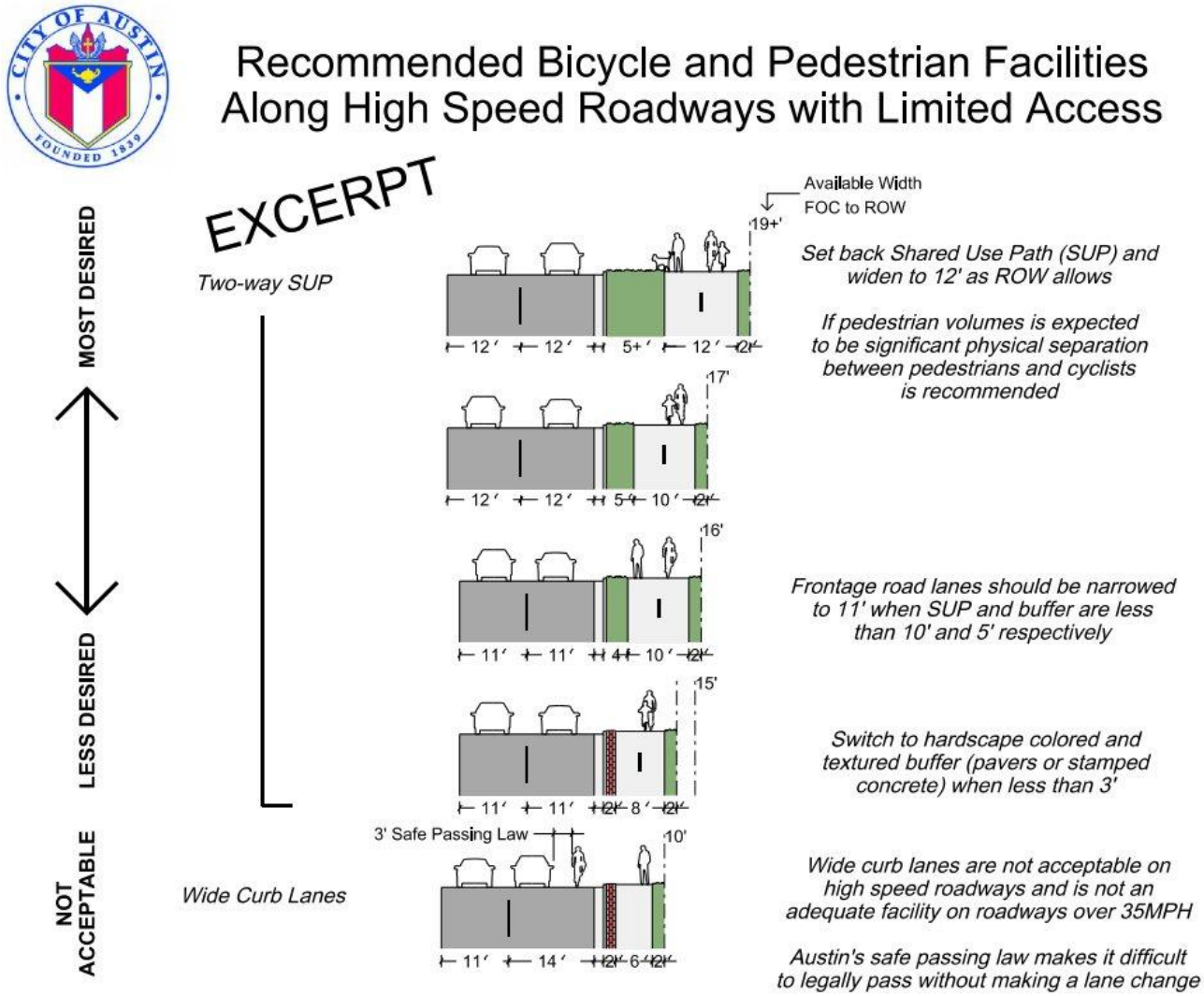


Design Flexibility

In August 2013, the Federal Highway Administration issued a memo in support of design flexibility for bicycle and pedestrian facilities. This memo offers the use of the *NACTO Urban Bikeway Design Guide* and the ITE *Designing Walkable Urban Thoroughfares: A Context Sensitive Approach.* This document provides options to further develop non-motorized transportation networks, particularly in urban areas. It also lays the groundwork for Austin to create tailored recommendations on how to best provide bicycle facilities on these types of roadways in a way that could be supported by City staff, TxDOT,

project consulting teams, bicycle community stakeholders and the Federal Highway Administration.

Stakeholders are working to develop recommendations for bicycle facilities along high speed roadways with limited access (excerpt from draft guidance shown below). The recommendations offer proposed shared-use path configurations at various widths representing varying rights of way constraints. It includes recommendations for two-way paths that are as narrow as 8 feet wide with a 2 feet colored and textured hard-scaped buffer to the roadway edge. The proposed buffer offers a compact means of providing separation from traffic, addressing maintenance concerns of narrow planted areas, and allowing a rideable and walkable surface in the event of passing movements. Narrower options are offered in less than 8 feet shared use path widths for the most constrained conditions that can certainly be defended as one way facilities. The intent of using design flexibility in developing these recommendations is to expand the toolbox for providing quality bicycle facilities in constrained conditions.



Caption: Excerpt from full guidance on Recommended Bicycle and Pedestrian Facilities along High Speed Roadways with Limited Access developed by the City of Austin in coordination with the TxDOT Austin District.

Austin's bicycle advisory council reviewed the attached guidance in their February 18, 2014 meeting

and passed the following resolution:

> "The Bicycle Advisory Council endorses the presented 'guidance for bicycle facility recommendations along high-speed roadways with limited access as vastly superior to a wide curb lanes with the following discussion points incorporated: including text for high pedestrian densities and when the path is below 8 feet consider the option of a bicycle lane."

This Plan recommends City staff, TxDOT, project consulting teams, bicycle community stakeholders, and the Federal Highway Administration continue developing flexible design approaches and a toolbox to better accommodate people on bicycles of all ages and abilities in constrained conditions.

TxDOT Barriers Analysis and TxDOT Austin District Bicycle Plan

There are two developments on which the City of Austin is working with TxDOT to improve bicycle access. City staff has developed a barriers list of TxDOT roadways categorized by implementation complexity and priority. This is a significant step forward as TxDOT and the City continue to develop a pipeline of projects to remove barriers on the bicycle network in Austin. Also, TxDOT is set to kick off a process to create an Austin district bicycle plan. The barriers analysis will serve as a foundation as the City works with TxDOT to complete this process.

Complete Bicycle Facility Network Recommendations

Bicycle facility recommendations include two layers: a set of recommendations to form an all ages and abilities bicycle network in the short term and a complete set of bicycle facility recommendations that would result in streets safe for people of all ages and abilities. Unlike the short-term recommendations, complete recommendations are not limited by near-term feasibility. To be realized, these recommendations will often require reconstruction of streets or private development support.

The complete set of recommendations were largely generated by the on-street bicycle facility criteria based on speed and volume of the roadway shown in chapter 2 section "On-Street Bicycle Facility Criteria". Other factors that influenced the recommendation include public input, specific amendments to the 2009 Plan that are a result of project delivery since its adoption, special approaches for bicycle facilities in TxDOT rights of way, and inclusion of streets in the short-term all ages and abilities bicycle network.

Recommendations reflect the current state of the practice in design of bicycle-friendly roadways and should be tested and refined over time. It is anticipated that this section of the plan will be revised, under the direction of the Bicycle Program, to reflect the continuing evolution of the national and international state of the practice. Selected design treatments will ultimately rely on good planning and engineering judgment with the goal of making bicycling safe and accessible for all citizens of Austin regardless of age and ability.

Because the existing network often provides only limited mobility for bicyclists and the complete streets policy goal is to accommodate people of all ages and abilities on all streets, the deletion of any roadway from the network should be done with the utmost care and only if alternative facilities can be provided. For this reason engineer-only approved "deviations" should not be allowed. Changes to the recommended network facilities should require input from the City Bicycle Program and ultimately be the responsibility of the City's Transportation Department Director. See Appendix G - Amendment Process.

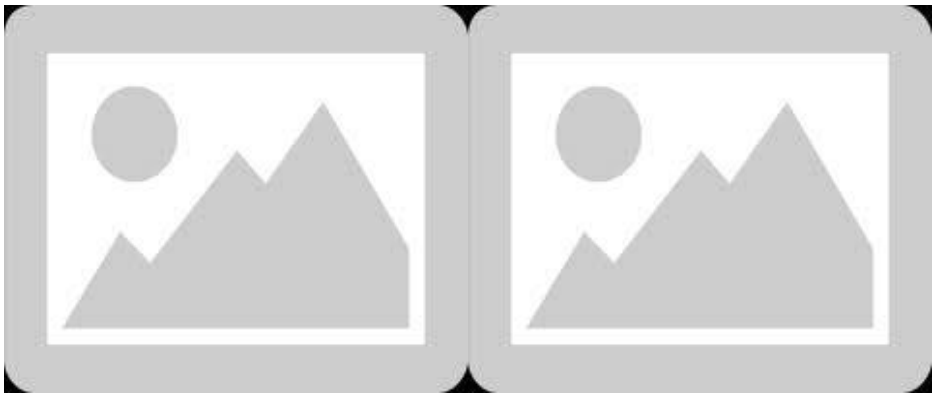
The full recommendations also encompass the recommendations for the short-term all ages and abilities bicycle network and are shown in the maps below. Bicycle facility recommendations listed by street name in Appendix B.

NOTES ABOUT THE PLACEHOLDER MAPS FOR THE COMPLETE BICYCLE FACILITY RECOMMENDATIONS SHOWN ON THE FOLLOWING PAGES: Upon Council adoption, the map placeholders on the following pages will be created for the final print version of this document from the data shown in the map included in “Appendix B: Complete Bicycle Facility Recommendations”. Appendix B will also be replaced with a table of streets and trails by from and to limits recommended in the complete bicycle facility recommendations including the recommended bicycle facility.

Map Index for Complete Bicycle Facility Recommendations

DRAFT PLACEHOLDER MAP INDEX - Detailed map to be included in final print document. Map data is included on map in Appendix B: Complete Bicycle Facility Recommendations. Index will show the division of the full city map divided into 16 pages (eight two-page spreads).

Sector Maps of Complete Bicycle Facility Recommendations



PLACEHOLDER FOR SECTOR MAPS - Detailed map to be included in final print document. Map data is included on map in Appendix B: Complete Bicycle Facility Recommendations. Sector maps will show the full city on divided into 16 pages (eight two-page spreads).

Operations and Maintenance Considerations for Protected Bicycle Lanes

Protected bicycle lanes have a number of complexities. Traditional painted bicycle lanes are effectively

part of the roadway and traditional approaches to maintenance and operations are generally unaffected by the addition of the painted stripe. Since protected bicycle lanes have an element of physical protection, maintenance and operations can be affected.

For the successful implementation of protected bicycle lanes, it is necessary to take a context sensitive approaches to providing the barrier that best balance all needs for the street. As part of this planning process, a robust toolbox of barrier types has been developed to assist with decision making.

DRAFT	Striped Buffer 	Flexible Bollards 	Large Bumps 	Parked Cars 	Planters 	Cast in Place Barrier Curb 
Cost/Benefit						
Cost per Foot of Barrier (per side of street) *Costs double for barriers on both sides	$1.50-3/ft. $8k-16k/mi.	$3-6/ft. $15k-30k/mi.	$4-8/ft. $20k-40k/mi.	$15-60/ft. $80k-300k/mi.	$15-75/ft. $80k-400k/mi.	$20-40/ft. $100k-200k/mi.
Cost	★★★★	★★★	★★★	★★	★★	★★
Cyclist Perceived Safety	★	★★★	★★★★	★★★★	★★★★	★★★★
Other Considerations						
Durability / Maintenance	★★	★	★★★	★★★★	★	★★★★
Sweeping	★★★★	Depends on Width	Depends on Width	★★★	Depends on Width	Depends on Width
Trash Collection	★★★★	★	★	Depends on Time of Day	★	★★★★
Storm Water	★★★★	★★★	★★★	★★★★	★★	★★
Traffic Compatibility (Motor vehicle / barrier interactions)	★★★★	★★★★	★★	★★★	★★★	★★★★
Aesthetics (factoring in damage over time)	★★	★	★★★	★★	★★★★	★★★
Construction Impacts	★★★★	★★★	★★★	★★★★	★★★	★★
Width Required	1.5'	1.5'	1.5'	8' If not existing	3'	1'

Caption: Excerpt of chart showing factors requiring special consideration when selecting the approach for a physical barrier. Source: City of Austin.

Bicycle Network Implementation Strategies

The following are common strategies to implement bicycle facilities within constrained retrofit environments.

Narrowing Existing Lanes

Existing lane widths are often wider than necessary to provide for safe operations. This extra space can be allocated to other uses and travel modes, including bicycle facilities without adverse impact on operations.

Lane Conversions (Right Sizing Roadways)

Lane conversion or right sizing projects are where travel lanes, typically streets with excess capacity

and after data collection and analysis, are removed from a roadway and the space is utilized for other uses and travel modes. Lane conversions have other benefits beyond improving the bicycling safety and comfort of a street. According to the *Road Diet Handbook: Setting Trends for Livable Streets*, "the resulting benefits [of a road diet] include reduced vehicle speeds; improved mobility and access; reduced collisions and injuries; and improved livability and quality of life" (Rosales, 2006, p. 3). Potential lane conversion projects should be evaluated on a case-by-case basis. The City of Austin has successfully right sized streets including Walsh Tarlton, Manor Road, St. Johns Avenue.

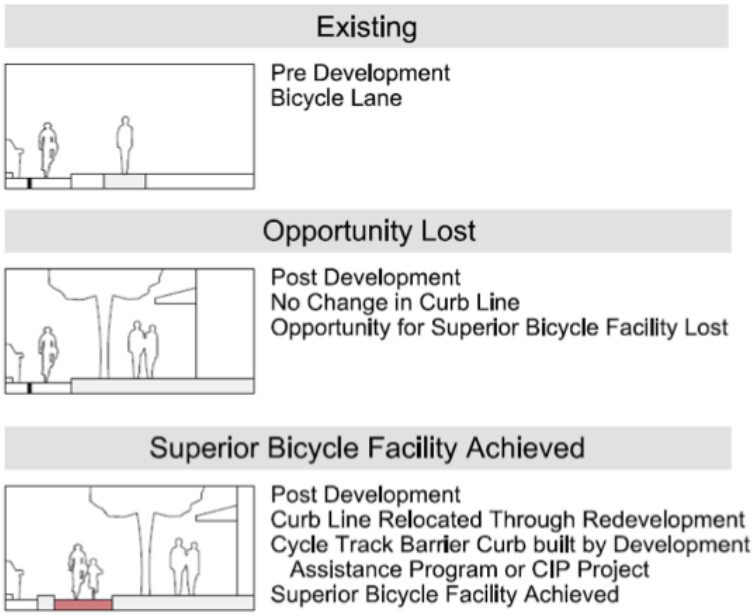
Street Reconstruction

Street reconstruction projects are an opportunity to reuse the space within the rights of way through a rebuild of the street in whole or part. While these projects are very expensive and few and far between, they present the most flexible opportunity to make the street complete including providing bicycle facilities that are safe for people of all ages and abilities.

Private Development

Private development projects present an opportunity to provide safe all ages and abilities bicycle facilities. These projects also present a risk that bicycle facilities will be precluded. The latter is due to the fact that the City of Austin's Commercial Design Standards often require the placement of street trees, furniture, and sidewalks and building faces to be close to the street to create a pedestrian oriented environment. While creating compact and connected walkable places benefit bicycling, if this sidewalk infrastructure is built immediately behind the existing curb it may preclude the appropriate bicycle facility adding width to the street is necessary. The following figure illustrates the opportunity to widen existing bicycle lanes to protected bicycle lanes at time of redevelopment.

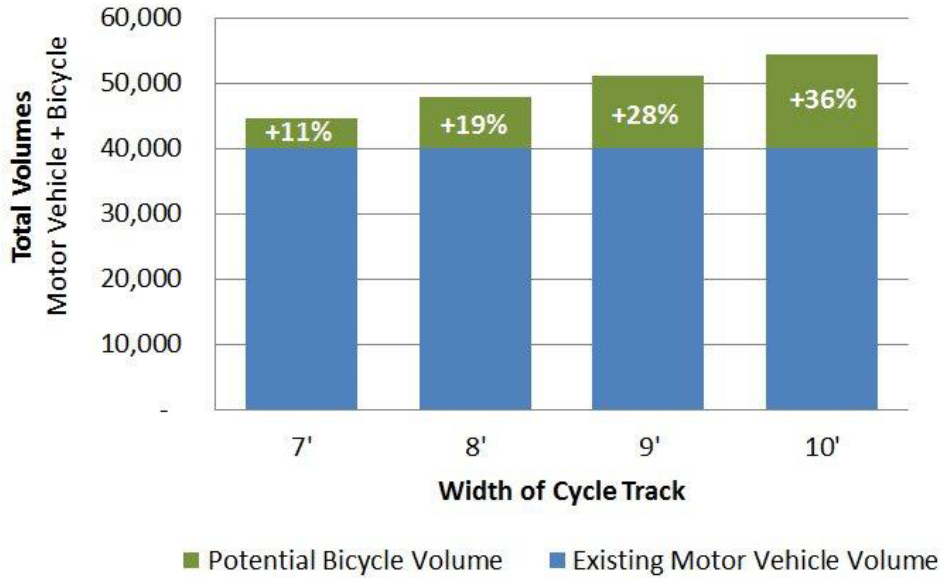
Redevelopment Scenarios that Either Create or Preclude Recommended Bicycle Facilities



Like enhanced sidewalks, protected bicycle lanes on major streets provide a significant benefit to the development. Utilizing this method as each development happens along a corridor would result in a bicycle facility that most of the population was comfortable riding in on a busy street. As more of the

street is developed, more of the existing bicycle lane would be converted to protected bicycle lanes similar to our approach in upgrading sidewalks at time of development. This strategy significantly improves bicycle mobility along congested corridors as density is added, enhancing the value of the project to the public. The chart below shows the potential mobility benefit, measured in expansion of vehicle capacity (both motor vehicle and bicycle), of South Lamar due to protected bicycle lanes. Depending on the width of the protected bicycle lane (not including the buffer) the expected increase in vehicle capacity ranges between 11% to 36% (Source: City of Austin / Dutch Design Manual for Bicycle Traffic - CROW).

Potential Increase in South Lamar's Mobility with All Ages and Abilities Bicycle Facilities



Caption: Additional corridor vehicle capacity on South Lamar with added cycle tracks of varying widths. Source: City of Austin.

This plan recommends City staff work with stakeholder groups to develop policy that requires providing protected bicycle facilities at the time of development. The upgrade of a bicycle lane to protected bicycle lane is estimated at $50,000 per block face as compared to $200,000 to $400,000 per block for required sidewalk infrastructure. City staff met with diverse stakeholders including Planning and Development Review department staff, CodeNEXT (Land Development Code) consultants, the Real Estate Council of Austin, developers, site plan engineers, land use attorneys and retailers to determine how best to incorporate this cost into private development projects. The following are findings of the stakeholder group toward these policy changes:

- This stakeholder group noted the value in the addition of protected bicycle lanes at time of development.
- It was recommended that there be some benefit to the developer for upgrading the bicycle facility to offset the additional cost for the upgraded bicycle facility.
- A potential package of added benefit to the developer could include counting the protected lane towards a portion of required parkland dedication fees or reduced on-site parking requirements.

The use of parkland dedication requirements could be justified on the basis of providing a bicycle facility to both the public and residents of the site that provides all ages and abilities access by bicycle to nearby parkland. If the protected bicycle facility were not built, access to nearby parks, may become

more motor vehicle dependent, with a potential result of greater parking needs that ultimately degrade these parks. One issue with parkland dedication requirements is obtaining land for parks instead of fee in lieu. In developing the proposed policy changes it will be important to preserve the principal intent of parkland dedication requirements for obtaining land for parks.

Reduced parking requirements could also be justified as protected bicycle lanes would make bicycling to the site viable for the majority of the population. Reduced parking requirements were seen as a greater benefit in the near term for smaller projects that have a harder time of meeting their parking requirement. For the time being larger sites may generally be over parked based on requirements from their financiers, though a reduction in parking requirements would give another degree of flexibility to make projects work. In the long run, as demand for on-site parking reduces, a parking reduction could be a benefit even to large projects.

The Plan also requires that the development of large land parcels provide bicycle facility connections within the parcels and to the nearby bicycle network, both existing and planned.

Incorporating Bicycle Facilities with All Projects

Incorporating accommodations for bicycles in new public and private development projects greatly increases the chances for superior bicycle infrastructure. Accommodating bicycles after construction often requires costly retrofitting, sometimes resulting in a non-standard and inferior design solution. In order to create this network, bicycle facilities shall be included in all reconstruction of arterials and collectors in already developed areas of Austin and all new roadway construction in areas under development (City of Austin, 2002, City Council Resolution #20020418-40.). Additionally complete streets that serve all modes and people of all ages and abilities should be included in all projects and phases (City of Austin, 2014, Complete Streets Policy).

Because roadways are often built in phases, this Plan requires the interim version of all new or improved roadways also include adequate bicycle access, as approved by the Austin Transportation Department. Designing the facilities in coordination with those who maintain them can reduce expensive maintenance in the future and assure a design which will better assure the intended use.

Inconsistency across construction documents presents a challenge to providing uniform quality in bicycle facilities. Some design standards are unique to the particular authority involved. Other standards, handicapped access for example, are applied to all projects by federal regulation.

Standalone Bicycle Projects

In addition to implementing bicycle facilities in coordination with other transportation projects, the City should be also develop the bicycle system through standalone bicycle projects. The reality is that streets are not rebuilt often enough to keep up with the demand for bicycle facilities. If implementation relies solely on other transportation projects, then the bicycle system will not be completed in the timeline outlined in the Plan.

Bicycle Network Priorities in Review

The following section reviews the highest priorities for the development of the bicycle network.

Bicycle Network Objective 2.1a) Create an All Ages and Abilities Bicycle Network

The first infrastructure recommendation will be the build-out of an all ages and abilities bicycle network. The network includes facility recommendations that would serve the majority of the population including those who are interested in riding a bicycle but concerned about safety due to motor vehicle traffic. Investment in these facilities would be targeted towards capturing short trips on the travel network to maximize return on investment. As funding for portions of the network become available, an implementation plan would be developed, detailing the most strategic facility investments that would be pursued at that time.

Total Estimated Cost: $151 Million

Benchmark: Complete 20 percent of the short-term all ages and abilities network by 2017; 50 percent by 2020; and 80 percent by 2025.

Bicycle Network Objective 2.1b) Remove Barriers in the Bicycle Network
The second infrastructure recommendation is to continue to prioritize the removal of barriers in the existing bicycle lane network. Removal of these barriers will provide improved access to destinations where all ages and abilities facilities are not feasible.

Total Estimated Cost: $10 Million

Benchmark: Remove 30% of barriers list by 2015 and 75% by 2020.

Objective 2.1 Benchmarks

- Complete 20 percent of the short-term all ages and abilities network by 2017; 50 percent by 2020; and 80 percent by 2025.
- Remove 30 percent of barriers listed in Plan by 2015; and 75 percent by 2020.
- Complete 25 percent of the complete bicycle facility network recommendations by 2020; 50 percent by 2025; and 75 percent by 2035.
- Annually contact adjacent jurisdictions to discuss bicycle system and connectivity improvements needed to realize our proposed system.
- Address issues of parking in all bicycle lanes by 2020.
- Establish a citywide ordinance prohibiting parking in bicycle lanes by 2020.

Objective 2.1 Action Items

2.1.1 Fund and implement the all-ages and abilities bicycle network as a top priority including both on-street bike ways and off-street urban trails.

2.1.2 Eliminate gaps in the existing bicycle network to allow continuous bicycle travel in the Austin area.

2.1.2a Coordinate bicycle transportation into all roadway and park land design, planning, and construction manuals, standards documents, and projects.

2.1.2b New development that abuts or includes existing or planned City of Austin bicycle routes shall provide continuity of that route (and existing or planned bicycle facility) through or along the property, or seek an appropriate amendment to the Bicycle Plan as defined in this Plan (See Appendix G).

2.1.2c Annually contact adjacent jurisdictions to discuss bicycle system and connectivity improvements needed to realize our proposed system.

2.1.2d Install "Share the Road" signs on all streets that are gaps without retrofit options in the

bicycle network by 2015.

2.1.3 The Bicycle Program Manager will work on a case-by-case basis with residents, neighborhood associations, and the bicycle community to determine local needs for parking and bicycle lanes. The Bicycle Program Manager will work to accommodate both the local needs and the needs of area bicyclists.

2.1.4 Require interim, first phase of roadway construction to provide bicycle facilities.

2.1.5 Make key operational improvements to the existing and recommended bicycle network.

2.1.5a Explore new technologies or techniques to detect bicycles at traffic signals – retrofit signals as appropriate with pavement markings instructing bicyclists where to stop to activate detection.

2.1.5b Improve bicycle accommodations on bridges.

2.1.5c Improve intersections to facilitate bicycle safety and comfort.

2.1.5d Utilize innovative options to implement this plan, such as protected intersections, bicycle signals, colored bicycle lanes, advanced stop lines/bike boxes, lane diets, road diets, etc.

2.1.6 Amend Land Development Code and Subdivision Regulations to reflect goals and objectives of this Plan.

2.1.6a Establish more detailed criteria for providing bicycling facilities on new streets, including driveways where the driveway serves as a continuation of an existing or planned bicycle route.

2.1.6b Continue development of code changes with a diverse group of stakeholders including development stakeholders, site engineers, business owners, and bicycle organizations for implementation of protected bicycle lanes on key corridors along with private development.

2.1.6c Ensure that implementation of protected bicycle lanes on key corridors by private developments are met through the development process.

2.1.6d Establish and provide incentives and / or requirements for bicycle network facilities and end-use facilities in private developments.

2.1.7 Use consistent standards to identify and design bicycle facilities.

2.1.7a Amend Transportation Criteria Manual and Land Development Code as necessary as it pertains to street design to accommodate bicycle use in the Austin region.

2.1.7b Use both national and international best practice bicycle facility planning and design guidance.

2.1.8 Coordinate with other city departments and public agencies to implement recommended bicycle network

2.1.8a Coordinate with Public Works Urban Trails Program, Parks and Recreation Department, and other relevant departments, public agencies and non-profits to integrate on and off-street networks and prioritize connections that meet the goals of this plan.

2.1.8b Work with all departments and partners agencies to support the implementation of the 2014 Complete Streets Policy.

2.1.8c *Authorize City Bicycle Program Manager to review all City and applicable private development plans (zoning, subdivisions, site plan, etc.) that add to or affect the operation of the bicycle network. Include Bicycle Program Manager in the review process for applications to vacate rights-of-way and exceptions or variances to these.*

2.1.9d *Coordinate with Texas Department of Transportation, Capital Area Metropolitan Planning Organization, Travis, Williamson, and Hays Counties and other jurisdictions and agencies to ensure appropriate bicycle connections are planned, constructed, and maintained, where feasible, to promote a regional on-and off-street bicycle network.*

2.1.9e *Coordinate with Austin Energy to incorporate bicycle facilities in utility rights-of-way and in conjunction with the installation of utilities, where feasible.*

2.1.9f *Coordinate with The University of Texas and other higher education institutions on improving bicycle access to, from, and within campuses and other major properties owned by those institutions.*

2.1.10 Establish standards for bicycle detours in the event of construction or street closures that impact bicycle facilities.

2.1.11 Evaluate opportunities to allow bicycle access where currently prohibited including right turn only lanes, dead ends, *and one way streets* to ensure that bicycle travel is as convenient and direct as possible.

2.1.12 Use contextual guidance for the selection of bicycle facilities from NACTO for facility selection as soon as it is available.

End-of-Trip Facilities

Objective 2.2: Provide Comprehensive End-of-Trip Facilities

The availability of end-of-trip facilities has the power to influence an individual's decision of whether or not to commute by bicycle. A review of best practices indicates that among other things, lack of facilities including bicycle parking, showers, and locker rooms at work significantly deters bicycle commuting. While the quality of on-street and off-street bicycle facilities tend to be the most significant factor in a person's choice to make a trip by bicycle, end-of-use facilities also play a significant role.

Additional end-of-trip facilities include changing facilities, car-sharing, and repair services and are all elements that improve the overall system and make bicycling easier and attractive for more people. City Code requirements should be reviewed and amended to facilitate the accommodation of bicycle end-use facilities.

Bicycle Parking

Bicycle parking is an integral part of comprehensive bicycle planning. It's not enough to develop and maintain a bicycle-friendly road system. People can't be expected to use their bicycles for transportation unless secure bicycle parking facilities exist at their destinations. Bicycle parking facilities can help reduce bicycle thefts, legitimize bicycle use, and often times provide protection from the elements.

Austin Bicycle Rack Program

Originally funded in the early 1990's through an Intermodal Surface Transportation Efficiency Act (ISTEA) grant, the City of Austin created a Bicycle Rack Program whereby Class III bicycle racks were installed free of charge in the public right of way and given to private businesses and public agencies for installation and use. The program serves to retro-install bicycle parking serving businesses and buildings built prior to the City Code bicycle parking requirement. To date approximately 4,000 bicycle racks have been installed throughout the City of Austin.

Chapter 25-6 of the City Code describes off-street parking requirements for bicycles. Bicycle parking requirements are based on land use classification and the number of motor vehicle spaces required. (See § 25-6-476, § 25-6-477, and Appendix A of Chapter 25-6, Article 7.) Bicycle parking design standards are a component of the Austin Transportation Criteria Manual.

Long-term parking is meant to accommodate cyclists who are expected to park for longer than two hours, such as employees, students, residents, and commuters. Long term parking is typically located at schools, high density residential areas, employment centers, airports, and transit hubs.

Safety from theft and vandalism, protection from the elements and accessibility are key issues for long term parking. A place to store accessories is also highly desired. Employers should consider providing showers and changing rooms in addition to secure parking.

The best type of parking facilities for long-term parking are either inside a building, office, guarded enclosure, or bicycle lockers. Bicycle lockers can be installed indoors or out. They are best provided on a user-application or lease basis to ensure appropriate use. Bicycle rooms are another solution, and can be created from any locked room. In locations without available indoor storage areas, or room for lockers, bicycle cages may be constructed by enclosing bicycle racks and aisle space with heavy gauge fencing and controlling access by lock.

Methods of Providing Long-Term Bicycle Parking

- Install in a covered, highly visible location
- Allow bicycles inside office buildings
- Provide bicycle storage room inside building

Bicycle Locker Practices

Bicycle lockers are desirable for users who would like to have a sheltered space that secures the entire bicycle for protection from the weather as well as theft. They are especially useful for all-day or multiple-day users.

Transit and airport centers are likely places for long-term bicycle storage. While many airports have bicycle parking, Oakland International Airport in Oakland, CA is the only airport in the U.S. with bicycle lockers. The New York State Metropolitan Transit Authority, TriMet in the Portland, OR region, Metro Area Transit Authority in the Washington, DC area, and Bay Area Rapid Transit in the San Francisco area, among other transportation authorities provide bicycle lockers at train and/or bus park and ride stations.

The cost of installing bicycle lockers is favorable compared to car parking spaces, but significantly more than installing bicycle racks. Therefore, it is important to place them in locations where they will be available to the highest number of users. Bicycle lockers at bus stations, park and ride and transit centers would serve daily commuters as well as persons traveling to the airport via the Airport Flyer.

Short-term parking is meant to accommodate visitors who are expected to depart within two hours. Short-term parking is typically found at retail shops and public buildings (libraries, clinics, etc.). Visibility and accessibility are key issues.

Short-term parking racks should support the bicycle at two or more points above and on either side of the bicycles center of gravity. The best types of parking facilities for short-term storage are simple inverted-U racks. The inverted "U" rack is a single piece of heavy gauge steel bent to form a U. Pipe ends are either installed in a concrete base or have welded mounting flanges bolted directly to a solid, flat surface. Each of these racks holds two bicycles and is available commercially or easily manufactured by fence shops. Areas without space for racks can provide parking through rings holding a bicycle against a vertical wall. These rings should be attached at a height 20" above ground. Alternatively, bars may be bolted to a secure wall where conflicts with pedestrian traffic can be avoided.

Bicycle Parking in Mixed Use Developments. The environment of a mixed-use development presents an opportunity for transportation planners to plan for alternative modes, such as bicycling. With a higher propensity to use alternative modes of transportation comes the importance of implementation of supporting facilities to ensure their use. For this reason, extra attention to bicycle facilities, including the bicycle network as well as parking and other end-trip facilities is imperative to well-designed mixed-use development.

On-street bicycle parking corrals are another tool to provide high quality and visibility bicycle parking. Where on-street parking is present, a parking space can be converted to park 14 bicycles. For business owners are interested in getting more people to their business, bicycle corrals can be a great alternative to depending solely on motor vehicle parking. To date there are 11 bicycle corrals installed throughout Austin.

Shower and Changing Facilities

Showers and changing rooms in employment centers are important for bicycle transportation. These facilities benefit not only commuting cyclists, but other fitness minded employees who can exercise during lunch hours. The combination of shower and bicycle parking facilities is usually less expensive than construction and maintenance of auto parking, and therefore should be considered during project planning.

There are very few publicly accessible (even for a fee) shower and changing facilities for bicyclists in the City. Gyms currently offer the most common and flexible option to bicyclists as they are located throughout the city. However, membership costs typically cover many more services than a bicyclist simply looking for a shower and place to change is willing to pay for. The City should consider communication with area gyms and other work-out types of facilities in an effort to create bicycle commuter memberships.

Several individual efforts have been made among public agencies and private developments to incorporate shower and changing facilities into developments to facilitate bicycling among their employees. The City of Austin has been active in incorporating showers and changing facilities for City employees, with nine of the City's buildings having shower and changing facilities. Additionally, incentives exist through City administered processes such as Green Building and the site development process. The City of Austin should continue to develop improved incentive programs and requirements for shower and changing facilities in future new developments.

Bike Stations

Across the United States, particularly in the West Coast, bike stations are emerging offering several services to commuters and bicyclists to support bicycling as a primary mode of transportation. While services differ at individual bike stations, typical service includes all or a combination of the following: long-term bicycle parking, bicycle repair, shower facilities and bicycle rentals. Bike stations are typically located near public transit and where demand for bicycle services is high, such as in high density areas or university campuses. These stations offer convenience to bicyclists, making it easier to choose bicycling as a primary mode of transportation.

The Puget Sound Regional Commission has created site selection criteria for locating bike stations in the Seattle area, including:

- Visibility
- Cost and feasibility of construction
- Cost of obtaining approvals
- Existing infrastructure
- Long-term viability timing
- Safe and convenient for bicycles

Source: Alta Transportation Consulting, et. al., 2002, p. 5.

An ideal location for bike stations would be Downtown Austin, where the major employment hub and an increasing residential population base exists to support use of a bike station. Convenience to the University of Texas - Austin might also be a consideration in site selection. The last stop on Capital Metro's MetroRail is also located downtown, another component that would influence use of a downtown bike station.

Objective 2.2 Benchmarks

- Reinstate a bicycle rack program or fund a public/private partnership to provide 500 new short-term bicycle parking spaces per year installed on the right-of-way or private property serving existing developments.
- Provide long-term bicycle parking at Austin Bergstrom International Airport by 2015.
- Establish incentives for showers and secure ground accessible bike parking rooms in residential and office uses by 2015.

Objective 2.2 Actions

2.2.1 Increase bicycle parking throughout city.

2.2.1a Establish a methodology for determining bicycle parking demand.

2.2.1b Provide or increase short term bicycle parking at all City of Austin buildings, parks, and libraries.

2.2.1c Provide or increase appropriate type of bicycle parking at all existing developments, employment centers, schools, parks and recreational areas, and government offices.

2.2.1d Review, and if necessary, enhance requirements or incentives for bicycle parking in all private or public parking structures.

2.2.1e Work with stakeholders to determine how bicycle parking can be improved in the downtown area and make improvements.

2.2.1f Develop criteria for consistent interpretation of City Code section 25-6-477 related to the required location of bicycle parking.

2.2.2 Reinstate a bicycle rack program or fund a public/private partnership to install short-term bicycle parking in the right-of-way or on private property serving existing developments until demand ceases.

2.2.3 Require that special events expecting over 1,000 attendees provide secure, affordable, and convenient bicycle parking.

2.2.4 Require shower, locker facilities and ground floor secure long-term bicycle parking in new office developments or redevelopments.

2.2.5 Create further and/or improved incentives to encourage developers to provide showers, changing facilities, lockers, and bicycle parking above any existing or proposed minimum requirements.

2.2.5a Coordinate *with Austin Energy, or other relevant Department(s), to provide rebates to commercial property owners to install shower and locker facilities in existing buildings having none.*

2.2.6 Work with local gyms and similar types of facilities to provide shower and locker facilities to bicyclists, at a reduced charge.

2.2.7 Establish incentives to encourage the development of additional end of trip bike stations at key locations throughout the City of Austin.

2.2.8 Explore possibilities to work with parking garage operators to allow overnight automobile parking for multiple consecutive days.

Integration of Bicycling with Transit Services

Objective 2.3: Fully Integrate Cycling with Transit Services

Bicycles can increase the effective service area of transit; similarly, transit can reduce travel times and energy requirements for riding bicycles longer distances. Among the barriers that deter bicyclists from bicycle commuting, one of the most common is distance, even among experienced bicyclists. Trip distance can be overcome by readily linking transit and cycling as a mode choice.

Public Transit

Public transit services are highly sensitive to the distance between user's residences and the nearest transit stop. And, lower density developments have traditionally been considered poor candidates for transit services because of the increased distance to transit stops (this is commonly referred to as the "first and last mile problem"). Bicycles can effectively increase the service area for either end of a transit trip. Commuters can cycle two to five miles from their homes to a bus or rail stop to finish their trip. This two to five mile radius of service around each transit stop is a considerable increase in area served compared to walking distances, which is usually estimated to be closer to one-quarter to one-half mile. There are additional benefits to be gained from joining bicycles with transit which each mode alone cannot provide: transit enables the bicyclist to take longer trips; transit enables the bicyclist to pass over or through topographical barriers; and bicyclists can increase transit ridership during surplus capacity periods such as weekends and midday (Doolittle, 1994, p. 1).

To maximize the potential integration of bicycle and transit modes the priority strategy will be to provide safe all ages and abilities routes to major transit stations as discussed in depth in the bicycle network section above. High capacity and secure bicycle parking should be provided at transit stops so bicycles can be parked and not take valuable space on transit vehicles during peak periods. Strategies to get more bikes on transit vehicles such as racks on buses that hold three bikes should be pursued to all for more flexible trips. Bike share is a great tool to flexibly make the "last mile" connection and is discussed more in the Bike Share System section below.

Spotlight on Capital Metro

Capital Metro supports the integration of bicycling and transit services in many ways.

- *Capital Metro provides comprehensive training to their bus operators on sharing the road safely with cyclists. Capital Metro's training program is the most widely recognized program in the nation. Innovative components to the training, such as bike-safety education, have resulted in multiple awards. Capital Metro's program is the national model according to the National Transit Institute and the American Public Transportation Association. Capital Metro will continue to improve upon our bike safety training element as future safety developments are made.*
- *Capital Metro has recently installed high capacity bicycle parking shelters, branded as MetroBike at seven major rail and bus transfer stations. They have also increased the capacity on their bus racks from two bikes to three providing more reliable transport of bicycles, especially during peak periods.*
- *Capital Metro recently completed a mile long urban trail between their Crestview and Highland stations. This trail is a great first step in providing bicycle facilities for people of all ages and abilities to major transit stations.*

Car Share Programs

With the hassle and expense of owning a motor vehicle today, car sharing has become a popular alternative to owning a motor vehicle instead shifting use cost on a per trip basis. Car sharing programs offer the convenience of having a motor vehicle to use without the hassle of payments and maintenance and provides a tool for people to become less car dependent.

This concept is also beneficial to bicycle commuters as they can use a motor vehicle to run an errand or go to a meeting in the middle of the day, even if they ride their bicycle to work. Even if a bicyclist owns a motor vehicle, the choice of driving versus bicycling to work may depend on needing a motor vehicle in the middle of the day. The ability to car share gives access to an automobile in the middle of the day that could solve that dilemma.

Another opportunity for car share is the possibility of having bicycle racks so people with bicycles can make one-way trips. This would be particularly useful for long trips, trips in the heat of the day or when there is not enough time to bicycle to the destination but it is still desired to have a bicycle when one gets there. This could also expand the effective range of car sharing programs as the last couple of miles to a destination could easily be biked. The Plan recommends that the City work with car share providers to provide easy to deploy bicycle racks integrated into their vehicle fleet.

Car sharing has taken off in dense cities that have policies to promote alternative modes of transportation to the automobile. Austin currently has two car share providers: Car2Go and Zipcar.

Objective 2.3 Benchmarks

- Where safe, all (100 percent) Capital Metro buses, rail cars, and van pools will be able to accommodate three (3) bicycles by 2020.
- Include short and long term bicycle parking at 100 percent of locations meeting transit stop bicycle parking criteria by 2015.

Objective 2.3 Actions

2.3.1 Coordinate with Capital Metro to provide secure and high capacity bicycle parking (including short and long-term parking and/or covered parking, lockers, covered attended rooms) at all major transit stations, existing and future park-and-ride lots, and rail stations as they are developed.

2.3.2 Coordinate with Capital Metro to establish criteria to identify transit stops needing short and long-term bicycle parking.

2.3.3 Coordinate with Capital Metro to coordinate bicycle and public transportation infrastructure and services.

2.3.3a Continue to coordinate with officials and planners of Capital Metro to ensure that all buses, commuter rail, light rail, and streetcars are connected to the bicycle network, equipped with bicycle racks, and accommodate bicycles.

2.3.3b Require the highest level of security (Type I bicycle lockers or security guard or locked rooms) or bicycle parking spaces at large scale public transportation facilities.

2.3.3c Coordinate with Capital Metro on grant and other funding opportunities to implement Rails with Trails projects to improve bicycle access to transit stops and stations

2.3.4 Coordinate with Capital Metro to establish system for counting bicycles on transit ridership.

2.3.4a Establish a system to count the number of bicycles on board transit vehicles to help assess demand for long term bicycle parking at stations.

2.3.4b Coordinate with Capital Metro to identify ways to safely accommodate three bicycles on all or select Capital Metro buses, streetcars, and rail cars.

2.3.5 Publicize the bicycle-transit link through events, media, and other marketing methods.

2.3.6 Coordinate with Capital Metro to integrate bicycle route information into transit route maps and signs.

2.3.6a Integrate bicycle route information into Capital Metro transit route maps and signs.

2.3.6b Integrate Capital Metro transit information into City of Austin bicycle route maps.

2.3.7 Assure the safety and efficiency of bicycles and bus transit coexistence.

2.3.7a Continue to coordinate with Capital Metro to educate Capital Metro bus drivers about operating buses around bicycles.

2.3.7b Educate bicyclists about proper riding techniques around buses.

2.3.7c Consider transit/bicycle interaction in all roadway designs.

2.3.8 Work with car share providers to provide easy to deploy bicycle racks integrated into their vehicle fleet.

Bike Share System

Objective 2.4: Maintain and Expand Austin's Bike Share System

Bike share systems allow users to check out public bikes to use for trips. Pricing structures often, including in Austin, require a membership (yearly, weekly, or daily) to gain access to the system. After gaining access, trips are free for the first thirty minutes with increasing use fees for additional time. The fee structure provides both a low cost mobility option for short trips and also encourages keeping the bicycle in circulation for the next user.

Bike share programs complement public transit, private vehicular transportation, and pedestrian activity by increasing mobility options available. Bike share systems are among the type of solutions that shift from dependency on private vehicle for transportation and towards more flexible and sustainable solutions. Bike sharing can also promote exercise without requiring significant lifestyle changes.

Bike share programs also sustain public access in an increasingly congested environment by bridging the gap between distances best served by vehicular and foot transportation. Bicycles provide on-demand transport that allows the user to reach locations not easily or efficiently accessible by other forms of transportation. In urban environments, bikes are often the best way to move around, especially if you are short on time and money (Tech Bikes, 2004).

Best Practices

- Collaborate with departments to dedicate space for bike share station on city right of way.
- Provide opportunities for public outreach to suggest bike share location.
- Use the bicycle network to support locations of bike share stations. Connectivity is key in attracting users beyond the typical cycling communities and makes cycling more viable, visible and comfortable.
- Make bike share visible and locate bike share stations 200 to 300 meters from each other. Visibility provides security that more than one bike share station is close by in case the preferred one is full.
- Locate in high employment and populated areas
- Locate bike share near recreation, event and retail corridors, and large employers.
- Collaborate with public transit to connect the first and last mile to destinations.
- Provide clear way-finding to locate bike share station and preferred and overall routes.

The bike share system's future is bright. Bike share growth will continue to provide opportunity for users to travel throughout Austin. The direction of bike share growth will depend on space availability, future development, user demand, sponsorship and funding.

Objective 2.4 Benchmarks

- Expand Austin's bike share system from 40 stations to 100 stations by 2015 and to 300 stations by 2017.

Objective 2.4 Actions

2.4.1 Seek and support partnerships for the expansion of the bike share system including both capital and operations costs with the University of Texas, Austin Community College, State of Texas Complex, Capital Metro Transportation Authority, private developers, and area employers.

2.4.2 Seek grants for the expansion of the bike share system.

Bicycle Facility Maintenance

Objective 2.5: Provide Superior Bicycle Facility Maintenance

Maintenance of bicycle facilities is critical to keeping them safe and usable through their life cycle. Designing bikeways to reduce maintenance needs, giving attention to sweeping the sides of streets where bicyclists ride, and ensuring that riding surfaces are relatively smooth are all requisites in attracting more of the general public to bicycling.

Maintenance of the bicycle network is typically done through regular roadway and park maintenance, depending on the facility. The primary on-street roadway maintenance activities include road resurfacing, street sweeping, maintenance of barriers on protected bicycle lanes, the treatment of bicycles through temporary road conditions and the operations of the signal system are elements. Urban Trails are maintained either by the Public Works or Parks and Recreation Departments.

Maintaining Protected Bicycle Facilities

Protected bicycle lanes introduce a number of maintenance challenges. New barriers in the rights of ways must be maintained and should not obstruct City services such as street sweeping and recycling and waste collection services. New approaches to operations and design criteria will ensure that protected bicycle lanes are properly maintained.

The physical barriers used to protect bicycle lanes will also need maintenance. Some barrier solutions will last longer than others but all will have a life cycle and need repair or replacement. Coordination between Public Works and Transportation and budgeting for ongoing maintenance is essential in providing high quality facilities through their lifespan.

Pavement Surface

Bicycles are more sensitive to irregularities and road debris than cars due to their smaller and lighter weight tires and lack of suspension. Roadway features that cause minor discomfort to motorists, such as potholes and improper drain grates, can cause serious problems for cyclists.

Even some “normal” features of road design can cause an inconvenience or danger for cyclists. “Safety features” like large, closely spaced rumble strips designed to alert motorists leaving the roadway create barriers and hazards for cyclists. All operational applications to roadways which serve as bicycle routes should be reviewed for the best application assuming bicyclists will be on the roadway.

Bicyclists and other road users can file maintenance requests and complaints through the City’s 3-1-1 system. Calls into the 3-1-1 system typically regard debris in bicycle lanes and parking in bicycle lanes. Depending on the issue, typically the Public Works Department, Solid Waste Services Department, Watershed Protection and Development Review, or the Parks and Recreation Department will work to resolve the issue.

Another routine street maintenance activity that can be bothersome to bicyclists is preventive maintenance surface treatments. Preventive maintenance is the most cost-effective way for the City to assure long lasting streets. Asphalt gets more brittle over time with aging and oxidation, which allow the surface to crack more easily. Preventive maintenance surface treatments can reduce these effects by shielding and protecting the pavement surface and sealing cracks that would allow water to weaken the pavement structure. There are a number of pavement surface techniques used by the City: Hot mix

paving, microsurfacing or slurry seal, and sealcoat (chip seal).

Streets that are seal coated often generate complaints from cyclists due to loose aggregate that last a month or two after application. Seal coat is applied in two stages, first an asphalt emulsion is applied and then loose rocks are distributed on top. Over time the aggregates settle into the asphalt emulsion which cures and the street hardens. Until the emulsion hardens rocks are able to come loose and will accumulate on street corners and near gutters requiring sweeping until all loose rocks are removed. The pavement surface is initially rough until the aggregate has time to sink in. While the other street maintenance treatments are better for cyclists initially since they don't have a curing period, sealcoat is a very cost effective method and gives the City the opportunity to improve conditions for bicycling. Staff in the Bicycle Program annually review of the sealcoat street maintenance program for the upcoming year and determine which streets can have new or improved bicycle lanes, including protected lanes.

Slurry seal is textured, skid resistant, flexible, waterproof, and has good cohesion, which allows it to be an economic and hard wearing surface. The process adds no structural strength to the pavement section, but does result in an extended service life – about seven years - depending on the volume of traffic. Slurry seal is a great preventive maintenance treatment for streets that are still in good condition with very little cracking. Microsurfacing has the same texture and finish as slurry, but is a little stronger, creates a more level surface, and is consequently more expensive. Microsurfacing is more stable and longer lasting under heavier traffic and is most often used on arterial and collector streets.

Thin surface treatments are planned for summer and early fall. Warm, dry weather is required for this type of work to be successful. Fortunately, this work is relatively quick and the roadway is returned to normal traffic use within hours.

Public Works intends to reduce the number of bicycle routes which will receive the rougher sealcoat texture. The Bicycle Program will take the list of roads scheduled to receive a thin surface treatment and highlight the key bicycle routes. The Street and Bridge Pavement Management staff will then determine the condition of each of the key bicycle routes. Street and Bridge will then use slurry or microsurfacing on all key bicycle routes in fair or better condition. Only bicycle route streets with excessive cracking or those in "poor" condition will receive a standard sealcoat if nothing else is planned in the foreseeable future.

Public Works will be prioritizing asphalt overlays or reconstruction for the rehabilitation of streets in the poorest condition; however, there are hundreds of neighborhood streets in this category. A sealcoat is often used in this case to "buy time" by preserving whatever value is left in these old pavements. This means that some bicycle routes will still receive a sealcoat. There are still quite a few older streets that we cannot afford to overlay or reconstruct within current budgets. Unfortunately, not every street in the City can be accommodated for cyclist use at the same time, but City staff is working hard to balance the needs of all of street users against available resources.

Street Sweeping

Street sweeping and bicycle lane sweeping is another routine maintenance that is very beneficial to bicyclists when done correctly. Currently, bicycle lane sweeping is a component of street sweeping. However, sweeping of bicycle lanes should be integrated into the traditional street sweeping schedule as a standalone item. Upon implementation of the Austin Bicycle Plan since 1998, sweeping bicycle lanes follows the traditional thoroughfare and residential street schedule. Ways to increase focus of street sweeping to allow more focus on bicycle lanes should be explored and implemented.

One major issue is street sweeping to keep protected bicycle lanes free of debris such as gravel and glass. As street and ROW space is limited it is not feasible to provide the 8.5 feet clear width required to operate our existing sweepers. In order to provide protected bicycle lanes in most cases it will be necessary to have the capability to sweep spaces as narrow is 7 feet wide. The plan recommends that narrow sweeping equipment or services be acquired as soon as possible to enable the expansion of the protected bicycle network.

Signal Detection

One maintenance issue with the bicycle network is traffic signals that detect automobiles fail to respond to cyclists. As a result people on bicycles choose to disregard red lights and even worse the behavior may transfer over to a disregard for all traffic controls. The Plan recommends that the bicycle system, including traffic signals shall accommodate cyclists like all other road users.

Temporary Traffic Controls and Construction Activities

Temporary construction along bikeways can create a big obstacle to bicyclists when an excess of debris is in the roadway and bikeway. When streets are completely closed off, bicyclists are forced to find an alternative route. Barricades for construction often obstruct bicycle travel. Steel plates over excavations are very hazardous to cyclists. Roadway construction often reduces roadway space, increasing the difficulty for motorists and bicyclists to share the road. Roadway construction should include steps to prevent added risk to cyclists from debris and reduced roadway space. It is often assumed that any barrier or alternative route provided for motor vehicles is also adequate for bicyclists. This is not always the case. Simple improvements to temporary construction closures can ensure continued and safe bicycle use in the area. Additionally, the Texas Manual on Traffic Control Devices (TMUTCD) requires that bicycles be safely accommodated during temporary traffic control on bicycle routes.

Objective 2.5 Benchmarks

- Include bicycle lane and protected bicycle lane installation and maintenance within the operating budget of the departments of Transportation and Public Works by FY 2015, and continue on an ongoing basis.
- Partner with Public Works to maintain protected bicycle lane barriers at good or acceptable condition.
- Work with Austin Resource Recovery to acquire narrow street sweeping equipment or services to address sweeping of protected bicycle lanes by 2015.

Objective 2.5 Actions

2.5.1 Provide ongoing and regular maintenance for all bicycle facilities.

2.5.1a Sweep all bicycle lanes regularly to remove glass and debris that endanger or inconvenience cyclists.

2.5.1b Maintain all bicycle route signs and markings.

2.5.2 Work with Austin Resource Recovery to acquire narrower street sweeping equipment to address sweeping of protected bicycle lanes by 2015.

2.5.3 Train 311 call takers regarding bicycle related calls and ensure proper routing of calls.

2.5.4 Establish Bicycle Program performance measures that require tracking of 311 maintenance

calls for assurance of responsiveness.