Transportation Framework Plan

DOWNTOWN AUSTIN PLAN

DRAFT 11.25.08

Vehicular

Transit

Bicycle

Pedestrian

ROMA DESIGN GROUP
LTK * KIMLEY-HORN * HDR/WHM * STUDIO 8

DOWNTOWN AUSTIN PLAN: TRANSPORTATION FRAMEWORK PLAN

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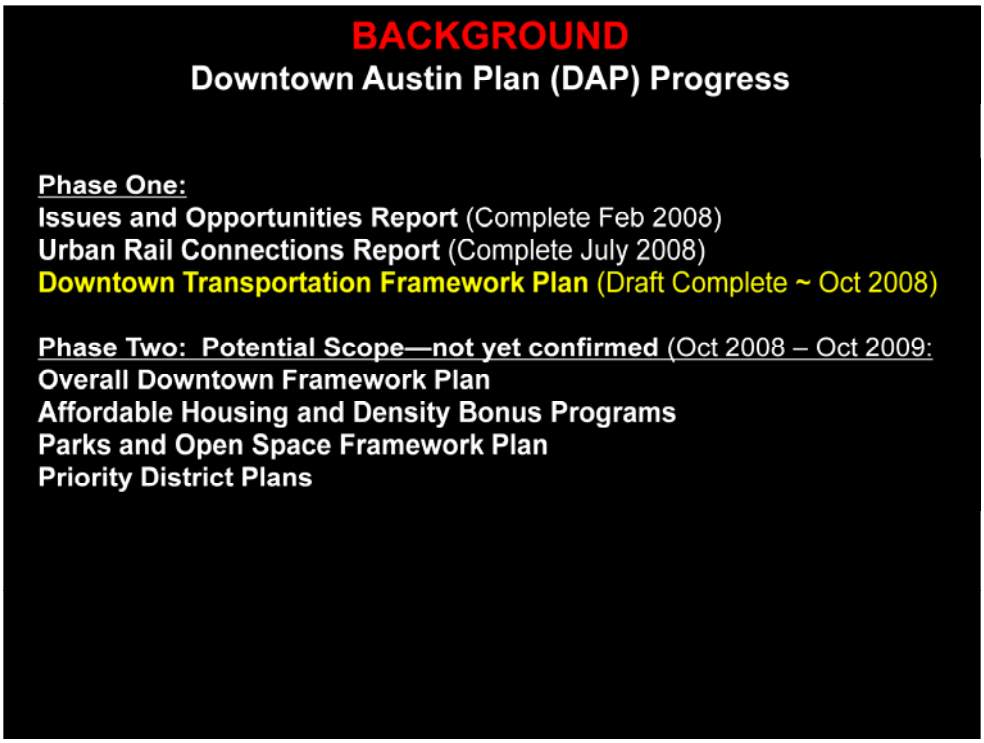
Background

The Phase One Issues and Opportunities report of the Downtown Austin Plan (DAP), issued in February 2008, provided a diagnostic assessment of Downtown in terms of place-making, sustainability, mobility, diversity, affordability, and economic viability. This Downtown Transportation Framework report along with the Urban Rail Connections Report issued in July 2008, comprise two additional studies that have been undertaken as part of the Phase One DAP effort to address mobility, the key challenge facing Downtown and the region. The goal of the Urban Rail Connections Study was to identify and evaluate potential alignments for urban rail that could connect key destinations within the Downtown and Central City, and in so doing, extend the reach of the Metro Rail system which is expected to come on line in March 2009.

The purpose of this study is to develop an initial Transportation Framework Plan for the Downtown core, taking into consideration the recommendations of the Urban Rail Connections Study and the findings of the Issues and Opportunities report. Rather than a final recommendation on Downtown circulation, the Framework Plan is intended as a *starting point* that can provide the basis for more detailed District planning and ongoing discussions with the community and key stakeholders in Phase Two of the DAP, which will begin in the Fall 2008. The Transportation Framework Plan builds on previous studies including, most notably, the 2001Downtown Great Streets Master Plan. The goal for the DAP Transportation Framework Plan is to establish a balanced multi-modal system for automobile, transit, bicycle and pedestrian circulation, that improves access to and mobility within Downtown, while recognizing the need for streets to be places for people to enjoy and linger, as well as to move on and through. The overall Downtown Framework Plan - part of Phase Two – will examine and finalize the recommended improvements and establish a phasing and financing program.



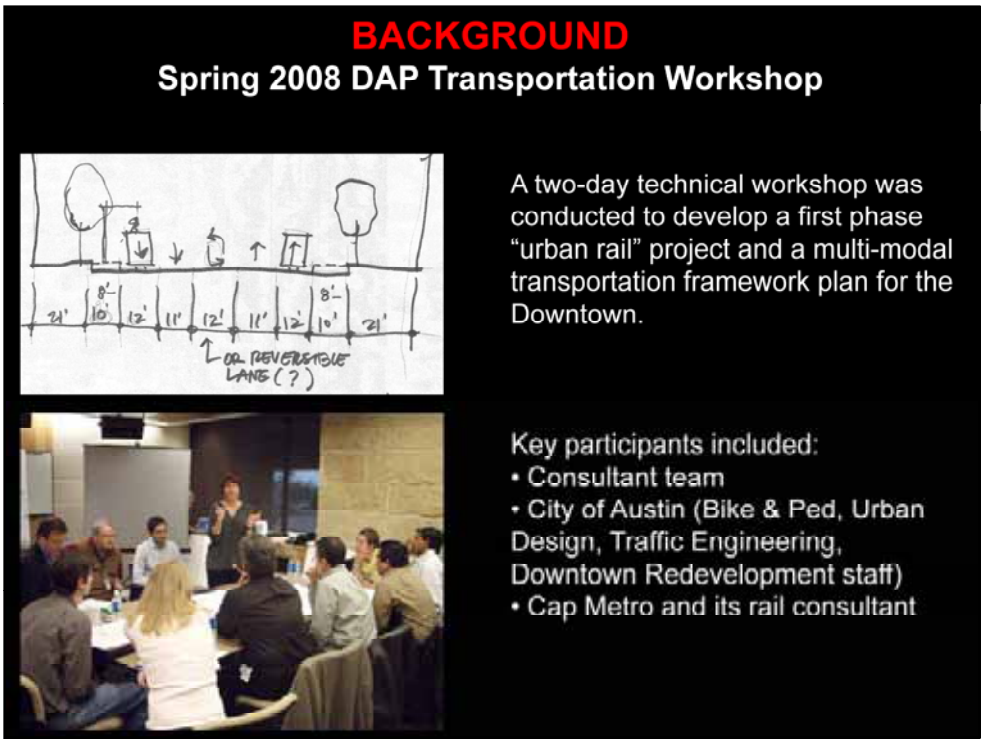
Phase Two of the DAP will begin later in Fall 2008 and, although the entire scope has not been finalized, it is projected to include:

- Downtown Framework Plan
- Affordable Housing and Density Bonus Programs
- Parks and Open Space Framework Plan
- Priority District Plans

Note: The DAP Study Boundaries are: IH 35 on the east; Lady Bird Lake on the south; Lamar Boulevard on the west; and Martin Luther King, Jr., Boulevard on the north.

The DAP Phase One report observed that the lack of a comprehensive transportation system was undermining Downtown Austin's ability to achieve its full potential as the commercial and cultural center of the region. The auto-dominant nature of the existing transportation system, and the lack of robust mass transit, continues to limit mobility to, and access within, the core and has resulted in an environment that is largely inhospitable to pedestrians and cyclists.

The DAP Phase One Report noted that even as density occurs, the automobile is still evidenced as the dominant factor in the design of the Downtown environment including its buildings, neighborhoods and streets. Typically, about one-third of the square footage of Downtown buildings is built as car parking. Entire blocks are devoted to drive-through banks and parking garages. A typical downtown street devotes more than three-quarters of its right-of-way to the car, leaving only a small proportion for pedestrians and bikes. The one-way street system gives priority to efficient through-movement over convenient and calm circulation.



In March 2008, a two-day technical workshop was conducted to develop a first draft of the Downtown Transportation Framework plan, including the development of an initial phase "urban rail" project that would connect rail Downtown to key destinations. The three, key destinations were:

• Mueller Redevelopment

• Austin-Bergstrom International Airport (ABIA)

• Zilker Park

The technical group consisted of:

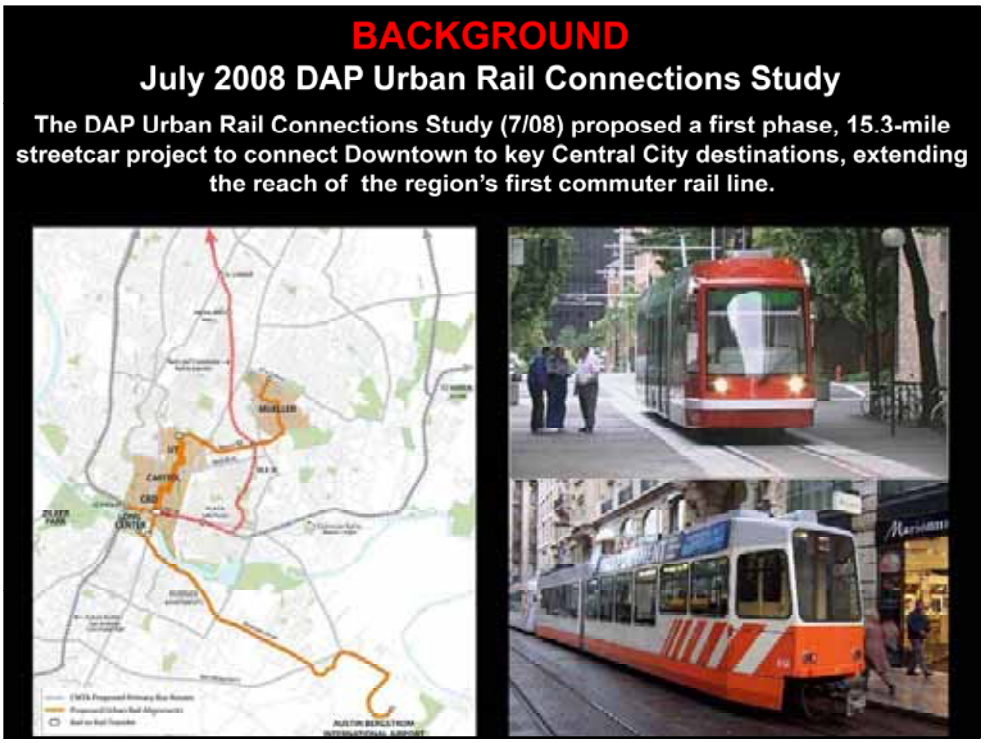
• The consultant team, including ROMA Design Group, LTK Engineering for rail planning and both Kimley-Horn and WHM/HDR for general transportation planning and traffic operations;

• City of Austin staff (Bike & Pedestrian, Urban Design, Traffic Engineering, Downtown Redevelopment staff);

• Capital Metro staff and rail consultant, Parsons Brinckerhoff; and

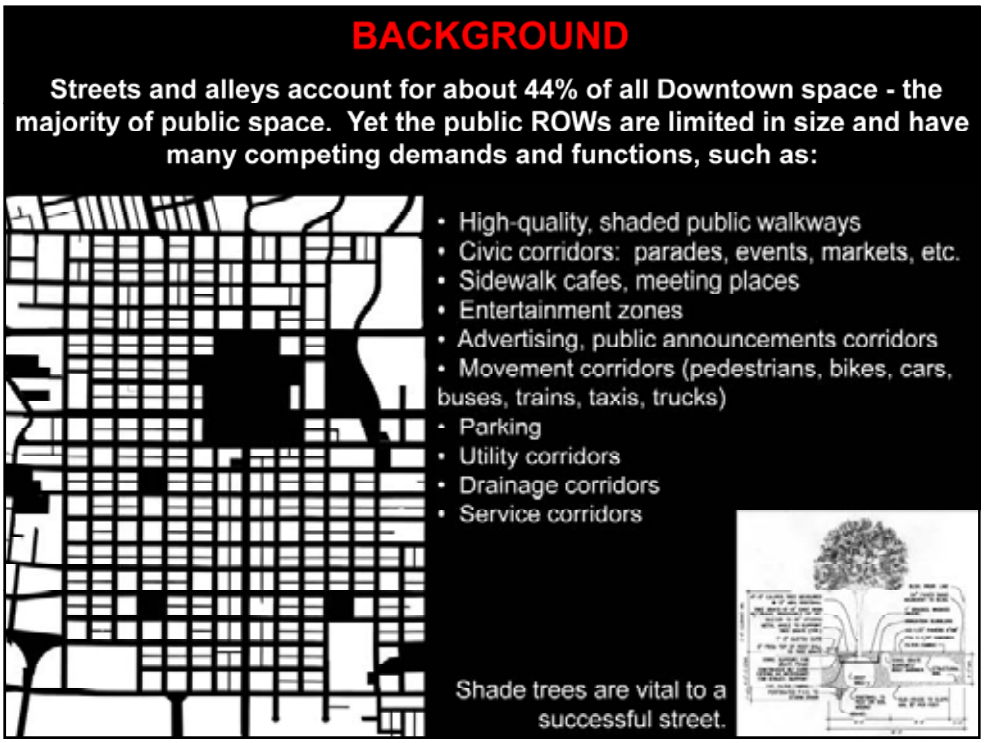
• Others (State Preservation Board staff, Capital Area Metropolitan Planning Organization (CAMPO) staff, Austin-San Antonio Intermunicipal Commuter Rail District (ASAICRD) staff).

While the technical group emerged with a rough framework for both the Urban Rail Connections study and the Downtown Transportation Framework, subsequent efforts focused first on developing more detail on the urban rail connections proposal. After an April 2008 Town Hall Meeting where community input was sought, the consultant team further refined and presented to the City Council the recommendation for a 15.3-mile starter streetcar line. (See www.cityofaustin.org/downtown for the July 24, 2008 Urban Rail Connections presentation to the City Council.)



The 15.3-mile streetcar "starter line" is proposed to connect Downtown with key Central City destinations (Capitol Complex, UT, Mueller, ABIA, Long Center), and in so doing, to extend the reach of Capital Metro's "Metro Rail" first commuter rail line which will begin service in March 2009. Increasing the availability of high-quality transit service both to and in the Downtown was deemed critical to the sustainability of downtown - and the region. This Downtown Transportation Framework Plan report knits this first phase, urban rail proposal into a Transportation Framework Plan that considers all modes of Downtown transportation.

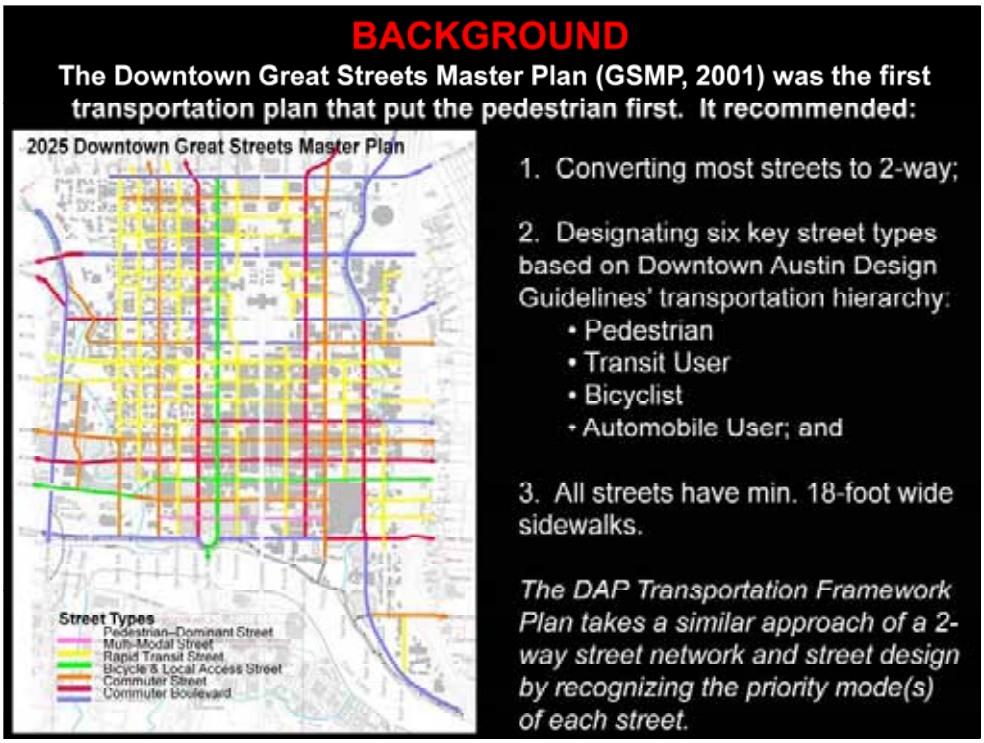
A key premise of the Downtown Transportation Framework Plan is that streets must be viewed as more than movement corridors. Streets set up and condition the way we actually see and understand the city, how it is organized, where we find places, how we participate in city life. The quality of "street life" is key to our rapport with and our enjoyment of the city and fellow citizens. The integrated design of the right-of-way (ROW) or space of the street, from property line to property line, must be a deliberate act of design that incorporates an understanding of the function of the street, both from mobility and human activity perspectives. This overall ROW design is referred to as the "streetscape", which integrates all modes of circulation (pedestrian, bicycle, transit, vehicular) with landscape, street furnishings and lighting, places for outdoor cafes, etc.



Streets and alleys account for about 44% of all Downtown space and comprise the majority of the publicly-owned space, or the "public realm". As such, great attention and care must be devoted to making streets work both as movement corridors, as well as places for the public life to unfold. The DAP Transportation Framework Plan recommendations aim to maintain the existing automobile capacity where it is needed on downtown streets, but also to achieve greater mobility for the pedestrian, cyclist and transit user. However, the public ROWs are limited in size and have many competing demands and functions, such as:

- High-quality, shaded public walkways
- Civic corridors: parades, events, markets, etc.
- Sidewalk cafes, meeting places
- Entertainment zones
- Advertising, public announcements corridors
- Movement corridors (pedestrians, bikes, cars, buses, trains, taxis, trucks)
- Utility corridors
- Service corridors
- Drainage corridors

Essential to making the streets in Downtown great is providing wider sidewalks with shade. The planting of street trees humanizes the downtown environment, makes walking and biking far more comfortable, helps to reduce the urban heat island effect and has even been shown to calm traffic. Planting rows of trees in sidewalks requires a wider sidewalk, irrigation and drainage - often requiring the relocation of underground utilities, the moving of the curb and gutter system, and along with it storm sewer inlets. Sufficient access to underground utility corridors needs to be incorporated into the streetscape design that allows for proper maintenance of all utilities. While sometimes complex and generally expensive, the civic investment in quality streetscapes is essential in Downtown place-making; enhancing economic and all other activities and uses along a street - even driving.



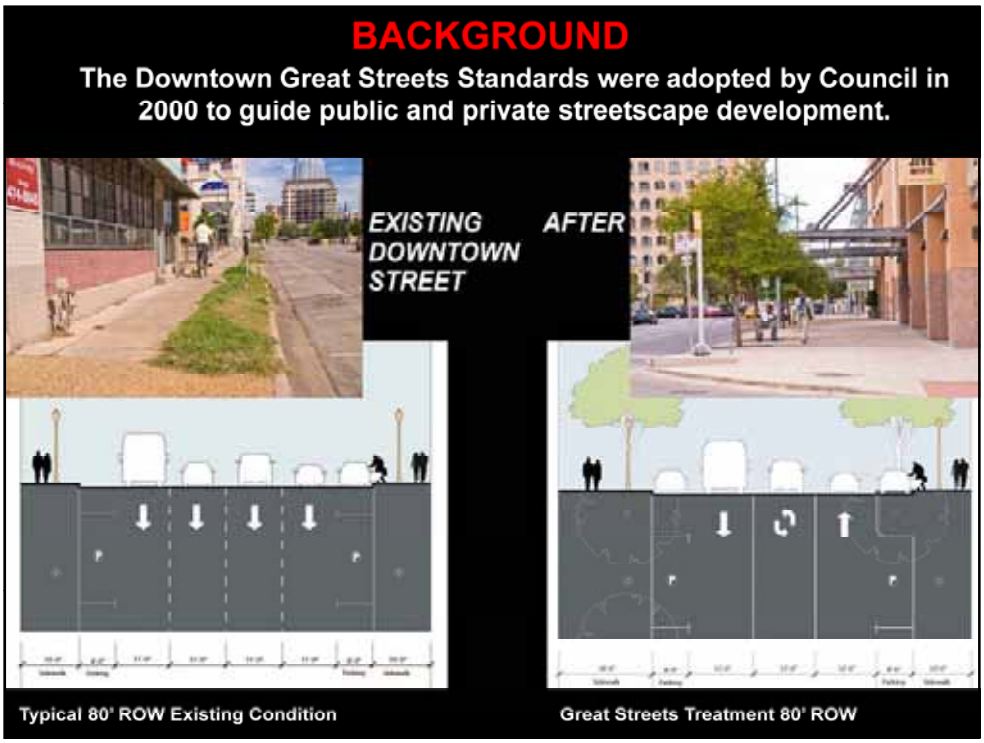
The Downtown Great Streets Master Plan (GSMP, 2001) was the first transportation plan that put the pedestrian first. It recommended:

1. Converting most streets to two-way (the 5th/6th and Guadalupe/Lavaca remained as one-way pairs);

2. Designating six key street types (shown above), based on the adopted Downtown Austin Design Guidelines' transportation hierarchy, of mode importance:

- Pedestrian
- Transit User
- Bicyclist
- Automobile User; and

3. Reserving a minimum of 18-feet for sidewalks, with or without "duck-in" parking. ("Duck-in" or "pull-out" parking is parallel parking that is carved into the 18-foot sidewalk width, therefore leaving a total of 10 feet clear for the through sidewalk zone. Trees, street lighting, traffic signal poles and sidewalk furnishings (trash bins, bike racks, benches, etc.) are located in the eight-foot wide curbside zone, between duck-in parking spaces and at the intersections and pedestrian crosswalks, where the sidewalk returns to the full 18-foot width. (See street cross sections on page 10.)



In the last eight years, Great Streets sidewalks have been implemented in the downtown by both the public and private sector. To encourage developers to build Great Streets sidewalks as properties redeveloped Downtown, the City established a Great Streets Program, whereby the City reimburses a certain amount of the sidewalk cost, if built to the Great Streets standards, including providing the specified furnishings: benches, bike racks, waste bins. The City sets aside 30% of the parking meter revenues collected in the lower CBD as "the Great Streets Program Fund". About $400,000 to $500,000 per year has been generated since the Council resolution creating this revenue stream in 1998. This rewarding of voluntary participation in the Great Streets Program has proven to be an effective way of implementing Great Streets, as most developers have chosen to comply.

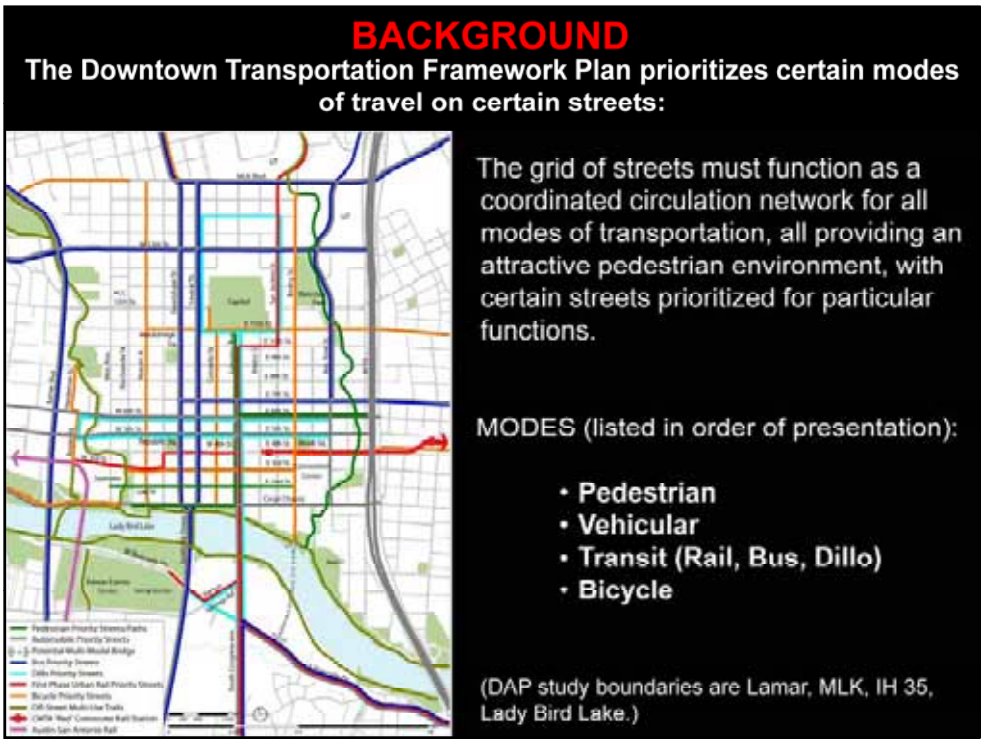
Some examples of streetscapes that were implemented with assistance from the Great Streets Program are Plaza Lofts, the Convention Center Hotel and Parking Garage, the Frost Bank Tower, the 404 Rio Grande Apartments, and the West 5th Street cluster of drive-through banks between Nueces and Rio Grande Streets. However, this opportunistic implementation approach has not created continuous lengths of Great Streets, thus the impact has not been as profound as when implemented as a public capital improvement project, or as part of a public/private development agreement, as was the case with the six blocks anchored by the City Hall block.

In its public/private partnership with Computer Science Corporation, the City required that Great Streets sidewalks be built around the three blocks where CSC buildings are located, as part of the Second Street District Plan. The City Hall project, also constructed the improvements around its new facility in the heart of the new district. The City of Austin has completed the first phase of the Second Street Improvement Project according to the Great Streets Master Plan. The entire street was converted to two-way operations and the segment between Colorado and San Antonio Street was constructed with a 32-foot sidewalk with a double row of trees on the north side and 18-foot sidewalks on the south. The Second Street Great Streets improvements will extend east to the Convention Center at Trinity Street and west through the Seaholm District to West Avenue.

Since Second Street was initiated, the City of Austin has gone on to implement Great Streets improvements along Cesar Chavez Boulevard, converting this one-way roadway to two-way and constructing a promenade along the Lady Bird Lake edge. The City is also proceeding with the design and construction of Great Streets improvements along Brazos Street, which are expected to be completed by 2010.

The DAP Transportation Framework Plan updates and refines the earlier Great Streets Master Plan, incorporating new ideas and realities that have emerged since 2001, including:

- Implementation of various Great Streets projects, both public and private;
- Integration of Capital Metro's first phase of Metro Rail along East Fourth Street;
- The DAP Issues & Opportunities Report, with its proposal for district planning and priority use streets (retail, entertainment, civic);
- The DAP Urban Rail Connections Study, which proposes streetcar operations on Downtown streets;
- The Dillo Task Force plan, which has concentrated this service along key corridors;
- The 2008 Austin Bicycle Plan Update and Lance Armstrong Bikeway project refinements;
- Seaholm & Green Water Treatment Plant redevelopment initiatives; and
- The Waller Creek Tunnel Project and upcoming District Master Plan.

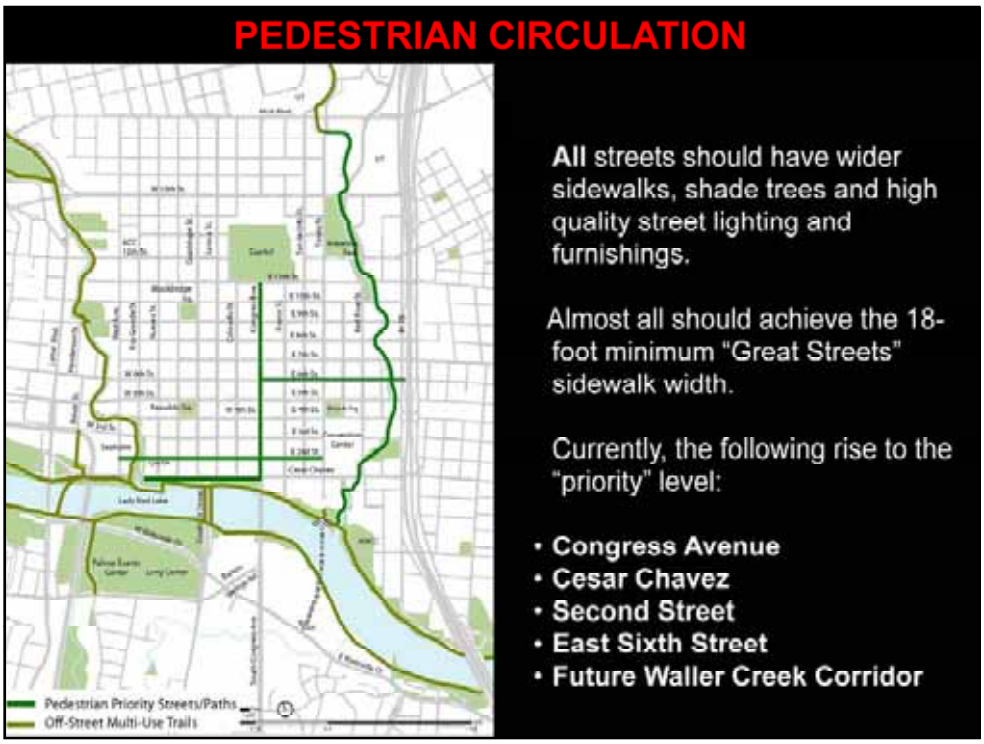


A new Downtown Transportation Framework Plan has emerged. Building on the Great Streets Master Plan, the Plan calls for the grid of Downtown streets to function as a coordinated circulation network for all modes of transportation, with all streets providing an attractive pedestrian environment, and certain streets prioritized for particular functions. (See composite map of street per priority mode above.)

The remainder of this report describes the recommendations for each transportation mode in the following order:

- Pedestrian
- Automobile
- Transit (Rail, Bus, Dillo)
- Bicycle

PEDESTRIAN CIRCULATION



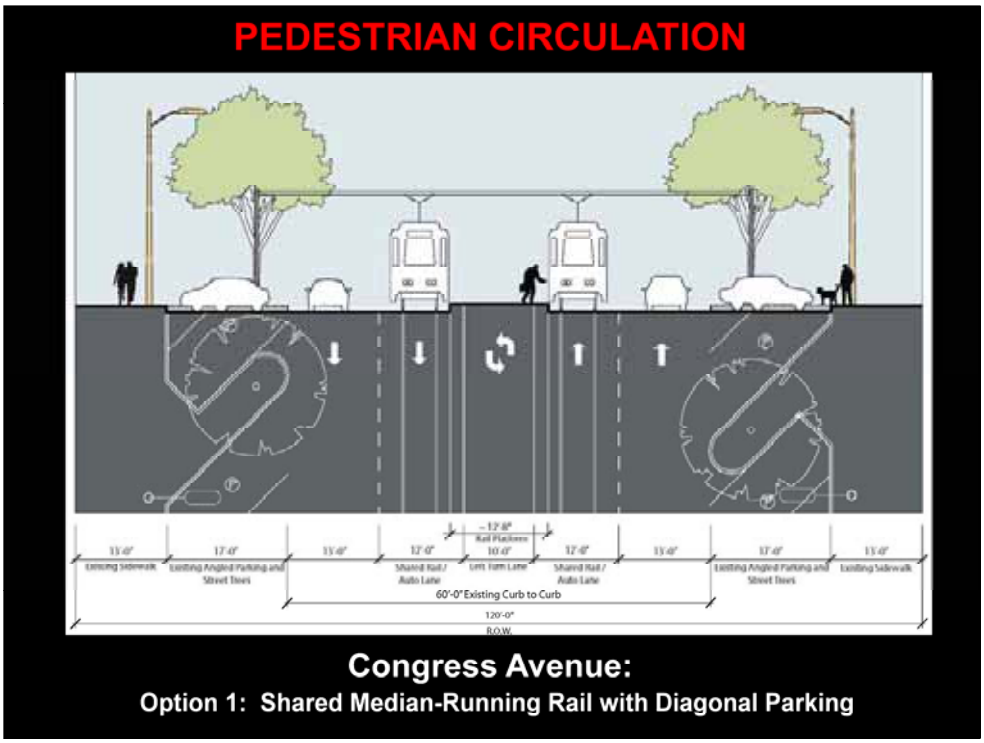
Pedestrian Priority Streets/Paths
As set forth in the Downtown Great Streets Master Plan, the pedestrian environment of ***all*** streets in the Downtown should be improved with wider sidewalks, generous tree canopies and high quality street lighting and furnishings. The Plan recommends that most Downtown streets should achieve the 18-foot minimum "Great Streets" sidewalk width. Second Street, Cesar Chavez, Congress Avenue and Sixth Street should meet or surpass these standards, as these streets are the spines of key retail, civic and pedestrian-oriented districts. The Waller Creek corridor, once the flood improvement tunnel is constructed, has the potential to become the major, north-south pedestrian spine linking Lady Bird Lake to Symphony Square and Waterloo Park, and potentially even farther north—to and through The University of Texas. This corridor will be the focus of the City of Austin's Waller Creek District Master Plan effort, which will begin in late 2008. During Phase Two of the DAP, this and other district plans will be completed in the Downtown, where priority uses (retail, entertainment, etc.) are determined, other streets or street segments may emerge as "pedestrian priority" and be designed accordingly.

A new bridge across Lady Bird Lake is also proposed as a southern extension of Trinity Street to the south shore near the Austin American Statesman/Cox-owned tract, where it is expected that significant redevelopment will occur in the next ten years. This is discussed below under the Automobile Circulation section (page 38).

Congress Avenue

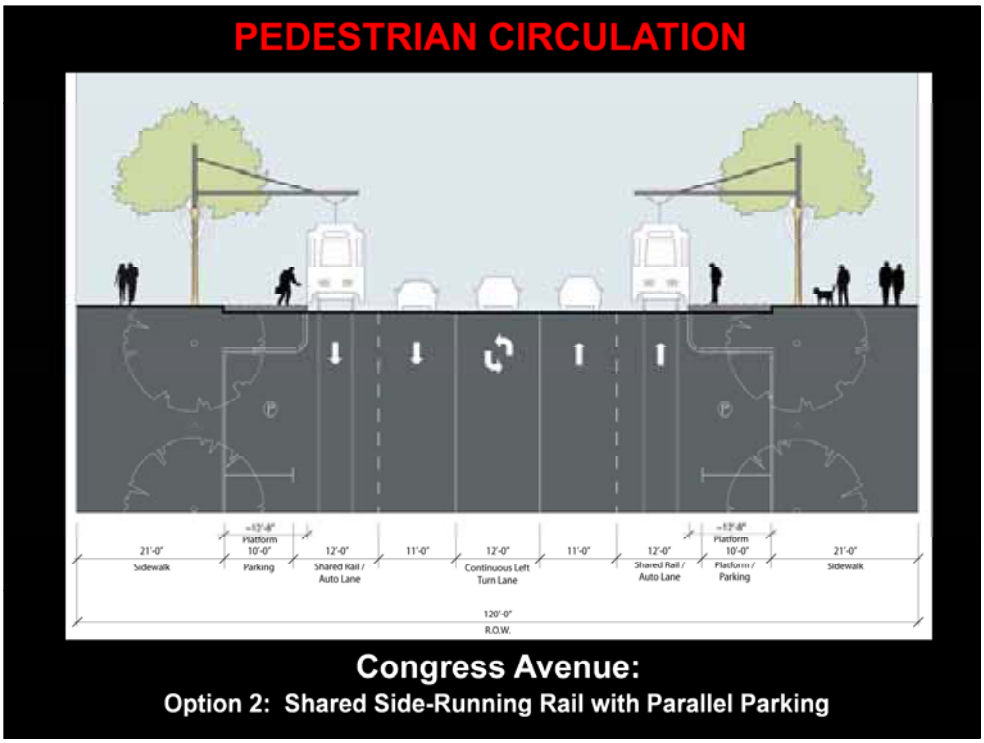
As the central spine of the Downtown, Congress Avenue has many functions. It is the symbolic gateway and "forecourt" to the Capitol and the most important ceremonial street of the City (and the State), serving as a venue for parades, festivals and civic celebrations. It is the historic "main street" of Austin, once featuring a continuous frontage of shops and department stores, and now serving as the City's most prestigious corporate office address. It is also one of the principal transportation corridors in the Downtown: its 120-foot wide right-of-way once accommodated Austin's historic streetcar routes. Currently, it is a two-way street with six vehicular lanes and curbside diagonal curbside parking on most blocks. It is a major corridor and transfer street for Capital Metro bus and Dillo routes.

The Downtown Transportation Framework Plan recommends that Congress Avenue be enhanced in a manner that is befitting of this role. The street should be viewed as more than an arterial for auto movement, but as a multi-modal corridor that is one of the most important public places in the City. With the potential introduction of streetcar service, and with retail and cultural activity resurgent, consideration should be given to the reconfiguration and enhancement of the street, which has not seen any significant improvements in nearly twenty-five years. Pedestrian enhancements should strive to: increase sidewalks widths to promote promenading as well as outdoor cafes; develop a consistent tree canopy that also frames views of the Capitol; improve the grading and sidewalk drainage of the street; and reduce the negative effects of fast-moving cars and buses.



Congress Avenue is the preferred north-south alignment for Downtown urban rail service, reflecting its historic role as a multi-modal trolley street, where all of the City's inter-urban streetcar lines converged. As described in the Urban Rail Connections Study (July 2008), the urban rail project is considering both exclusive-running (dedicated) trackway, as well as a streetcar option, where the rail tracks would share lanes with automobile traffic. On Congress Avenue, there are several alternative streetscape designs that could be considered for each of these rail options. The first two (Options 1 and 2) assume that the streetcar will *share* a vehicular lane with the automobile; and the second two (Options 3 and 4) explore a *dedicated* rail trackway in the center of the street. All four options aimed to maintain and even maximize curbside parking along Congress Avenue.

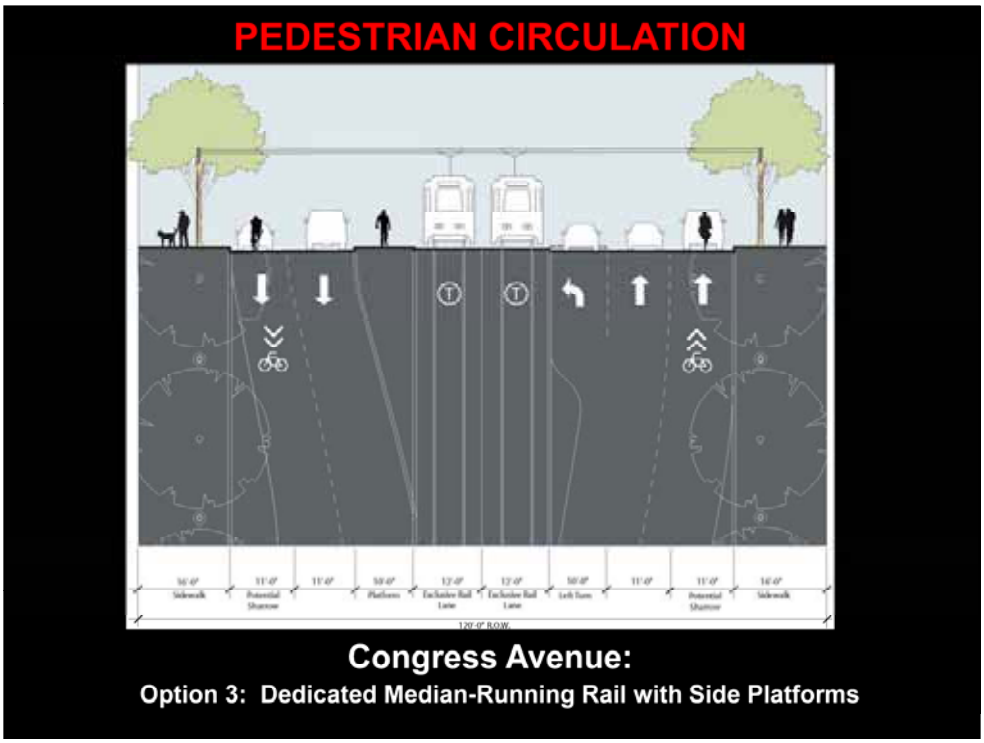
<u>Option 1: Shared Median-Running with Diagonal Parking</u>*:* This option maintains the street's existing sidewalks (13 feet in width), curb and diagonal parking and proposes streetcar service in the middle lane with a central platform. The street would function as a five-lane roadway with two lanes in each direction and a center-turn lane, interrupted only by transit platforms, which would be located at intervals of about every third block. A bicycle facility is not included in this option, as the angle parking creates an unsafe condition for bicyclists. (Note: This is the option that Capital Metro proposed as part of its earlier 2006-2007 "Future Connections" streetcar proposal.)



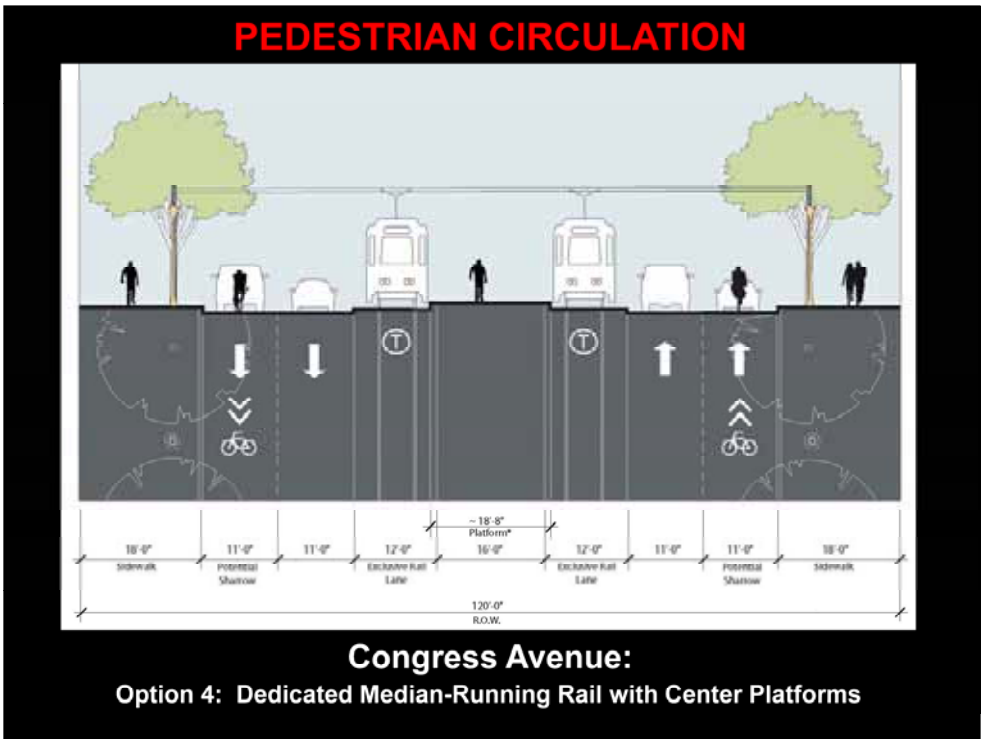
Option 2: Shared Side-Running Rail with Parallel Parking*:* The second option also proposes a five-lane roadway with a center turn lane, but calls for the streetcar to run in the curbside automobile lane. In this option, although the diagonal parking would be replaced with parallel parking, there would be no loss of parking because of the relative inefficiency of the current angle parking layout. In fact, there could be a gain of up to 34 spaces assuming relatively continuous curbside parallel parking, interrupted by intersection bulb-outs and streetcar platforms. Sidewalks in this option would be 21 feet in width. This option does not include a bicycle facility, as the side-running rail would conflict with bicyclists traveling in the outer lanes and result in bicyclists making dangerous rail crossings at angles less than 45 degrees.

Of the two shared-running options, the principal advantage of the first option (and corresponding disadvantage of the second) is the minimal construction impact and disruption that would occur, since construction of rail would be confined to the center lanes of the street, with the sidewalks and parking areas remaining largely intact. A key disadvantage of the first alternative is the reduction in vehicular capacity that would occur with the outside lane providing access and maneuvering to the diagonal parking. The second side-running option has some key advantages, including:

- Wider sidewalks (21 feet, rather than 13 feet)
- Less visual obstruction of the axial Capitol view since overhead electrical lines would be along the side of the street, rather than in the center.
- Less physical obstructions for parades and other events that use the street, since there are no raised platforms/medians in the center of the street.
- More convenient and direct passenger access to streetcar from sidewalk platforms.
- Potential for increased curbside, parallel parking.



<u>Option 3: Exclusive Median-Running Rail with Split, Side Platforms:</u> This option places the dedicated trackway in a center median, with adjacent "split" platforms (rather than a central platform), located on either side ("farside") of the intersection. Passengers would access the platforms at intersection crosswalks. Since curbside parking could only occur at locations where there is no platform or left turn lane, some loss of existing spaces would result. Sidewalks would be 16 feet in width, less than the 18 feet recommended by the Great Streets Master Plan for a typical street. The outside vehicular lane could be striped as a "sharrow" lane, indicating to motorists that bikes are present on the street, and are allowed to "take the lane", as discussed further in the Bicycle Circulation section below.

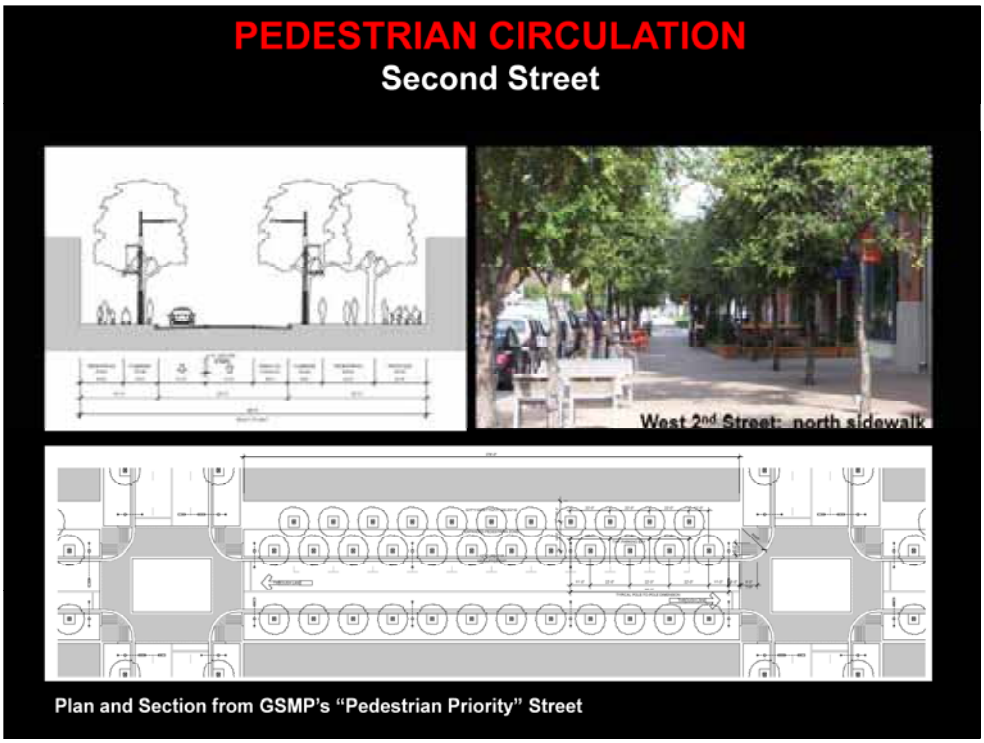


<u>Option 4: Congress Ave. Exclusive Median-Running, Single Center Platform:</u> Like Option 3, this alternative has a dedicated trackway in the center of the street, but instead of two farside platforms, Option 4 proposes a single, centrally-located platform serving both directions of streetcar travel. Two vehicular lanes would be provided in each direction, one of which could be striped as a bike "sharrow" lane. This option would allow for a continuous 18-foot sidewalk, consistent with the Great Streets Master Plan, and is the preferred of the two dedicated trackway options, from a pedestrian standpoint. Its principal disadvantage is the limited left-turn capacity.

Selection of a preferred alternative for Congress Avenue will be further informed by the DAP Phase Two District Planning in the CBD, and will be finalized as part of the detailed design and engineering of the streetcar project.

Second Street

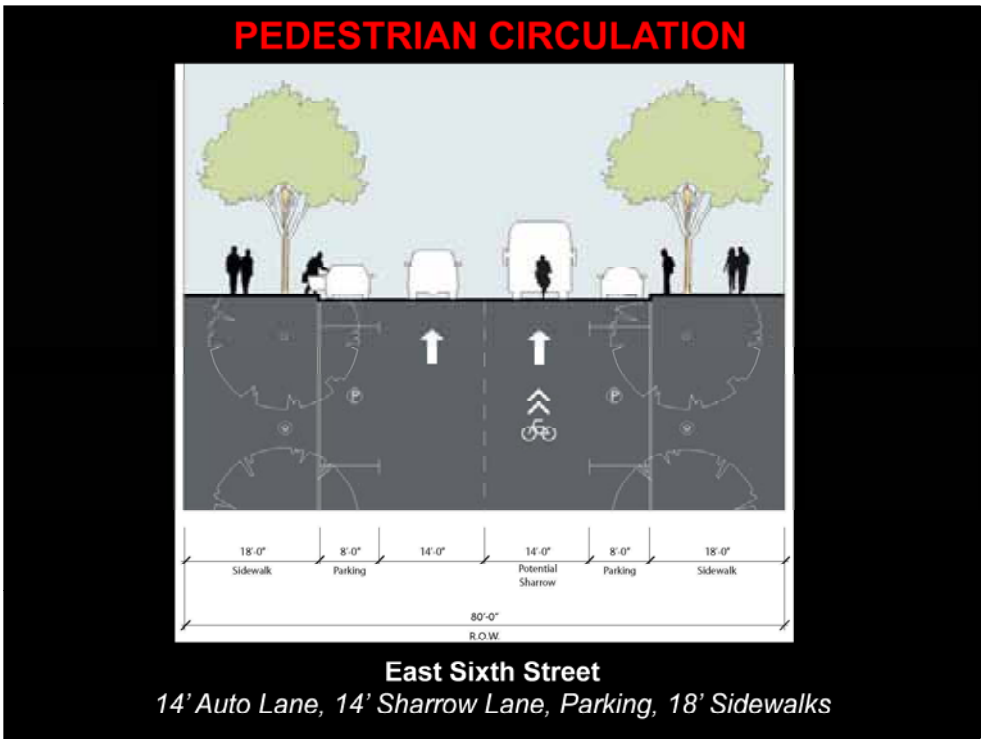
Second Street is the first major Great Streets project implemented by the City of Austin as part of the public/private redevelopment of the six-block Second Street Retail District, which includes the new City Hall. The street is designed as a pedestrian-priority, retail and civic corridor with a 32-foot wide promenade along the north side of the street, an 18-foot sidewalk along the southern curb and parallel parking along both curbs. Cafes spill out onto the wide promenade. Although only two blocks of the street have been completed, the ultimate intent is for the street to stretch across the Downtown, connecting the Convention Center at Trinity Street with the redeveloped Green Water Treatment Plant and Seaholm Power Plant sites at West Avenue: a distance of ten blocks.



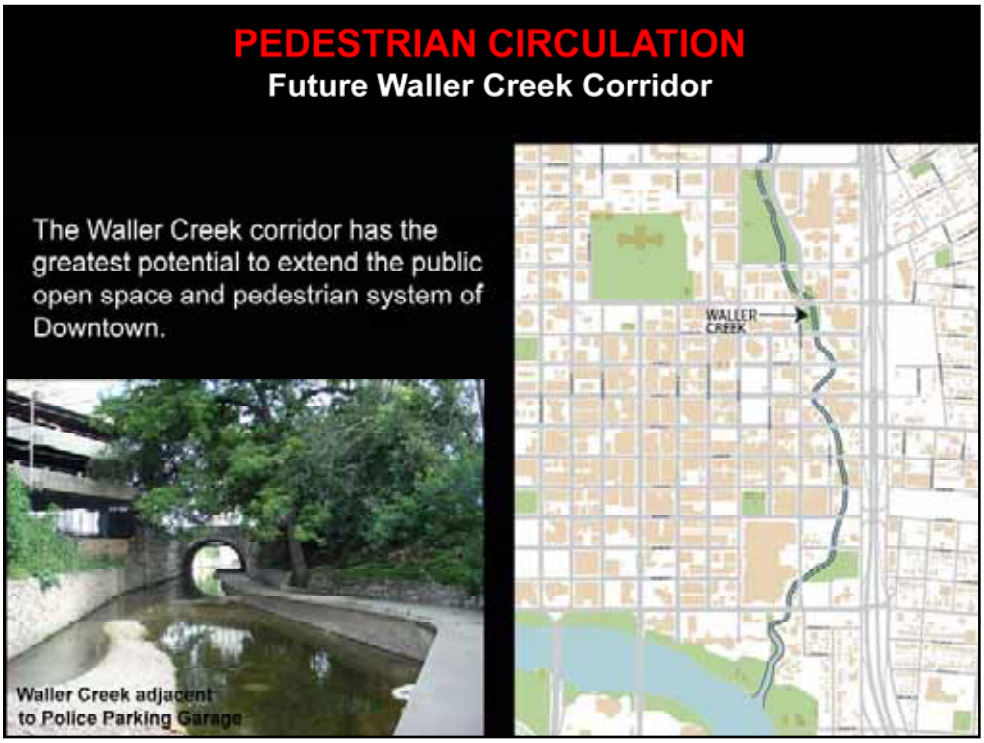
As development proceeds along the Second Street corridor, it will be important for new projects to reinforce the pedestrian character and vitality of the street. Drop-offs, driveways, curb-cuts, and other elements that interrupt the pedestrian and retail continuity of the street should be avoided. Ground level uses should be designed to accommodate viable and continuous retail or restaurant uses along the street front, with appropriate retail depths (e.g., no less than 45 feet), and floor-to-floor heights (e.g., of at least 18 feet). Lobbies, service areas or other activities that reduce the energy and animation of the street should be avoided.

East Sixth Street

East Sixth Street is Downtown Austin's historic commercial street, lined with 19th and early 20th century mercantile buildings. Known originally as Pecan Street, the seven block segment of the street between Congress Avenue and IH 35 has evolved into an entertainment district, with many bars and clubs attracting students and young people. Crowds are so intense, and behavior sometimes so unruly, that the street is closed to vehicular traffic on weekend evenings. The excessive number of single-purpose bars has had negative impacts on the street and the Downtown; many live music venues have been "priced" out of the area and have been forced to locate elsewhere (including nearby Red River Street); and the daytime life and vitality of the street has suffered. The Downtown Austin Alliance (DAA) has taken a proactive role in trying to attract a more diverse mix of businesses and retailers along the street, and Phase 1 of the Downtown Austin Plan has recommended that policies and incentives be developed to increase the number of live music venues, that could broaden the appeal of the street to all age groups.



In spite of the intensive levels of pedestrian activity, the sidewalks along East Sixth Street are only 10 feet wide. The roadway currently operates as a four-lane one-way roadway that takes up three-quarters of the 80-foot wide right-of-way. As discussed below (Automobile Circulation), it is recommended that the street be maintained as a one-way westbound entry into the Downtown, but with wider sidewalks and a narrower roadway section. As shown above, it is proposed that the street follow the prototypical dimensions of the Great Streets Master Plan, with 18-foot wide sidewalks and a 44-foot wide roadway. Operation of the street would include two westbound lanes of 14-feet in width, permitting the right-hand lane to be striped as a "sharrow" lane and also allowing for enhanced safety for vehicular maneuvering, drop-off and loading operations. Two curbside parking areas could be managed to provide for commercial and/or musicians' loading and unloading. There may be opportunities for the 18-foot wide sidewalks to expand into the parking area to provide 26-foot wide sidewalks for outdoor café tables or street performance areas. (The specific design and treatment of the street will be refined as part of the Phase Two DAP District Planning.)



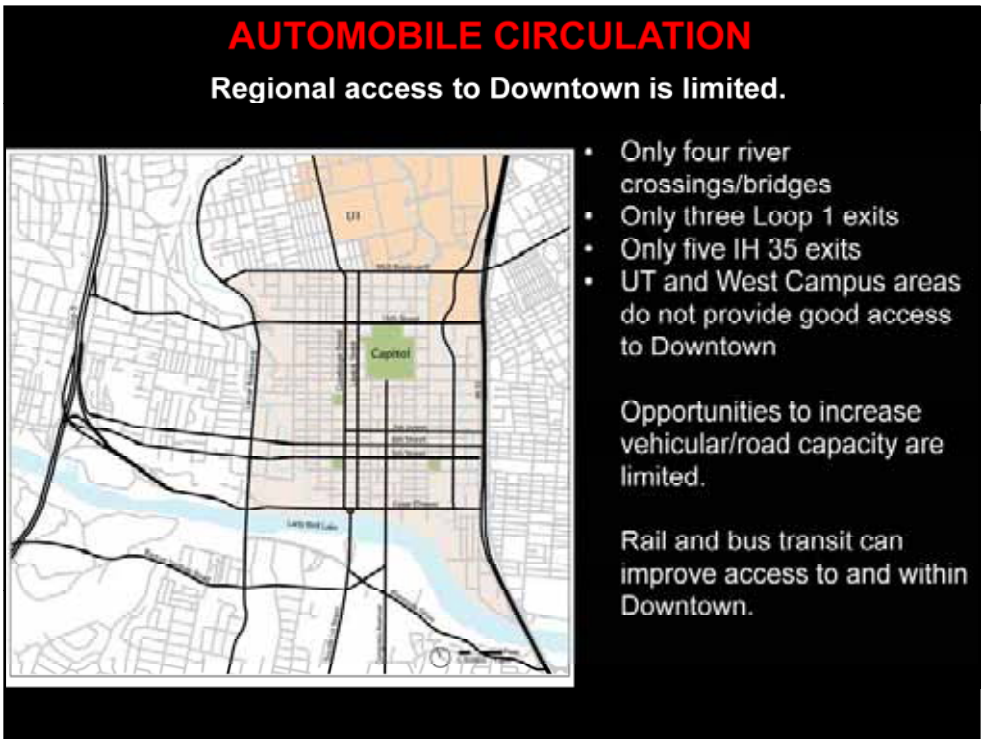
Waller Creek

Clearly , the most significant opportunity for increasing and enhancing the pedestrian and open space system of Downtown is made possible with the construction of the City and County-sponsored, Waller Creek Tunnel Project, which will remove much property from the 100-year flood plain and improve the southernmost one-mile segment of the creek. In so doing, the Waller Creek corridor can provide an attractive and active pedestrian promenade providing continuous access between Lady Bird Lake and The University of Texas, with linkages to other Downtown open spaces, such as Waterloo Park and Palm Park, and beyond to East Austin at key crossings of IH 35.

PEDESTRIAN CIRCULATION
Summary of Key Recommendations

1. Increase sidewalks and incorporate shade trees on all streets, per the Prioriity by Mode Map.
2. Achieve "Great Streets" sidewalk widths on most streets.
3. Establish Second Street, Cesar Chavez, Congress Avenue, Sixth Street and the Waller Creek Corridor as pedestrian priority streets/paths, surpassing "Great Streets" standards.
4. Extend Trinity Street southward across Lady Bird Lake as a bridge to the south shore with excellent pedestrian and bicycle accommodation.

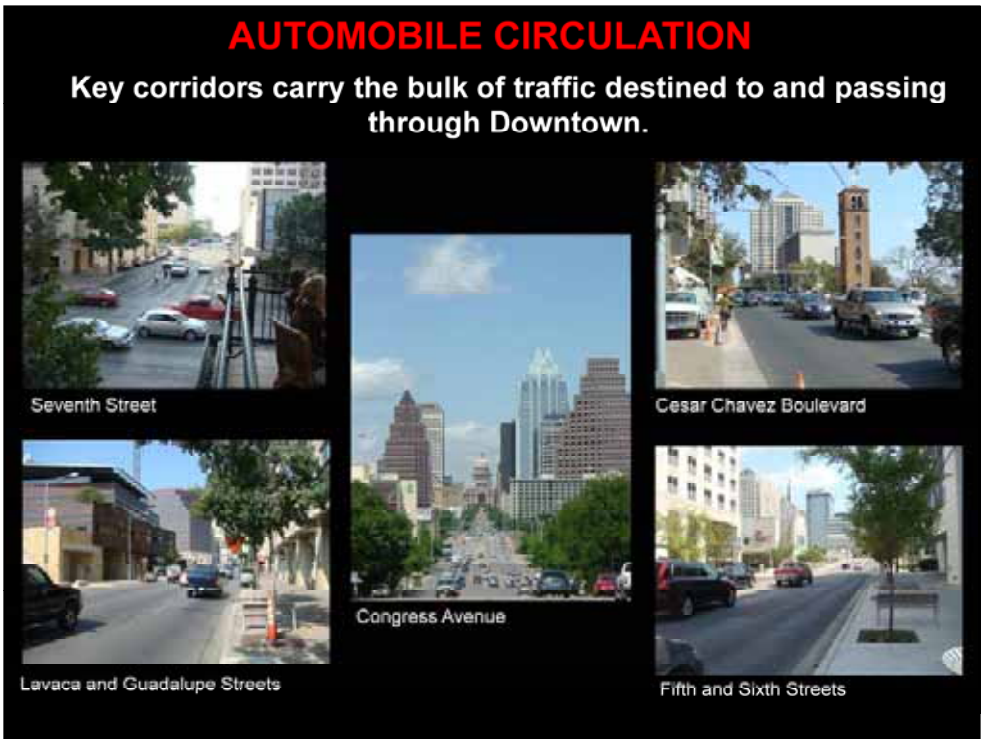
AUTOMOBILE CIRCULATION



Regional Access to Downtown

There are natural and man-made barriers that limit access into Downtown Austin. Only four vehicular bridges cross the Colorado River within and at the edge of Downtown: at Lamar Boulevard, South First Street (the Drake Bridge), at Congress Avenue (the Ann W. Richards Bridge) and at IH 35. The two main freeways on each side of Downtown have few on/off ramps serving Downtown: Loop 1 (MoPac) has only three exits (Cesar Chavez, West 5th and Enfield Road (Fifteenth), and IH 35 has five exits (Cesar Chavez, East 6th, East 11th, East 15th, East MLK). Most of the streets from the north do not feed directly into the Downtown grid, because of the interruptions of the Capitol and The University of Texas. The UT campus, northeast of Downtown has a street system that is largely non-public, and the West Campus to the northwest of Downtown has a shift of the street grid at MLK, limiting the connectivity between these two areas. Only Lamar Boulevard, Guadalupe and Red River streets provide good, non-freeway access to the Downtown from the north. In addition to these man-made barriers, the north-south-running Waller and Shoal creeks have also interrupted the continuity of certain east-west streets, notably West 7th and 11th streets.

As the region's population has increased and expanded outside the central city, Loop 1 and IH 35 have become highly congested, particularly during peak periods. The few entry points into Downtown have become chokepoints. The limited physical space of Downtown allows few opportunities for the construction of new roadways or for the expansion of existing ones to increase vehicular capacity. As discussed in the DAP Urban Rail Connections Study (July 2008), significant access capacity improvements to the Downtown will depend upon the implementation of a more robust transit system, including urban rail and bus-priority streets. There are currently no HOV lanes or transit priority streets in Austin, so buses share congested roadways with automobiles, reducing their potential for providing competitive travel times.



Because of these "pinch points" there are only a few major corridors that carry the bulk of traffic to, and through, the Downtown. These include:

- Cesar Chavez, Lamar, and Martin Luther King, Jr. boulevards along the southern, western, and northern edges of Downtown, and the IH 35 frontage roads along the east edge;
- East Seventh Street, providing access from East Austin, and serving as a principal gateway from the Airport;
- West Fifteenth Street, which connects IH 35 to Loop1 via Enfield Road, and provides direct access to the Capitol;
- Congress Avenue, providing access from the south, and serving as the City's (and State's) principal ceremonial street.
- In addition to these corridors, Downtown has two major pairs of one-way streets that provide north-south and east-west connectivity through the Downtown: Lavaca and Guadalupe streets, and Fifth and Sixth streets.

As noted above in the Pedestrian Circulation section, a new bridge across Lady Bird Lake is also proposed as a southern extension of Trinity Street to the south shore near the Austin American Statesman/Cox-owned tract, where it is expected that significant redevelopment will occur in the next ten years. The bridge is intended to:

- increase vehicular access to and from Downtown, linking the convention Center directly to south shore hotels, both existing and future ones,
- provide great and scenic pedestrian and bicycle connectivity between Downtown and South Austin, and
- enhance considerably the connectivity of the Town Lake Trail system, linking to the proposed boardwalk and trail improvements currently being planned by the City.

(The cross section design and type of bridge, as well as its general alignment are very conceptual at this stage, but could include one lane each way for vehicles, dedicated bicycle lanes and wide sidewalks.)

Despite limited vehicular capacity along the main arterials leading into the Downtown, most streets within the core have plenty of vehicular capacity. Many streets are wider than they need to be to meet traffic needs, and as a result devote only a small portion of the right-of-way to the pedestrian or to the cyclist. These streets are unpleasant places to walk, and do not support the level of activity that is characteristic of a vibrant mixed-use downtown.

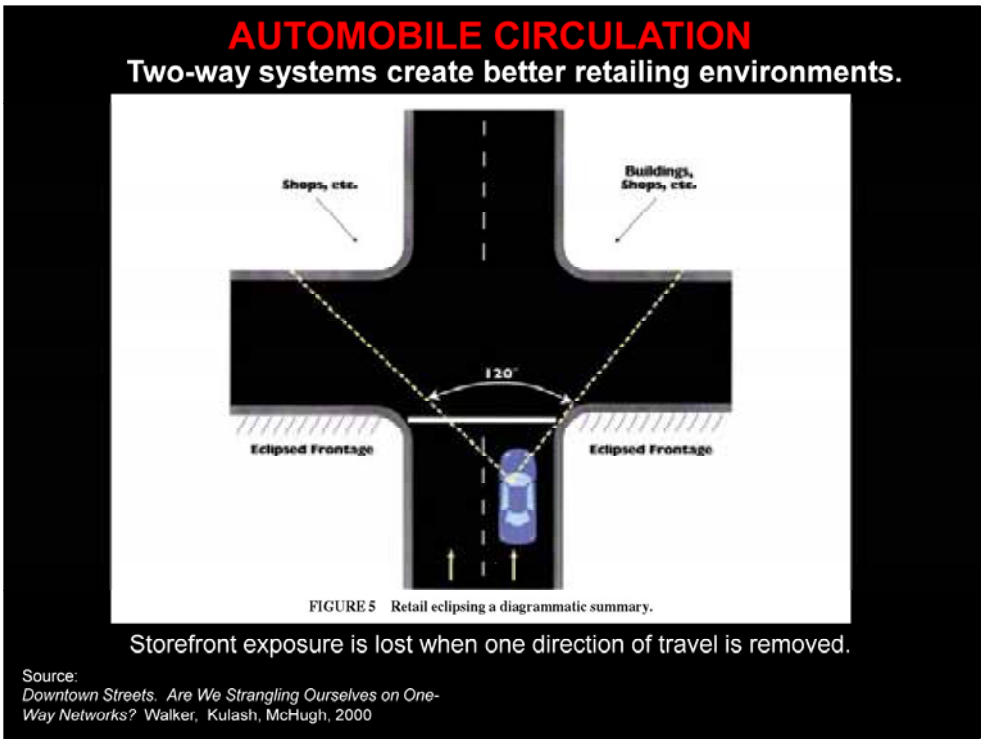
As downtown evolves into a mixed-use district, urban residents as well as workers, look to the downtown street system to provide more than a conduit for the movement of cars. Reducing the speed of traffic, and providing space for other modes of travel including walking, biking and transit, can create a more livable and sustainable environment.

Downtown's one-way street network does not contribute to the creation of a livable people place. The one-way system can encourage faster-moving traffic and can make way-finding difficult. One-way street systems can force drivers to follow out-of-direction routes to their destinations, causing an increase in both the number of turning movements required and vehicle miles traveled (VMT). The direct result of this is an increase in traffic volumes on a given segment or intersection, with a corresponding degradation in air quality within the downtown.

A national study of one versus two-way street systems completed in 2000 concluded that two-way street networks create safer and more predictable pedestrian crossings than one-way networks. The study notes:

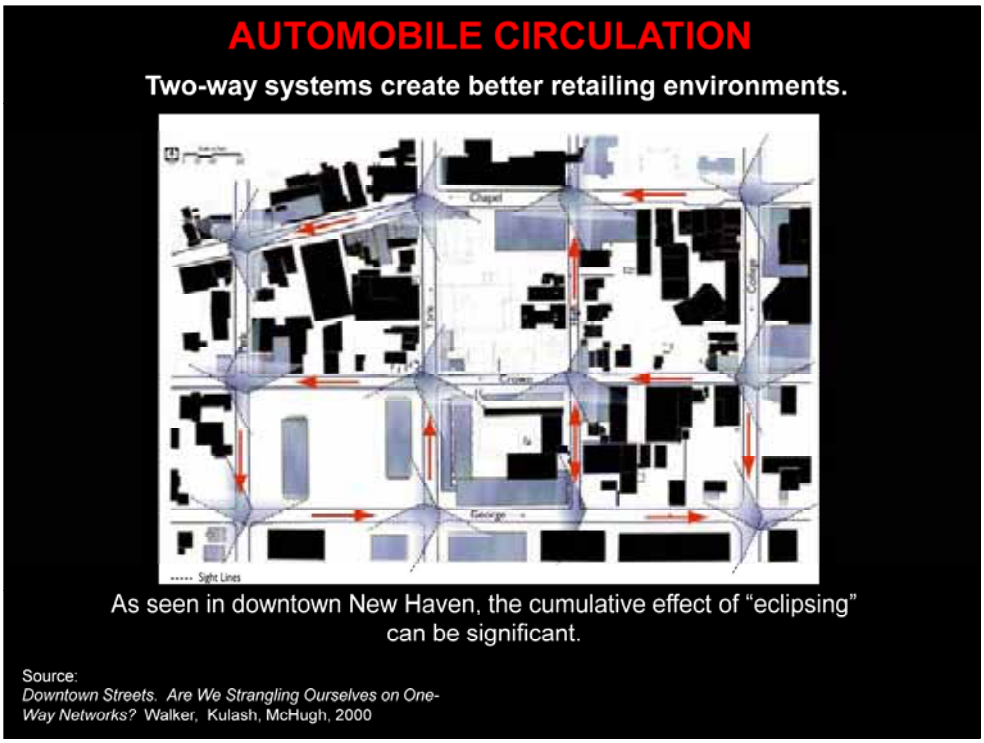
> "The conventional wisdom has always assumed that one-way streets were safer and more comfortable for pedestrians to cross than two-way streets. Superficially, it would seem that crossing the single direction of traffic on a one-way street is always preferable to crossing a two-way street. As is often the case, the conventional wisdom is wrong. In fact, crossing a one-way street presents greater difficulties to the pedestrian than crossing a two-way street. The explanation lies in the greater number of different vehicle/pedestrian conflict sequences (hereinafter "conflict sequences") that are encountered in crossing the one-way street. Any given conflict sequence consists of: (1) the kind of turning movement that the vehicle is engaged in, (2) the direction (left-to-right or vice versa) in which the vehicle path intersects with the pedestrians and (3) the location of the vehicle with respect to the pedestrian's field of view, at the beginning of the vehicle movement…."

(Source: *Downtown Streets. Are we Strangling Ourselves on One-Way Networks?* Walker, et al, 2000)



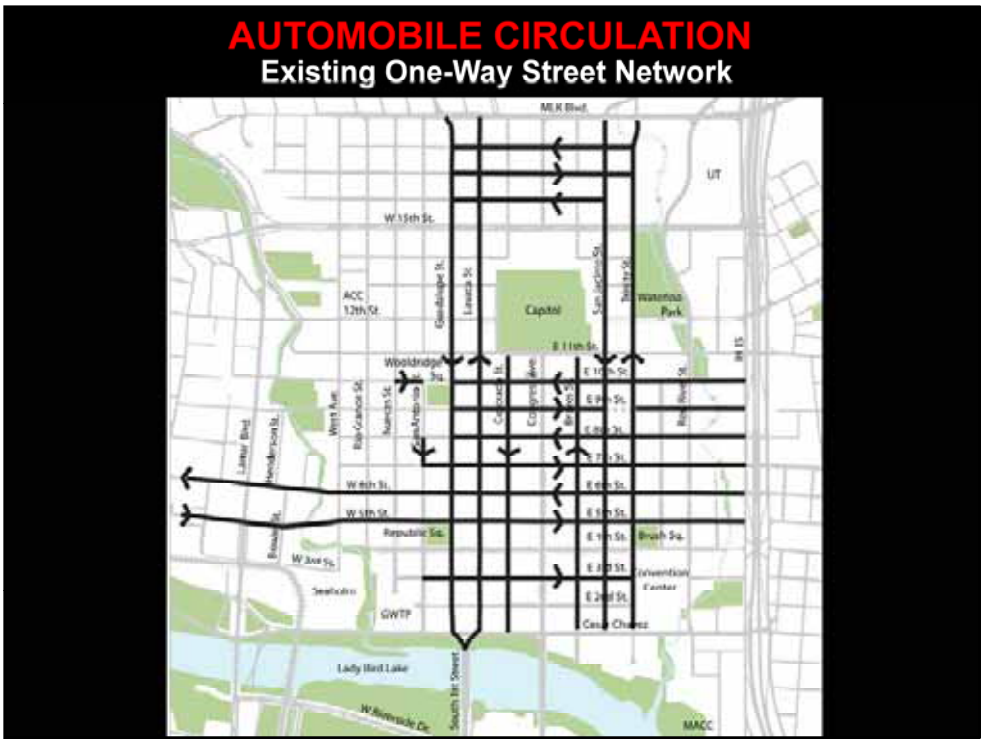
One-way street networks do not create good retailing environments, as the single direction of travel limits views to storefronts of businesses. As a vehicle stops at or enters an intersection, the driver has excellent visibility of the storefronts on the far side of the cross street, but the nearside stores are largely "eclipsed" from view.

(Source: *Downtown Streets: Are we Strangling Ourselves on One-Way Networks?* Walker, et al, 2000).

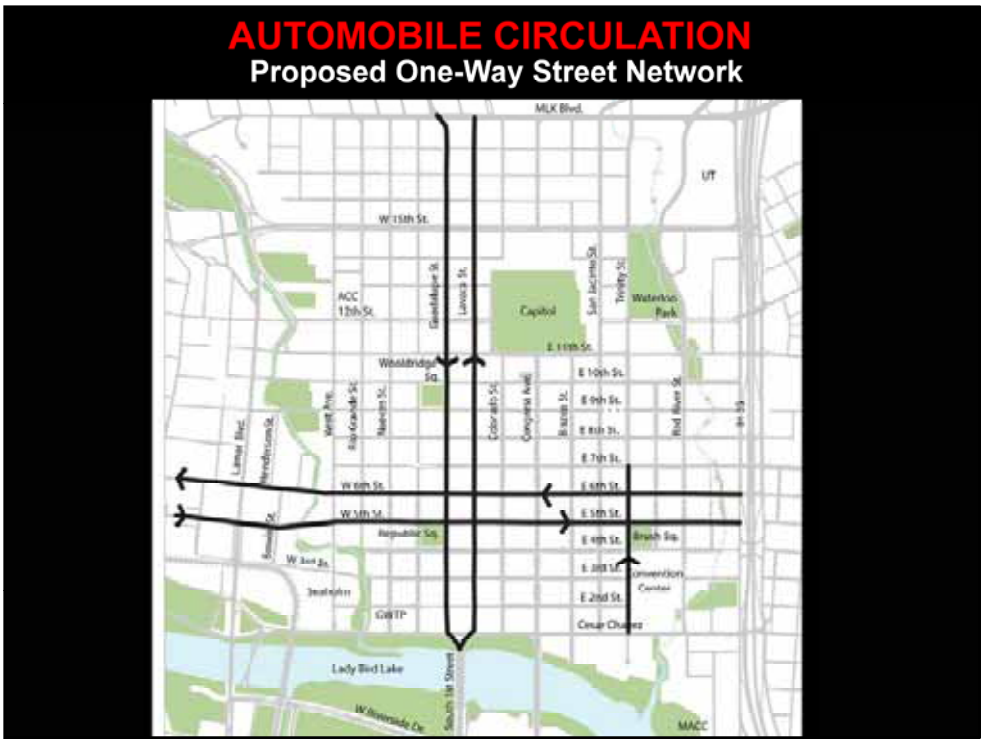


"Eclipsing" occurs on cross-street storefronts along the nearside of the intersection relative to the direction of travel, and where downtown street networks contain many one-way streets, the accumulated negative impacts are significant, as seen in this example from downtown New Haven, Connecticut. New Haven is studying the conversion of its one-way streets to two-way, as are many other communities, like Richmond, Virginia, Dayton, Ohio, Birmingham, Alabama and Atlanta, Georgia. Other cities that have successfully converted one-way streets to two-way streets in their downtown areas include:

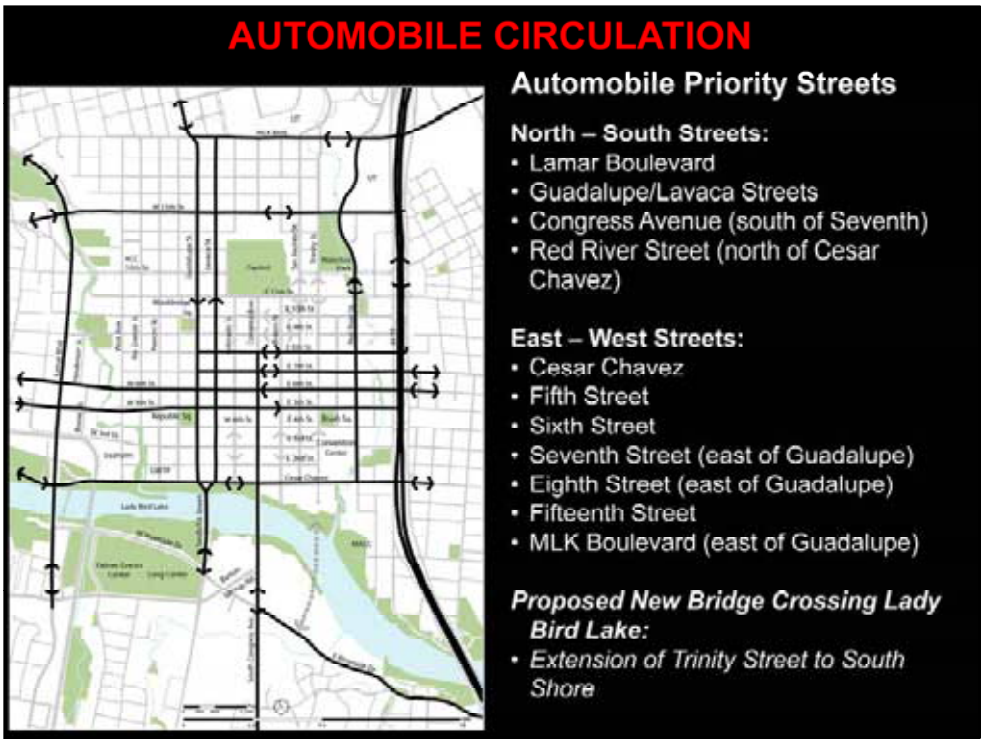
•Santa Monica, CA
•Berkeley, CA
•Pasadena, CA
•Sacramento, CA
•Colorado Springs, CO
•Lubbock, TX
•Tampa, FL
•Milwaukee, WI
•Columbus, OH
•Toledo, OH
•Raleigh/Durham, NC
•Wilmington, NC
•Charleston, SC
•Perth, Western Australia



Many of Austin's downtown streets are one-way. Studies over the past fifteen years, including the four Regional Urban Design Assistance Teams (RUDATs) conducted by the AIA, have all concluded that the one-way street system should be reconsidered. The Great Streets Master Plan also made the same conclusion. Since that time, Second Street and Cesar Chavez Boulevard have been converted to two-way travel, an improvement that has simplified east-west travel through Downtown, and one that has little noticeable negative impact on Downtown mobility.



Because of their importance for north-south and east-west connectivity, it is recommended that Lavaca and Guadalupe streets and Fifth and Sixth streets be maintained as one-way couplets. In addition, Trinity Street between Cesar Chavez Boulevard and Seventh Street is also recommended to be maintained as a one-way street segment, because of the heavy bus and drop-off activity at the Convention Center. All other streets are recommended for conversion to two-way traffic, which could be implemented over time, in stages.

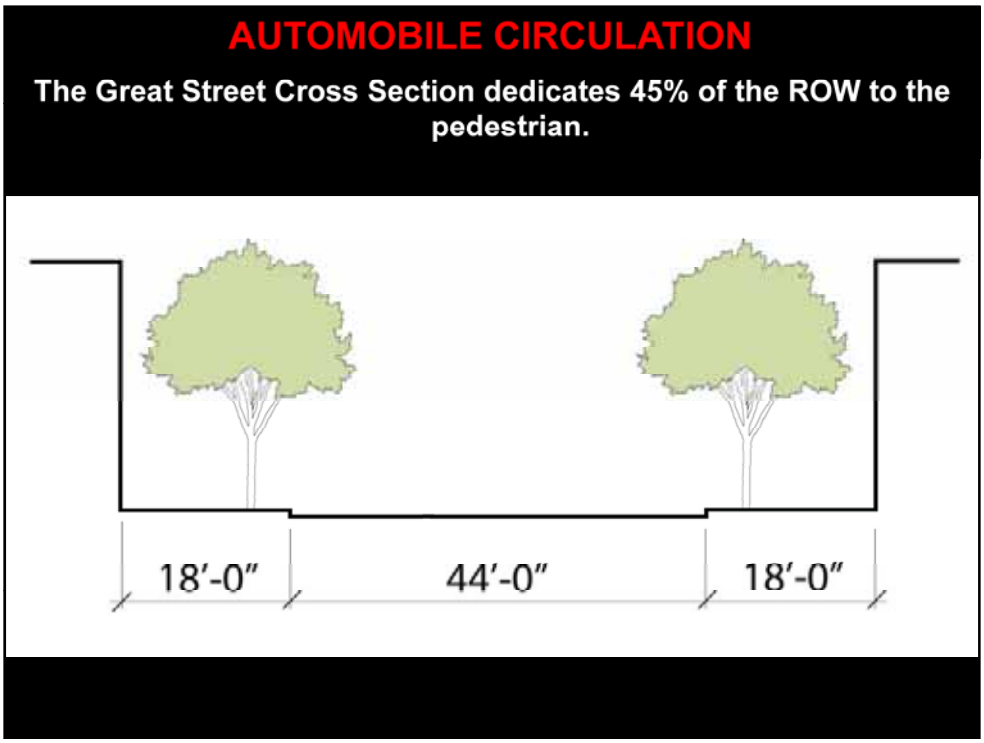


The proposed Downtown Transportation Framework Plan recognizes that certain streets have a priority to move automobiles and to provide access to Downtown, in addition to creating a positive pedestrian environment, and providing for other transportation modes. North-south automobile priority streets, include: Lamar Boulevard, Lavaca and Guadalupe streets, Congress Avenue (south of Seventh) and Red River (north of Cesar Chavez). East-west automobile priority streets include Cesar Chavez Boulevard, Fifth and Sixth streets, Seventh and Eighth streets (east of Guadalupe), 15th Street; and Martin Luther King, Jr., Boulevard.

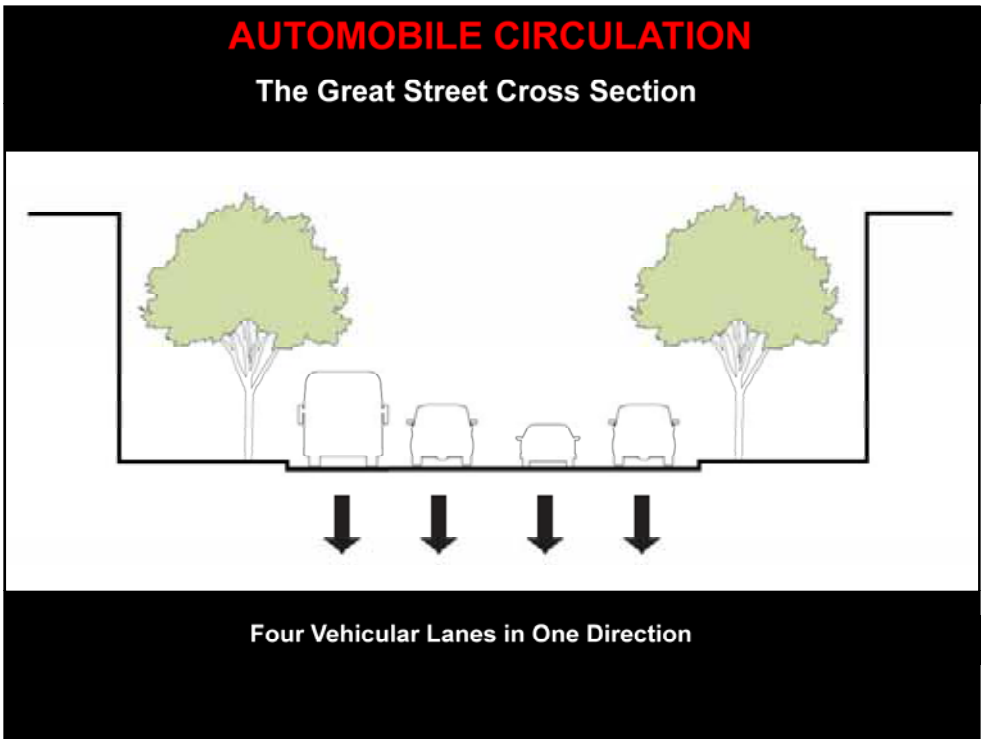
While not an automobile priority street, a new bridge across Lady Bird Lake is also proposed as a southern extension of Trinity Street to the south shore near the Austin American Statesman/Cox-owned tract, where it is expected that significant redevelopment will occur in the next ten years. The bridge is intended to:

• increase vehicular access and mobility to and from Downtown, linking the Convention Center directly to existing south shore hotels, the TxDOT employment campus and new development,
• provide great and scenic pedestrian and bicycle connectivity between Downtown and South Austin, and
• enhance considerably the connectivity of the Town Lake Trail system, linking to the proposed boardwalk and trail improvements currently being planned by the City.

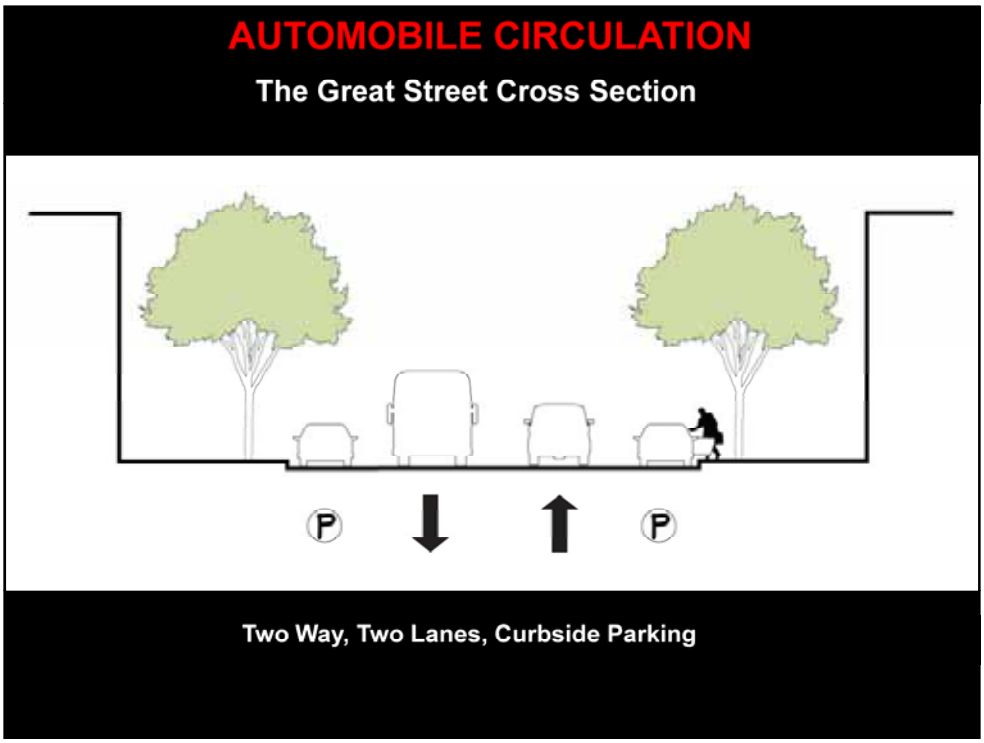
(The cross section design and type of bridge, as well as its general alignment are very conceptual at this stage, but could include one lane each way for vehicles, dedicated bicycle lanes and wide sidewalks.)



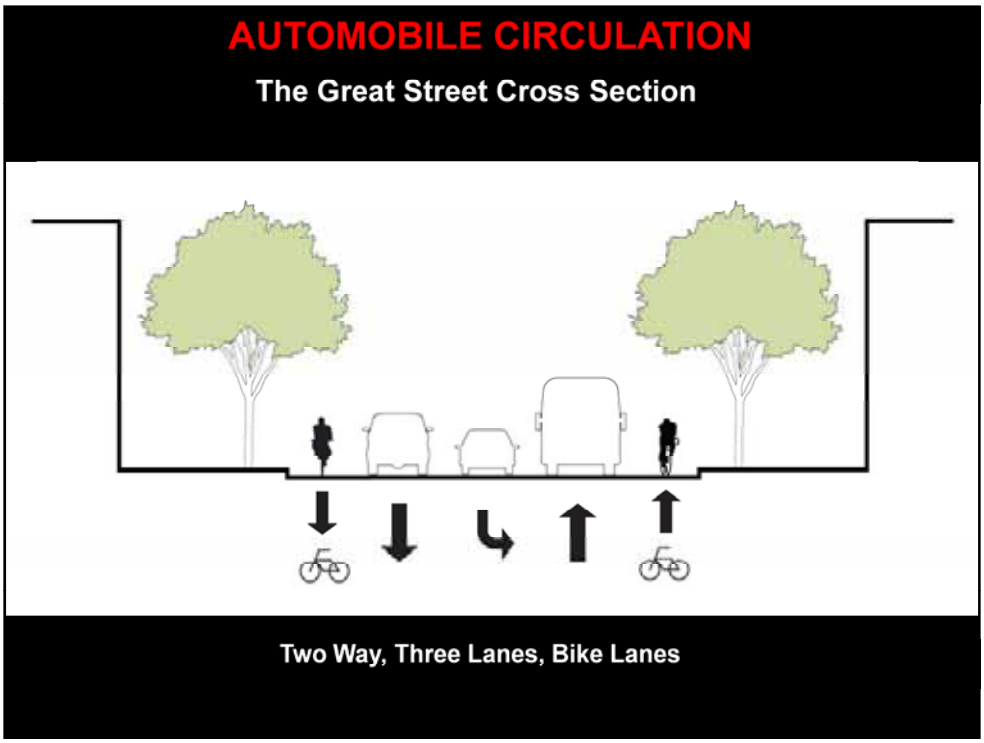
But even with their role as vehicular priority corridors, it is important that Downtown streets be designed to accommodate more than just the automobile. The Great Streets Master Plan developed a standard cross section for Downtown streets, which provides considerable versatility. With a 44-foot roadway width and 18-foot sidewalks for most of the 80-foot wide rights-of-way within the Downtown, a significant portion (45%) of the public right-of-way (ROW) is maintained for pedestrian movement and the type of activities that make the Downtown an interesting and engaging place to be. The section provides for many operational options, including:



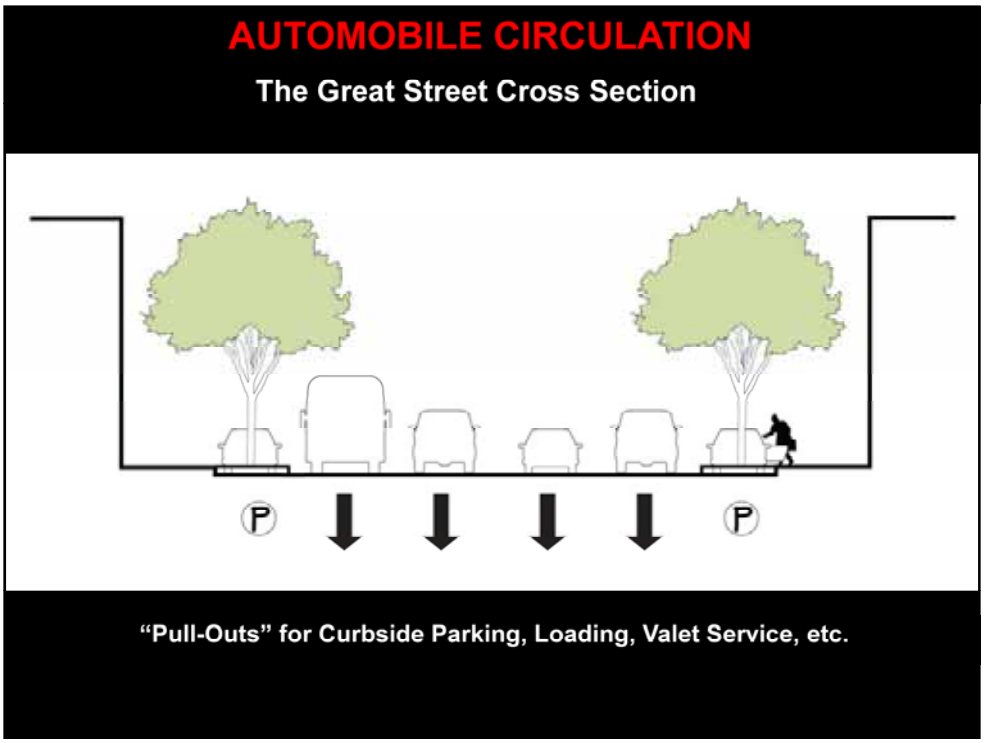
- Four travel (vehicular) lanes in one direction.



- Two-way operations with two lanes and curbside parallel parking.

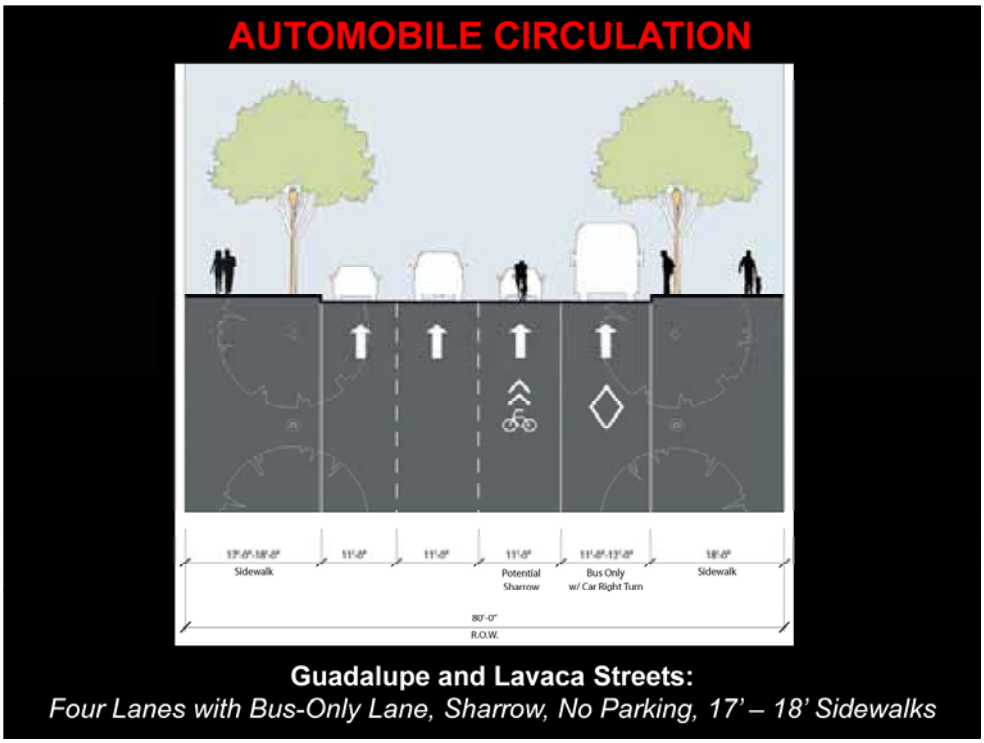


- Two-way operations with three lanes (including a continuous center turn lane) and bike lanes at the curbsides.



- And where necessary, pull-outs for curbside parking, valet service and commercial loading.

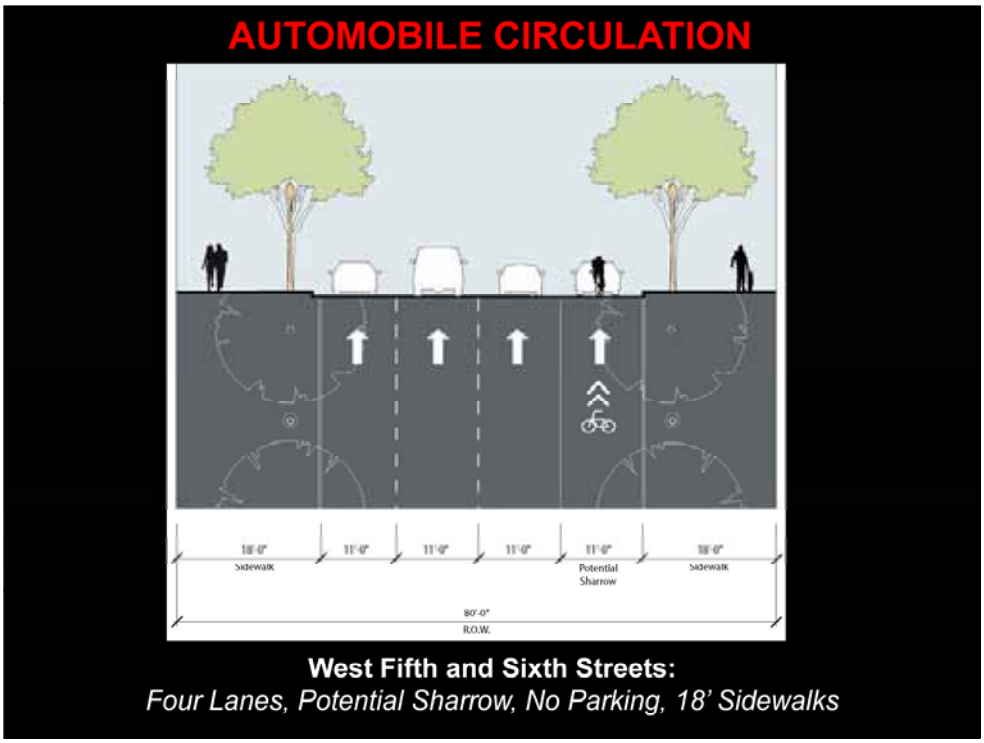
It is this basic "Great Streets" cross section that is recommended as the starting (or continuing) point for the design of Downtown streets. The following provides the recommended design for the key vehicular corridors within the Downtown Transportation Framework Plan.



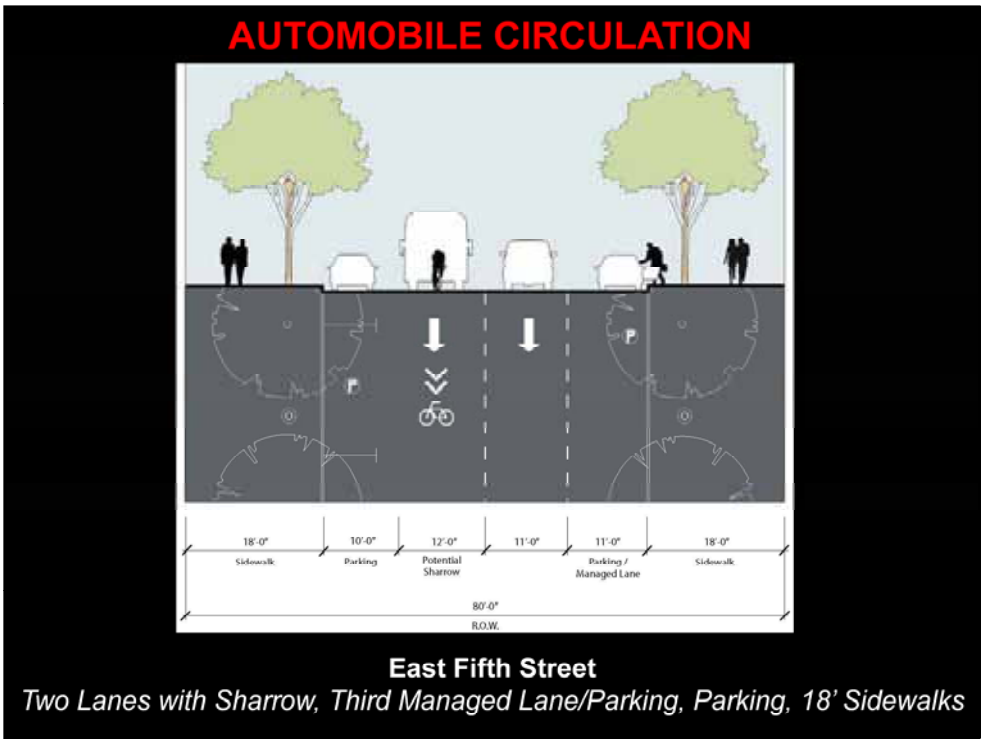
As the major north-south arterials within the Downtown, Guadalupe and Lavaca Streets are programmed both as vehicular and transit priority streets. In addition to providing vehicular connectivity through much of the city, the one-way pair is also proposed as the principal bus trunk line through Downtown. As such, it is recommended that the streets be maintained as a one-way couplet, with four through-lanes. The right-hand lane on both streets is proposed as a bus-only ("diamond") lane, and the second lane from the right as a "sharrow lane", or shared bike and vehicular lane.

The bus lane would be striped as a diamond lane, which gives priority to bus transit, but allows for right-hand vehicular turns for bikes and cars. Buses would also use this lane to stop and pick up passengers. The shared lane marking, "sharrow" lane, is intended to accommodate the experienced commuting cyclist and to notify drivers that bikes are present on the street. Sharrows also guide the bicyclist into the appropriate lane and help bicyclists better position themselves within the lane. (See Bicycle Circulation for further discussion.)

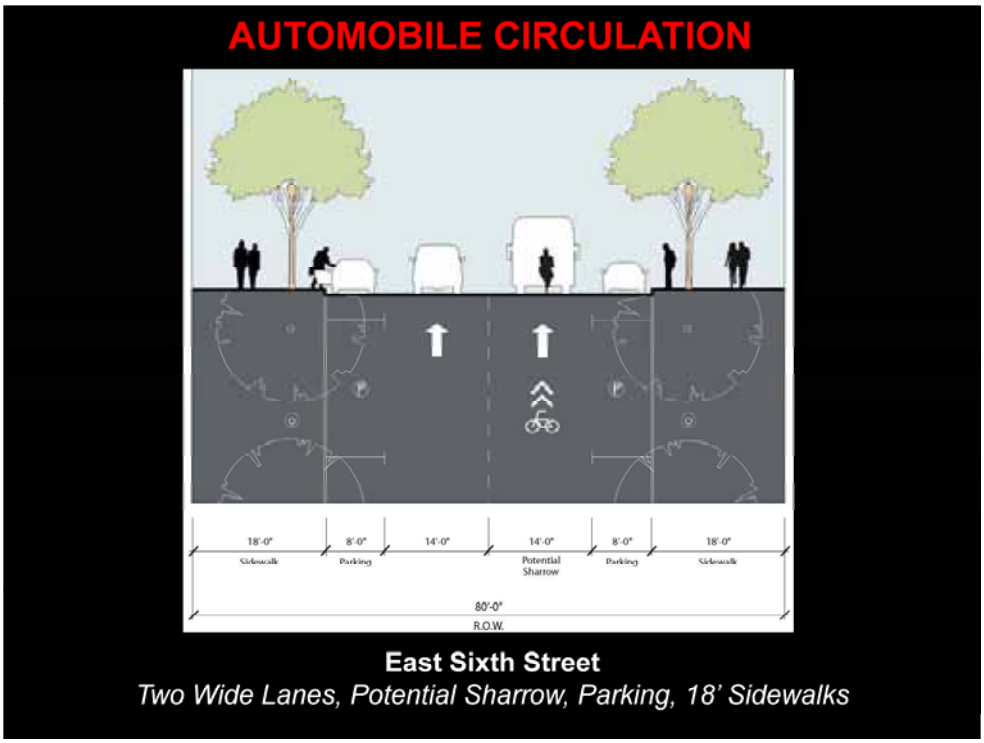
The cross section for these streets could be consistent with the Great Streets section, providing a 44-foot wide roadway and 18-foot wide sidewalks. Alternatively, it may be desirable for the bus lane to be designed with a 12-foot wide lane (rather than 11 feet), which would reduce one of the sidewalks to 17 feet in width. Curbside parking would be removed from the street; however opportunities for drop-off and valet service would be provided in "pull-outs" along the street.



West Fifth and Sixth streets are also recommended to be maintained as the east-west, one-way pair through Downtown. The typical cross section for these streets follows the Great Streets prototype, with four through-lanes on a 44-foot wide roadway and 18-foot wide sidewalks. Wider roadway sections are required to accommodate left turn lanes at the Lamar Boulevard intersection. Like Guadalupe and Lavaca streets, curbside parking would be prohibited; drop-off and valet service would occur in "pull-outs" as needed.



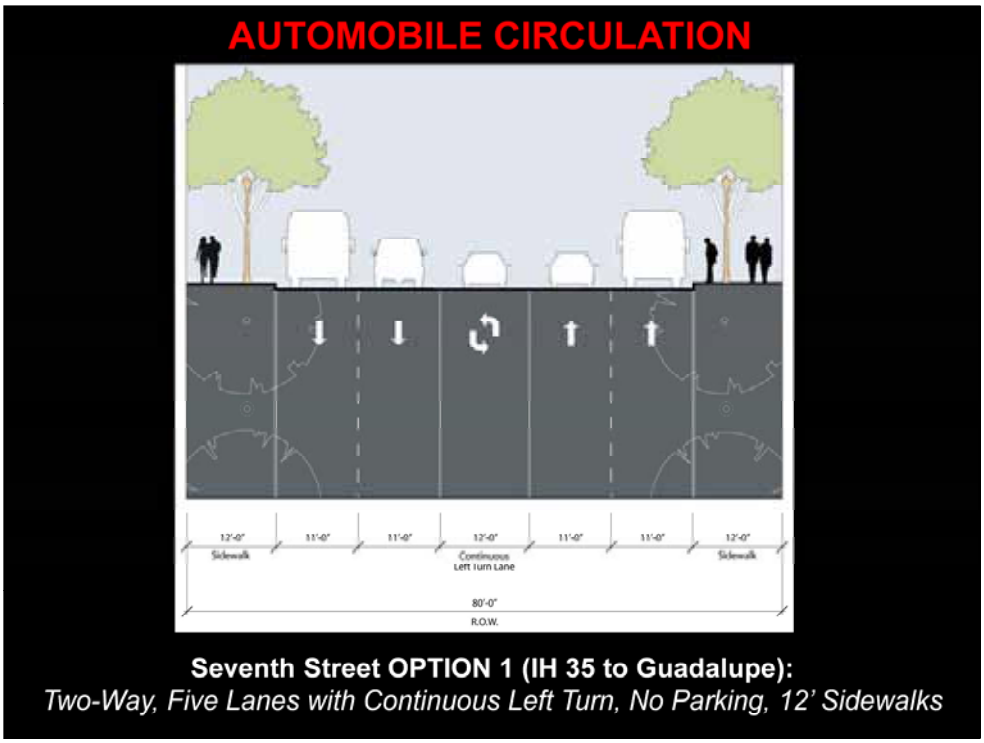
East Fifth Street, east of Brazos Street, has significantly less traffic volume than the western segments that link Loop 1 with the Downtown, and as such the street is programmed with two through-lanes and curbside parking along each side. Parking will be removed at intersections to provide for left and right-turn lanes as needed, but the 18-foot wide sidewalk will remain constant, in keeping with the higher volumes of pedestrian activity in this part of Downtown. As with West Fifth Street, the right-hand lane is proposed as a "sharrow" lane.



Like East Fifth Street, East Sixth Street (east of Brazos Street) has significantly less traffic volume than its western segment. As discussed above in the Pedestrian Circulation section, this street, once known as Pecan Street, is the historic commercial street of Downtown Austin, with many 19th and early 20th century mercantile structures along its length. It has evolved into an entertainment district with many bars and clubs; on weekend nights it is often closed to traffic to accommodate the significant throngs of revelers.

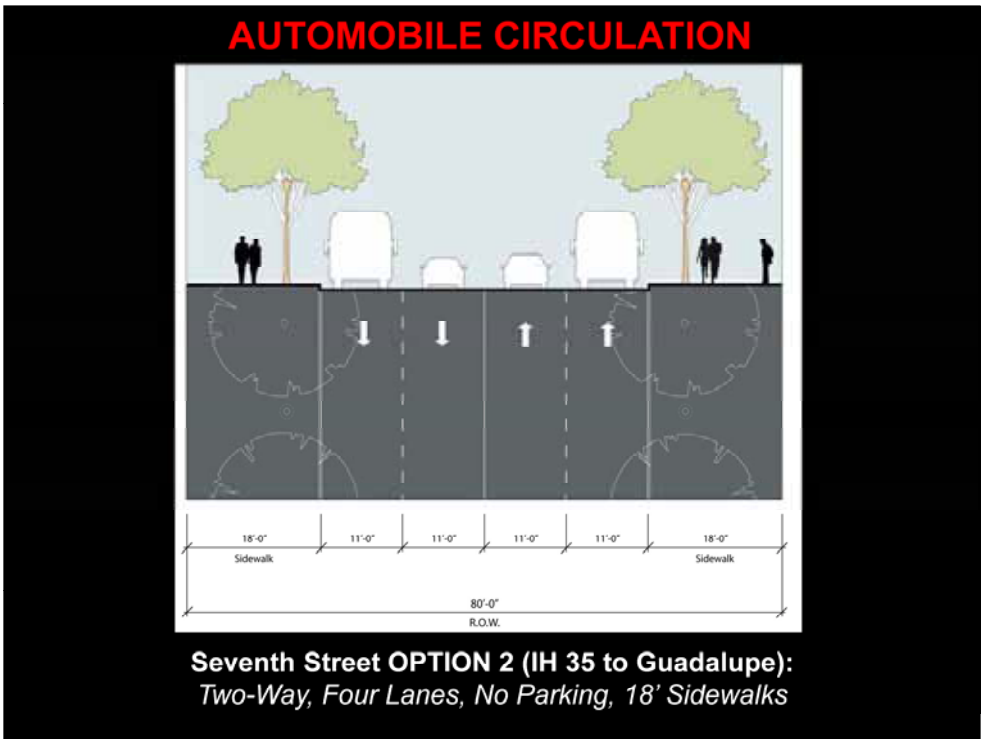
The cross section for this segment of East Sixth has two, 14-foot wide travel lanes (one designated as a "sharrow" lane), and curbside parking. The extra-wide travel lanes are recommended to provide for increased maneuverability around delivery and musician unloading vehicles. (This cross section has been very successful in Berkeley's Fourth Street retail district.) It is recommended that the curbside parking lane be programmed for commercial loading and unloading during business hours. It is also possible and desirable for the curbside parking lane to be made part of the sidewalk to provide for outdoor cafes and seating.

A more detailed design plan for East Sixth Street should be undertaken as part of a revitalization strategy for the area, and in concert with the adjacent businesses and property owners. This could occur as part of the DAP Phase Two district planning process.

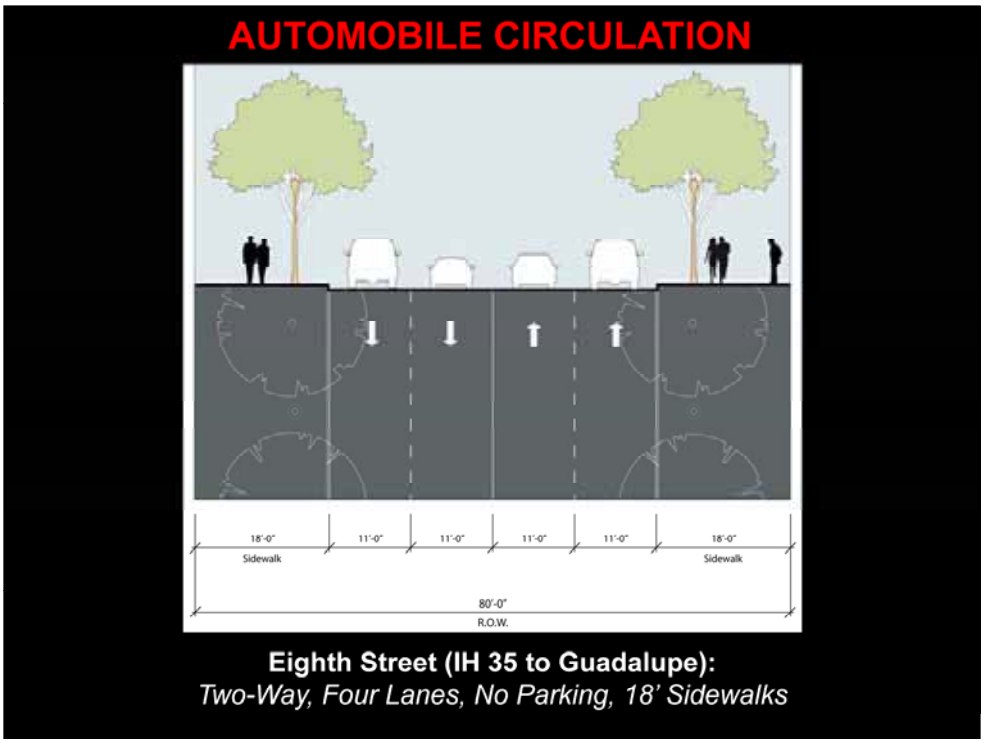


Seventh Street is an important east-west corridor in Downtown Austin, providing connectivity with East Austin and serving as a gateway to Downtown from the airport. This gateway role is undermined by its current operation as an eastbound one-way street, forcing westbound traffic east of IH 35 to divert one block north to Eighth Street to enter the Downtown. This Framework Plan recommends that Seventh Street be converted to two-way operation to provide continuity across IH35, and to allow it to also operate as an important east-west bus street connecting to the north-south Guadalupe/Lavaca Street couplet, where Capital Metro's major north-south bus routes are proposed to be relocated.

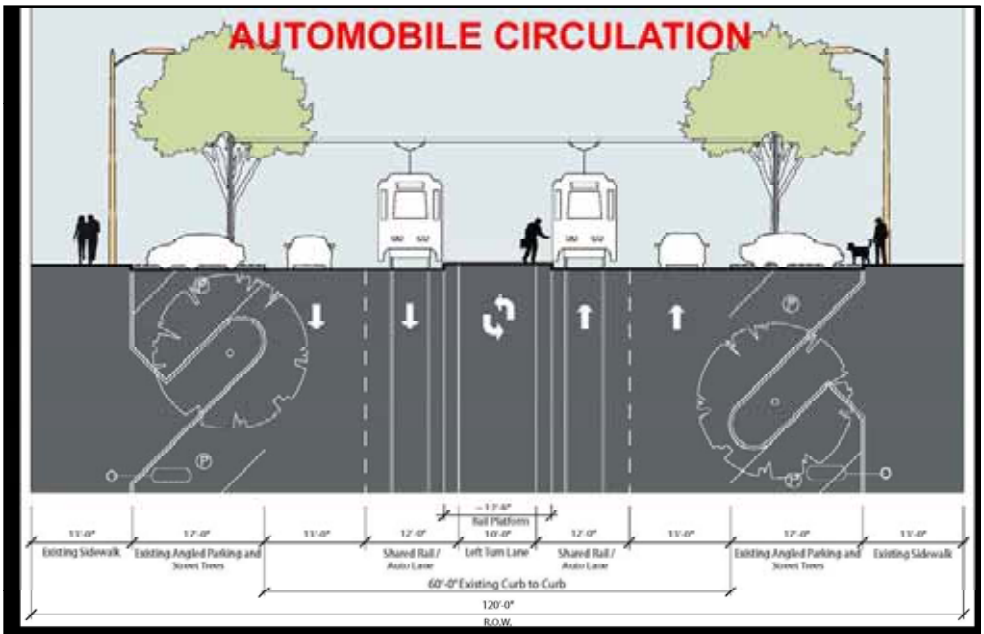
There are two options for the design of Seventh Street, which will require further evaluation and traffic modeling. Option 1, shown above, proposes a five-lane (56-foot wide cross section, with two through-lanes in each direction and a continuous center turn lane. Sidewalks would be 12-feet in width. Parking would be eliminated along the street. As shown, this section departs from the prototypical Great Streets cross section in order to accommodate the left turn movements.



A second option for Seventh Street would employ the Great Streets cross section as the typical condition along the street, eliminating the continuous left turn lane in the center of the street. In this option, it is assumed that the street could be widened to accommodate left turns at selective intersections (e.g., Guadalupe, Lavaca), and prohibited at most locations. While this option, with its wider 18-foot sidewalks, is viewed as the preferred condition for pedestrians and transit patrons, it could constrain automobile and bus mobility too much, and as such, requires further study and analysis. Some parking could be provided along streetscape in "duck-ins".



Eighth Street is also proposed to be converted from one to two-way operation. In conjunction with Seventh Street, it provides important connectivity between IH 35 and the Downtown core. As shown, the cross section employs the Great Streets prototype, with two through-lanes in each direction and 18-foot wide sidewalks. Parking would be prohibited along this street, with valet, drop-off and loading accommodated in occasional "pull-outs".



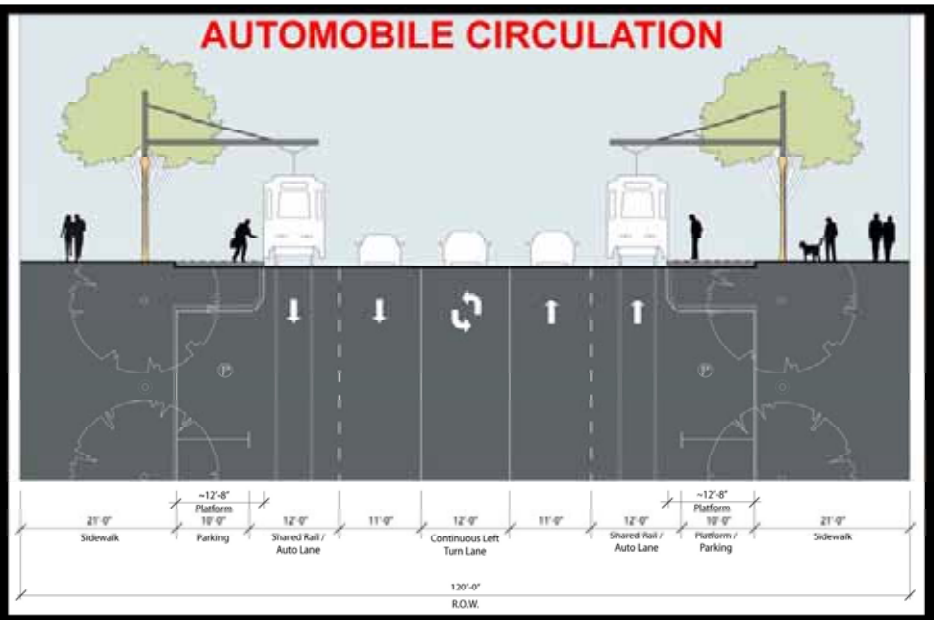
Congress Avenue OPTION 1:
Shared Median-Running Rail with Center Platform, Left Turn Lane, Sharrows, Angle Parking,13' Sidewalks (Platform Condition Shown)

Congress Avenue

In addition to its ceremonial and symbolic role, Congress Avenue is a major north-south street providing vehicular connectivity between South Austin and the Downtown and Capitol. The existing 120-foot right-of-way today consists of six vehicular lanes (three in each direction), diagonal parking along both sides, and sidewalks of 13 feet in width. At intersections sidewalks are widened to nearly 30 feet as" bulb-outs". Because of parking maneuvering, and the heavy bus volumes, the street operates with two effective through-lanes in each direction.

Congress Avenue is the preferred north-south alignment for Downtown urban rail service, reflecting its historic role as a multi-modal trolley street, where all of the City's inter-urban streetcar lines converged. As described in the Urban Rail Connections Study (July 2008), the urban rail project is considering both exclusive-running (dedicated) trackway as well as a streetcar option where the rail tracks would share lanes with automobile traffic. On Congress Avenue, there are several alternative roadway designs that could be considered for each of these rail options.

Option 1: Shared Median-Running Rail Conserving Diagonal Parking*:* This option proposes that Congress Avenue be configured as a five-lane roadway, with the center lane serving for left turn movements and for rail platforms, and the adjoining lanes providing shared vehicular and streetcar service. This option would retain the existing diagonal parking and sidewalks in their current configuration. (Currently there are 148 parking spaces on Congress Avenue that would be retained with this option.)

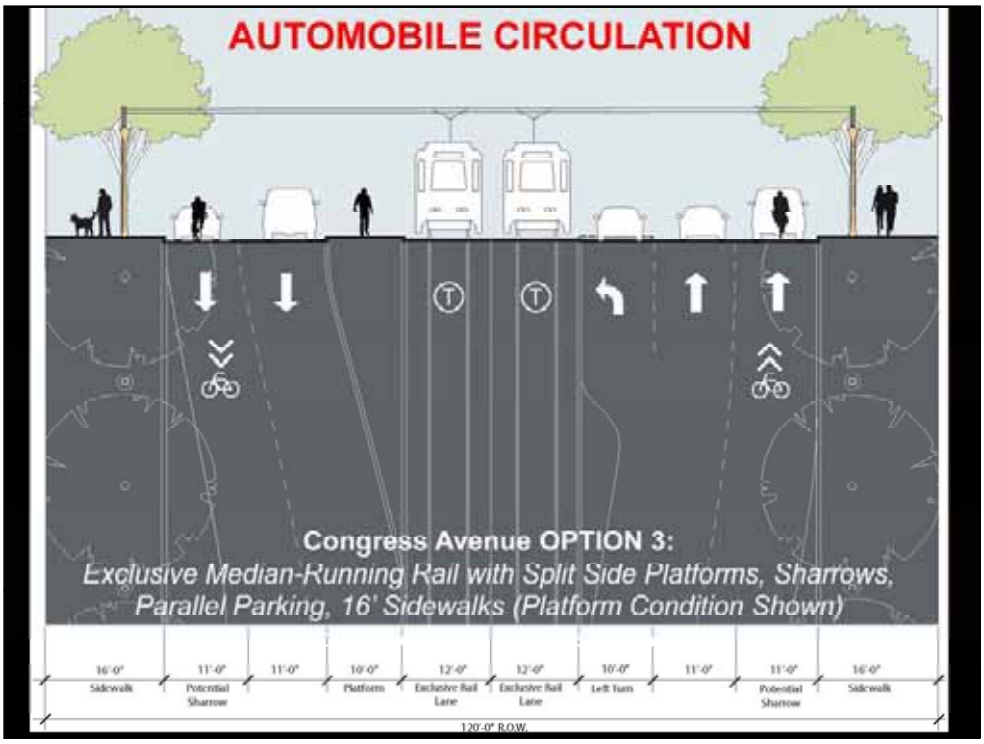


Congress Avenue OPTION 2:
Shared Side-Running Rail, Left Turn Lanes, Parallel Parking
(Sidewalk Platforms)

<u>Option 2: Shared Side-Running Rail with Parallel Parking</u>*:* The second option also proposes a five-lane roadway with a center turn lane, but calls for the streetcar to run in the curbside automobile lane. In this option, although the diagonal parking would be replaced with parallel parking, there would be no loss of parking because of the relative inefficiency of the current layout. In fact, there could be a gain of up to 34 spaces (from Cesar Chavez to Eleventh Street) assuming relatively continuous curbside parallel parking, interrupted by intersection bulb-outs and by streetcar platforms. Sidewalks in this option would be 21 feet in width.

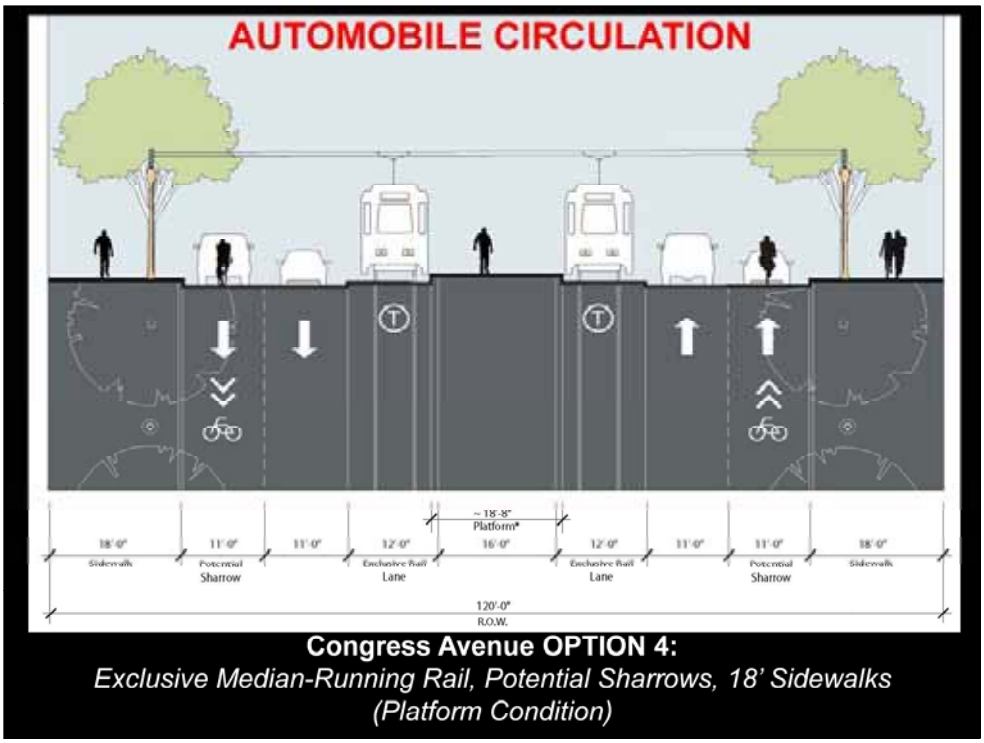
Of the two shared-running options the principal advantage of the first option (and corresponding disadvantage of the second) is the minimal construction impact and disruption that would occur, since construction of rail would be confined to the center lanes of the street, with the sidewalks and parking areas remaining largely intact. A key disadvantage of the first alternative is the reduction in vehicular capacity that would occur with the outside lane providing access and maneuvering to the diagonal parking. The second side-running option has some key advantages, including:

- Less visual obstruction of the axial Capitol view since overhead streetcar electrical lines would be along the side of the street, rather than in the center.
- Less physical obstructions for parades and other events that use the street.
- More convenient and direct passenger access to rail from sidewalks.
- Potential for increased parking.



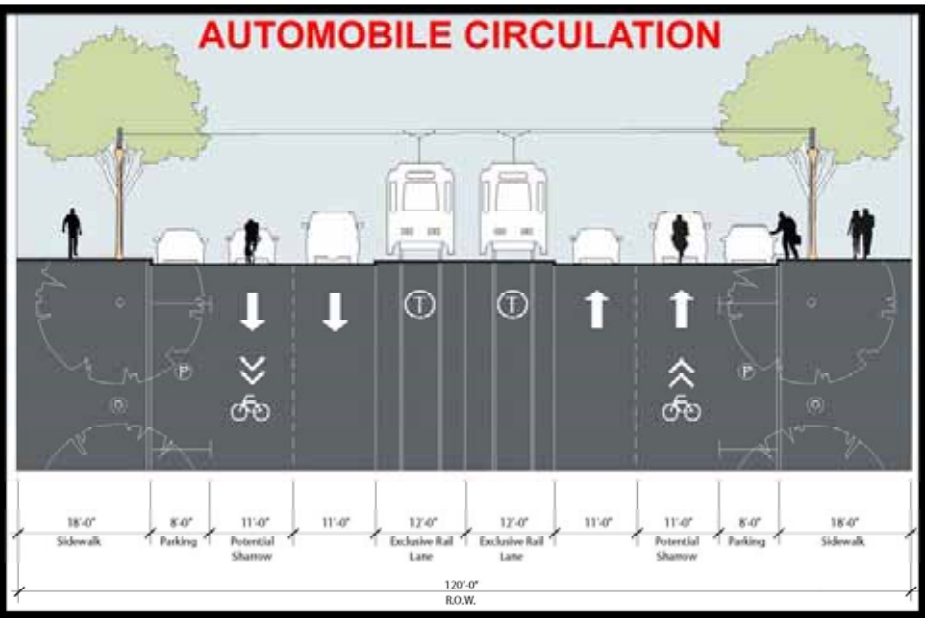
Two additional options with dedicated rail have been developed for Congress Avenue:

<u>Option 3: Exclusive Median-Running Rail with Split, Side Platforms:</u> This option places the dedicated trackway in a center median, with passenger platforms alongside, located on either side ("farside") of the intersection. Passengers would access the platforms at intersection crosswalks. Since curbside parking could only occur at locations where there is no platform or left turn lane, some loss of existing spaces would result. Sidewalks would be 16 feet in width, less than the 18 feet recommended by the Great Streets Master Plan. The outside vehicular lane could be striped as a "sharrow" lane, indicating to motorists that bikes are present on the street, and are allowed to "take the lane", as will be discussed further in the Bicycle Circulation section.



Congress Avenue OPTION 4:
Exclusive Median-Running Rail, Potential Sharrows, 18' Sidewalks
(Platform Condition)

<u>Option 4: Congress Ave. Exclusive Median-Running, Single Center Platform:</u> Like Option 3, this alternative has a dedicated trackway in the center of the street, but instead of two farside platforms, Option 4 proposes a single, centrally-located platform serving both directions of streetcar travel. Two vehicular lanes would be provided in each direction, one of which could be striped as a bike "sharrow" lane. This option would allow for a continuous 18-foot sidewalk, consistent with the Great Streets Master Plan, and is the preferred of the two dedicated trackway options, from a pedestrian standpoint. Its principal disadvantage is the limited left-turn capacity.



Congress Avenue OPTION 4:
Exclusive Median-Running Rail, Sharrows, Parking, 18' Sidewalks
(Non-Platform Condition Shown)

Where there is no platform, curbside parallel parking could be placed along the street. It is estimated this parallel parking could increase the existing on-street diagonal parking count by up to 30 spaces. Of the two dedicated trackway options, the principal advantage of Option 3 (side platforms) is that left turn lanes could be accommodated at most intersections, whereas in Option 4, they would need to be largely prohibited. (At the same time, prohibition of left turns could provide for more efficient transit operations and less delay time at the intersections.) Advantages of Option 4 include:

- Wider sidewalks consistent with the Great Streets standard;
- Wider passenger platforms protected from vehicular traffic;
- Potential gain of on-street parking.

The ultimate design of Congress Avenue, and the other streets designated for rail service within the Downtown will depend on whether the City elects to pursue a dedicated or shared trackway. This decision will be made as the rail project proceeds into more detailed engineering and design.

AUTOMOBILE CIRCULATION

Relative Comparison of Congress Avenue Options

	Option	Pedestrian Accommodation	Traffic Operations	Transit Operations	Bicycle Accommodation	On-Street Parking Impacts	Capitol Views / Parades Impacts
1	Shared, Median-Running	○ 1	◒ 5	◒ 9	◒ 13	○ 17	○
2	Shared, Side-Running	● 2	◒ 6	○ 10	○ 14	● 18	●
3	Exclusive, Median-Running with Split Side Platforms	◒ 3	● 7	● 11	● 15	◒ 19	○
4	Exclusive, Median-Running with Center Platforms	◒ 4	○ 8	● 12	● 16	◒ 20	○

Relative Comparison
- ● Best
- ◒ Neutral
- ○ Least Best

The above table provides a relative comparison of key attributes of the four Congress Avenue options. The attributes are briefly defined below:

Pedestrian Accommodation: compares the width of sidewalks and the comfort of the transit user as a pedestrian.

Traffic Operations: compares number of through and left-turn lanes, as well as whether the vehicular lanes are shared with rail.

Transit Operations: compares exclusive versus dedicated rail lanes, as well as the higher level of transit delay due to the friction of right-turning autos and parallel parking/loading spaces.

Bicycle Accommodation: compares the level of facility provided.

On-Street Parking Impact: compares number of spaces gained.

Capitol Views/Parades Impact: compares impacts on the Capitol views due to overhead electrical cables, as well as the impediment that raised medians in the center of the Avenue would have on parades.

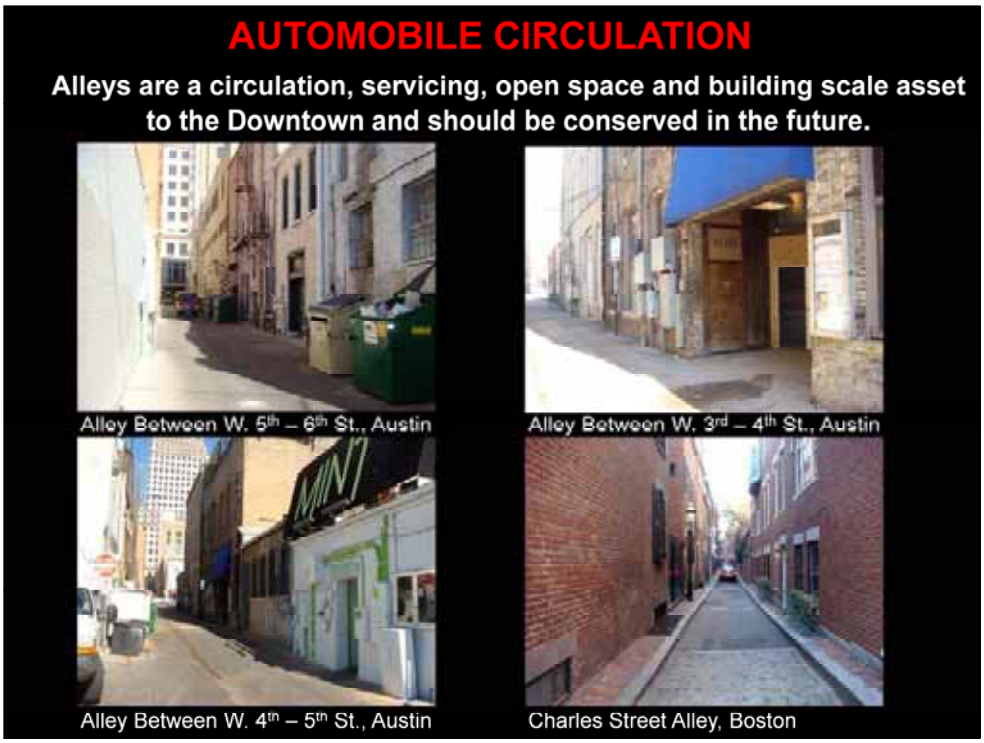
Notes:
1. 13’-0” sidewalks 2. 21’-0” sidewalks 3. 16’-0” sidewalks 4. 18’-0” sidewalks

5. Four thru lanes, center left turn lane/platform 6. Four thru lanes, center left turn lane 7. Four thru lanes and dedicated left turn lane 8. Four thru lanes, no center left turn lane

9. Shared median-running rail 10. Shared side-running rail 11. Exclusive median-running rail 12. Exclusive median-running rail

13. No sharrow, median-running rail 14. No sharrow, side-running rail 15. 11’-0” sharrow 16. 11’-0” sharrow

17. Existing angle parking remains (148 spaces) 18. Gain of 34 spaces 19. Gain of at least 3 spaces 20. Gain of 3 spaces



The network of alleys that were part of the 1839 Waller Plan still provide the best location for building servicing activities, such as deliveries, loading, waste collection. In addition, they create a secondary open space and circulation network that is also an asset to be conserved through time. Some cities are actually revitalizing alleys and creating building entrances from them that make for unique retail and entertainment districts. Finally, the alleys serve to break down the scale of the downtown block, allowing for a finer grain of development to occur, and a more articulated building mass. The City should adopt a clearer, stronger policy to conserve alleys in the future, as was recommended in the *Downtown Austin Design Guidelines*, which were adopted by City Council in 2000.

(Further study of loading policies and use of alleys will be conducted during the district planning process.)

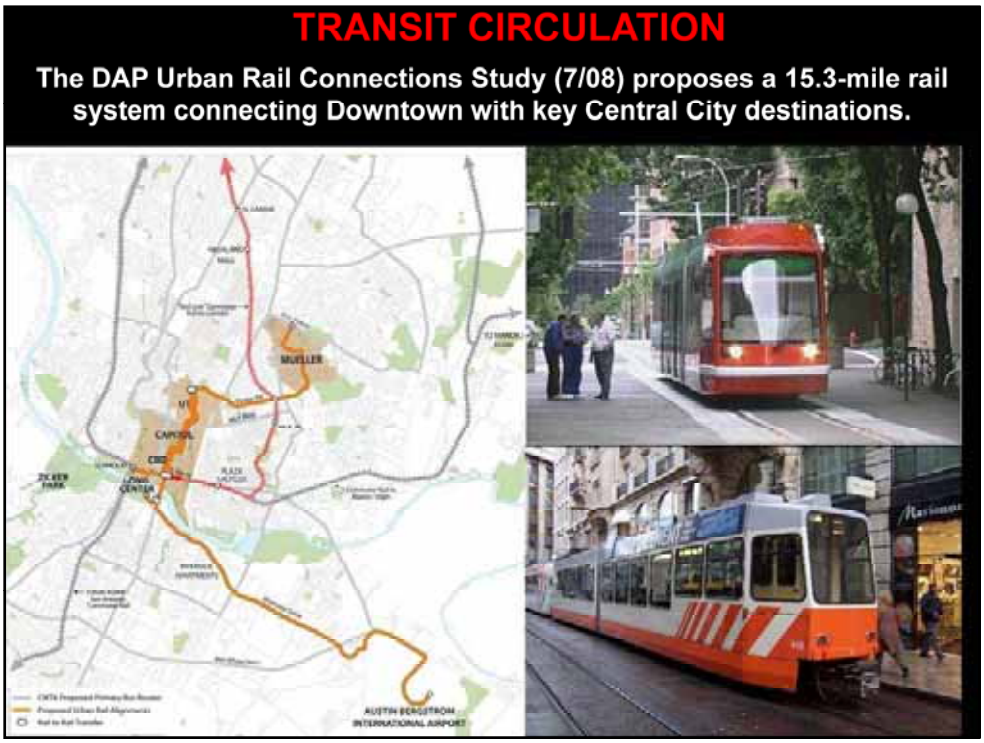
AUTOMOBILE CIRCULATION
Summary of Key Recommendations

1. Convert all one-way streets to two-way streets, except Guadalupe, Lavaca, Fifth, Sixth and Trinity (between Cesar Chavez and Seventh).

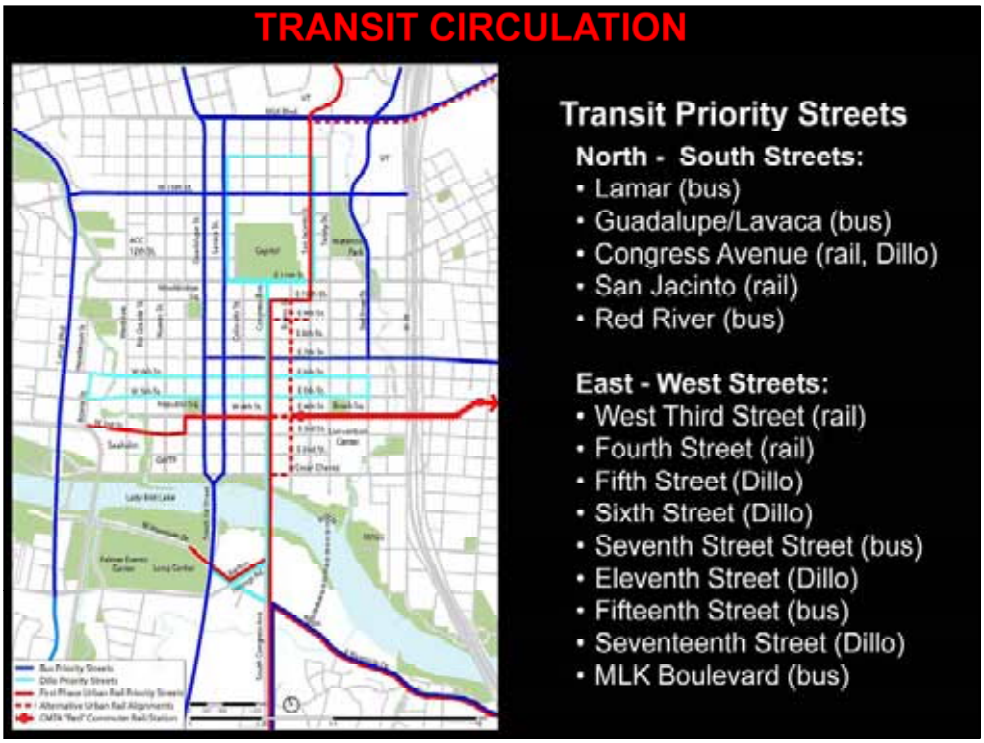
1. Establish the following as vehicular priority streets: Lamar Boulevard, Guadalupe/Lavaca Streets, Congress Avenue (south of Seventh), Red River (north of Cesar Chavez) Cesar Chavez, Fifth Street, Sixth Street, Seventh Street (east of Guadalupe), Eighth Street (east of Guadalupe), Fifteenth Street and MLK Boulevard (east of Guadalupe).

2. Establish alleys as the primary building servicing zones, and establish a policy to prohibit alley vacations.

TRANSIT CIRCULATION



The DAP Urban Rail Connections Report (July 2008), proposes an initial phase 15.3-mile streetcar project to connect Downtown with key Central City destinations (Capitol Complex, UT, Mueller, ABIA, Long Center). As mentioned, the purpose of this line is to extend the reach, and so, effectiveness, of the first regional Metro Rail line which will debut next year. The proposed alignment is shown on the following Transit Priority Street Map, and other modes have been located and designed to be compatible with and optimize this initial streetcar service.



Transit Priority Streets

There are currently no HOV lanes or transit priority streets in Austin, so buses must share congested roadways with automobiles, reducing their potential for providing competitive, commuter travel times. The Transportation Framework Plan calls for transit to be concentrated along particular streets to provide priority routes, more predictability and "legibility" within the Downtown, as well as to allow for convenient transfers between routes and modes.

West 3rd and West 4th streets, Congress Avenue, and San Jacinto Street are envisioned as rail streets, as described in the DAP Urban Rail Connections Report. It is proposed that the major north-south bus routes be consolidated along Lavaca and Guadalupe streets, and for major east-west routes to be concentrated along Seventh, Fifteenth and Martin Luther King Boulevard.

Overlaying the bus routes, Capital Metro's Dillo recently revised routes provide a circulator function, accommodating the short trips within and across the Downtown. This service could maintain the two existing routes: on the Congress Avenue corridor with a loop around the Capitol; and along the Fifth and Sixth Street corridors between Red River Street and Bowie Street. Alternatively, when streetcar service is introduced on Congress, the Dillo could be looped in a clockwise configuration along Brazos and Colorado Streets, thereby increasing transit coverage in the Downtown core.

Downtown Transit Transfers

Passenger transfers between the numerous bus routes, Dillo and future rail service need to be accommodated efficiently within the Downtown, in a way that promotes transit as a mode of choice rather than one of last resort. Some cities have introduced such intermodal terminals or transfer centers, where major bus routes converge providing transit patrons with direct and convenient transfers to other city and inter-city bus lines, and often to rail or other modes. These facilities can have amenities that serve the transit patron, including information and ticket sales, retail and food services, and even day-care. Such facilities require a significant amount of downtown real estate to accommodate buses pulling off the to provide this type of passenger transfer. Charlotte, North Carolina's Transportation Center, depicted above, is an example of such an off-street bus transfer facility.

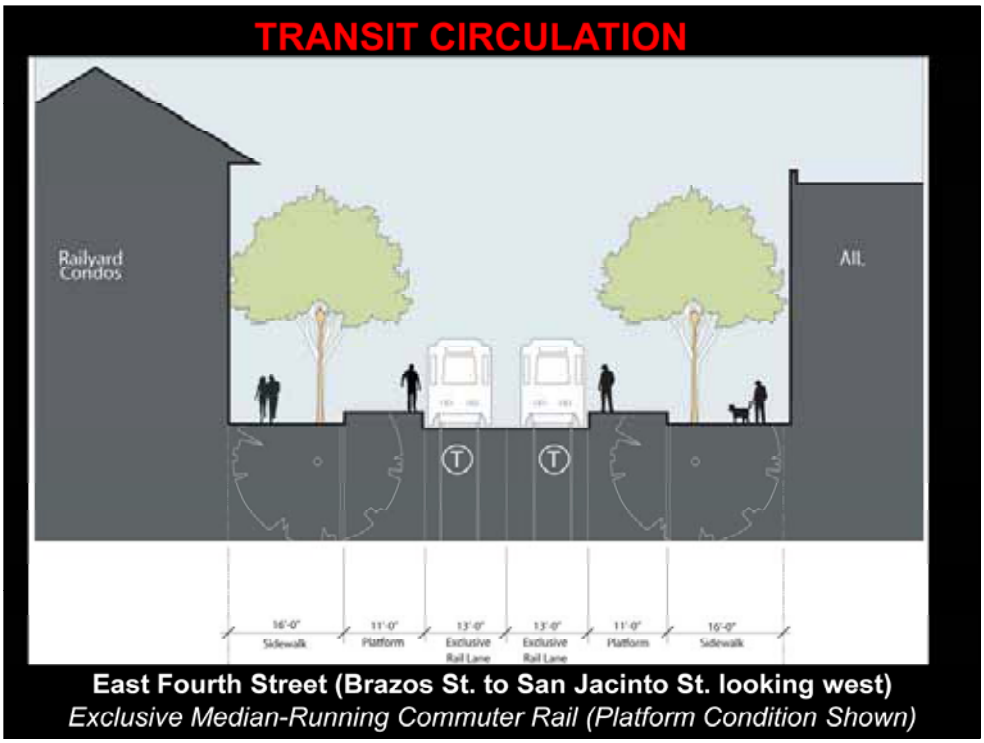
Other cities have distributed intermodal transfers along transit priority streets or malls, referred to as an "on-street" transfer station. Bus or rail routes converge along key corridors, and the streets are designed with amenities that provide for the comfort and convenience of the transit patron (shelters, benches, real time route information, district maps, water fountains, public art, etc.) The advantage of these types of facilities is that bus routing can be directed along these corridors, avoiding circuitous or indirect routes to a single terminal, and that valuable downtown real estate is not required since the facilities are part of the public right-of-way. Examples of such facilities can be found in Portland, Oregon where streets are designed for bus, light rail and street car service.

The Portland example of street-oriented transfers is the more appropriate model for Downtown Austin, for a number of reasons:

• It is generally more time-efficient to operate an in-street transfer, as it does not require buses to leave the street system and maneuver to park or dwell off-street.

• Buses and transfer to other modes is often clearer to the transit user, and more transfers can generally be accommodated, i.e., to rail, Dillo, taxi, car share, etc., as these would not typically be accommodated within an off-street transfer station.

• It is much less real estate consumptive than providing an off-street transfer station. Rather than dedicating a single city block (or more) to a bus terminal or transfer center, transfers could occur at several key points where transit modes intersect: e.g., Fourth Street and Guadalupe/Lavaca streets where proposed streetcar service will intersect with north-south bus routes; and Seventh Street at Congress Avenue and Guadalupe/Lavaca streets where east-west bus service intersects with streetcars and north-south buses respectively.

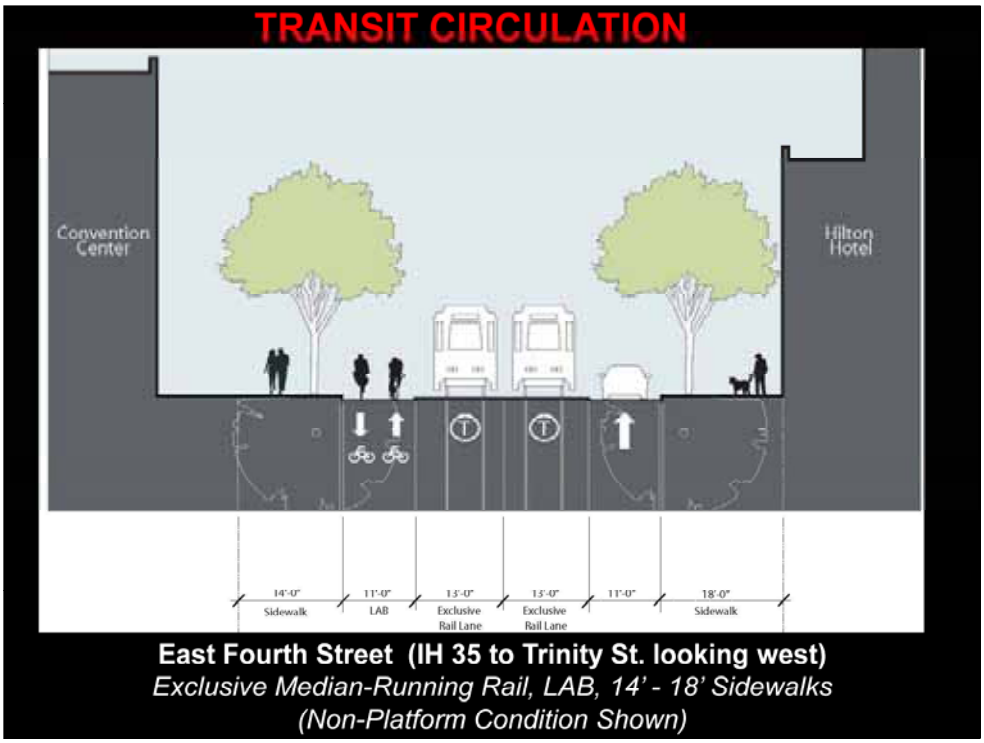


Transit Priority Street Cross Sections

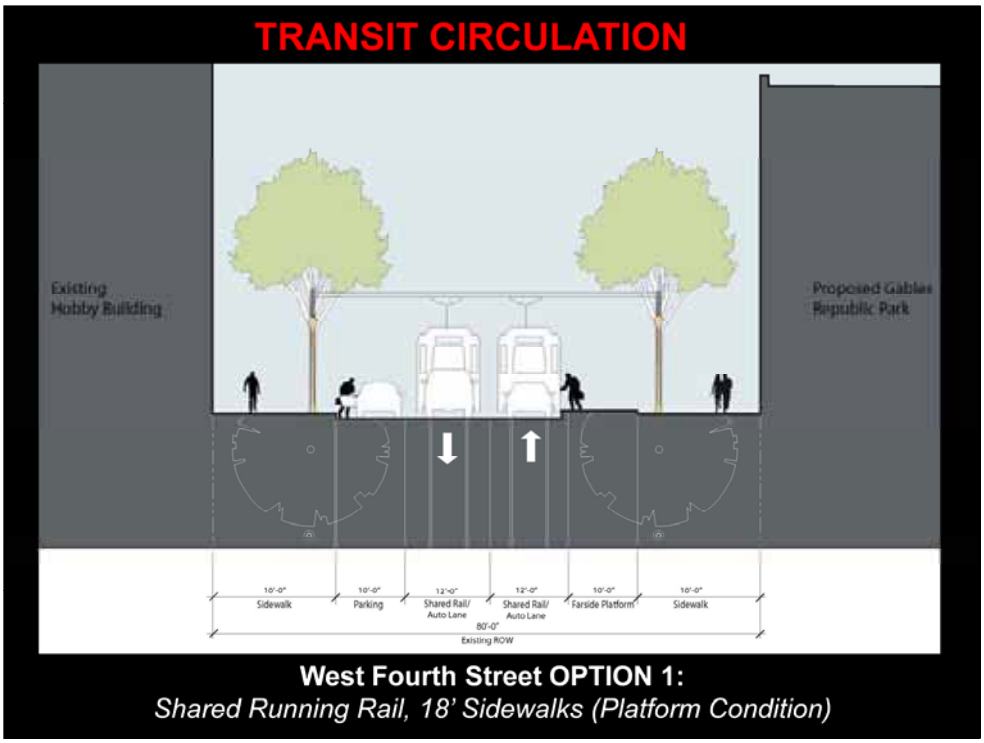
The following cross sections provide a description of the recommended configuration of transit-priority streets throughout the Downtown, including: commuter rail service along East Fourth Street; streetcar service along West Third and Fourth Streets, Congress Avenue, Ninth and Tenth Streets, and San Jacinto Street; and bus priority streets along the Guadalupe/Lavaca Corridor, and Seventh Street. These recommendations (some of which include options) will be further refined in Phase Two of the DAP as a result of more detailed district planning.

East Fourth Street Metro Rail*:* Metro Rail (Red Line) service will have a dedicated trackway of 26 feet in width along the center of East Fourth Street, with a terminus station between San Jacinto and Brazos Street (shown above). Vehicular traffic would be closed along this blockface to accommodate the trackway and the station platforms.

(Note: The "opening day" or first phase configuration consists of a single track and single platform between Neches and Trinity streets at Brush Square. Capital Metro plans to extend the line and double-track to reach to a terminus station in the block between Brazos and San Jacinto streets. This will place the platforms within a one-block walk to Congress Avenue, where the streetcar platform will be located.)



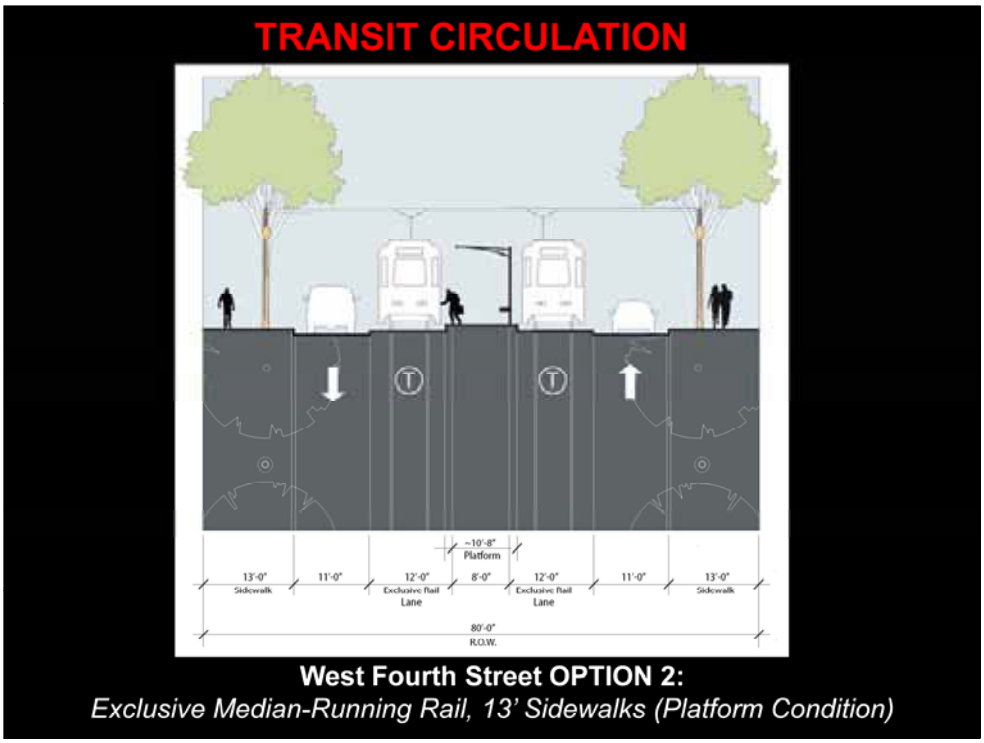
Along the IH 35 to Trinity Street segment of East Fourth Street, adjacent to the Convention Center, vehicular travel would be limited to the westbound direction. The zone south of the 26-foot wide commuter rail trackway would be dedicated to the Lance Armstrong Bikeway as a contra-flow, two-way bikeway.



As recommended in the Urban Rail Connections Study, two options for streetcar service in Downtown should be carried forward for further evaluation and refinement during the preliminary design and engineering phases of the streetcar rail project. These include a shared-running system where the streetcar shares a lane with automobile travel and a dedicated system where the streetcar travels in its own exclusive trackway, separate from automobile traffic. The following provides a description of the two options from the Seaholm District through the Downtown to Congress Avenue and San Jacinto Street:

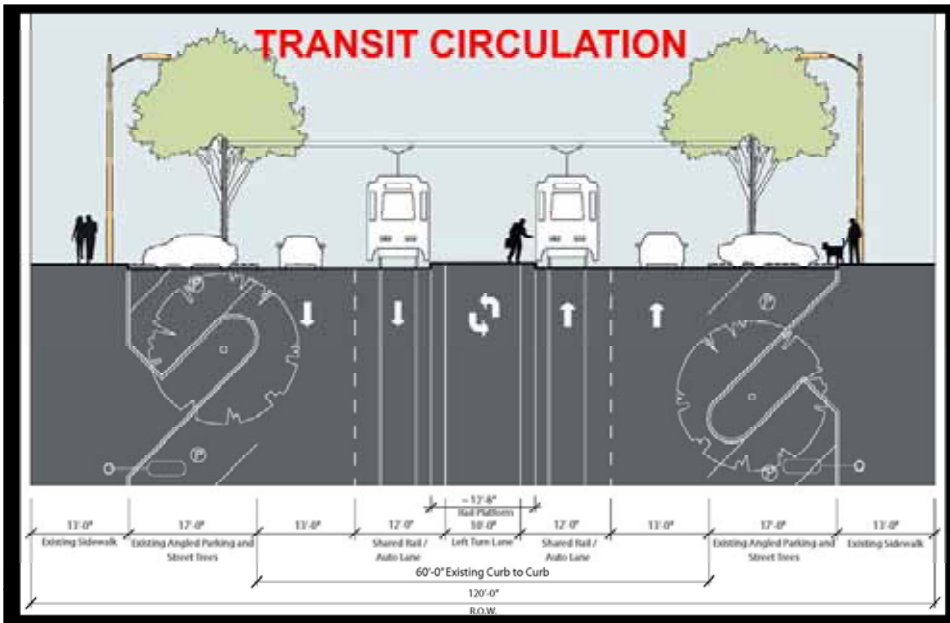
West Fourth Street*:* The above cross section shows the platform condition for shared-running rail service on West Fourth Street between Guadalupe and Lavaca Street. This option creates farside platforms that are extensions of the sidewalks.

(Note: See ROMA's November 2008 West Third and Fourth Street Rail Study for more street cross-section alternatives for West Third and Fourth streets.)



West Fourth Street: This option shows exclusive, median-running rail service on West Fourth Street between Nueces Street and Congress Avenue. An eastbound and westbound platform would be defined within the median of the block, thus allowing for vehicular lanes on either side of the exclusive trackway.

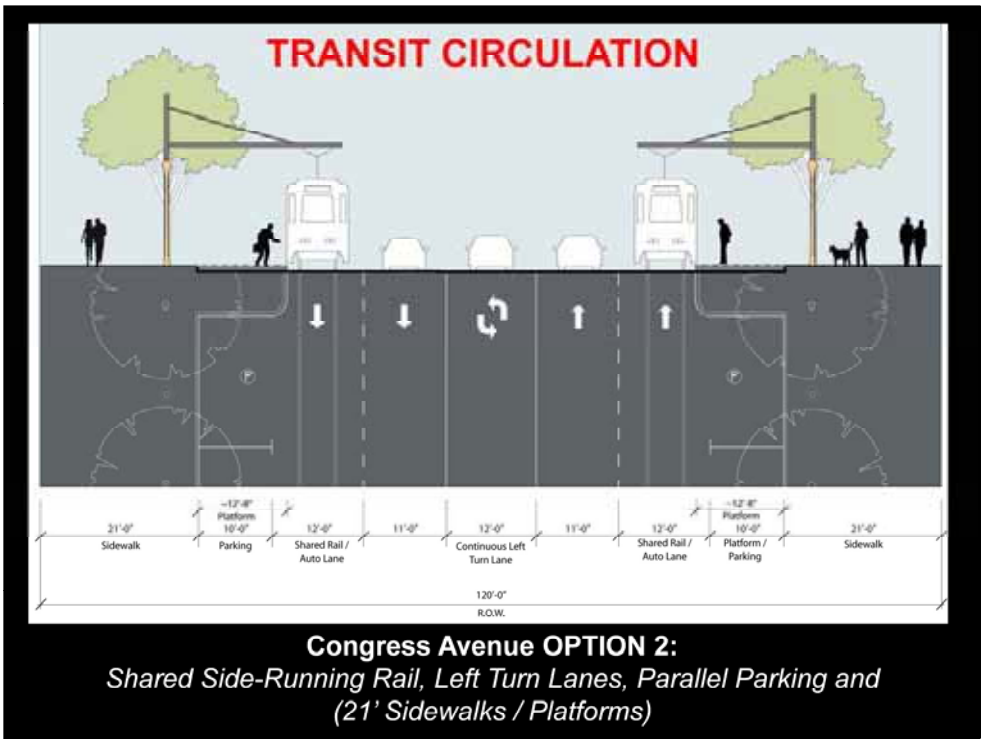
(Note: See ROMA's November 2008 West Third and Fourth Street Rail Study for more street cross section alternatives for West Third and Fourth streets.)



Congress Avenue OPTION 1:
Shared Median-Running Rail, Left Turn Lane, Sharrows, Angle Parking (Platform Condition)

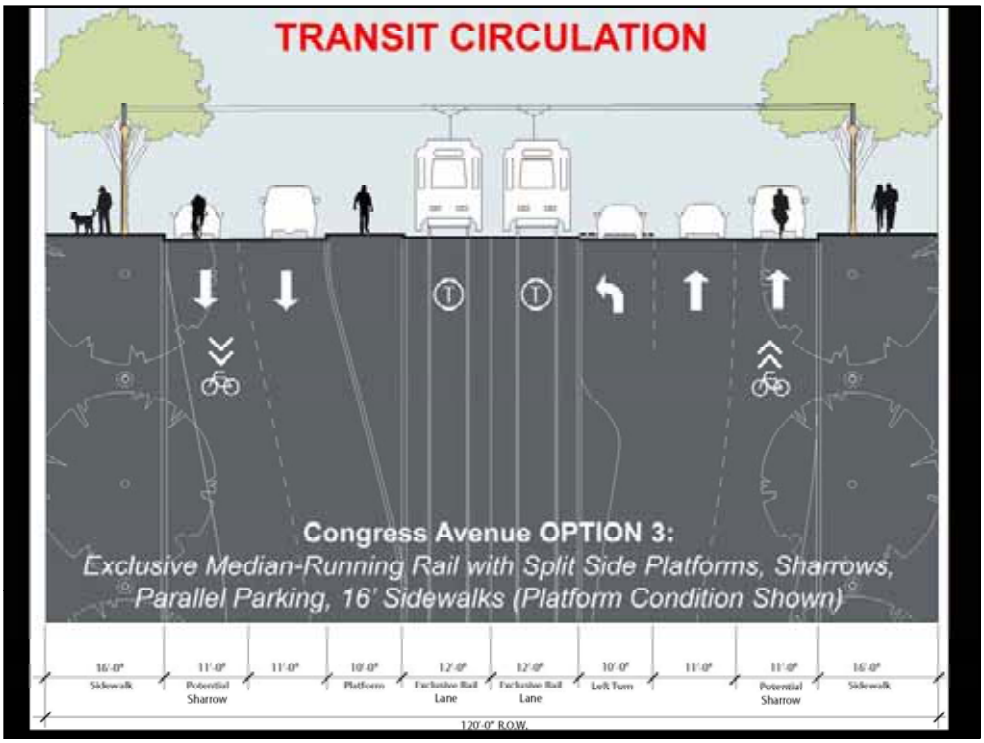
<u>Congress Avenue</u>*:* Four rail options are shown for Congress Avenue, two with shared lanes and two with dedicated trackways. These options are described in detail in the previous section (Vehicular Circulation) of the report, but include:

• Option 1 (above) a shared median-running rail conserving existing diagonal parking;

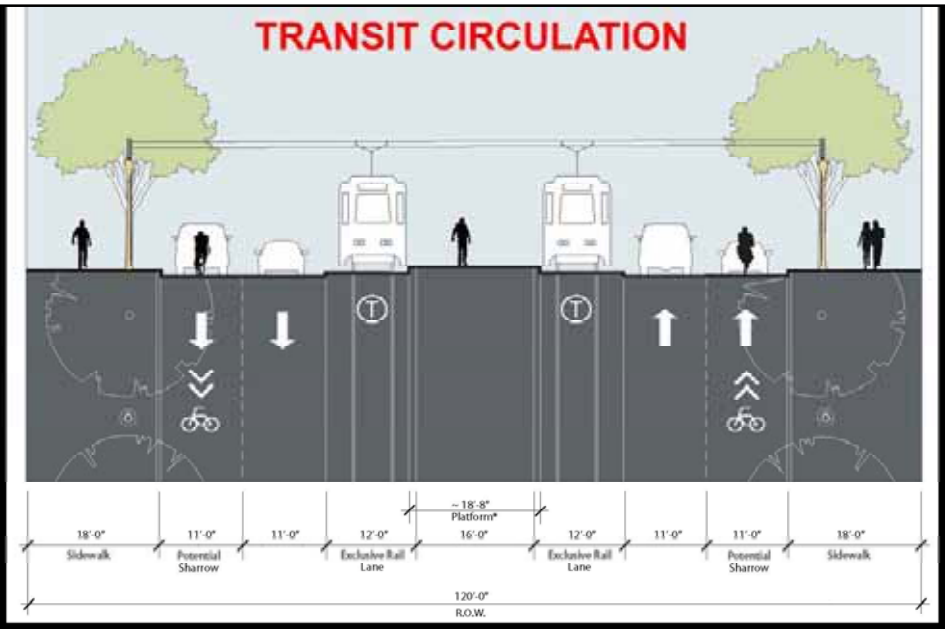


Congress Avenue OPTION 2:
Shared Side-Running Rail, Left Turn Lanes, Parallel Parking and (21' Sidewalks / Platforms)

• Option 2: Shared side-running rail along the curbside lane, with parallel parking;



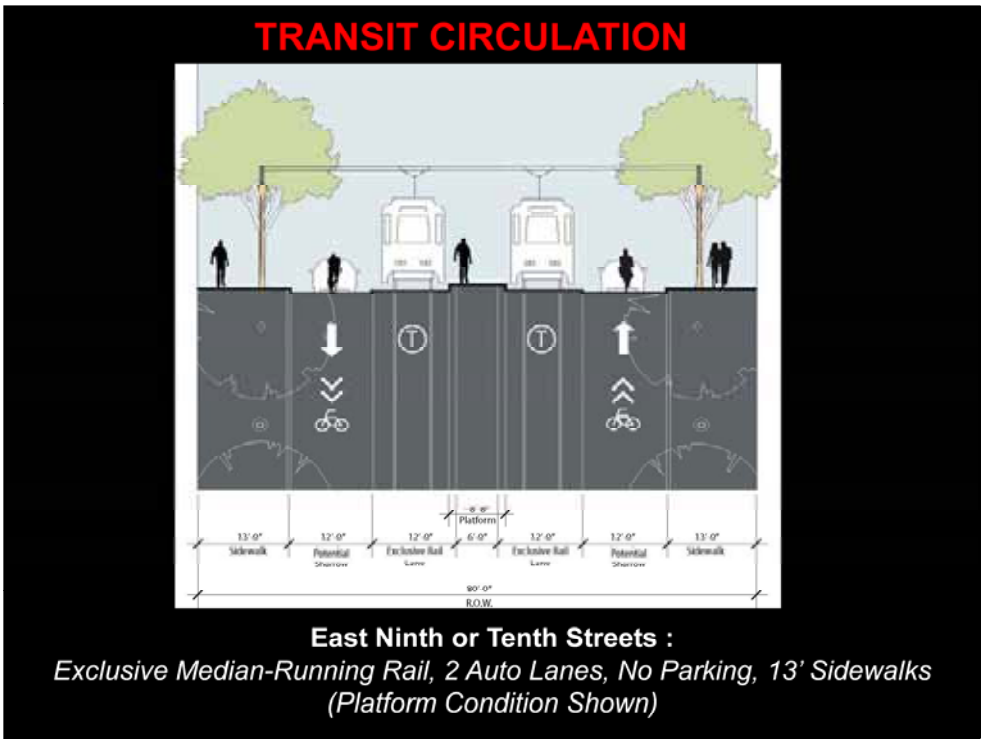
• Option 3: An exclusive median-running trackway with split side platforms (located on far side of intersection; and



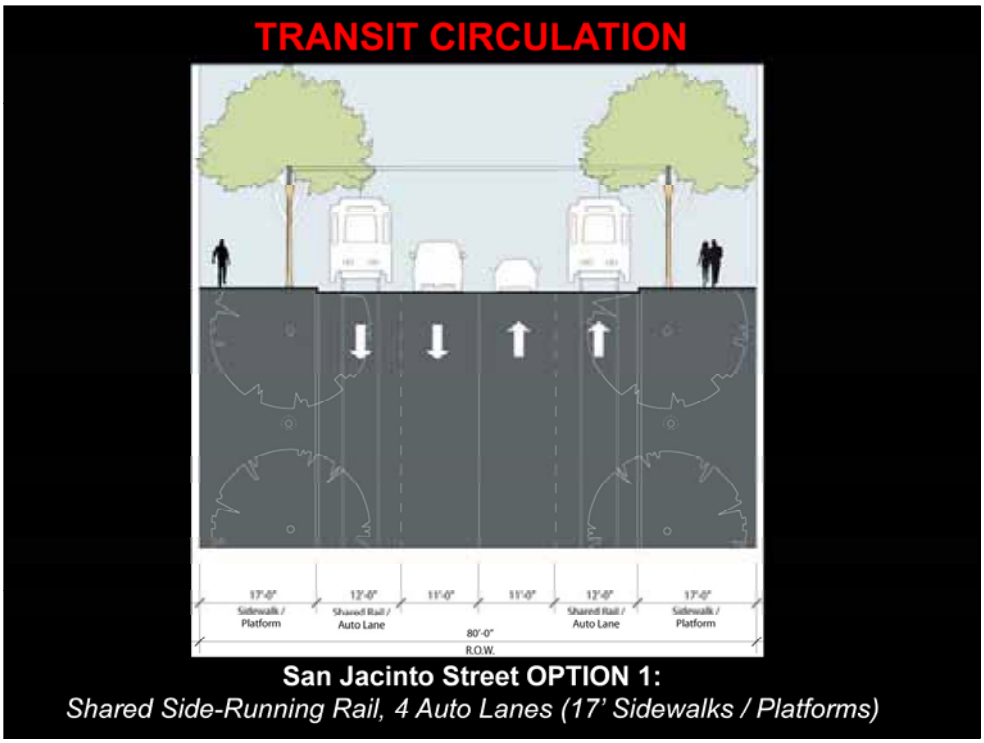
Congress Avenue OPTION 4:
Exclusive Median-Running Rail, Potential Sharrows, 18' Sidewalks
(Platform Condition)

• Option 4: An exclusive median-running trackway with center platforms.

The selection of a preferred alignment and configuration for Congress Avenue will await more detailed district planning in Phase 2 of the DAP, as well as the preliminary design and engineering of the streetcar project.

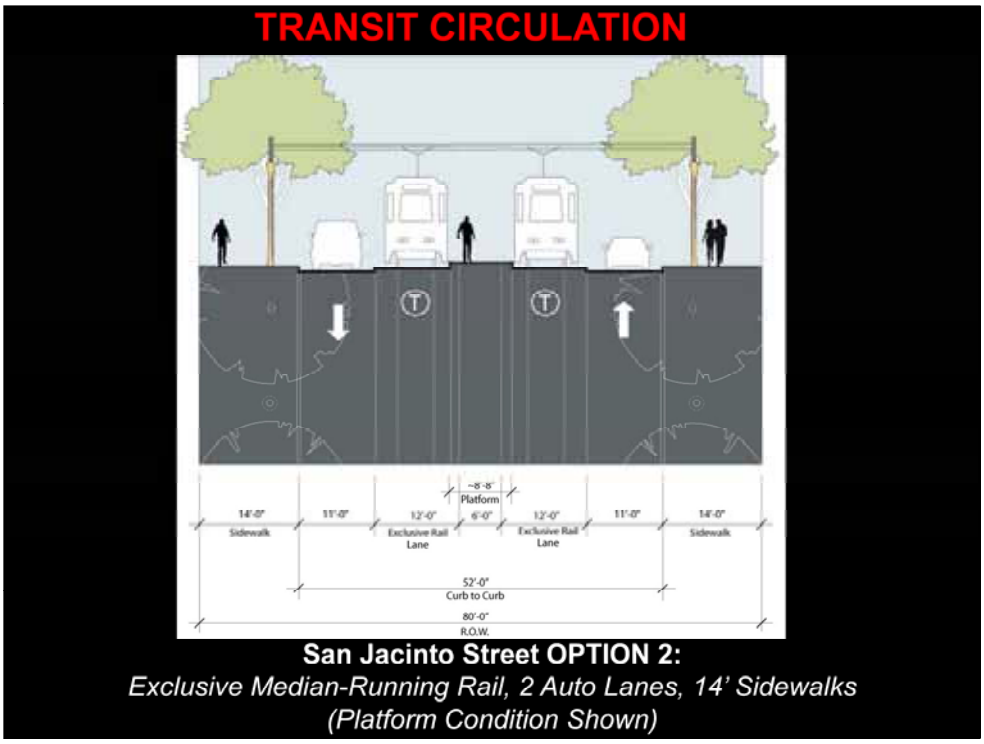


East Ninth or Tenth Street*:* From Congress Avenue, the streetcar would turn eastward on East Ninth Street and/or Tenth Street to San Jacinto Street. (Tenth Street is preferred to provide more coverage along Congress Avenue, but the ultimate decision will depend on a more detailed engineering and operational analysis of the streetcar project.) An exclusive median-running configuration is recommended on this two-block segment (as shown above) to accommodate both the streetcar turning radius from Congress Avenue and the proposed sharrow lanes along Ninth and Tenth streets. Although the cross-section above depicts a platform, this short stretch of Ninth or Tenth Street would probably not be the optimum location for one. Other options that could be considered include a rail couplet where rail could run eastbound on Ninth Street and westbound on Tenth Streets, thereby increasing vehicular capacity somewhat on both streets.

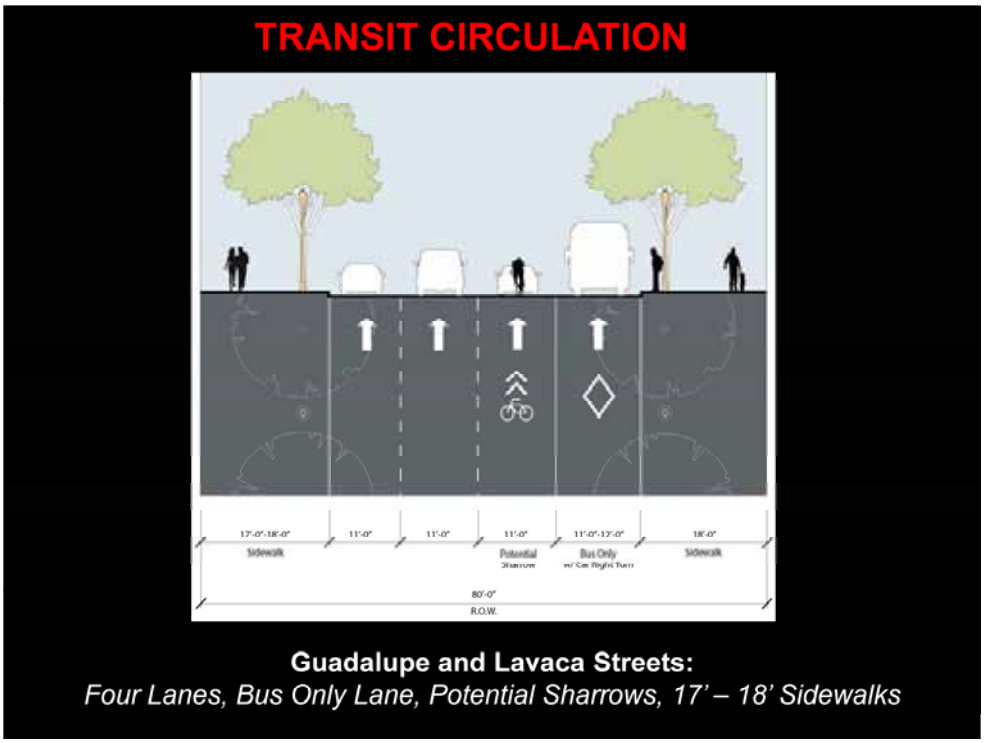


San Jacinto Street: Similar to West Fourth Street, there are two options for San Jacinto Street:

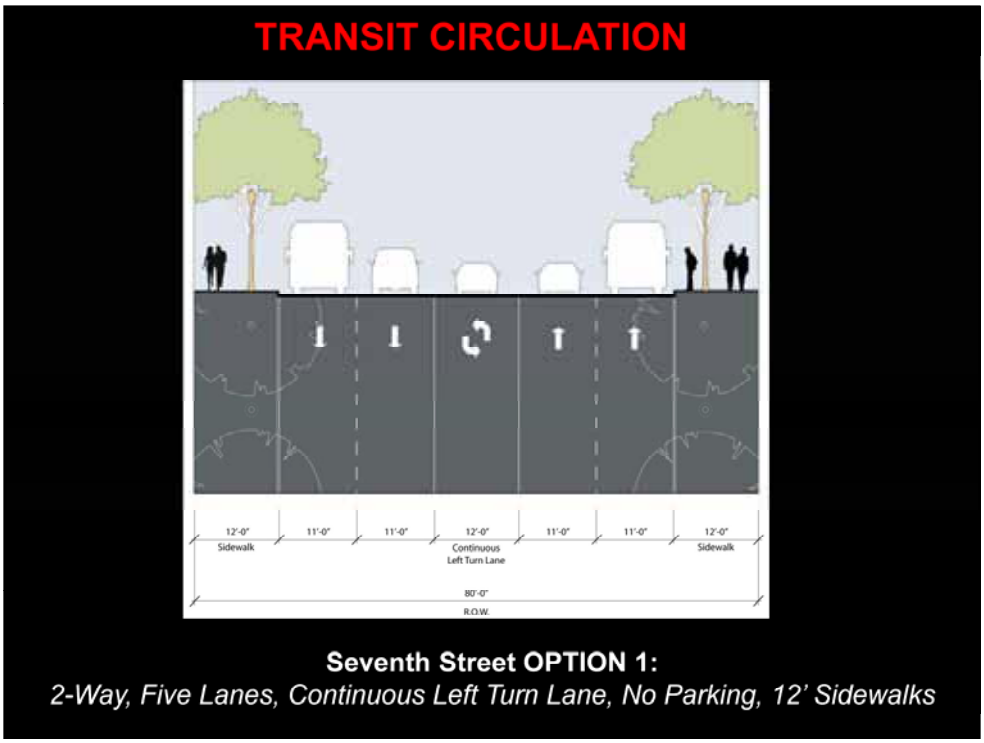
• Option 1: A shared-running streetcar in the curbside lane; and



• Option 2: An exclusive median-running rail option with a center median platform and one lane of vehicular traffic on either side.

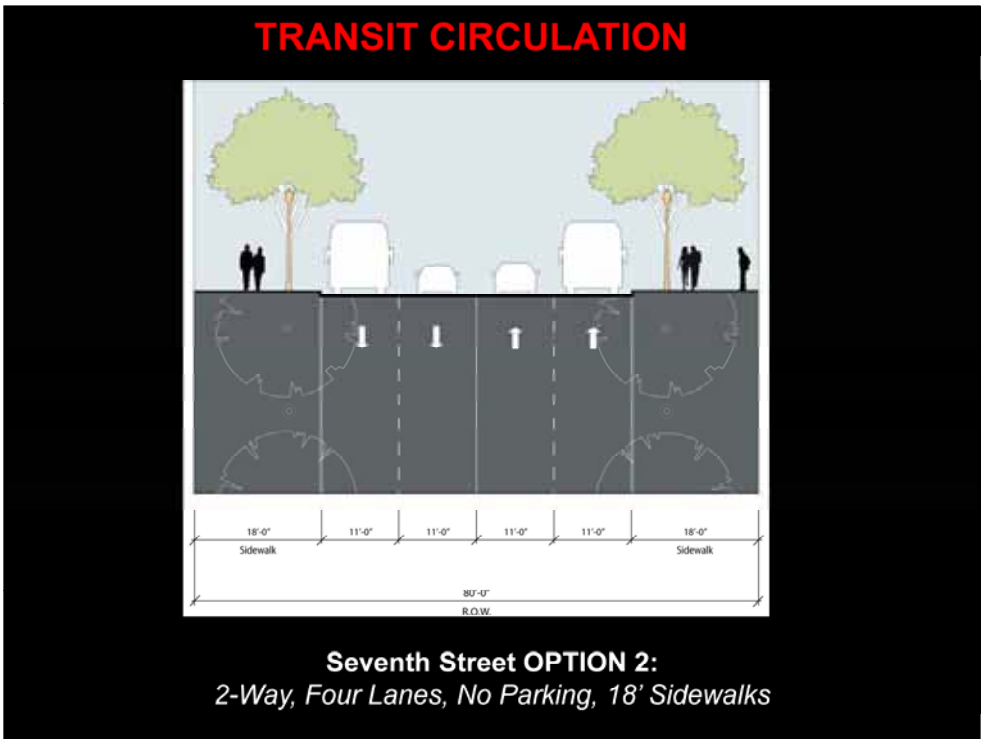


Guadalupe and Lavaca Streets*:* The Guadalupe and Lavaca Street corridors are designated as bus-priority streets, serving multiple routes as they pass through the Downtown and providing opportunities for passengers to transfer to other bus routes, Dillo routes and future rail routes. It is proposed that the right-hand lane on each of these one-way streets be designated as bus-only lanes. Cars and bikes would be permitted in the lanes only to turn right. As described in the Bicycle Circulation section, the second lane from the right would also be designated as sharrow lanes to serve the commuting cyclist. Parallel parking along Guadalupe and Lavaca can still occur as "duck-in" parking. (See Appendix C.)



Seventh Street*:* Seventh Street, between IH 35 and Guadalupe Street is also designated as a bus-priority street, however, buses would share the curbside vehicular lanes along this east-west corridor. As described in the Vehicular Circulation section above, the street is proposed to be changed to two-way operation, and there are two optional cross sections under consideration for Seventh Street:

• Option 1: A five-lane cross section with a continuous left turn lane and 12-foot wide sidewalks; and



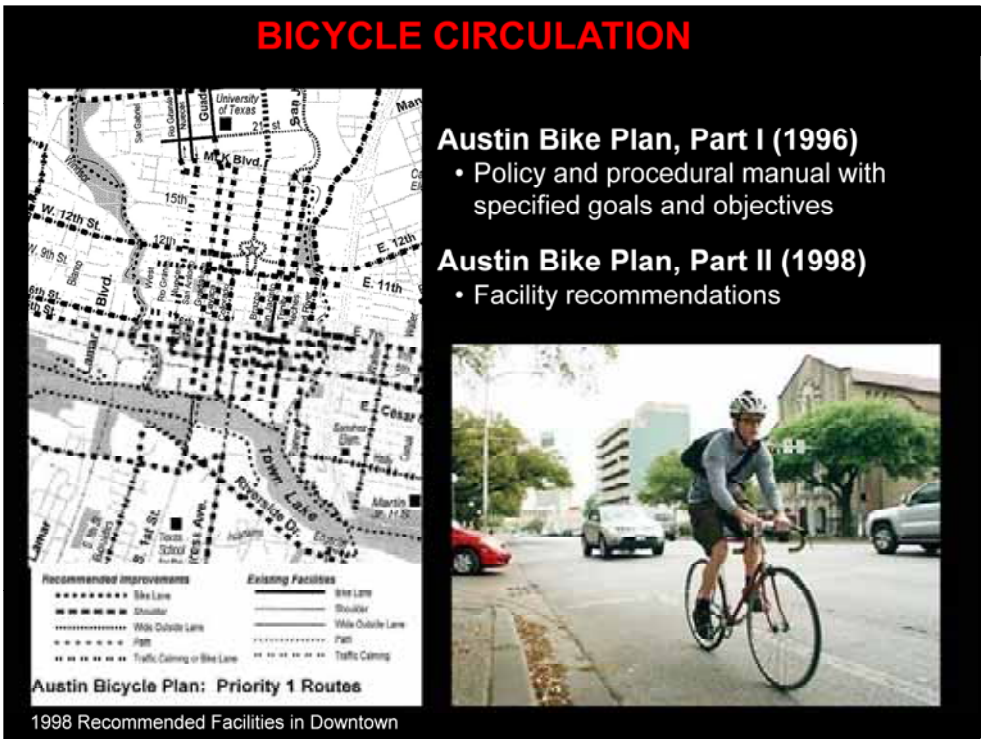
• Option 2: A four-lane cross section with 18-foot wide Great Streets sidewalks. While this issue is preferred from the standpoint of the pedestrian and the transit patron, the key issue with is the limited left turn movement capacity. Further study and analysis is needed to determine the constraints on automobile and bus mobility with a four lane configuration.

TRANSIT CIRCULATION
Summary of Key Recommendations

1. Establish transit priority streets: Lamar (bus), Guadalupe/Lavaca (bus), Congress Avenue (rail, Dillo), San Jacinto (rail), Red River (bus), West Third Street (rail), Fourth Street (rail), Fifth Street (Dillo), Sixth Street (Dillo), Seventh Street Street (bus), Eleventh Street (Dillo), Fifteenth Street (bus), Seventeenth Street (Dillo), MLK Boulevard (bus).

2. Work with Capital Metro to develop an on-street bus transfer system that will also allow bus-to-rail transfers.

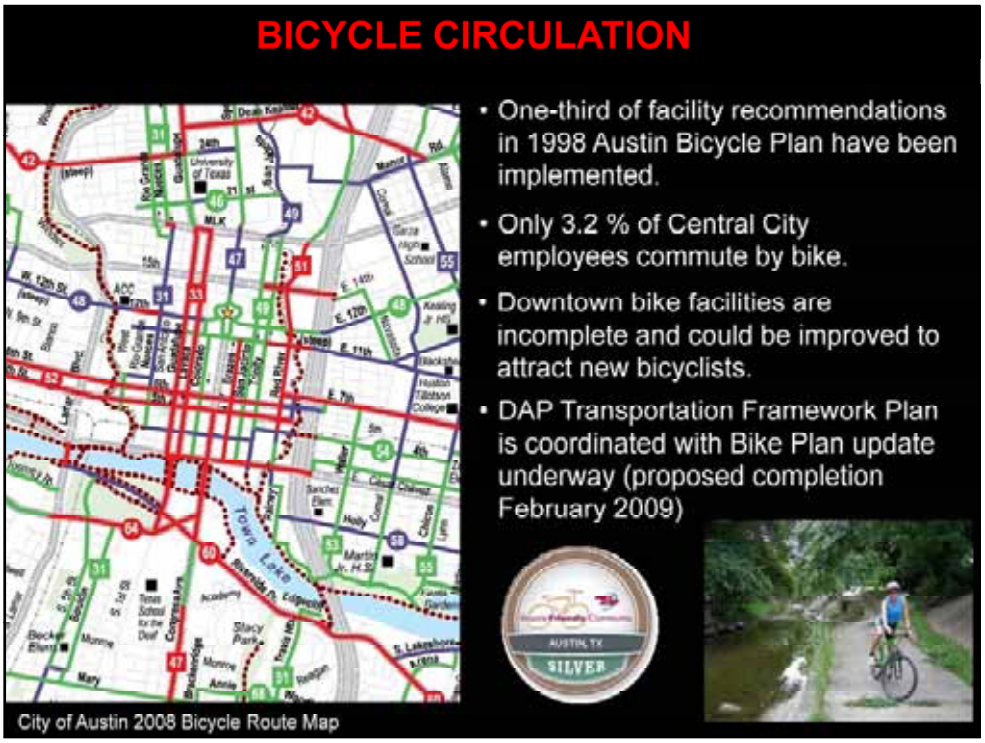
BICYCLE CIRCULATION



History of Austin Bicycle Planning

Bicycle planning in Austin began in 1972 with the City Council adoption of the *Proposed Bicycle Plan*. Several other plans and initiatives were proposed and/or adopted in the 1970s and 1980s including the *Austin Tomorrow Plan* in 1979,the *Austin Area Bicycle System: Interim Report* in 1975, *Austin Bikeway Plan* in 1980 and the *Austin Bicycle Plan* in 1986. In 1991 the first edition of the Austin Bicycle Map was published, and the Austin Bicycle Safety and Mobility Task Force was created. In response to the Task Force recommendations, the City of Austin re-instigated the Bicycle Coordinator position in 1994 and adopted an updated Austin Bicycle Plan in 1996 (Part 1 – policy and procedural manual) and 1998 (Part II – facility recommendations).

The facility recommendations in the 1998 plan identified desired bicycle facilities and routes throughout the city. The plan established a recommended bicycle network at a conceptual level, but little design work was conducted that studied facilities in the actual rights-of-way and curb-to-curb conditions.



Bicycling in Austin Today

Only 3.2 percent of central city employees (area between Oltorf Street, FM 2222, Pleasant Valley Rd., and Loop 1) bicycle to work, according to the 2000 Census. Despite Austin's many bicycle advocacy groups and Capital Metro's provision for bikes on buses, biking to and in the Downtown remains very challenging and often dangerous. While some transportation funding exists for bike facilities from the most recent bond package, most of it is not dedicated to Downtown, where the ability to walk and bike safely is critical to maintaining a vibrant downtown. Easy access for bicycles and quality bicycle facilities within downtown are key to ensuring non-motorized mobility and a more sustainable environment within the downtown area. The lack of facilities (bike stations with lockers, showers, etc.) and coherent, high-quality bike routes discourage commuting.

However, progress has been made citywide. Over the last ten years, since the adoption of the Austin Bicycle Plan, approximately half of the policy recommendations and a third of the facility recommendations have been implemented. In May 2007, the City received a Silver Level Bicycle Friendly Community designation from the League of American Bicyclists.

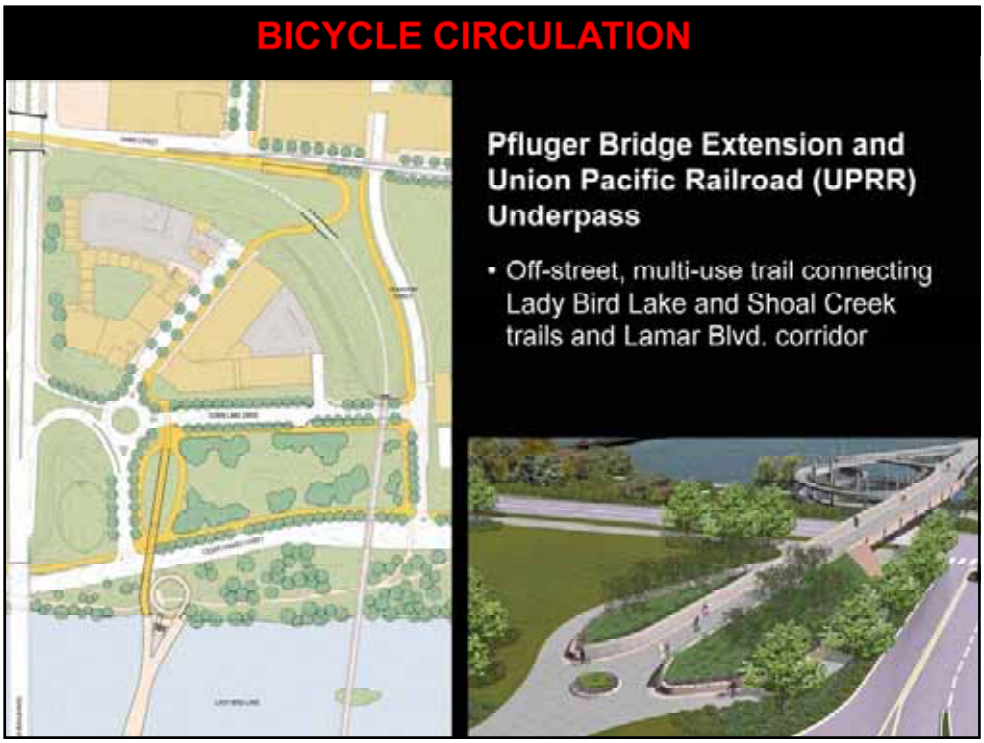
The 2008 Bicycle Route Map shows the existing routes/desired facilities and level of difficulty in Downtown. Few of the routes in the downtown area actually contain bicycle facilities and several of the routes are dangerous for bicycling due to lack of facilities, poor maintenance and/or barriers along the route. In an effort to update bicycle policy and facility recommendations, the City of Austin is in the process of updating the Bicycle Master Plan which should be complete in early 2009. This effort has been closely coordinated with the DAP Transportation Framework Plan. The updated plan aims to provide a high-quality bicycle network throughout the city that accommodates all levels of bicyclists: one that considers bike circulation in relation to other modes of transportation.

Existing bicycle facilities within downtown are limited, resulting in a dangerous and poorly connected network through the core of the city. Trinity and San Jacinto streets are the only significant corridors with on-street bike lanes in the entire Downtown study area. The recreational, off-street trail system is more successful and includes:

• the popular Town Lake Trail which provides good connectivity along Lady Bird Lake, but is very congested with all types of users traveling at many different speeds (dogs on leashes, children, strollers, walkers, etc.;
• the Shoal Creek trail, which despite interruptions in the vicinity of Fifth Street, has great potential to link Downtown with neighborhoods to the north and west; and
• although limited in width and posing significant grade and sight line challenges, portions of the Waller Creek corridor may also have potential for off-street biking.

There are several new projects and initiatives, which will improve the Downtown bike environment significantly:

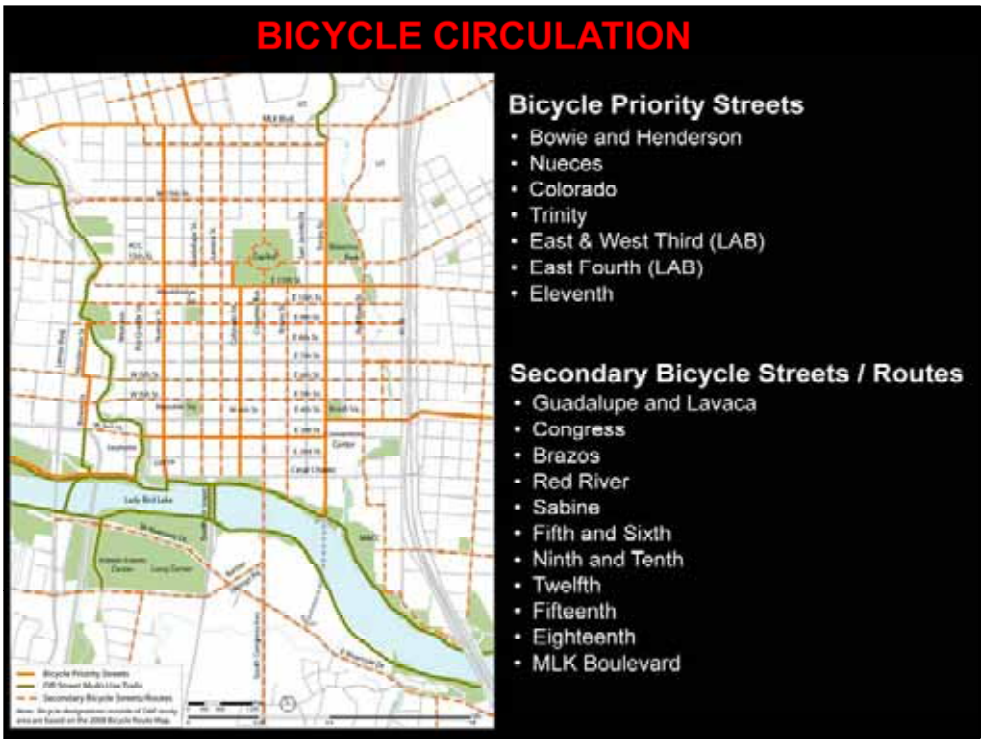
The Lance Armstrong Bikeway (LAB), now under construction, is a six-mile long, east-west commuter route from US 183 on the east to Loop 1 on the west. The bikeway will consist of a combination of off-street concrete trails, on-street striped bike lanes, potential sharrows and on-street signed bike routes. The presence of continuous and high-quality bikeways, like the LAB and amenities can play a significant role in converting some car commuters to bike commuters.



The Pfluger Bridge Extension and the Underpass of the Union Pacific Railroad tracks, will provide a much needed connection between the hike-and-bike trail along Lady Bird Lake / Lamar Boulevard Corridor and Downtown. The Pfluger Bridge Extension project is expected to be completed in 2009, an it is not known when the Underpass will be completed, as the project is currently on hold.

The Street Smarts Task Force was convened in March 2007 with the mission "To create and promote the best environment for the friendly co-existence of bicycle riders and other transportation users in Austin". The overall recommendations include improving infrastructure, education, safe behavior and law enforcement and the establishment of a board or commission to oversee bike initiatives. The infrastructure recommendations focus on eliminating existing barriers and creating a comprehensive network of on-street and off-street facilities that are well-integrated with other modes of transportation.

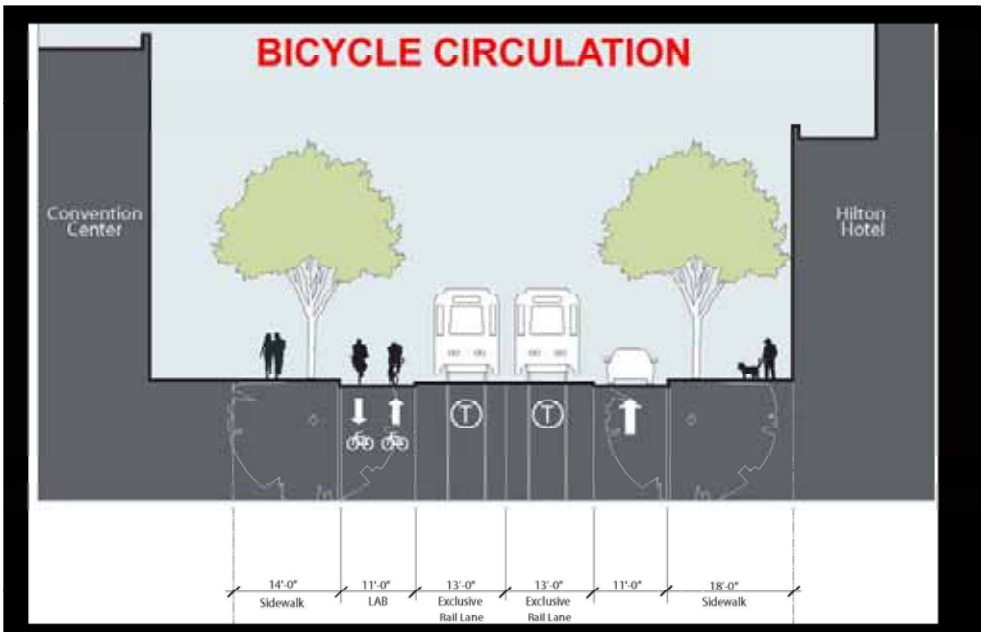
Off-street multi-use trails are important facilities for both the commuter and recreational bicyclist. The trails in and around Downtown provide great east-west and north-south connections through the city and accommodate all levels of bicyclists. The "gap" in the Shoal Creek trail south of Fifth Street needs to be addressed by the City's acquisition of an access easement. Maintaining a strong network of multi-use trails is important in promoting bicycle travel and improving bicycle safety.



Bicycle Priority Streets

Downtown streets should be designed to provide a safer and more comfortable environment for the recreational as well as the commuting bicyclist. The DAP Transportation Framework Plan proposes a network of bike-priority streets along Bowie, Henderson, Nueces, Colorado, Trinity, Third, Fourth, Eleventh and Eighteenth streets. The bicycle priority streets include: separated bikeways, a bicycle boulevard, dedicated bicycle lanes (without adjacent on-street parking) and dedicated bicycle lanes separated from parallel parking by a shy space/buffer zone. These streets provide direct linkages to the system of off-street hike and bike trails along Lady Bird Lake and Shoal Creek and the larger bicycle route network beyond Downtown. In addition, a network of secondary bicycle streets/routes with bike lanes or shared lane markings, "sharrows" (lanes shared by both bikes and cars), is proposed to complement the bike-priority street network and preserve the existing bicycle routes. "Sharrows" are used to instill a heightened consciousness and a safer coexistence between motorists and cyclists.

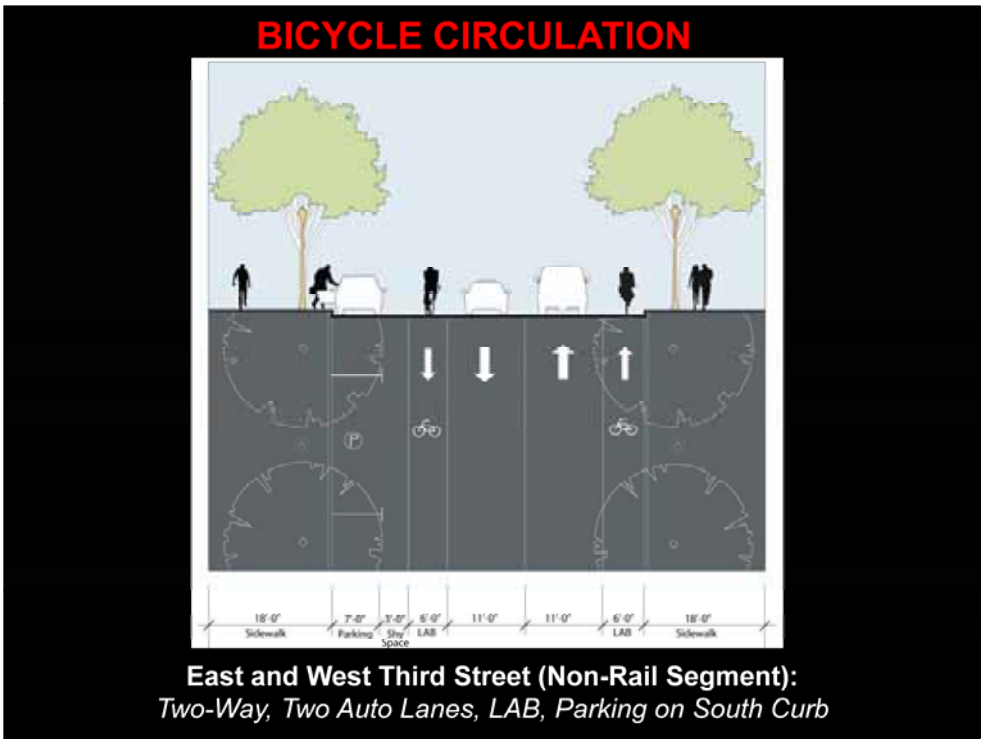
The bicycle priority streets provide a clear and safe network for bicyclists of all experience levels. The proposed plan will result in increased connectivity in Downtown Austin by creating a network of high quality priority and secondary facilities that traverse Downtown at frequent north-south and east-west intervals. The following provides a description of the proposed priority bike streets in the Downtown:



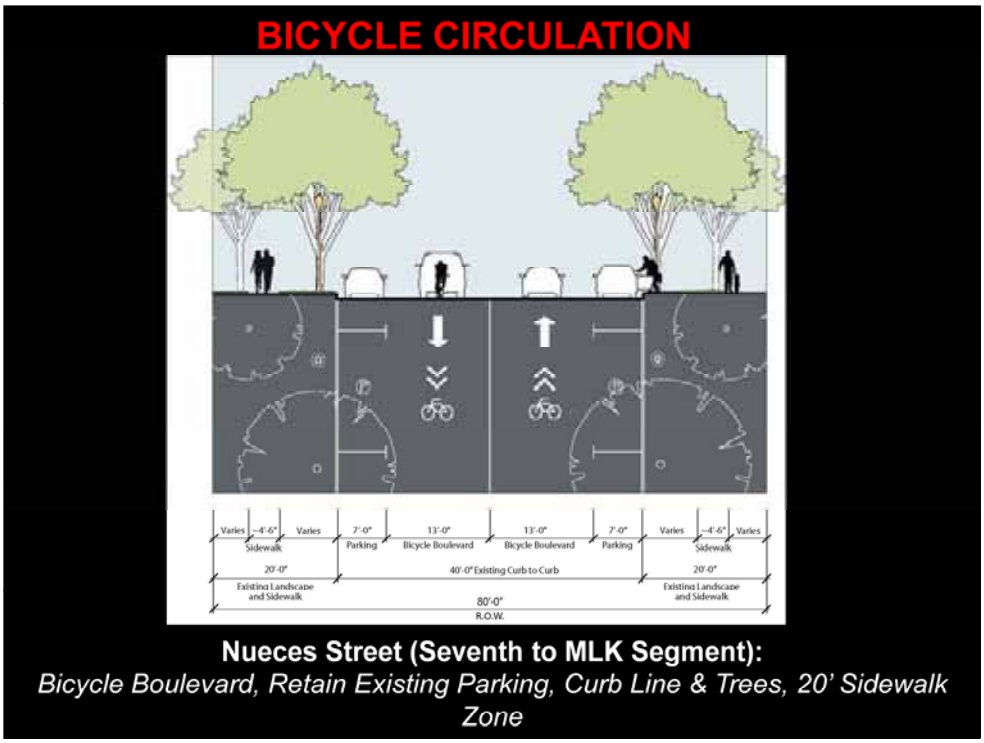
East Fourth Street (IH 35 to Trinity Segment):
Exclusive Median-Running Commuter Rail, One WB Auto Lane, LAB (Non-Platform Condition)

Lance Armstrong Bikeway

The Lance Armstrong Bikeway (LAB) is an on-street facility through most of the downtown. Between Trinity Street and IH 35, in the vicinity of the Convention Center along East Fourth Street, the bikeway is planned as a two-way "contra-flow" facility, 11 feet in width, located along the southern curb of the street, parallel with the commuter rail line. (A contra-flow bicycle facility is one in which both directions of bike travel are immediately adjacent to one another, in a 10 to 14-foot wide space.)



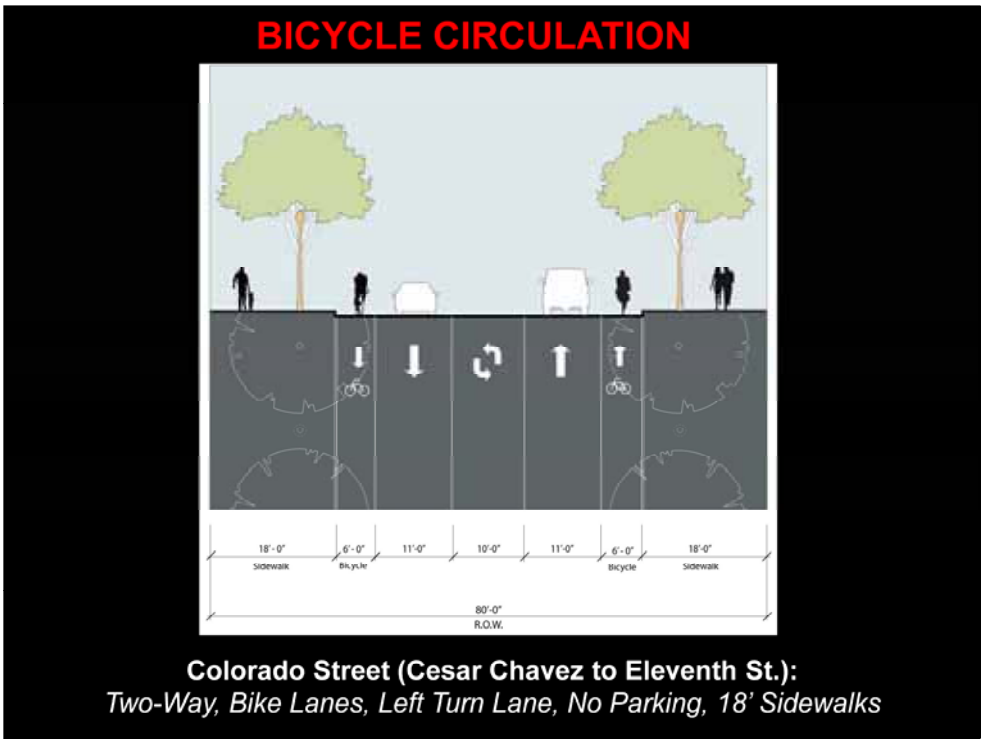
The LAB transitions south to Third Street via Trinity Street and continues west on Third Street. The cross section has two, six-foot wide, dedicated bike lanes with parallel parking on the south curb only. A shy space of three feet is provided between the parallel parking and bike lane to give bicyclists a safe distance from the parked cars.



Nueces Street Bicycle Boulevard

Nueces Street is an important north-south bicycle connection through Downtown, providing connectivity from Lady Bird Lake to MLK Boulevard, and continuing north through the West Campus area. It is proposed as a signature north-south bike corridor, complementing the east-west Lance Armstrong Bikeway. In addition to its strong connectivity, Nueces Street is an attractive street for bicyclists of all levels due to the low vehicular traffic volumes, the relatively flat profile of the street and the existing tree canopy.

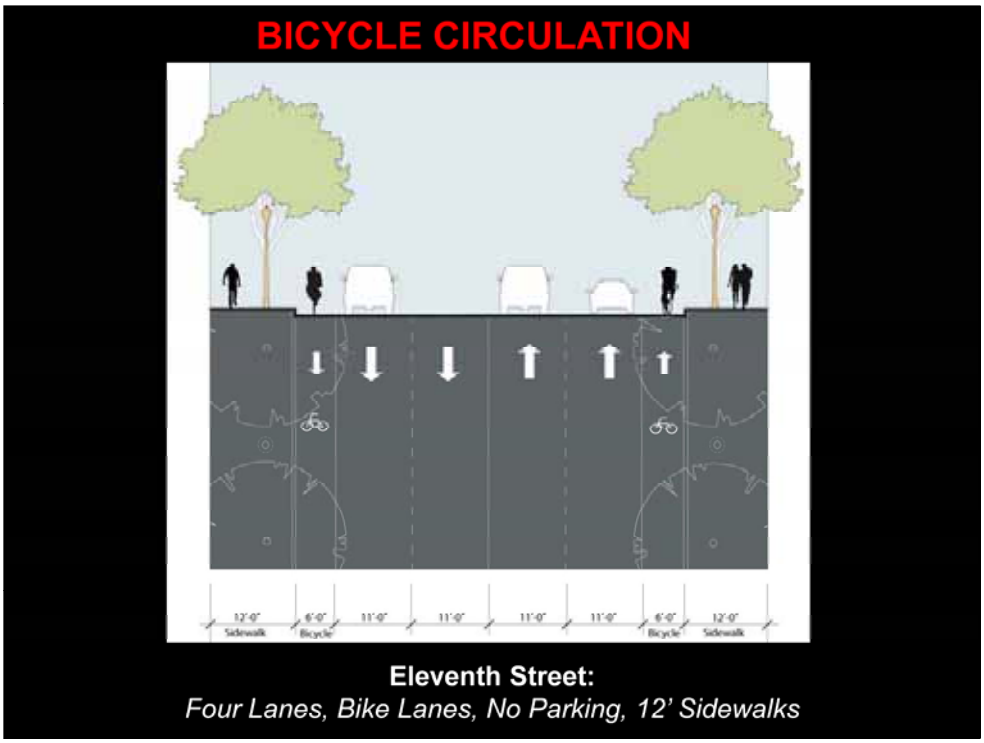
Nueces Street should be designed as a "bicycle boulevard", a bike priority street to attract all types of cyclists by providing a safe and convenient corridor with a limited number of stop signs and with traffic-calming devices that slow cars down and discourage through traffic. Small roundabouts at non-signalized, minor street intersections are recommended to slow automobile traffic. Bicycle/pedestrian detectors (as opposed to vehicle detectors) are proposed at signalized intersections to give priority to cyclists and pedestrians. The existing roadway curb-to-curb dimension of 40 feet is maintained to ensure preservation of the mature street trees that provide continuous shade along the street.



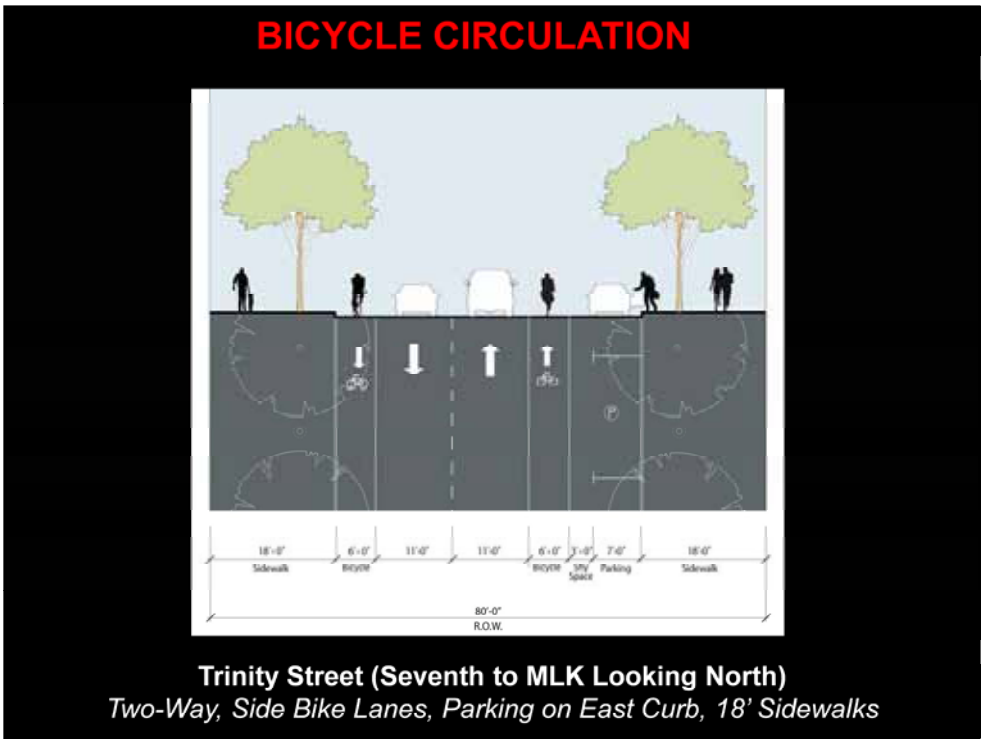
Dedicated Bicycle Lanes

In addition to the signature bike facilities (the Lance Armstrong Bikeway and the Nueces Street bike boulevard), the DAP Transportation Framework Plan proposes dedicated bike lanes on several streets within the Downtown to provide a safer environment for cyclists and a clearer delineation from automobile traffic. More specifically:

Colorado Street is an important north-south bicycle route, providing an attractive alternative to the more congested Congress Avenue and connecting many important east-west priority bike streets and secondary routes. As discussed above, the DAP proposes that Colorado Street be converted to two-way vehicular traffic. Six-foot wide dedicated bike lanes are proposed along both sides of the street. The street could be operated as a three-lane vehicular roadway (one lane in each direction and a center turn lane as shown in the cross section above), or as a two-lane roadway with parking on one side of the street.

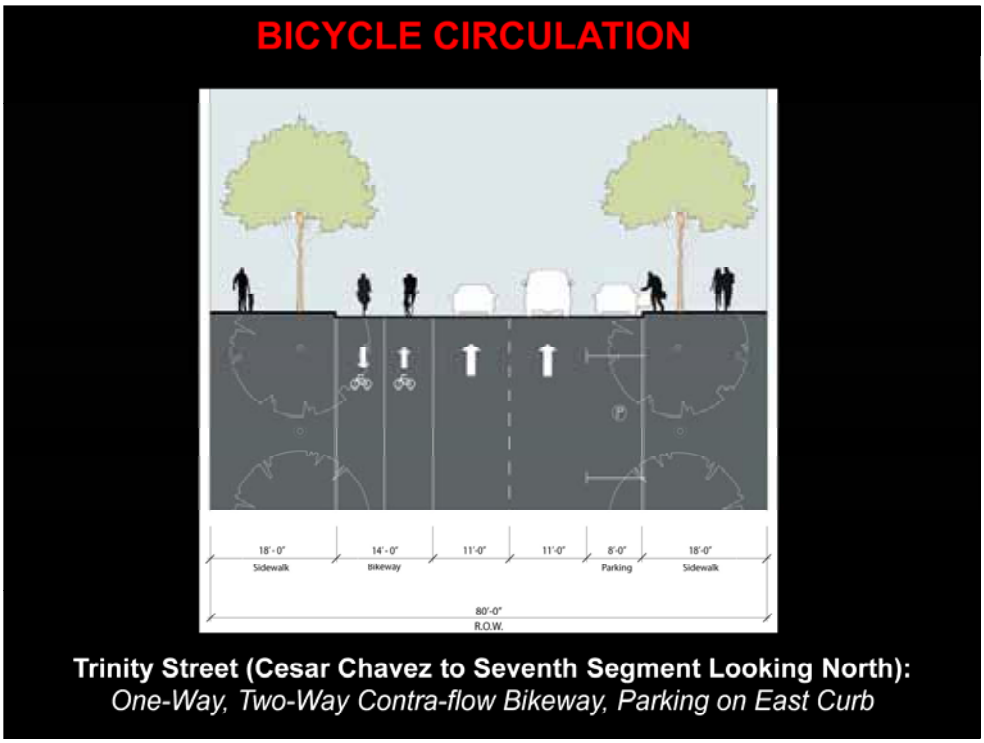


Eleventh Street, between IH 35 and Nueces Street, is proposed to be enhanced for bike and pedestrian circulation by widening the existing 10-foot sidewalks to at least 12 feet and by introducing continuous dedicated bike lanes of six feet in width along both curbs. Removal of parking will also increase the safety of cyclists, as well as keep the vehicular traffic flowing more steadily.

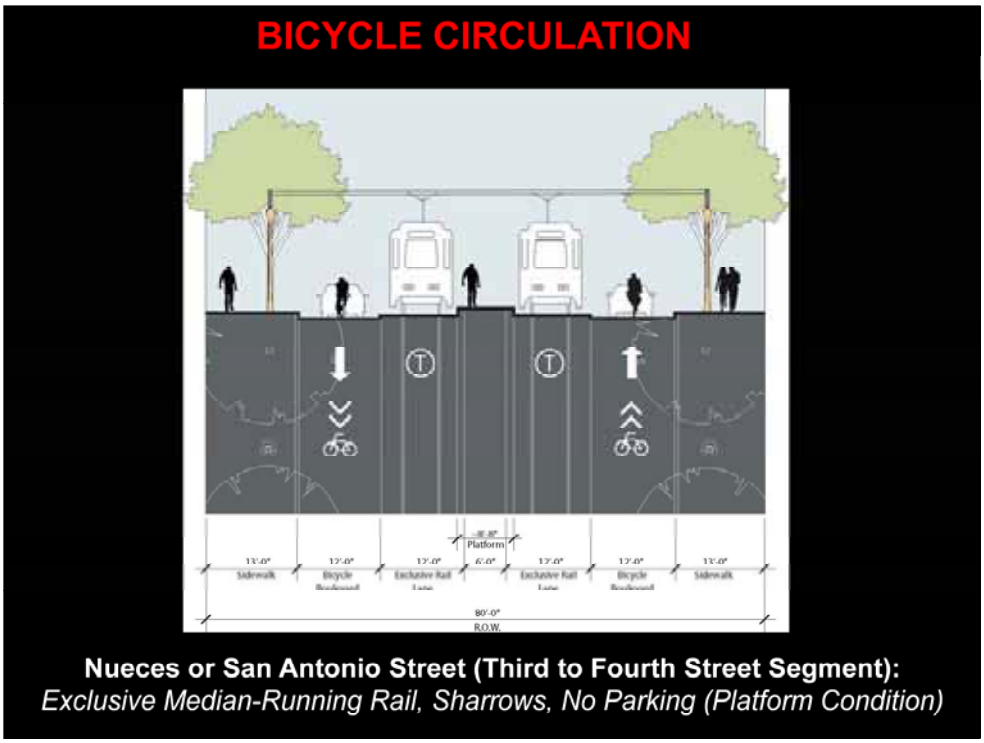


Trinity Street is also an important north-south bicycle priority street that traverses downtown, connecting the trail along Lady Bird Lake with Lance Armstrong Bikeway, The University of Texas and other bicycle priority streets and destinations. The DAP proposes that the segment of this street north of Seventh Street be converted to two-way operation, with one vehicular lane in each direction, and six-foot bike lanes along both sides of the street. Parking is proposed along the east curb only. A shy space of three feet is provided between the parallel parking and bike lane to give bicyclists a safe distance from the parked cars.

Eighteenth Street is only a 60-foot ROW. In this case, the DAP proposes that Eighteenth Street be converted to two-way with sharrow lanes, which would allow the conservation of one of the two lanes of existing curbside parking. Another option would be provide dedicated bike lanes with *no* on-street parking.



Trinity Street transitions to a one-way street south of East Seventh Street, to accommodate the sometimes very intense amount of vehicular drop-off activity at the Convention Center. The bicycle facility along this one-way segment of Trinity Street is proposed as a two-way contra-flow bikeway along the western curb of the street. Between Third and Fourth Street, this segment of the street also serves as the Lance Armstrong Bikeway. In designing this facility, it will be important to carefully transition between the one- and two-way segments of the bikeway to reduce bicycle and vehicle conflicts and to give motorists and pedestrians clear notification of the contra-flow condition and the resulting bicycle movements.

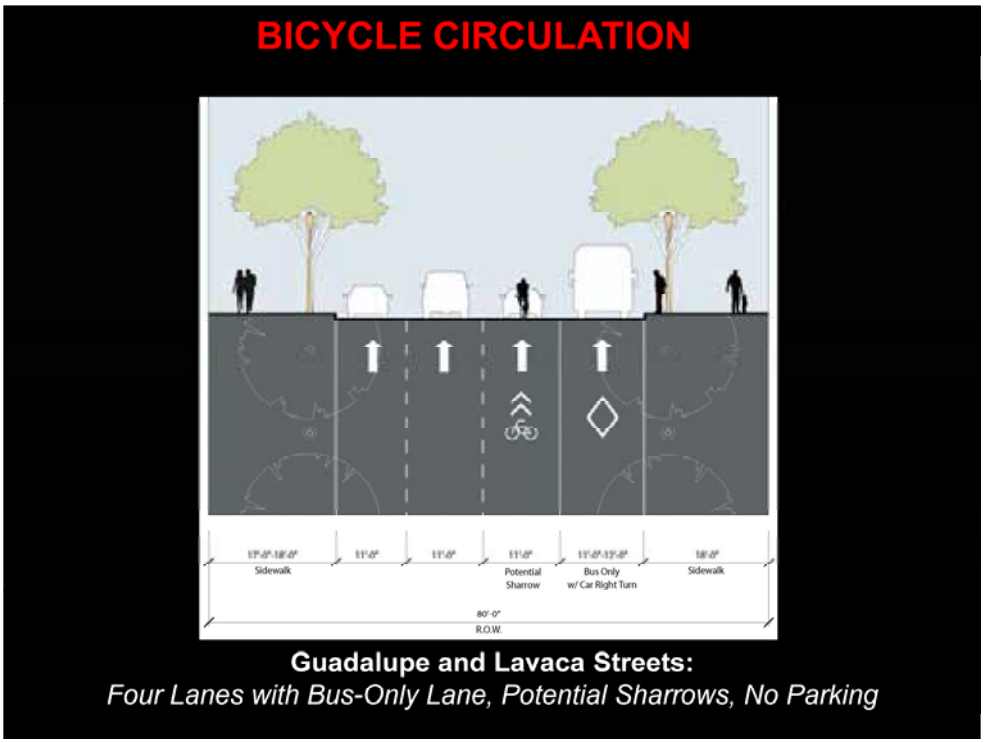


Bike Facilities on Rail Priority Streets

In developing the DAP Transportation Framework Plan, efforts have been made to segregate bicycle and rail facilities as much as possible to avoid the hazard of bikes having to cross rails. However, there will be intersections where rail and bike crossings will be unavoidable, and a few segments (e.g., along Fourth, Trinity and Third streets, or along Nueces or San Antonio Street between Third and Fourth Streets as shown in the cross section above) where bikeways will run parallel with the rail for a portion of the street. In these situations, it will be very important to provide clear roadway striping and delineation, as well as signage that alerts cyclists to the danger of crossing rails at angles of less than 45 degrees. Clear indication of where safe perpendicular crossings can be made will also be important. Some cities are exploring the potential for rubber flange fillers, also known as "depressible rail inserts" along portions of the rail that have heavy bike usage. In a recent study by Alta Planning + Design, "Bicycle Interactions and Streetcars: Lessons Learned and Recommendations," it was noted that flange filler material used for heavy rail can reduce crash danger, but experiments in Switzerland seem to indicate that flange filler is not appropriate for streetcar tracks.

(Note: See also ROMA's November 2008 Third and Fourth Street Rail Study.)

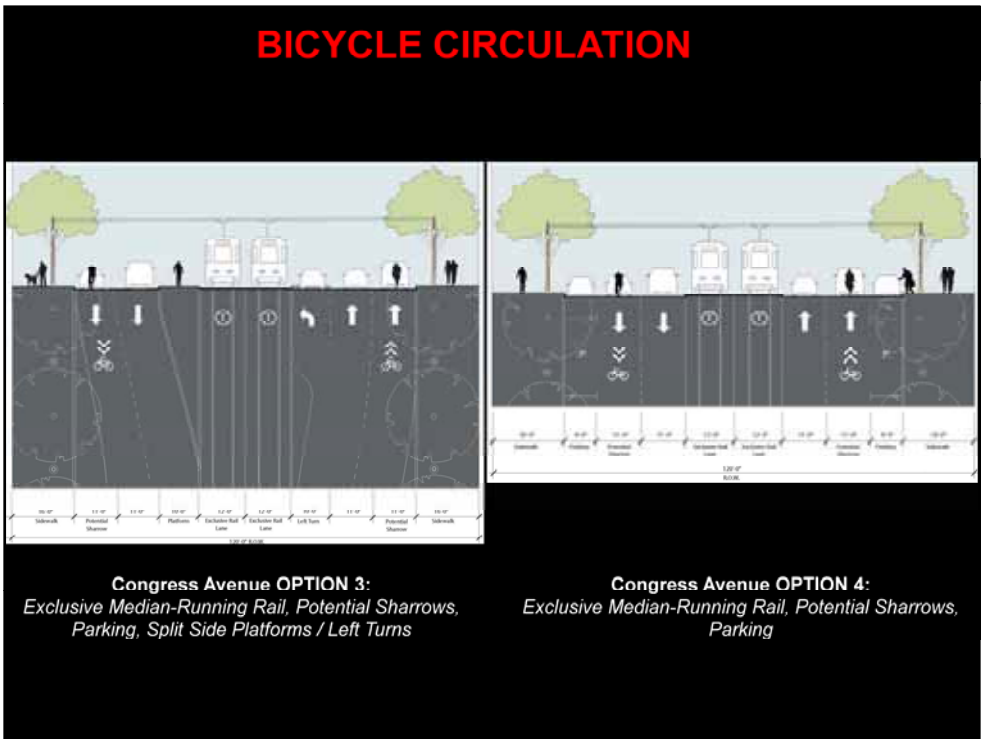
(Source: *Bicycle Interactions and Streetcars: Lessons Learned and Recommendations,* Alta Planning + Design, 2008).



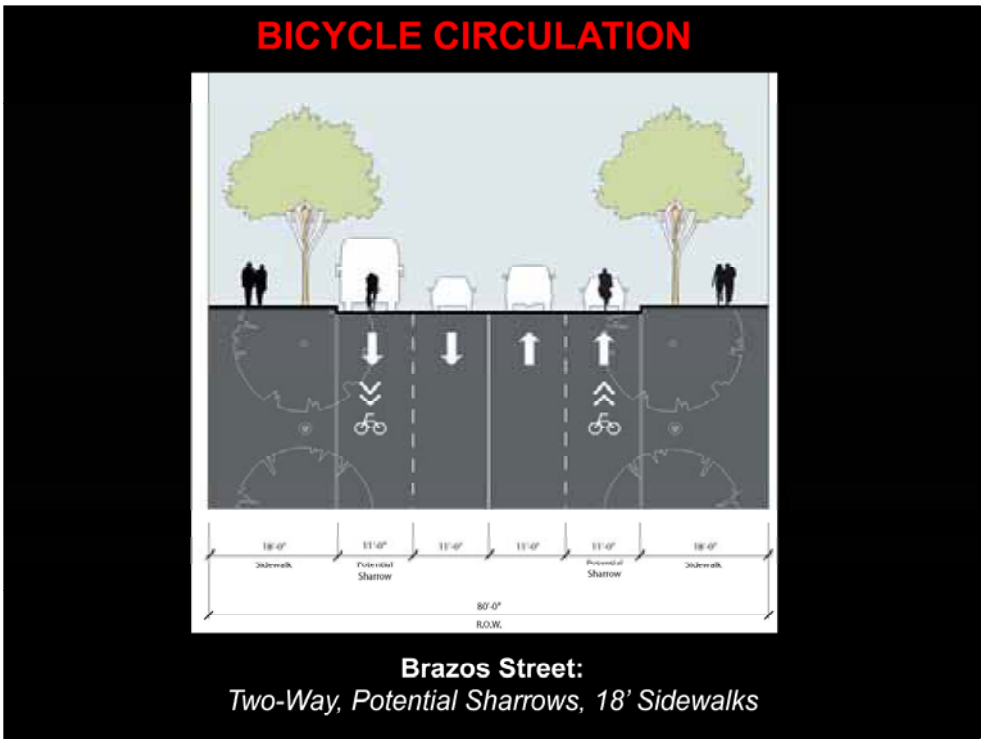
Sharrows

The DAP Transportation Framework Plan proposes a network of "sharrow" lanes within the Downtown that will promote safer routes for bicyclists. Sharrows are used to direct bicyclists outside the car door zone (when adjacent to parallel parking) and/or into the appropriate lane, as well as increase motorist awareness. Sharrows are not in the current version of the Texas Manual of Uniform Traffic Control Devices (TMUTCD), but the City of Austin plans to submit an application to the FHWA (in fiscal year 2009) for inclusion of sharrow lane markings in a pilot program intended to study their effectiveness. The pilot program application should recommended sharrows on a downtown street. Sharrows are being successfully used in several cities including Seattle, San Francisco, Portland and New York City. Additional information on sharrows is included in Appendix 2. The following sections provide information on proposed sharrows in Downtown:

Guadalupe and Lavaca streets are important north-south streets, connecting Lady Bird Lake and UT. Due to the high traffic volumes and dedicated bus lanes, these streets are more appropriate for the advanced bicyclist. A potential sharrow is proposed in the lane adjacent to the dedicated bus lane. The sharrow will position the bicyclist in the center of the lane.

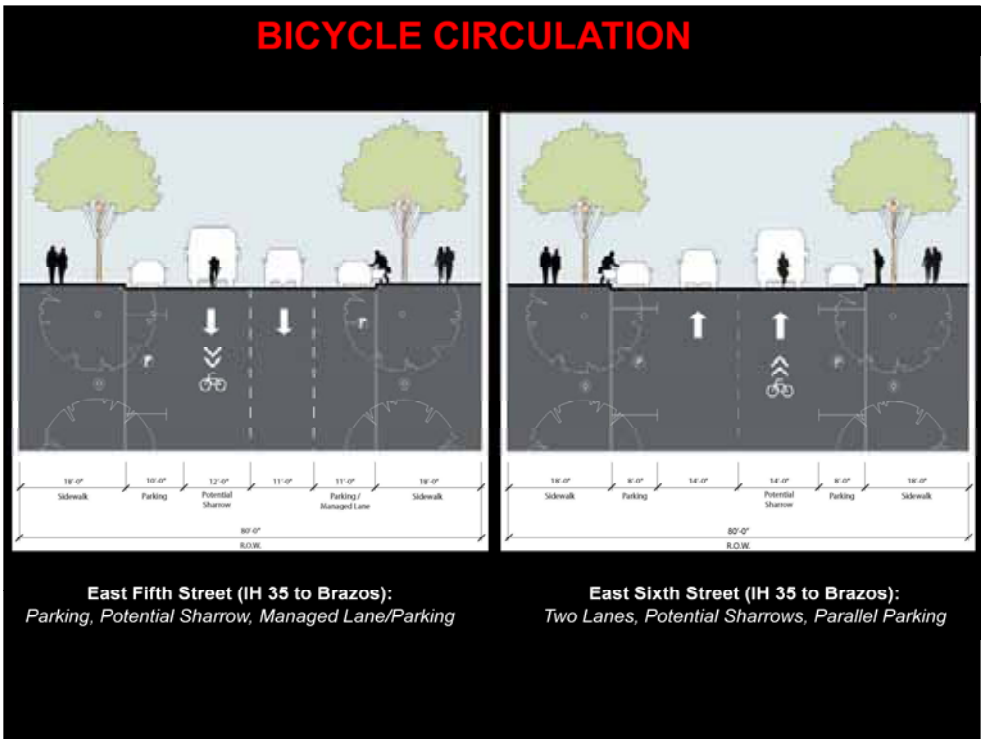


Congress Avenue has four alternative roadway designs. Two options with exclusive median-running rail accommodate sharrows in the outer lanes. Bicycle facilities are not provided on the shared side-running options, as rail in the outer lanes creates unsafe conditions for bicyclists. Parallel bicycle facilities on Colorado and Brazos Streets are good north-south alternatives to Congress Avenue.



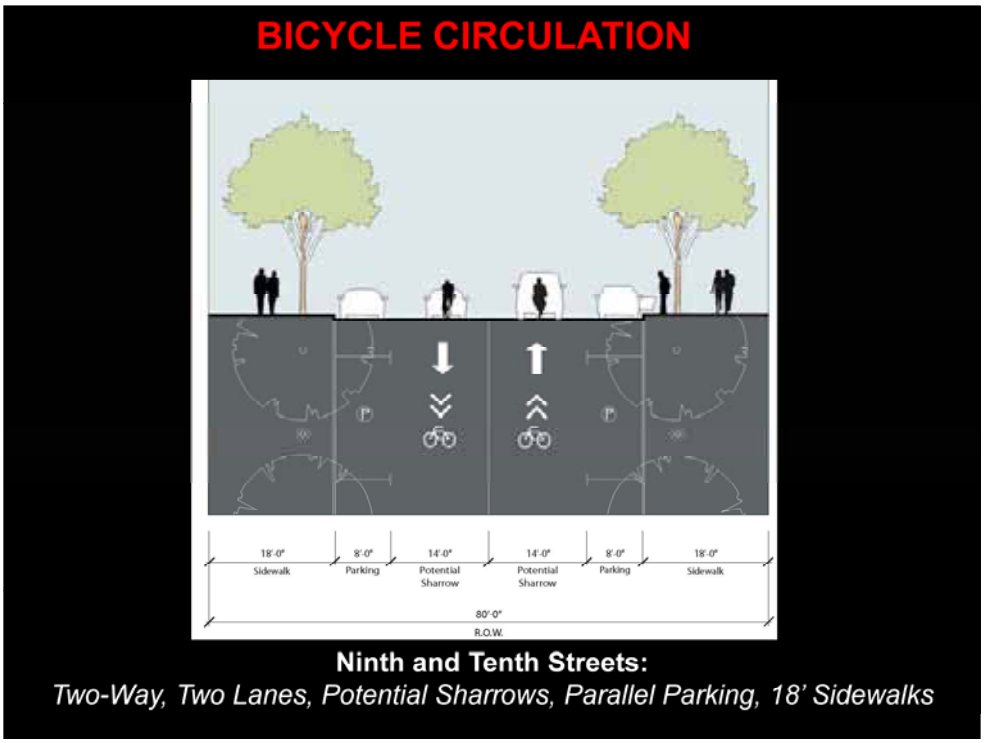
Brazos Street provides an alternative bicycle facility to Congress Avenue. Sharrows along Brazos direct the bicyclist to travel outside the car door zone of the duck in parallel parking.

Like Brazos Street, the DAP proposes that MLK Boulevard and Fifteenth Street have sharrows in the center of the outer lanes for the more advanced bicyclist.



Fifth and Sixth Streets

Fifth and Sixth Streets are important east-west connections through Downtown, providing direct routes between east and west Austin. Sharrows are proposed along both East Fifth and Sixth streets.



Ninth and Tenth Streets provide east-west connections between Lamar, Shoal Creek Trail and IH 35. The DAP proposes sharrows on Ninth and Tenth streets to create safer alternatives to Seventh and/or Eighth Streets.

Like Ninth and Tenth streets, the DAP proposes that Red River and Twelfth Streets contain sharrows adjacent to the parallel parking. Red River provides important north-south connectivity, running parallel to Waller Creek, and Twelfth Street is an important bike route, connecting Downtown and the Capitol Complex with east and west Austin.

BICYCLE CIRCULATION
Summary of Key Recommendations

1. Complete alignment for Shoal Creek trail south of Fifth Street.

2. Establish network of bicycle priority streets: Bowie/Henderson, Nueces, Colorado, Trinity, East & West Third (LAB), East Fourth (LAB), Eleventh and Eighteenth streets.

3. Establish network of secondary bicycle streets/routes: Guadalupe and Lavaca, Congress, Brazos, Red River, Sabine, Fifth and Sixth, Ninth and Tenth, Twelfth, Fifteenth and MLK Boulevard.

4. Include one or more Downtown streets in a sharrow pilot program application.

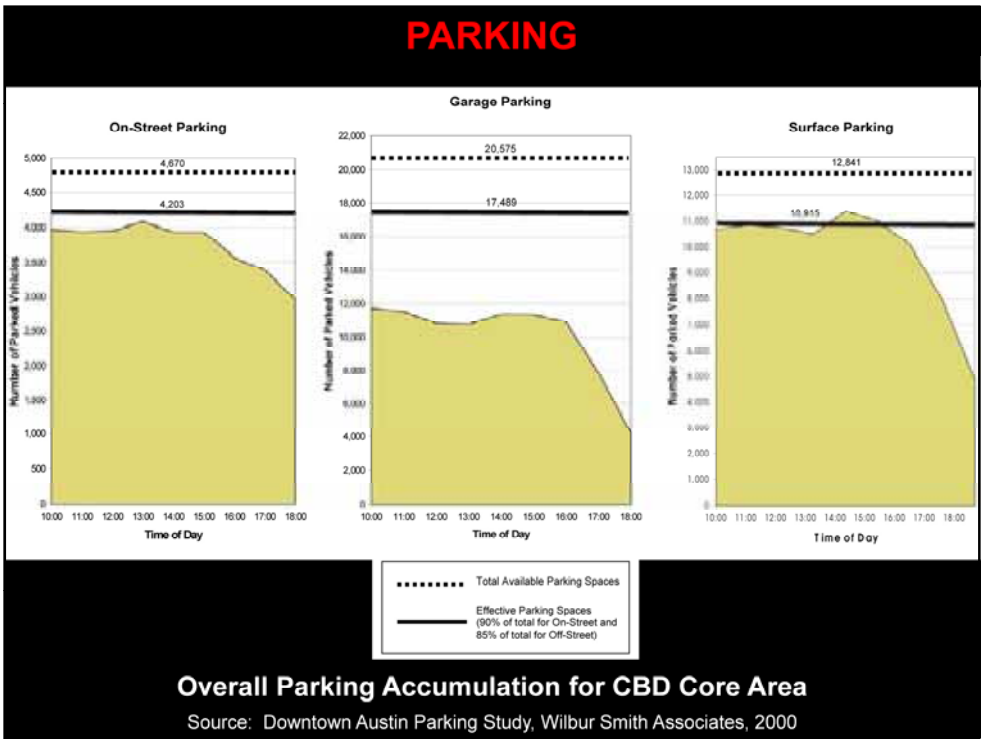
PARKING

Parking

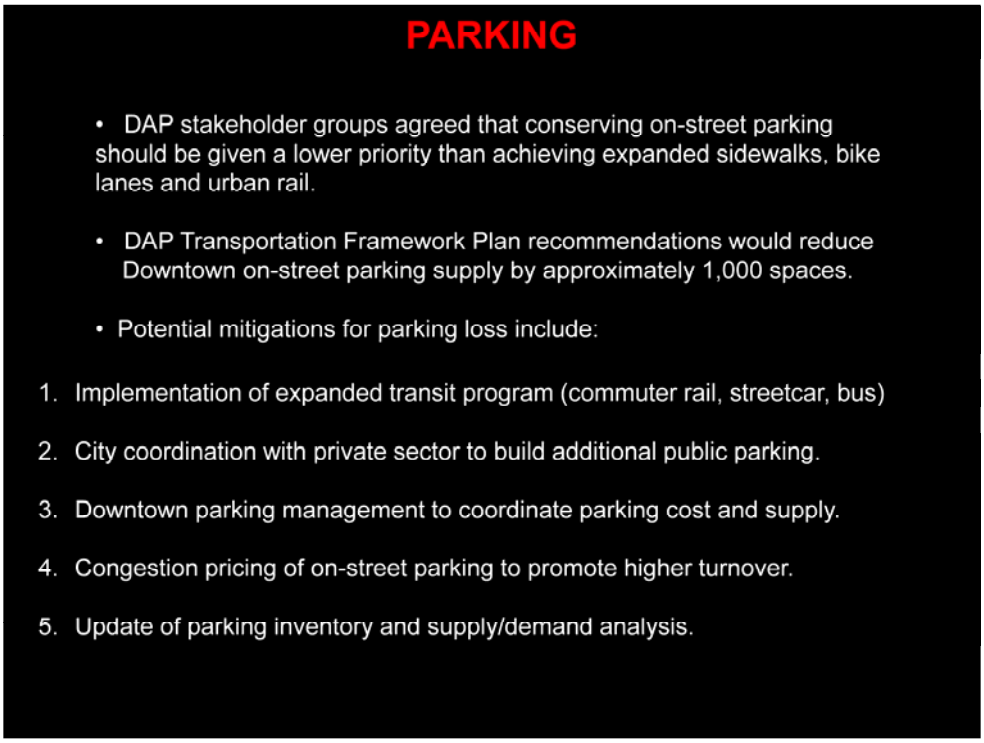
The last comprehensive inventory of Downtown parking was undertaken in 2000 by Wilbur Smith Associates. At that time, the study estimated that the CBD Core (an area that smaller to that of the Downtown Austin Plan as shown above) had a total supply of 38,086 parking spaces, including:

- 4,670 on-street spaces (12% of total),
- 20,575 garage spaces (54%), and
- 12,841 spaces in surface parking lots (34%).

The study projected an overall surplus of approximately 3,200 spaces in the Downtown by 2005, but areas of considerable deficiency (approximately 7,000 spaces) were identified within three blocks of Congress Avenue. The study noted that this deficiency could be erased if Downtown were able to increase its "mode share" of transit trips to and from Downtown from its existing eight percent to 20 percent, a goal that the study noted was achievable.



The report analyzed the accumulated parking demand throughout the day for on-street curbside parking, surface lots and garages, and as shown in the chart above, found that usage of on-street and surface parking facilities approached 100 percent, while usage of off-street garages peaked at 65%.



In discussions with stakeholder groups, there appeared to be agreement that if trade-offs needed to be made regarding competing uses of the Downtown rights-of-way, storage of automobiles should be given the lowest priority. By increasing sidewalk widths, adding bike lanes and introducing street-running rail, the recommendations of the DAP Transportation Framework Plan will impact the supply of on-street parking spaces. If all of the recommendations described in this report were implemented, approximately 1,000 on-street spaces would be removed, potentially further exacerbating deficiencies in the core area along Congress Avenue.

Strategies for overcoming these deficiencies include:

- Implementation of the recommended transit program, including commuter rail, streetcar and enhanced bus service, which can significantly reduce parking demand.
- Provision of additional off-street public parking as part of joint public/private initiatives.
- Congestion pricing of on-street spaces, to promote higher turnover through an increase of short-term parking meter rates.
- Introduction of a Downtown Parking Management entity to coordinate pricing and supply of parking.

It is also recommended that the Parking Study undertaken in 2000 be updated to take into consideration the significant amount of development that has occurred in the past eight years, and the levels of transit that are projected to come on line over the next ten years.

The DAP Transportation Plan recommendations will rebalance the role of streets in Downtown to improve overall mobility and sense of place. They will provide the framework or basis for more detailed district planning in Phase 2 of the overall Downtown Austin Plan Project.

Appendix 1

Downtown Priority Maps and Street Sections

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DOWNTOWN PRIORITY MAPS AND STREET SECTIONS

Downtown Austin Plan

Prepared by ROMA Austin for the City of Austin

November 25, 2008

PRIORITY MAPS:

PRIORITY STREETS BY MODE (All Modes)

TRANSIT PRIORITY STREETS (Rail, Bus and Dillo)

BICYCLE PRIORITY STREETS / TRAILS / SECONDARY STREETS

AUTOMOBILE PRIORITY STREETS

PEDESTRIAN PRIORITY STREETS/PATHS

STREET SECTIONS:

Note: In many cases, various alternative street cross sections are proposed. For example, Congress Avenue has four alternative sections depicting both side-running or exclusive-running rail options, as well as different platform locations and parking/sidewalk types/dimensions.

EAST FOURTH STREET – *NOTE: COMMUTER RAIL*

- **Exclusive, Median-Running: Lance Armstrong Bikeway, No Parking (IH 35 to Trinity)**
- **Exclusive, Median-Running: Side Platforms (Brazos to San Jacinto)**

WEST FOURTH STREET

- **Exclusive, Median-Running: Central Platform, LAB on Third Street, No Parking (Between Nueces Street and Congress Avenue)**
- **Shared-Running: Sidewalk Platforms (Between Guadalupe and Lavaca Streets)**

CONGRESS AVENUE (Cesar Chavez to Eleventh Street)

- **Shared, Median-Running: Conserves Angle Parking, Center Platform, Left Turn Lanes**

- **Shared, Side-Running: Sidewalk Platforms, Parallel Parking, Continuous Left Turn Lane**
- **Exclusive, Median-Running: Center Platform, Potential Sharrows**
- **Exclusive, Median-Running: Non-Platform Condition, Potential Sharrows, Parallel Parking**
- **Exclusive, Median-Running: Split Platform, Left Turn Lanes, Potential Sharrows**

EAST ELEVENTH STREET (Nueces Street to IH 35)

- **Four Lane Section: Bike Lanes, No Parking**

SAN JACINTO STREET (Downtown segment)

- **Shared, Side-Running: Two-Way Conversion, Sidewalk Platforms**
- **Exclusive, Median-Running: Two-Way Conversion, Center Platform**

GUADALUPE & LAVACA STREETS (Downtown Segments)

- **Four Lane Section: Potential Sharrow, Bus Only Lane, No Parking**

SEVENTH STREET (Guadalupe Street to IH 35)

- **Two-Way Conversion: Five Lane Section, Continuous Left Turn Lane**
- **Two-Way Conversion: Four Lane Section, Restricted Left Turns**

EAST FIFTH STREET (IH 35 to Brazos Street)

- **Three-Four Lane Section: Managed Lane, Potential Sharrow, Parallel Parking**

EAST SIXTH STREET (IH 35 to Brazos Street)

- **Two Lane Section: Potential Sharrow, Parallel Parking**

FIFTH AND SIXTH STREETS (West of Brazos Street)

- **Four Lane Section: Potential Sharrow**

EIGHTH STREET (Guadalupe Street to IH 35)

- **Two-Way Conversion: Four Lane Section, Restricted Left Turns**

NUECES STREET (Downtown segment)

- **Bicycle Boulevard, Parallel Parking (Seventh Street to MLK Boulevard)**
- **Bicycle Boulevard, Parallel Parking (Seventh Street to Cesar Chavez)**

COLORADO STREET

- **Two-Way Conversion: Bike Lanes, Left Turn Lane, No Parking**

TRINITY

- **One-Way: Two-Lanes, Two-Way Bikeway, Parallel Parking on East Side (Cesar Chavez to Seventh Street)**
- **Two-Way: Two Lanes, Bike Lanes, Parallel Parking on East Curb (Seventh Street to MLK Boulevard)**

BRAZOS STREET

- **Two-Way Conversion: Potential Sharrows**

NINETH & TENTH STREETS

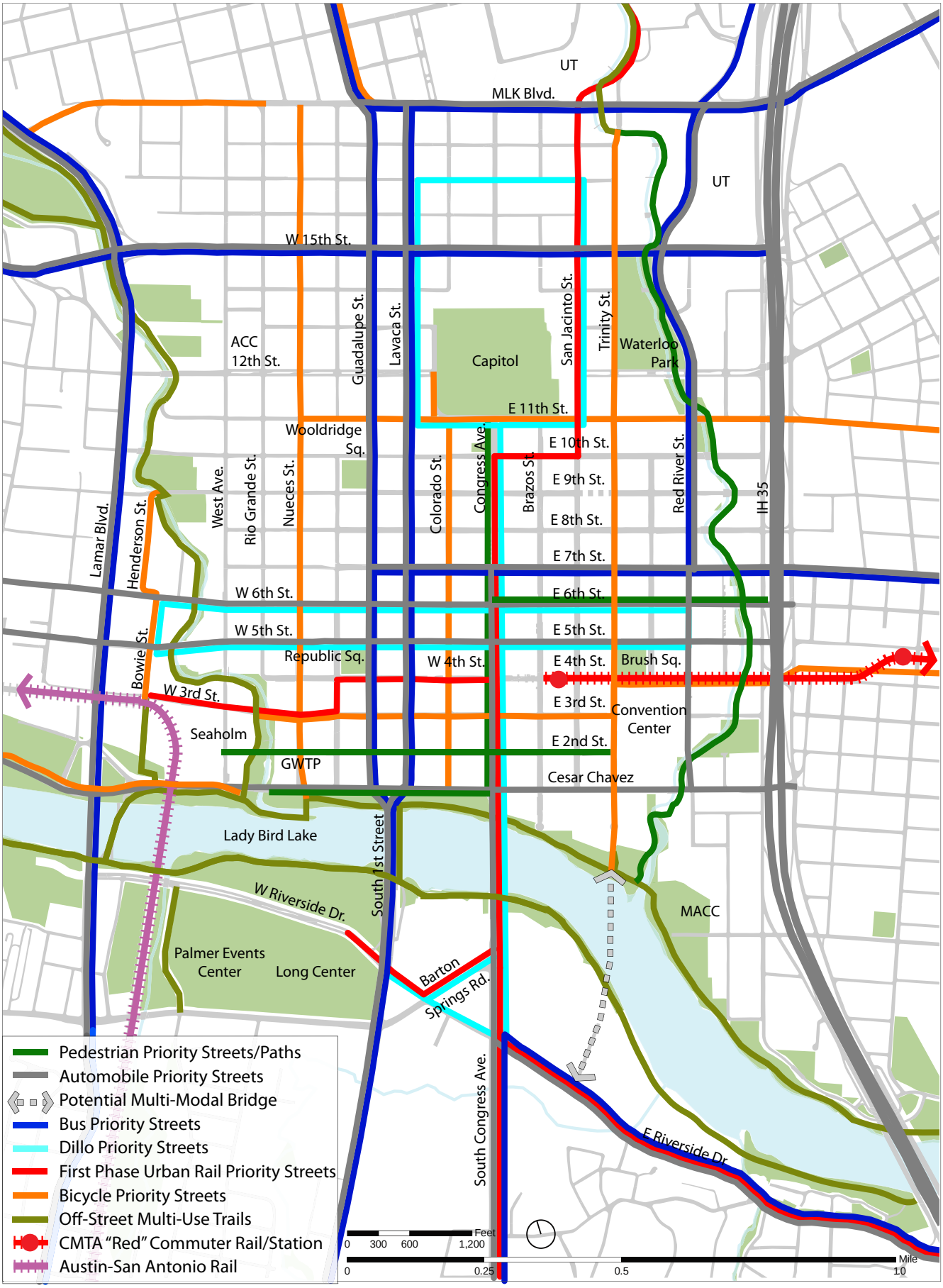
- **Two-Way Conversion (Non-Rail Segments): Potential Sharrows, Parallel Parking**

TYPICAL DOWNTOWN EXISTING 80' ROW

- **One-Way: Narrow Sidewalks, No Trees, Parallel Parking**

TYPICAL GREAT STREETS 80' ROW

- **Two-Way: Three Lanes, Parallel Parking**



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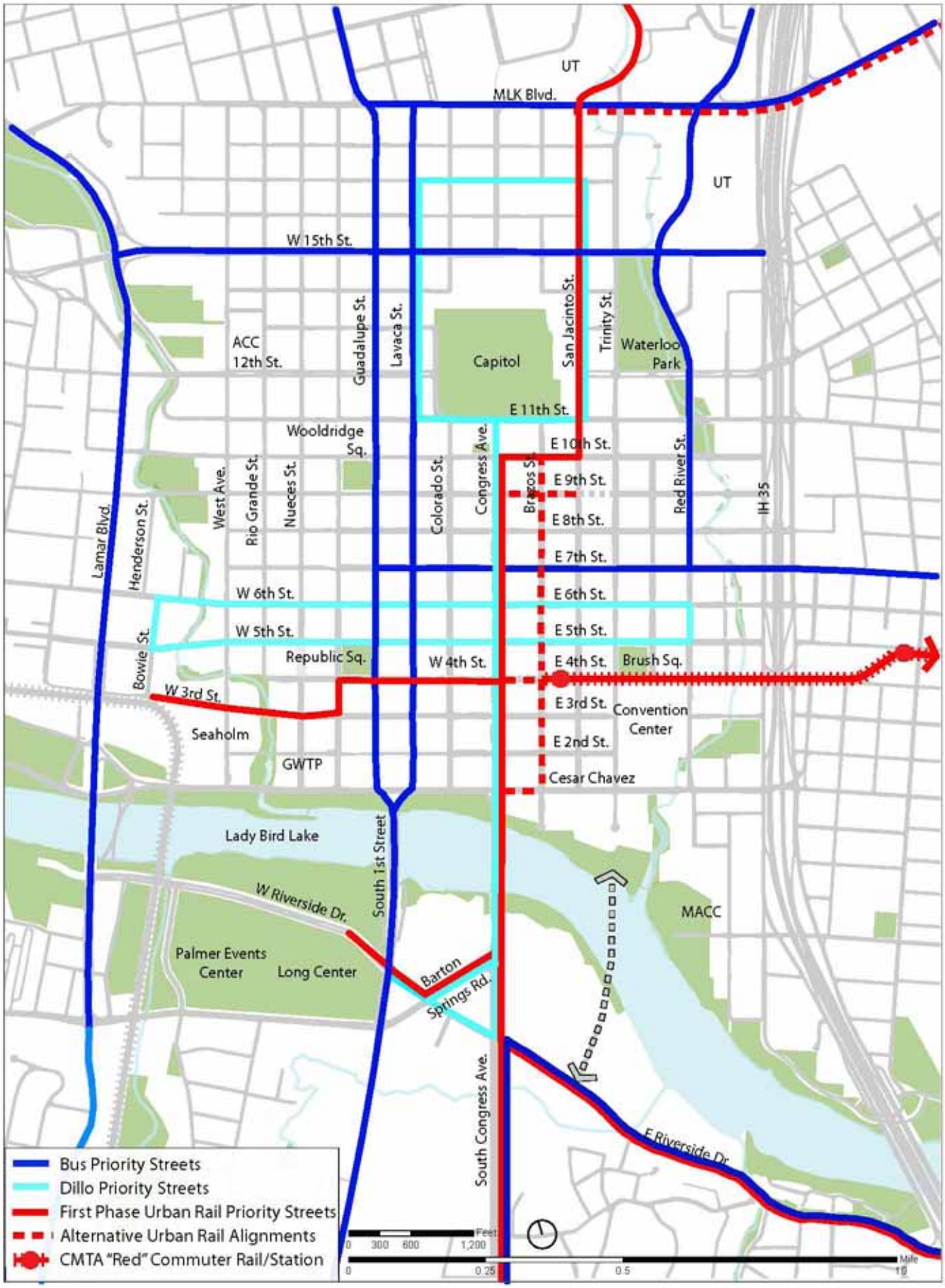
PRIORITY STREETS BY MODE

Downtown Austin Plan

Prepared by ROMA Austin & Studio 8 Architects for the City of Austin

November 25, 2008



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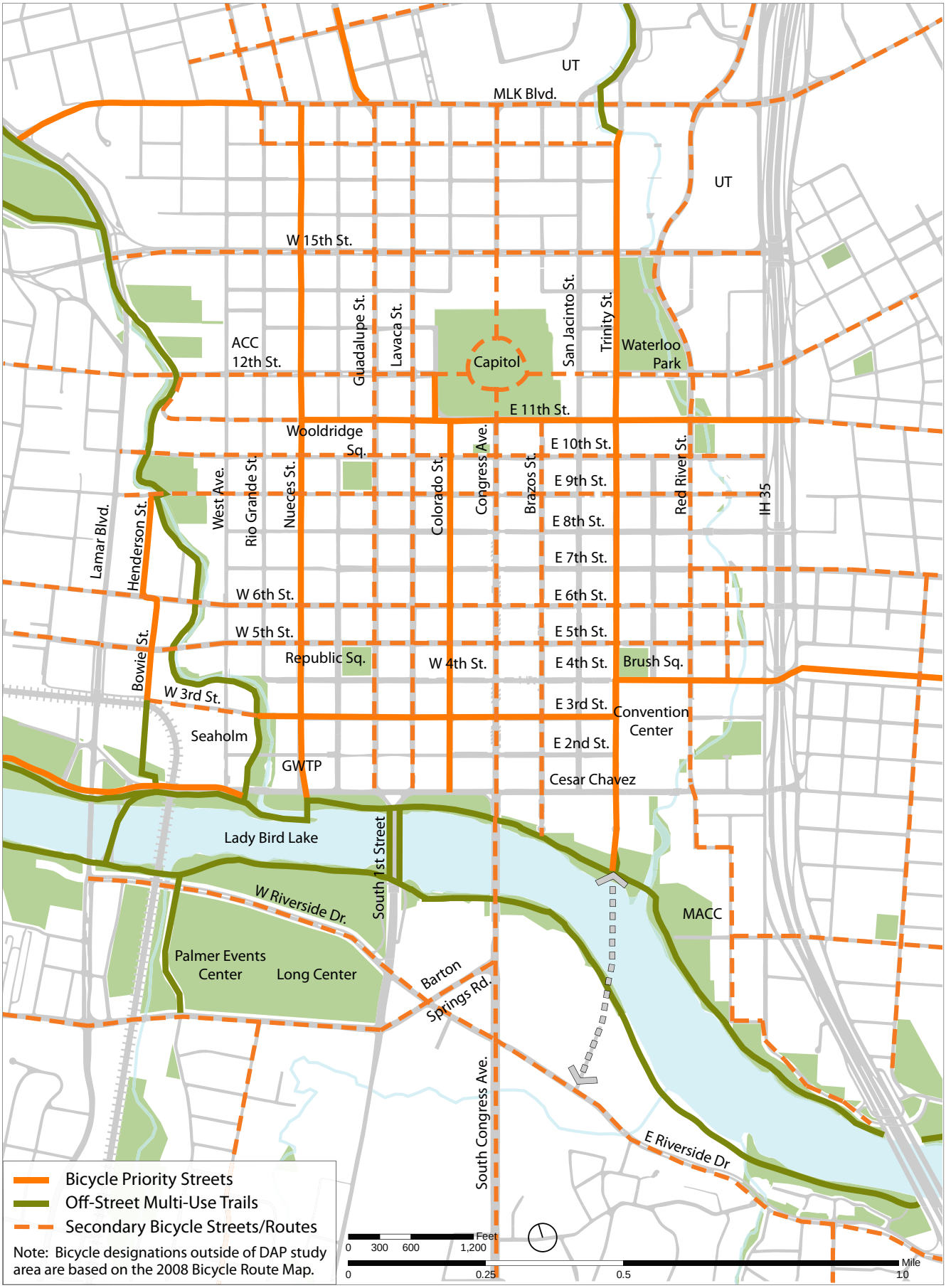
TRANSIT PRIORITY STREETS

Downtown Austin Plan

Prepared by R.O.M.A Austin & Studio 8 Architects for the City of Austin

October 3, 2008



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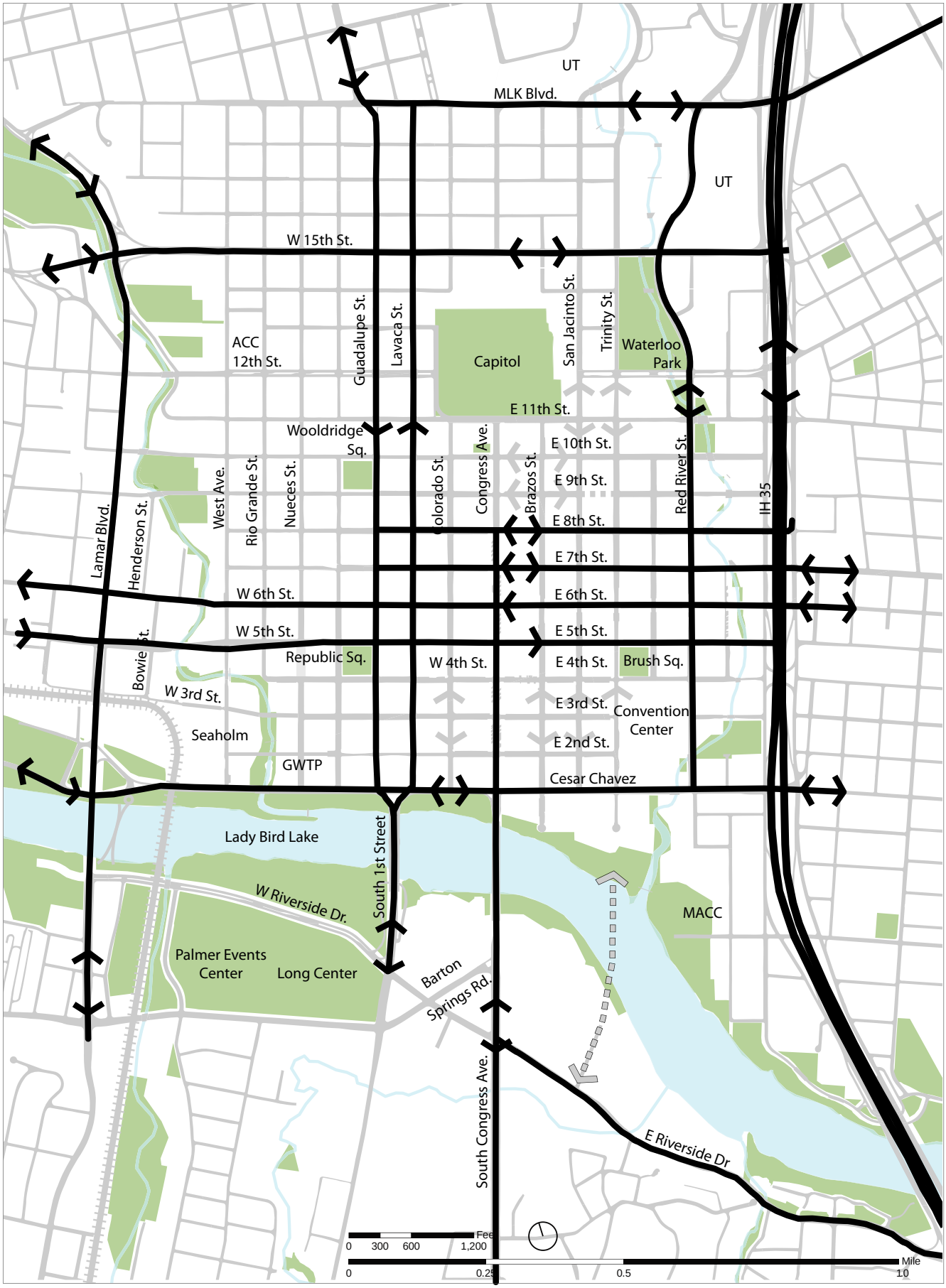
BICYCLE PRIORITY STREETS/TRAILS/SECONDARY STREETS

Downtown Austin Plan

Prepared by ROMA Austin & Studio 8 Architects for the City of Austin

November 18, 2008



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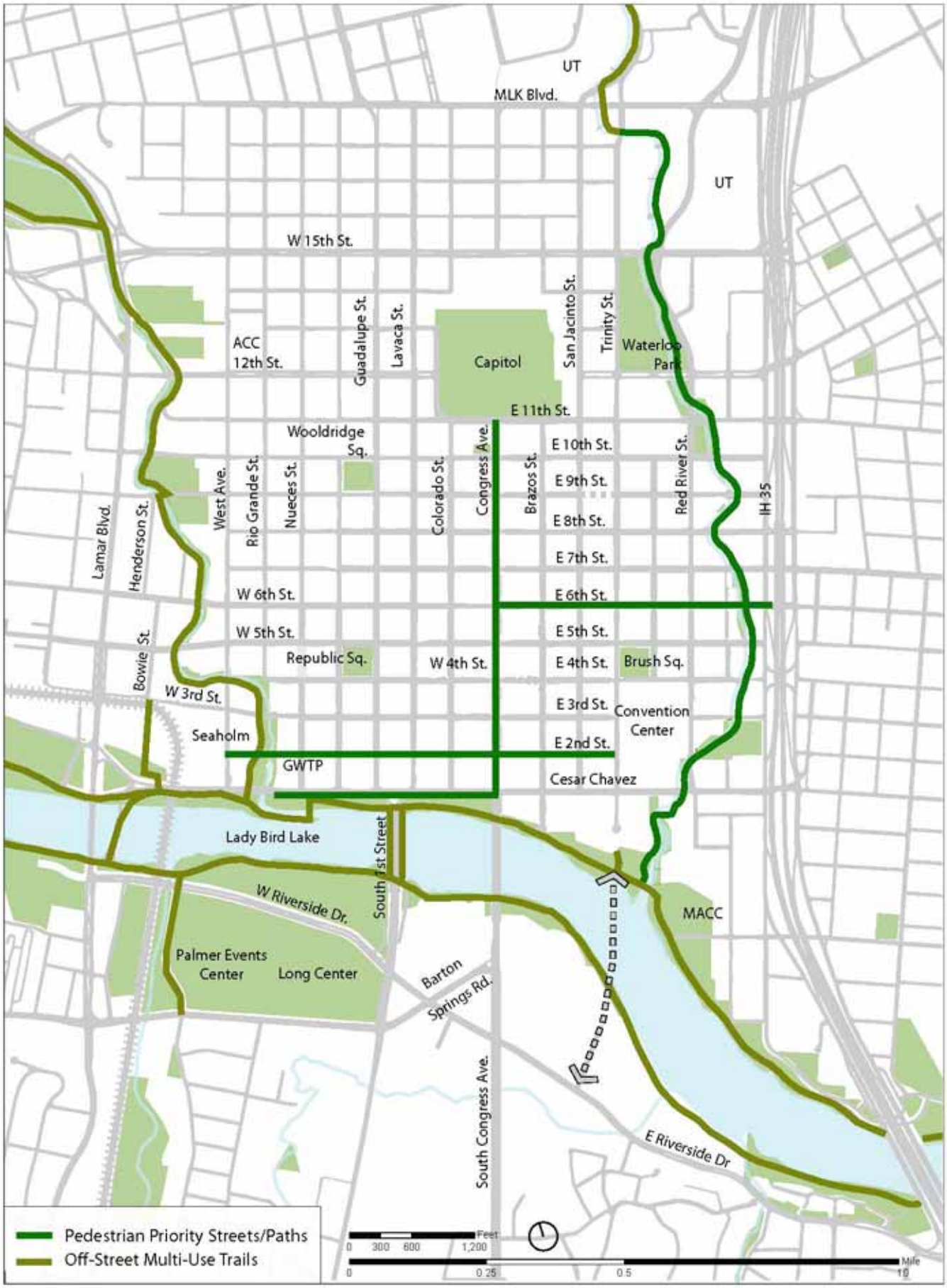
AUTOMOBILE PRIORITY STREETS

Downtown Austin Plan

Prepared by ROMA Austin & Studio 8 Architects for the City of Austin

November 25, 2008



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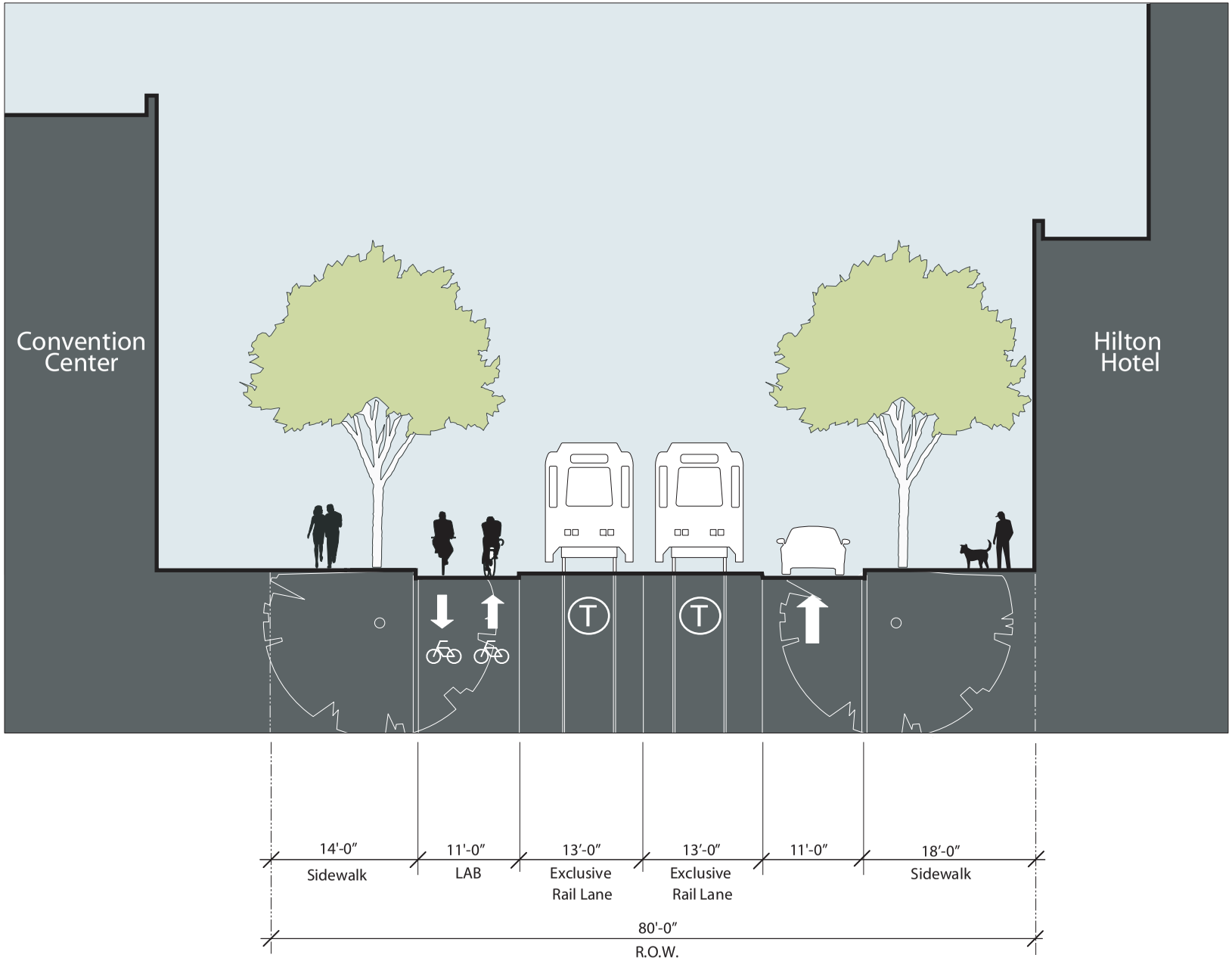
PEDESTRIAN PRIORITY STREETS/PATHS

Downtown Austin Plan

Prepared by ROMA Austin for the City of Austin

October 3, 2008



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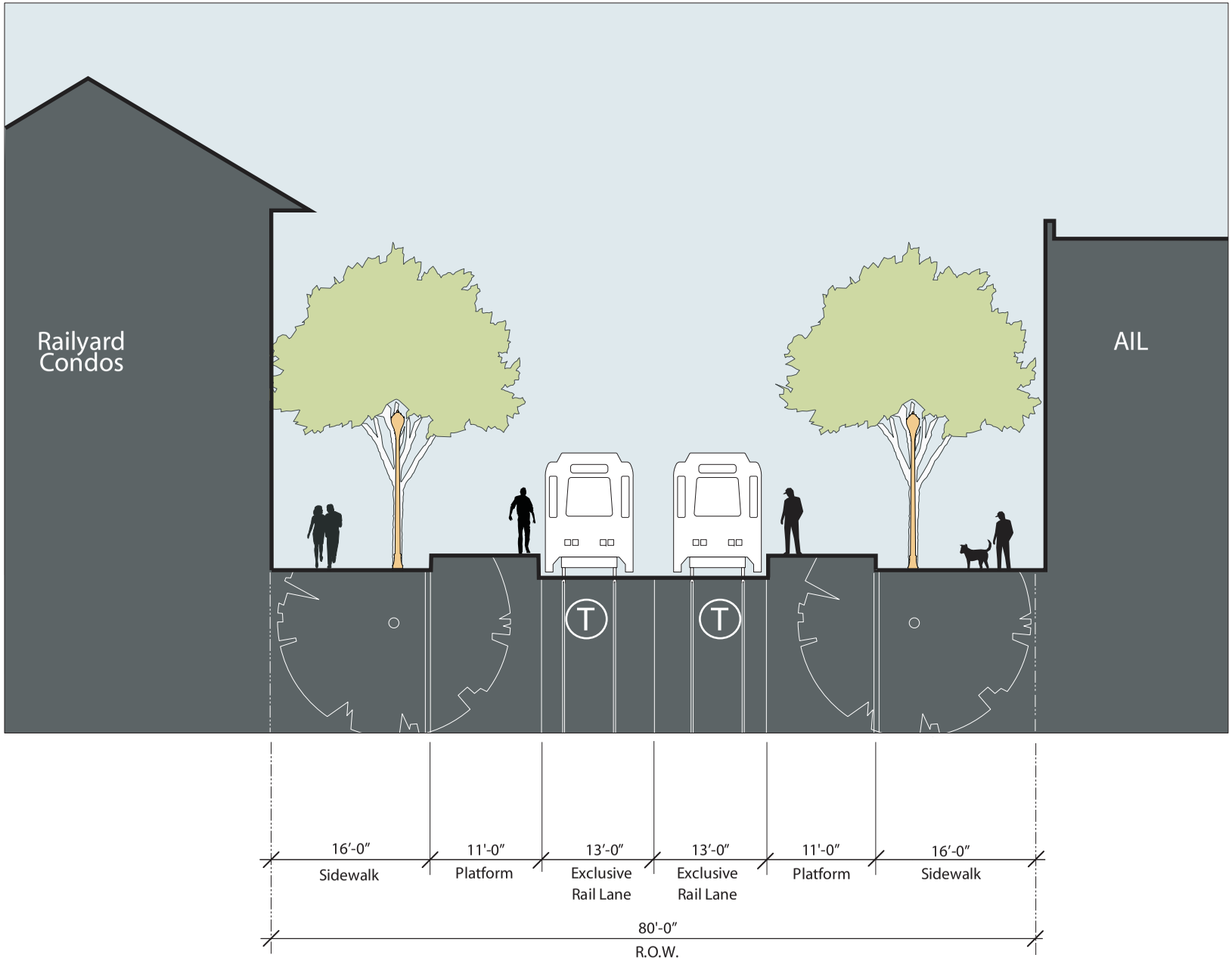
East Fourth Street: Exclusive Median-Running Commuter Rail with Lance Armstrong Bikeway

DOWNTOWN AUSTIN PLAN

Prepared by ROMA Austin for the City of Austin

September 18, 2008



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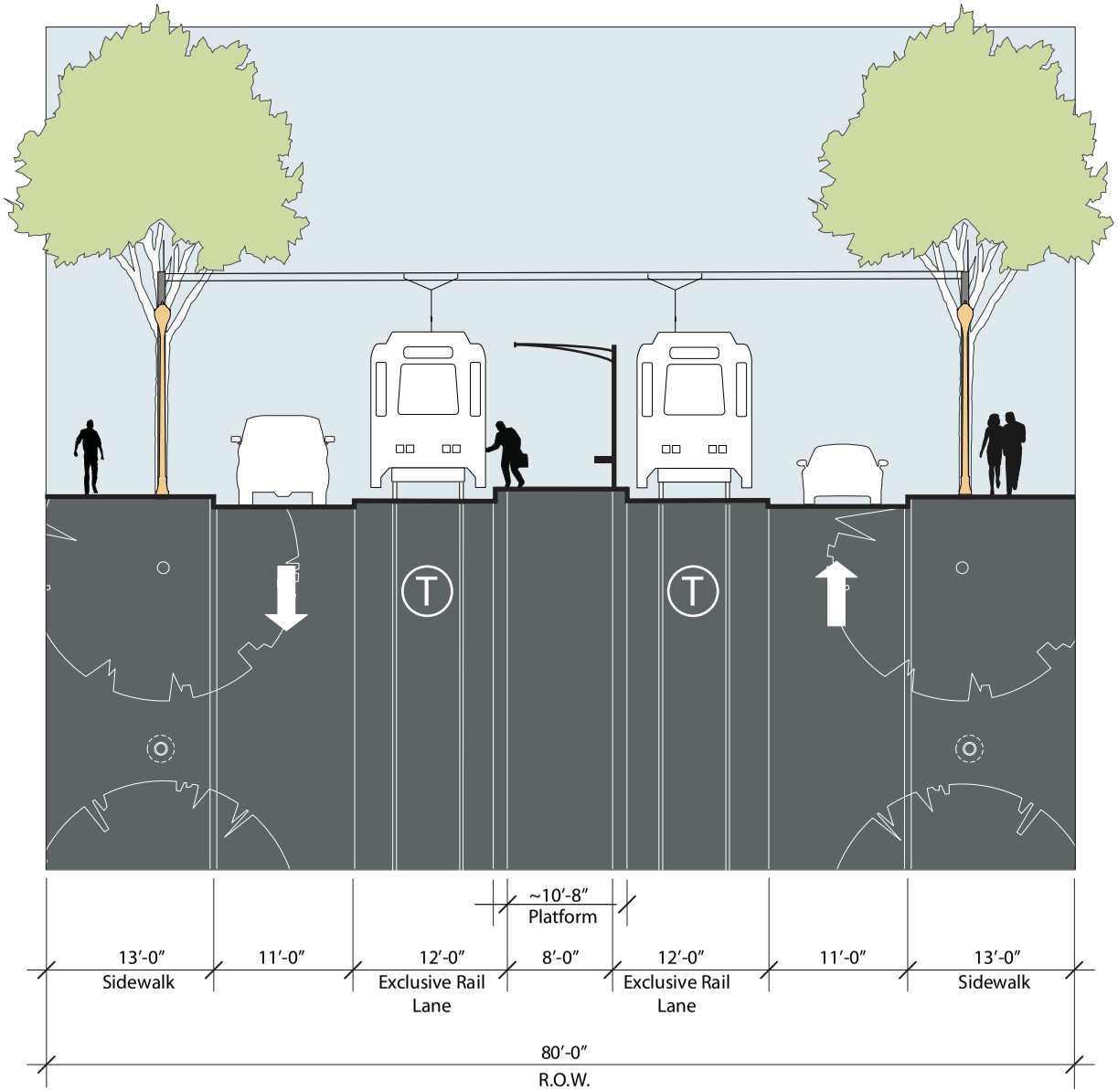
East Fourth Street: Exclusive Median-Running Commuter Rail Platform Condition (Brazos to San Jacinto)

DOWNTOWN AUSTIN PLAN

Prepared by ROMA Austin for the City of Austin

September 18, 2008



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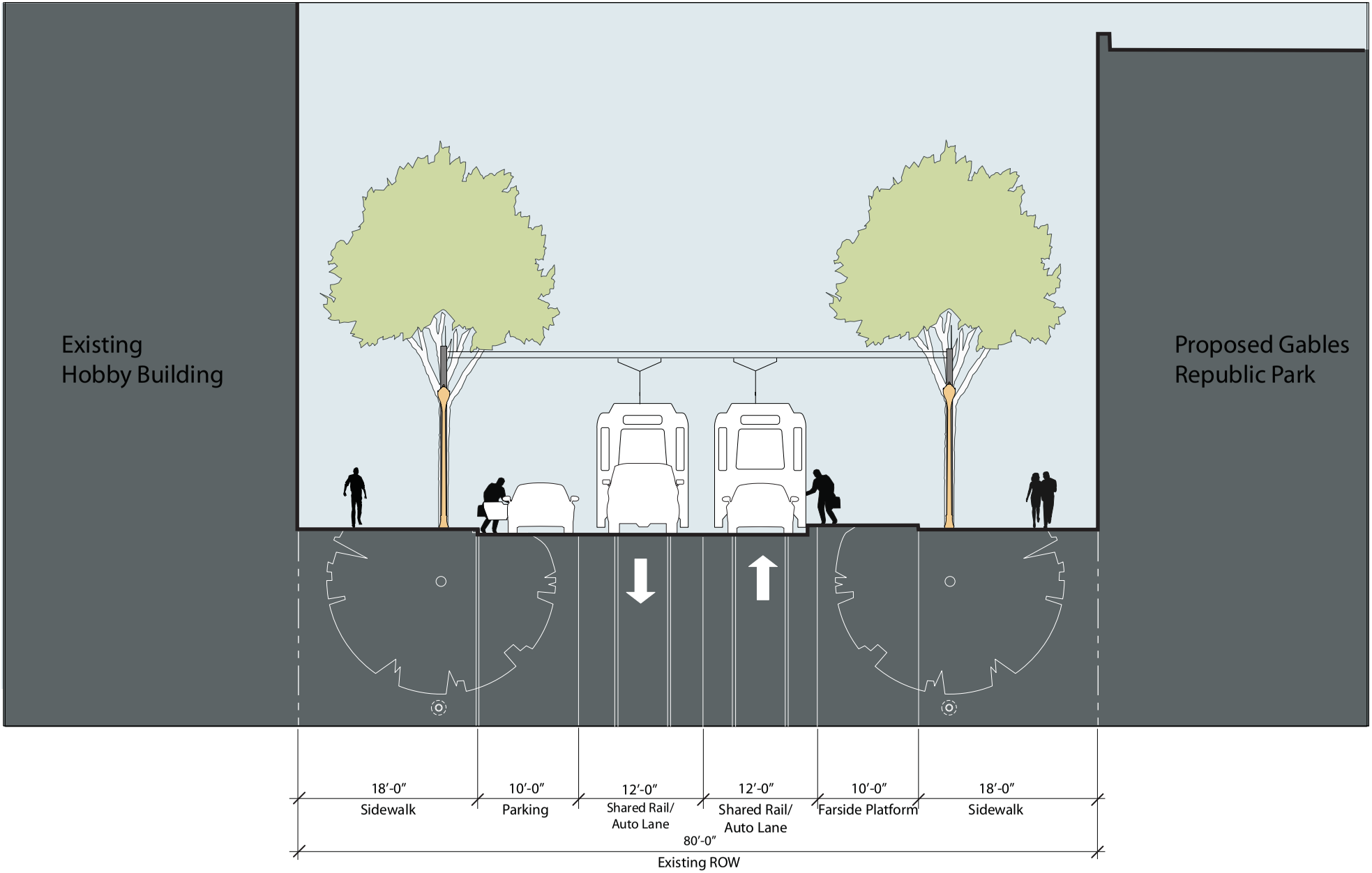
West Fourth Street: Exclusive Rail (Congress Avenue to Nueces Street)

DOWNTOWN AUSTIN PLAN

Prepared by ROMA Austin for the City of Austin

October 29, 2008

Note: Depth of utilities is unknown.



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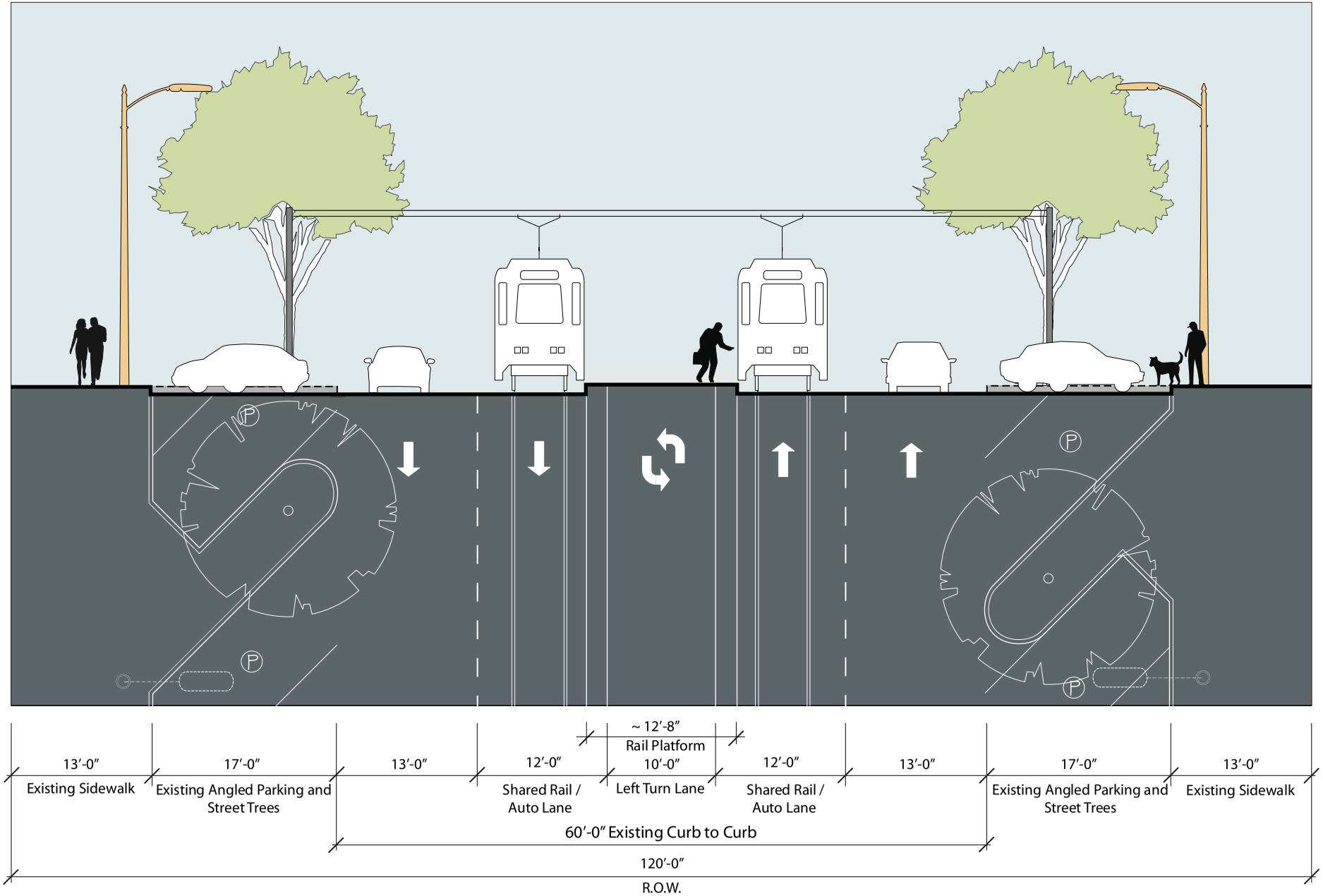
West Fourth Street: Shared Rail (Guadalupe Street to Lavaca Street)

DOWNTOWN AUSTIN PLAN

Prepared by ROMA Austin for the City of Austin

October 29, 2008



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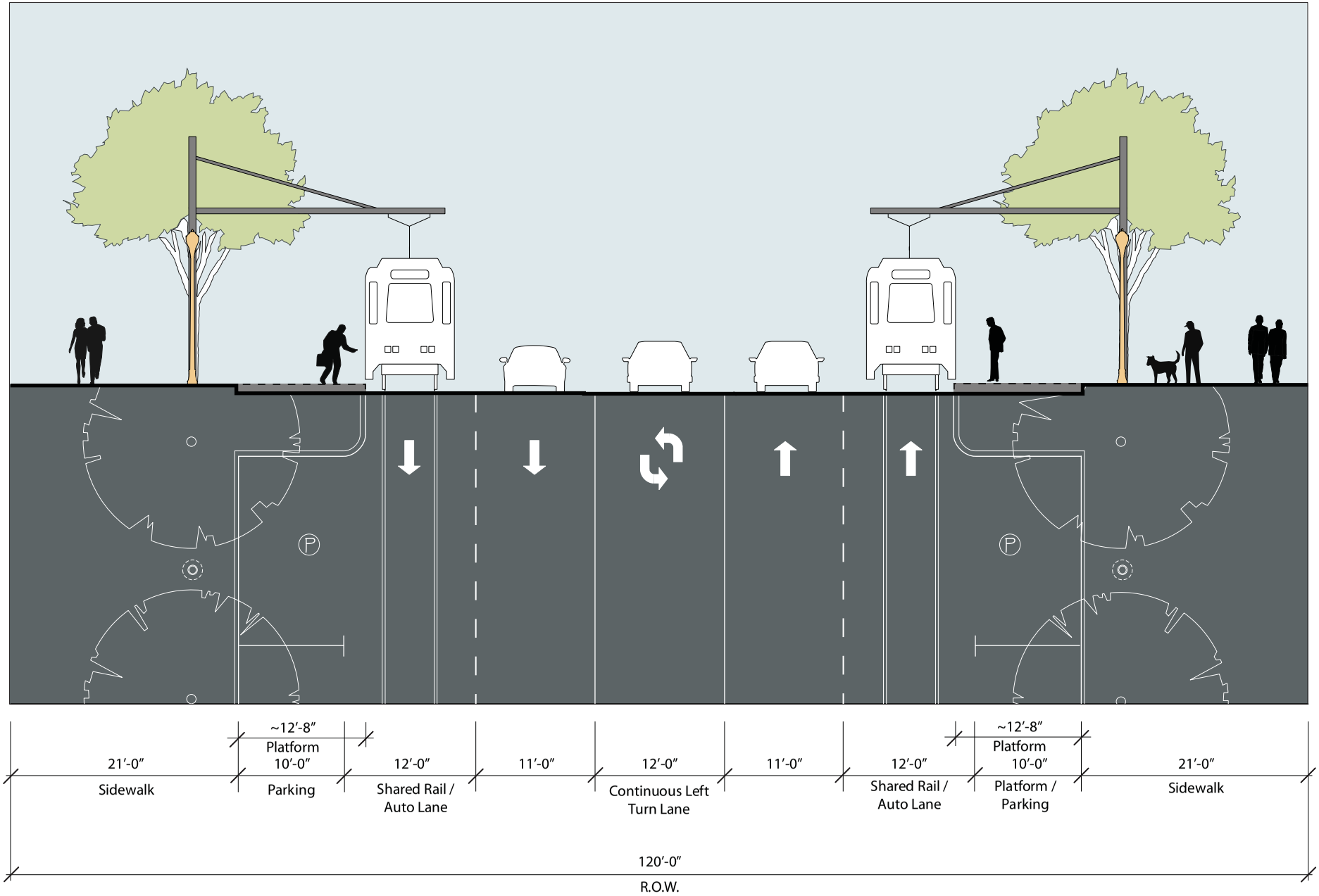
Congress Avenue: Shared Median-Running Rail Conserving Diagonal Parking (Eleventh Street to Cesar Chavez Street)

DOWNTOWN AUSTIN PLAN

Prepared by ROMA Austin & Studio 8 Architects for the City of Austin per Capital Metro Proposal

September 18, 2008



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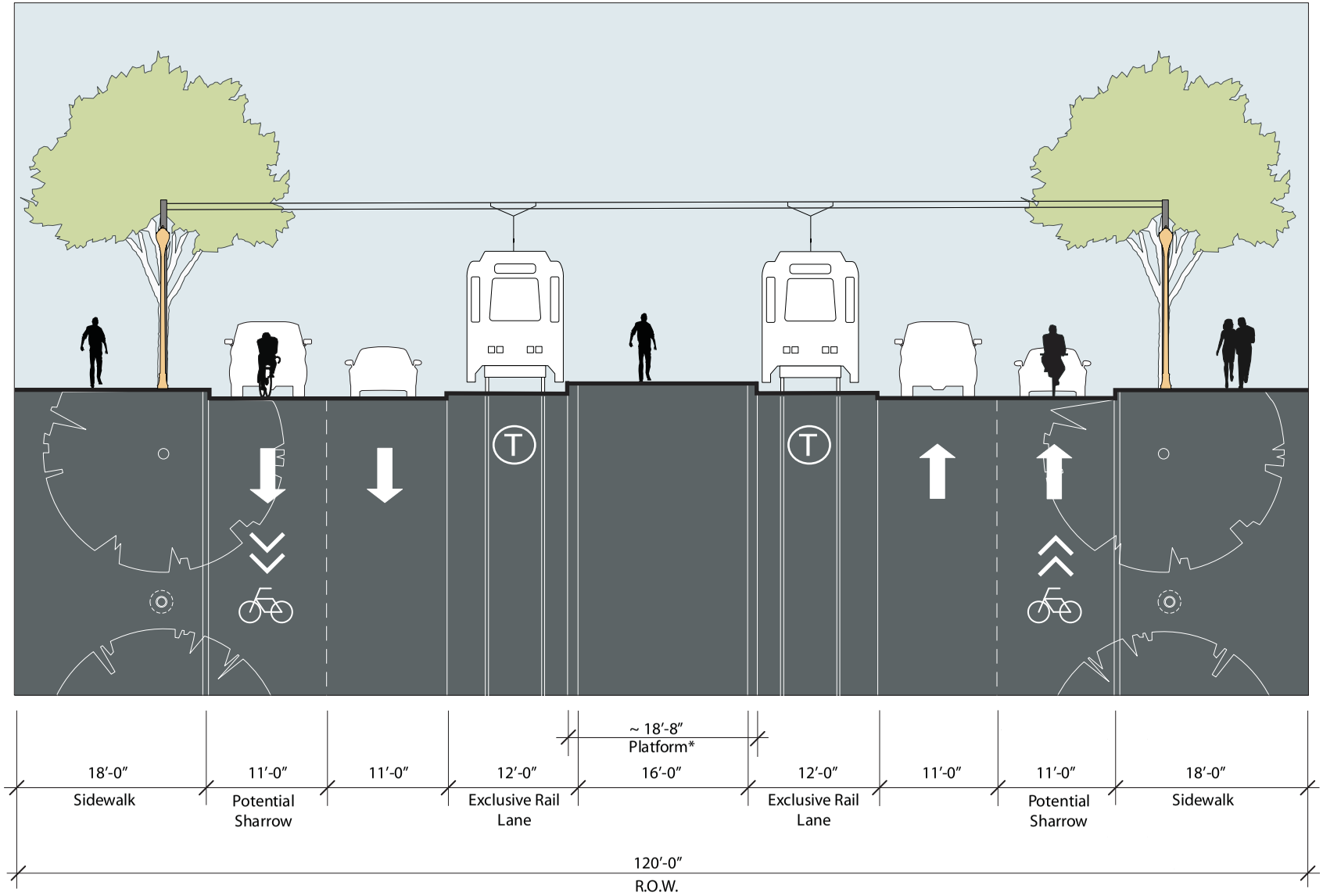
Congress Avenue: Shared Side-Running Rail with Parallel Parking (Eleventh Street to Cesar Chavez Street)

DOWNTOWN AUSTIN PLAN

Prepared by ROMA Austin & Studio 8 Architects for the City of Austin

September 18, 2008



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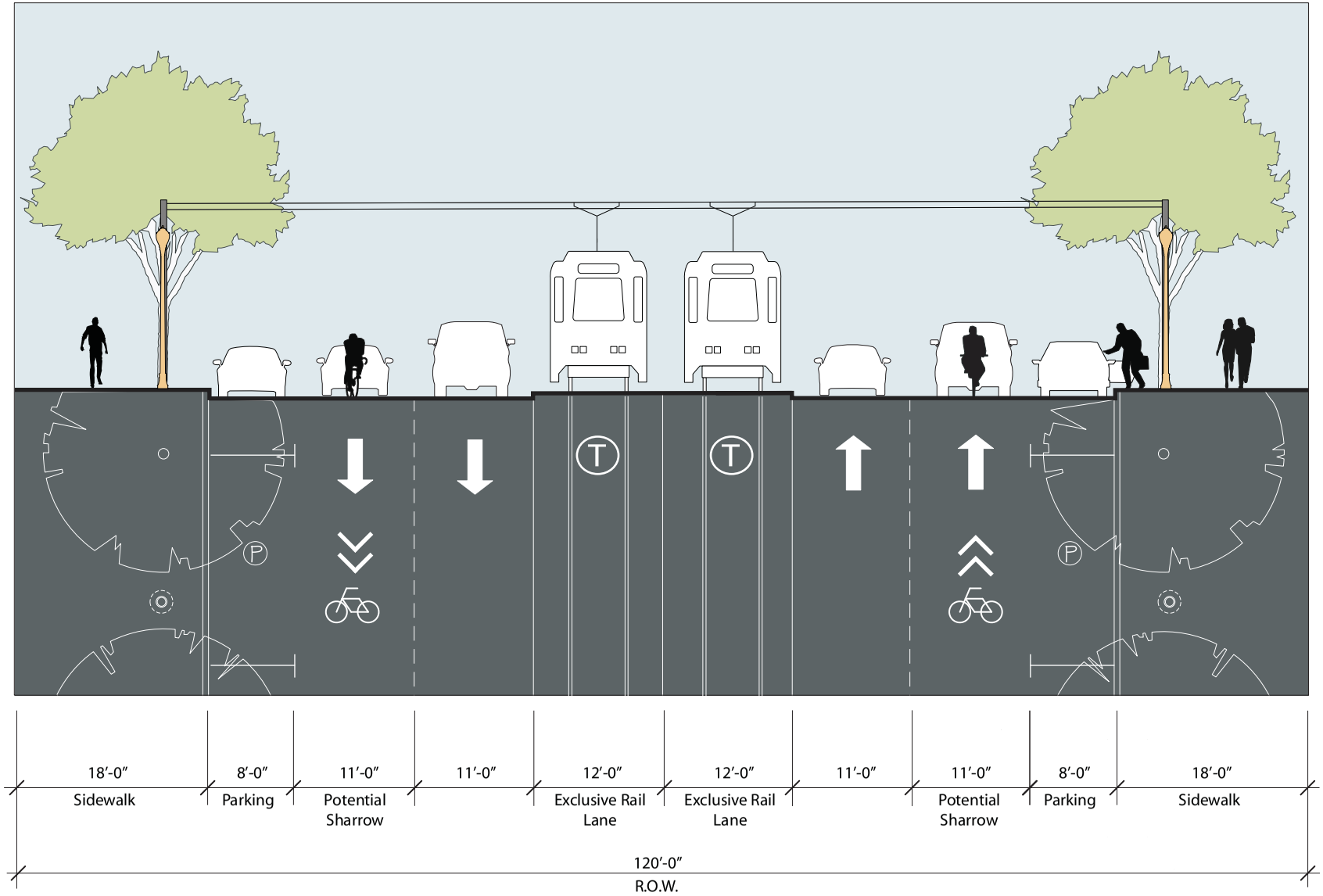
Congress Avenue: Exclusive Median-Running Rail with Single, Center Platform (Eleventh Street to Cesar Chavez Street)

DOWNTOWN AUSTIN PLAN

Prepared by ROMA Austin for the City of Austin

September 18, 2008

*Note: Platform at Fourth Street is ~12’-8”.



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Congress Avenue: Exclusive Median-Running Rail, Non-Platform Condition (Eleventh Street to Cesar Chavez Street)

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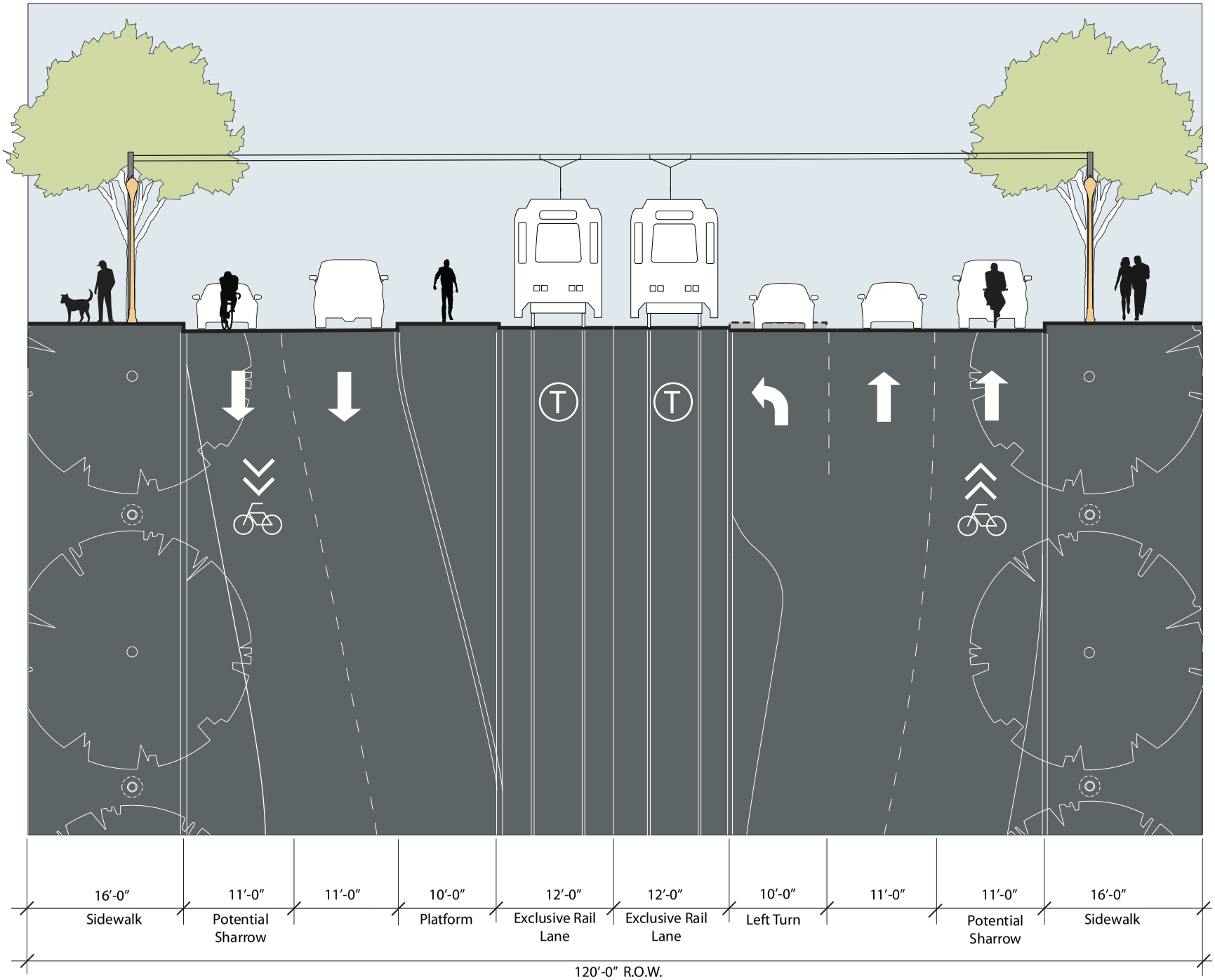
September 18, 2008



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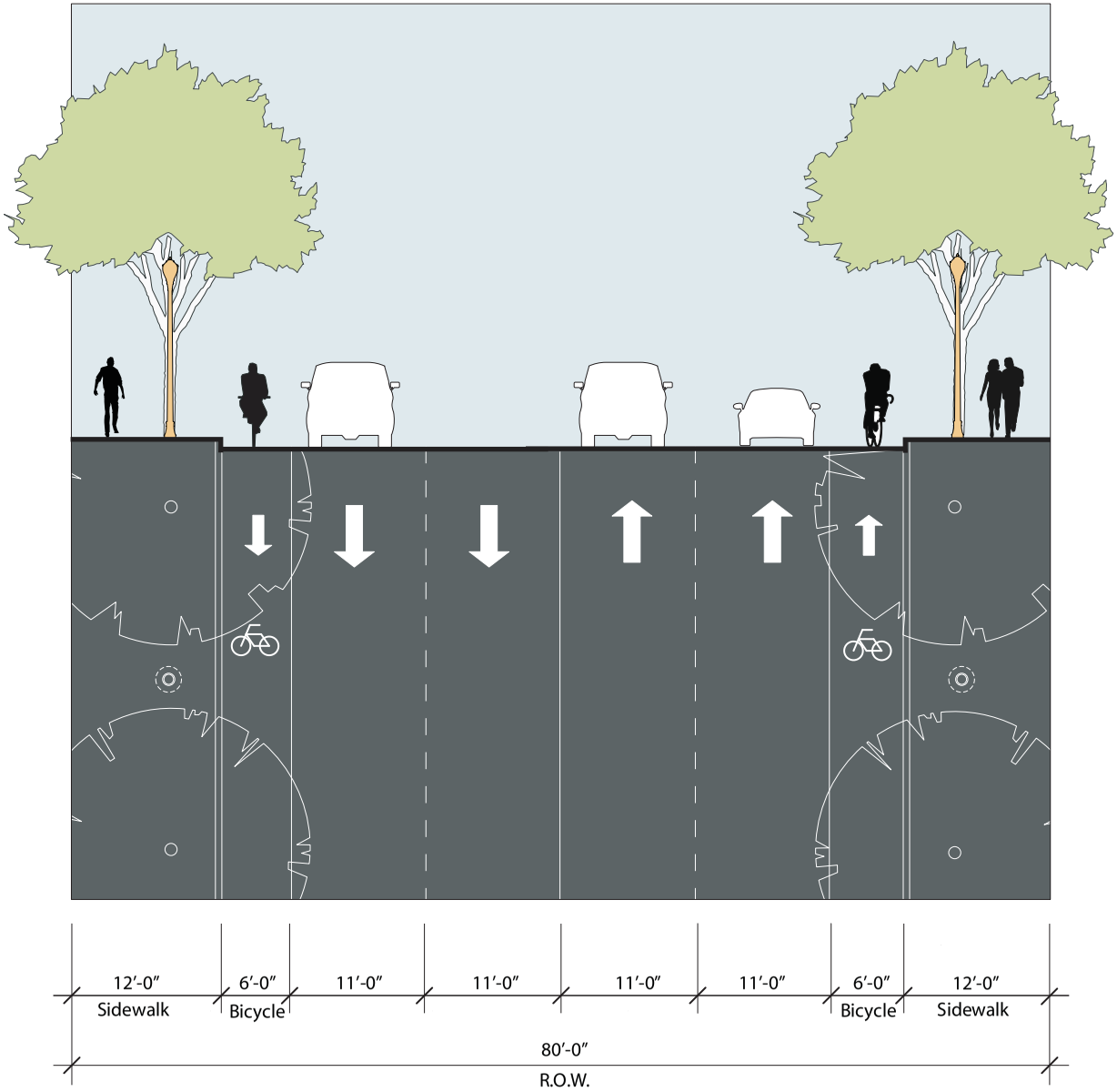
Congress Avenue: Exclusive Median-Running Rail (Eleventh Street to Cesar Chavez Street)

DOWNTOWN AUSTIN PLAN

Prepared by ROMA Austin for the City of Austin

September 18, 2008



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East Eleventh Street: Two-Way with Bike Lanes (Nueces Street to IH 35)

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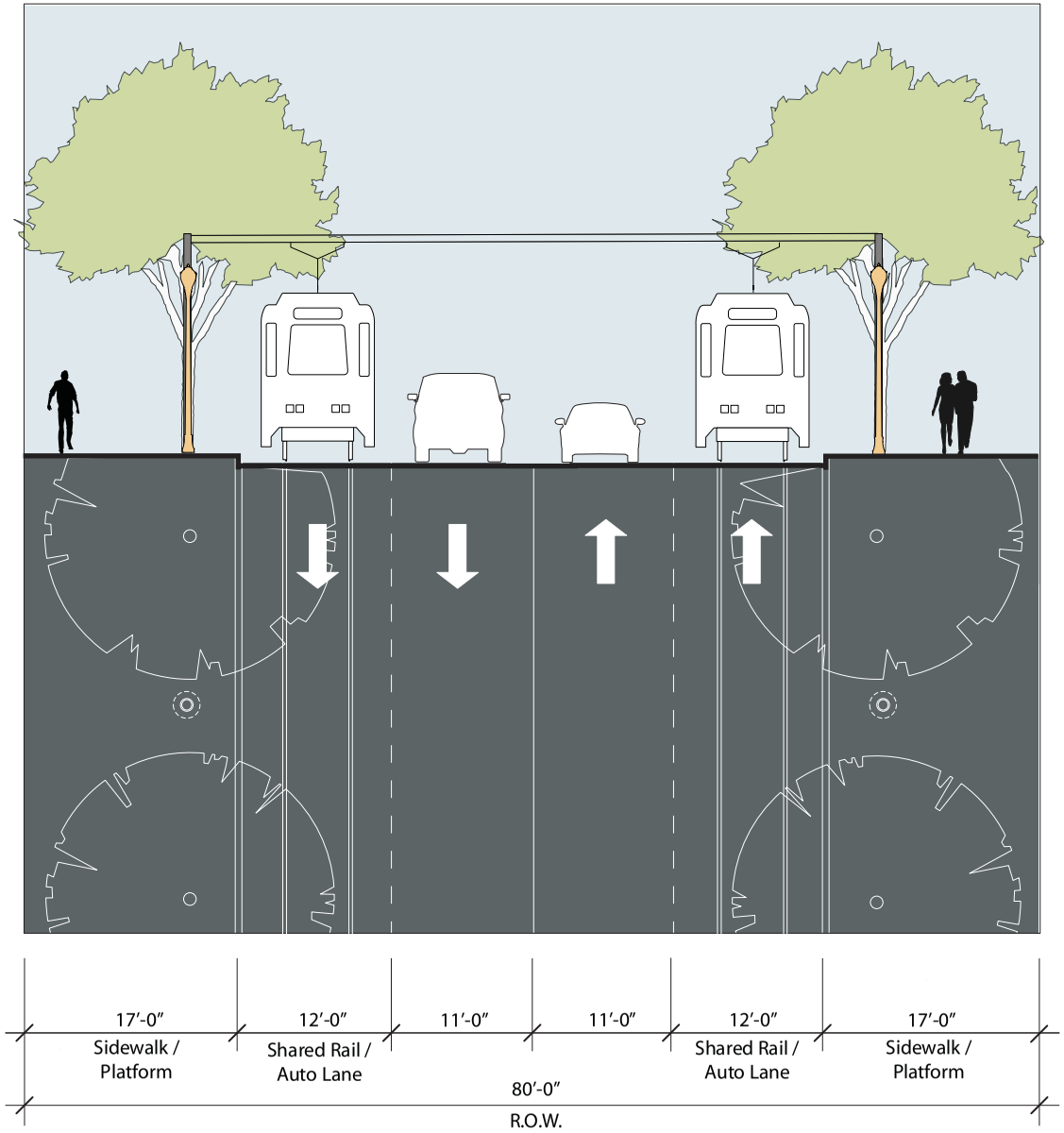
Prepared by ROMA Austin for the City of Austin

September 18, 2008



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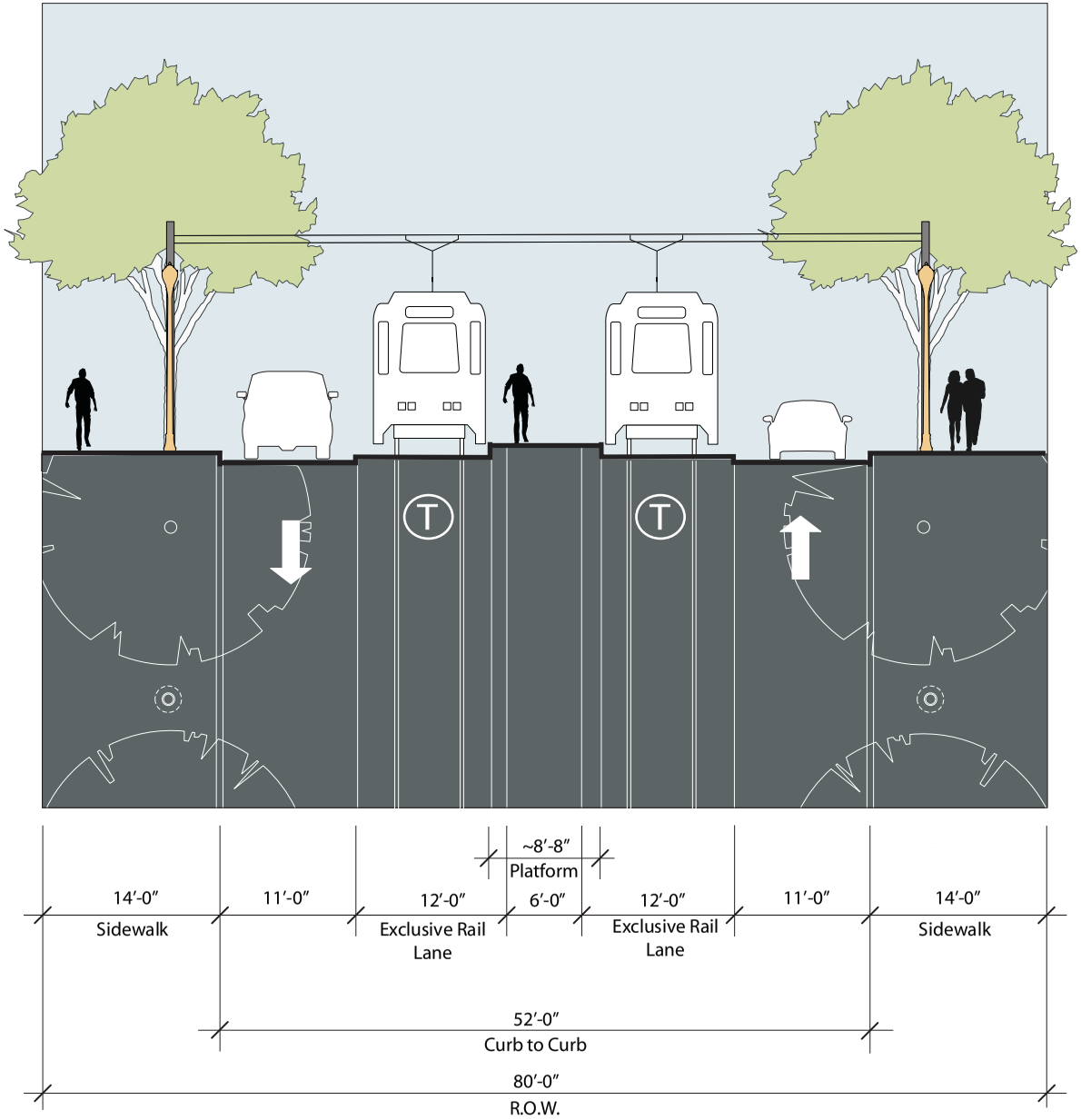
Two-Way San Jacinto Street: Shared Side-Running Rail

DOWNTOWN AUSTIN PLAN

Prepared by ROMA Austin for the City of Austin

September 18, 2008



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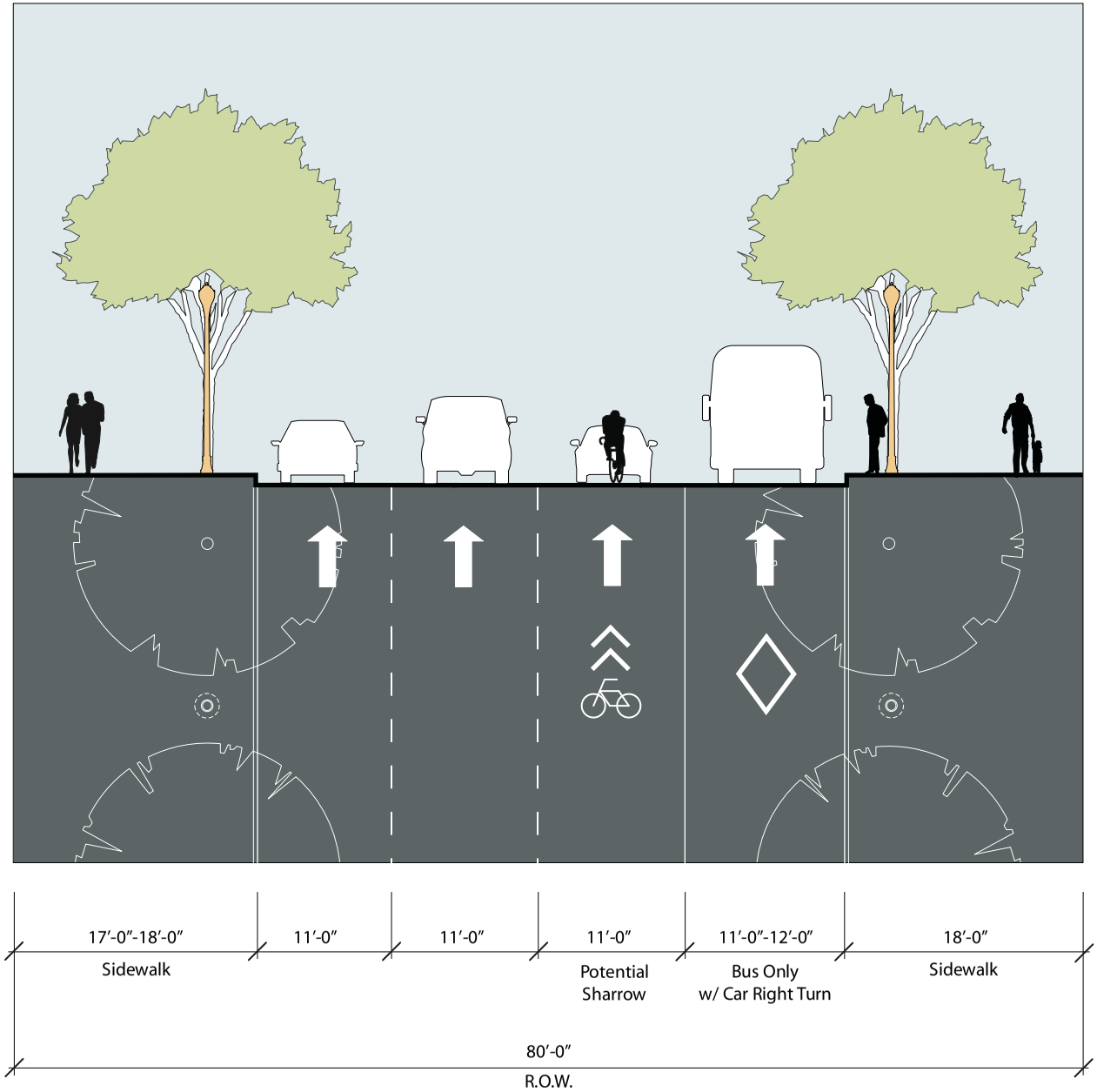
Two-Way San Jacinto Street: Exclusive Median-Running Rail

DOWNTOWN AUSTIN PLAN

Prepared by ROMA Austin for the City of Austin

September 18, 2008



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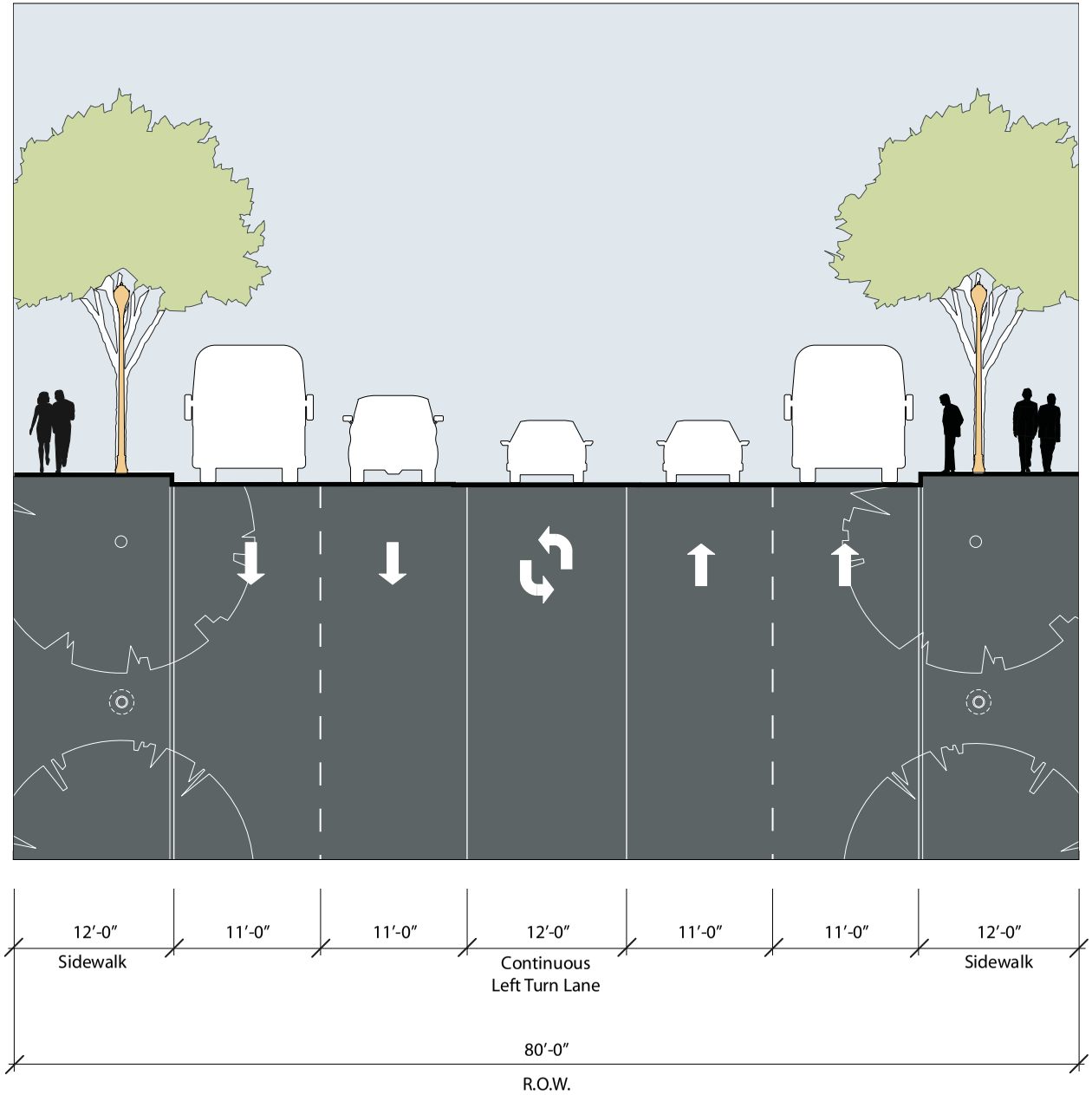
Guadalupe and Lavaca Streets: Bus Only Lane and Potential Sharrow

DOWNTOWN AUSTIN PLAN

Prepared by ROMA Austin tudio Ar hite ts for the City of Austin

November 10, 2008



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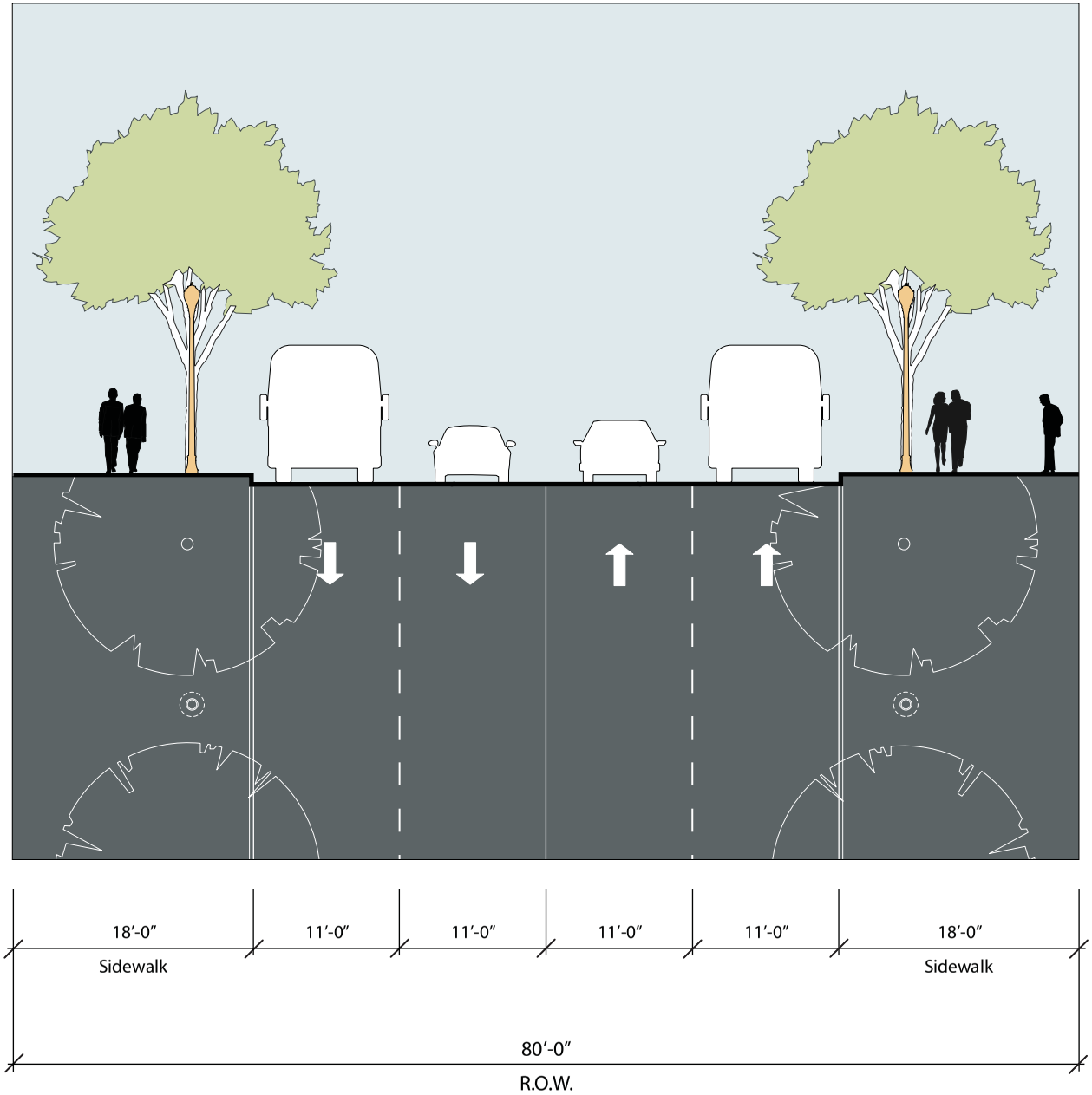
Seventh Street: Two-Way Five Lane Section (Guadalupe Street to IH 35)

DOWNTOWN AUSTIN PLAN

Prepared by ROMA Austin tudio Ar hite ts for the City of Austin

September 18, 2008



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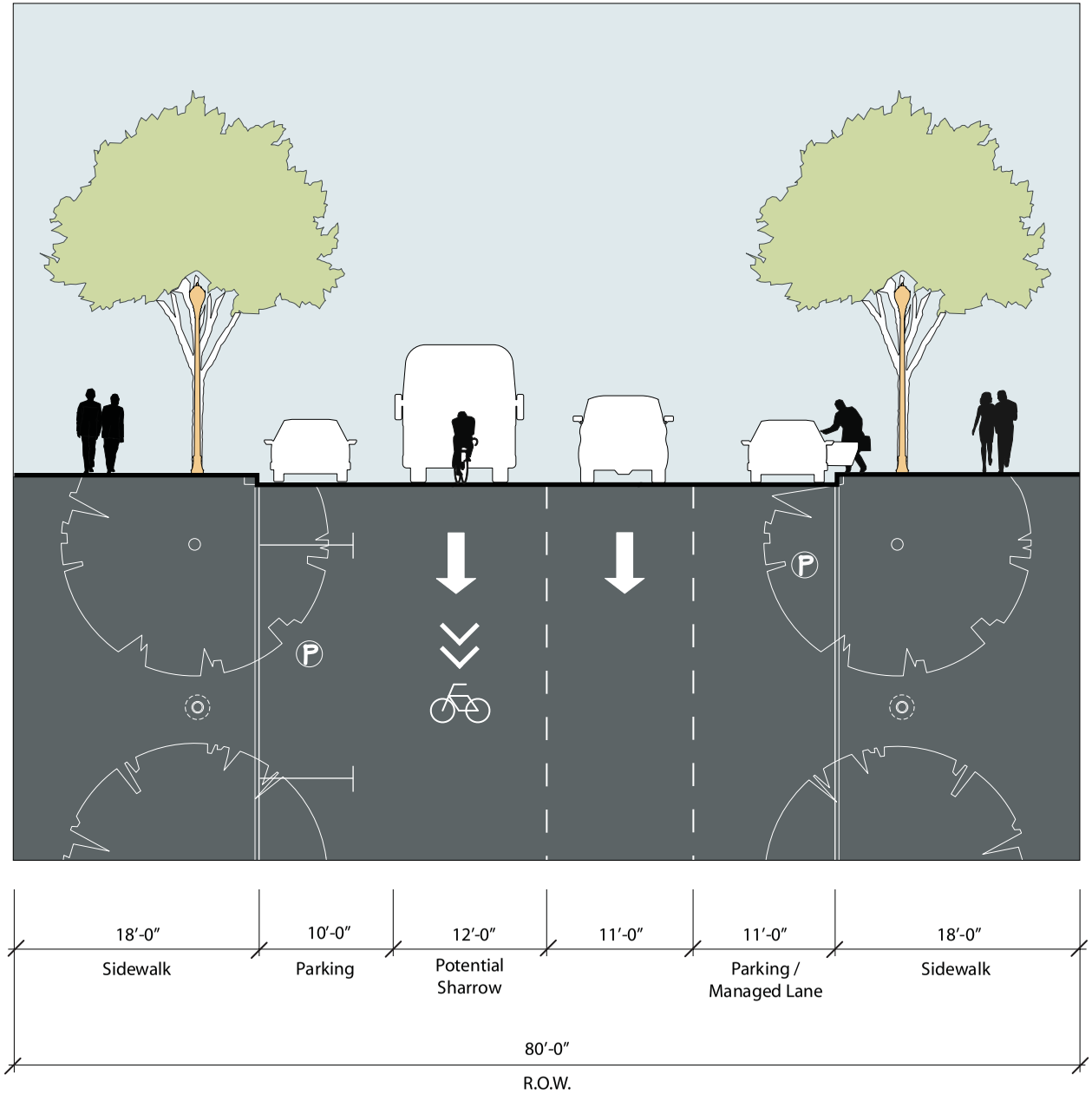
Seventh Street: Two-Way, Four Lanes with Restricted Left Turns

DOWNTOWN AUSTIN PLAN

Prepared by ROMA Austin tudio Ar hite ts for the City of Austin

September 18, 2008



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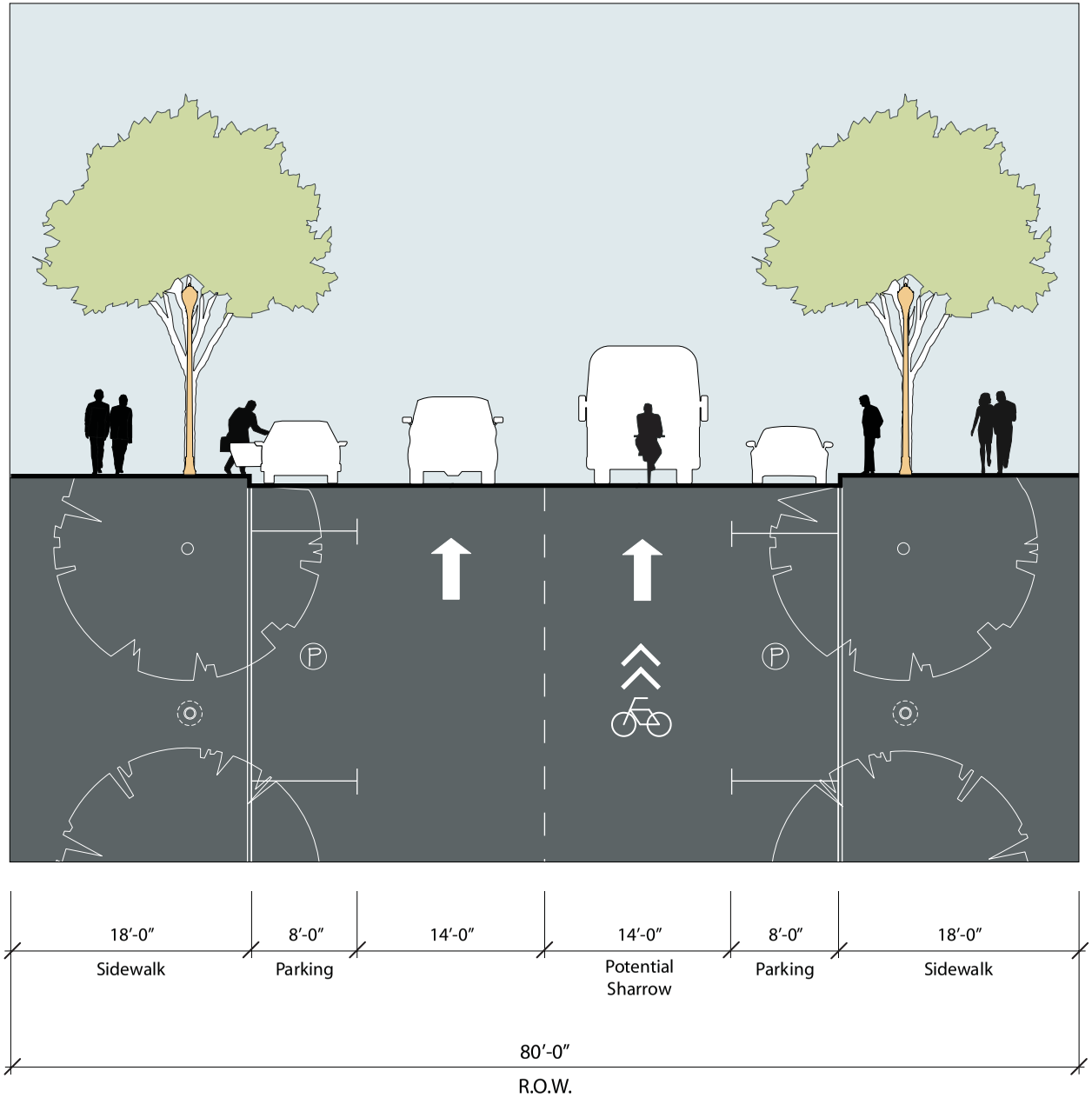
East Fifth Street: IH 35 to Brazos Street Segment Looking West

DOWNTOWN AUSTIN PLAN

Prepared by ROMA Austin tudio Ar hite ts for the City of Austin

September 18, 2008



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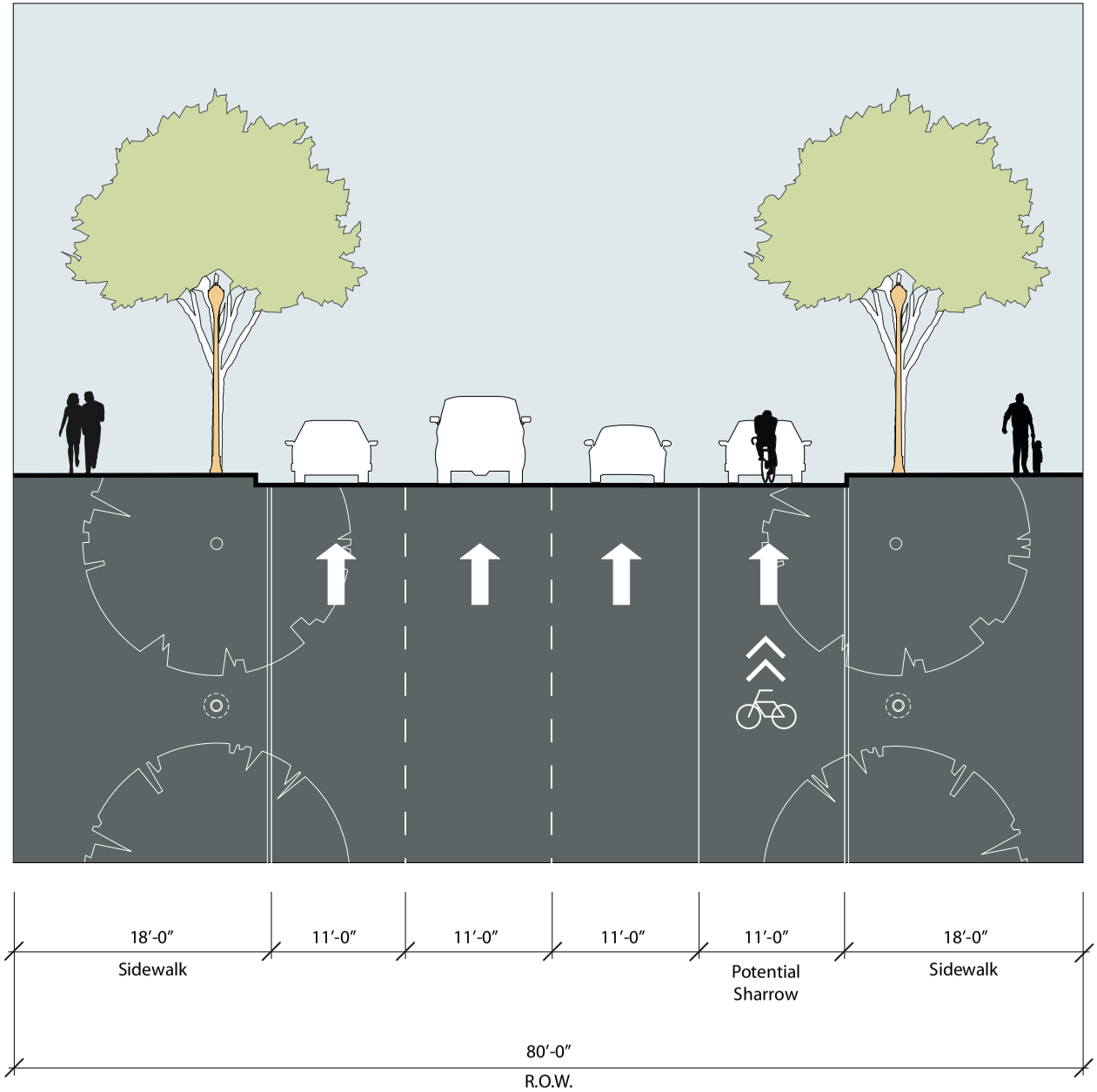
East Sixth Street: IH 35 to Brazos Street Segment Looking West

DOWNTOWN AUSTIN PLAN

Prepared by ROMA Austin tudio Ar hite ts for the City of Austin

September 18, 2008



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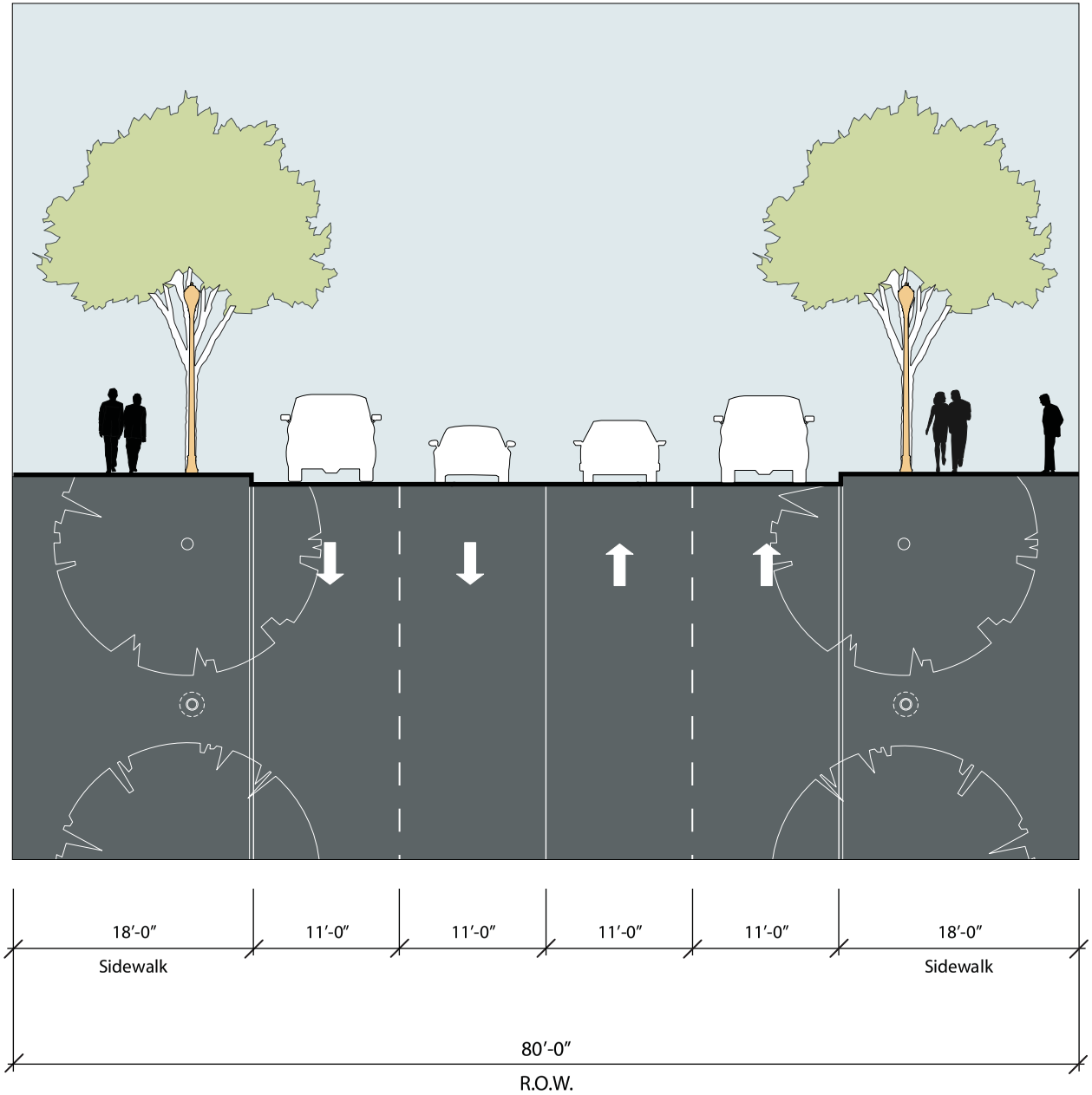
Fifth and Sixth Streets: One-Way with Potential Sharrow (West of Brazos Street)

DOWNTOWN AUSTIN PLAN

Prepared by ROMA Austin for the City of Austin

October 3, 2008



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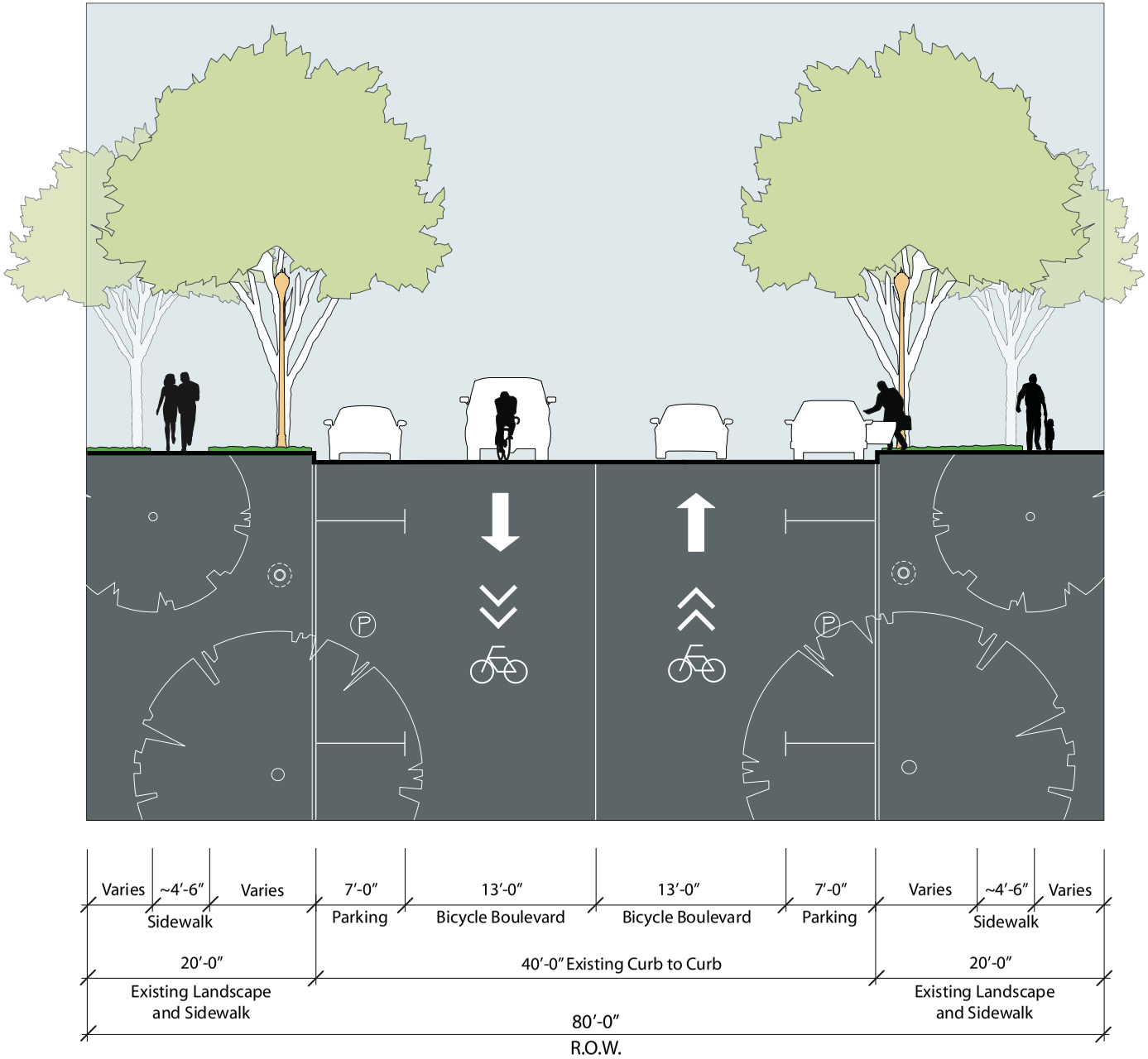
Eighth Street: Two-Way, Four Lanes with Restricted Left Turns (Guadalupe Street to IH 35)

DOWNTOWN AUSTIN PLAN

Prepared by ROMA Austin tudio Ar hite ts for the City of Austin

September 18, 2008



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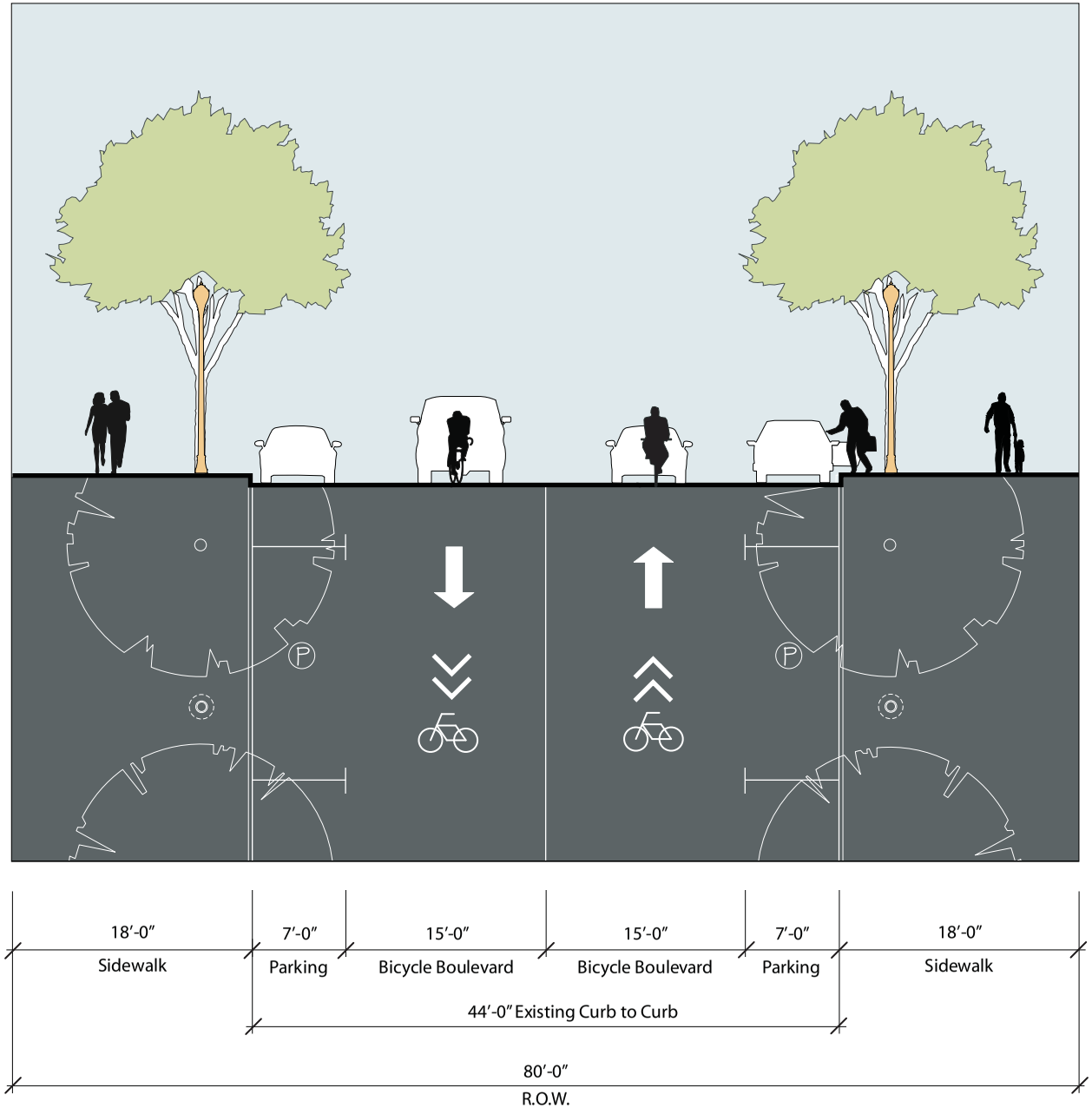
Nueces Street: Bicycle Boulevard (Seventh Street to MLK Street Segment)

DOWNTOWN AUSTIN PLAN

Prepared by ROMA Austin & Studio 8 Architects for the City of Austin

September 22, 2008

Note: Small roundabouts at non-signalized minor street intersections.



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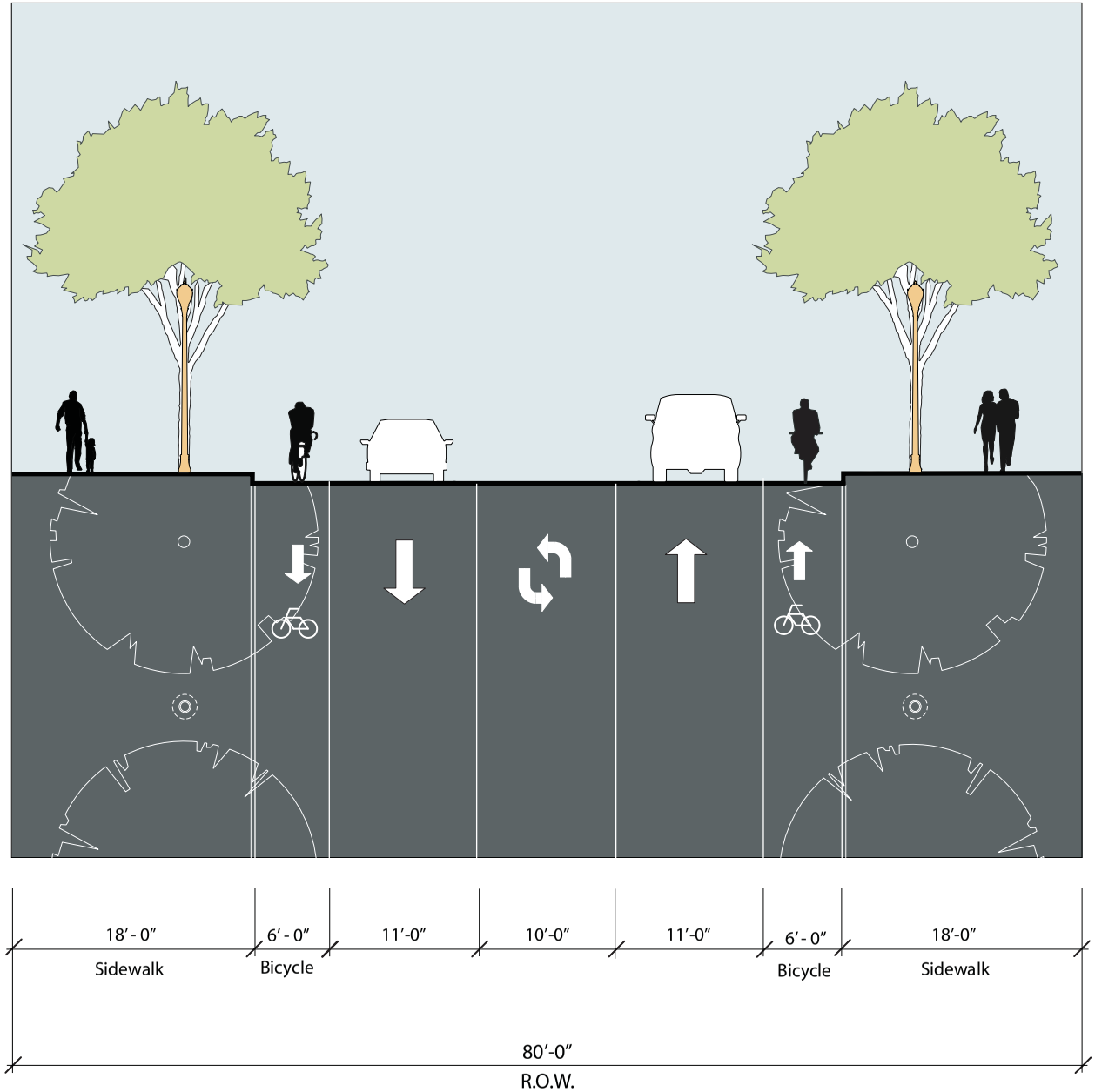
Nueces Street: Bicycle Boulevard (Cesar Chavez to Seventh Street Segment)

DOWNTOWN AUSTIN PLAN

Prepared by ROMA Austin tudio Ar hite ts for the City of Austin

September 22, 2008

Note: Small roundabouts at non-signalized minor street intersections.



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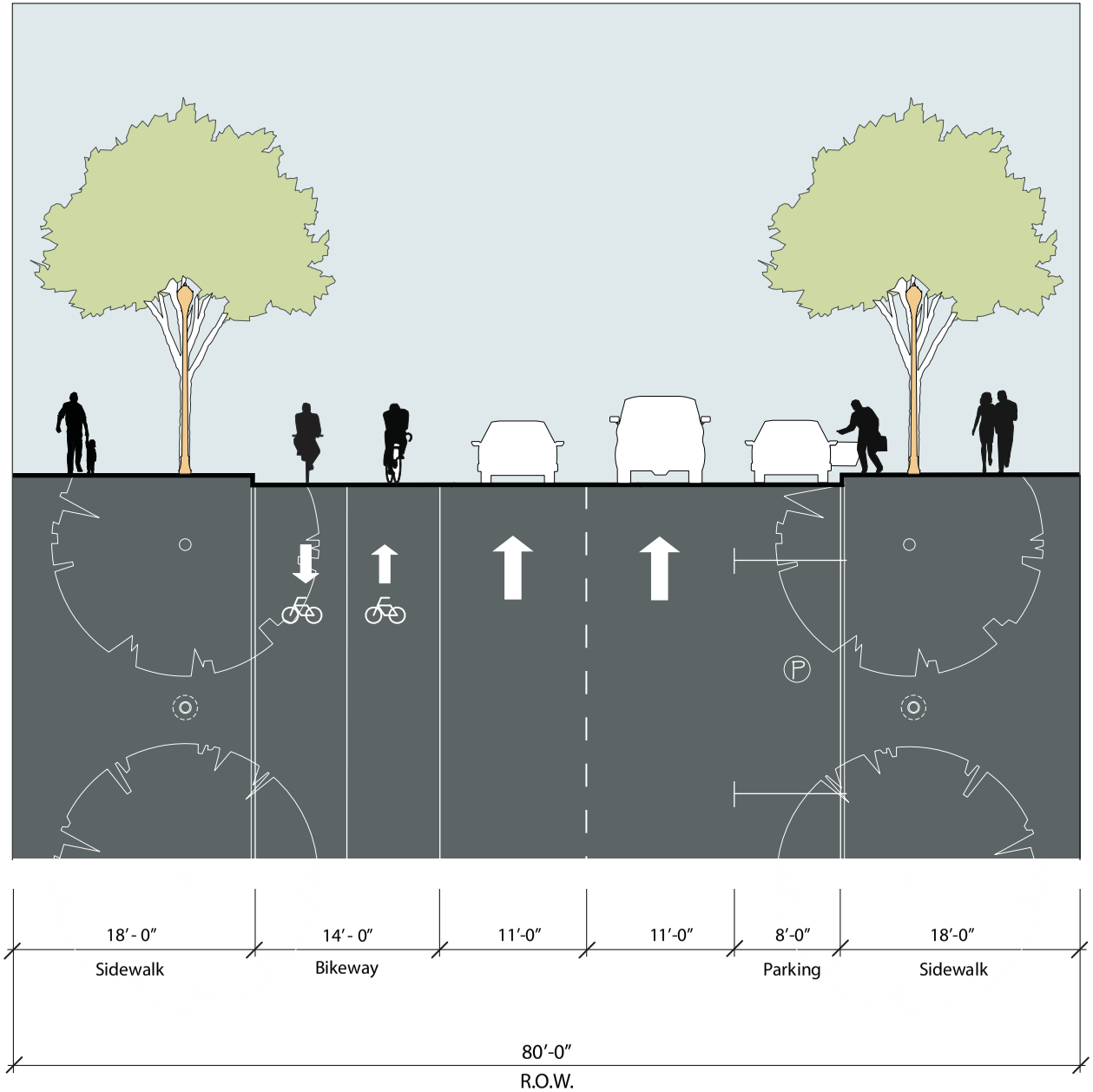
Colorado Street: Two-Way Conversion with Bike Lanes

DOWNTOWN AUSTIN PLAN

Prepared by ROMA Austin for the City of Austin

September 19, 2008



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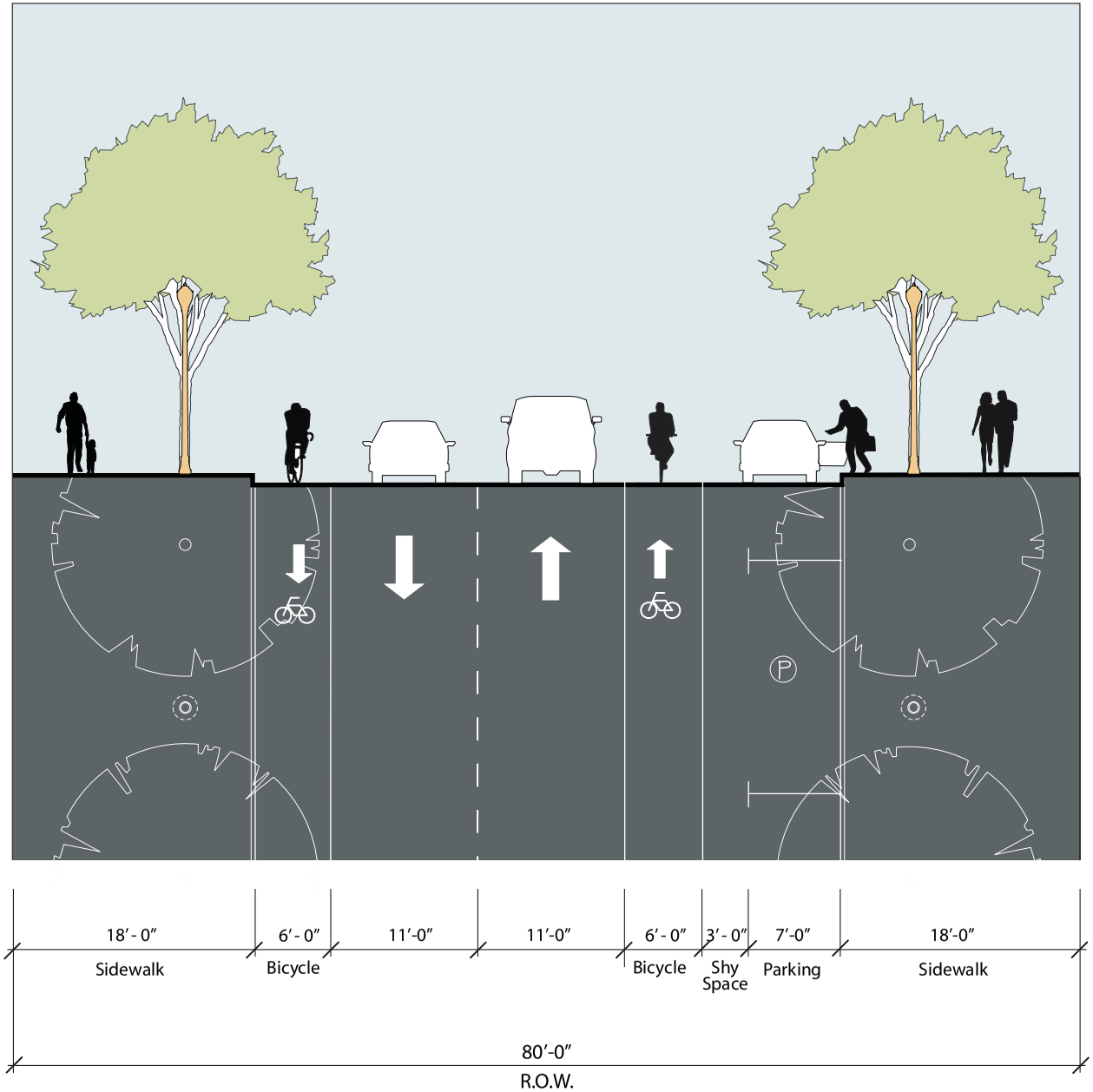
Trinity Street: One-Way with Two-Way Bikeway (Cesar Chavez to Seventh Street Segment Looking North)

DOWNTOWN AUSTIN PLAN

Prepared by ROMA Austin for the City of Austin

September 26, 2008



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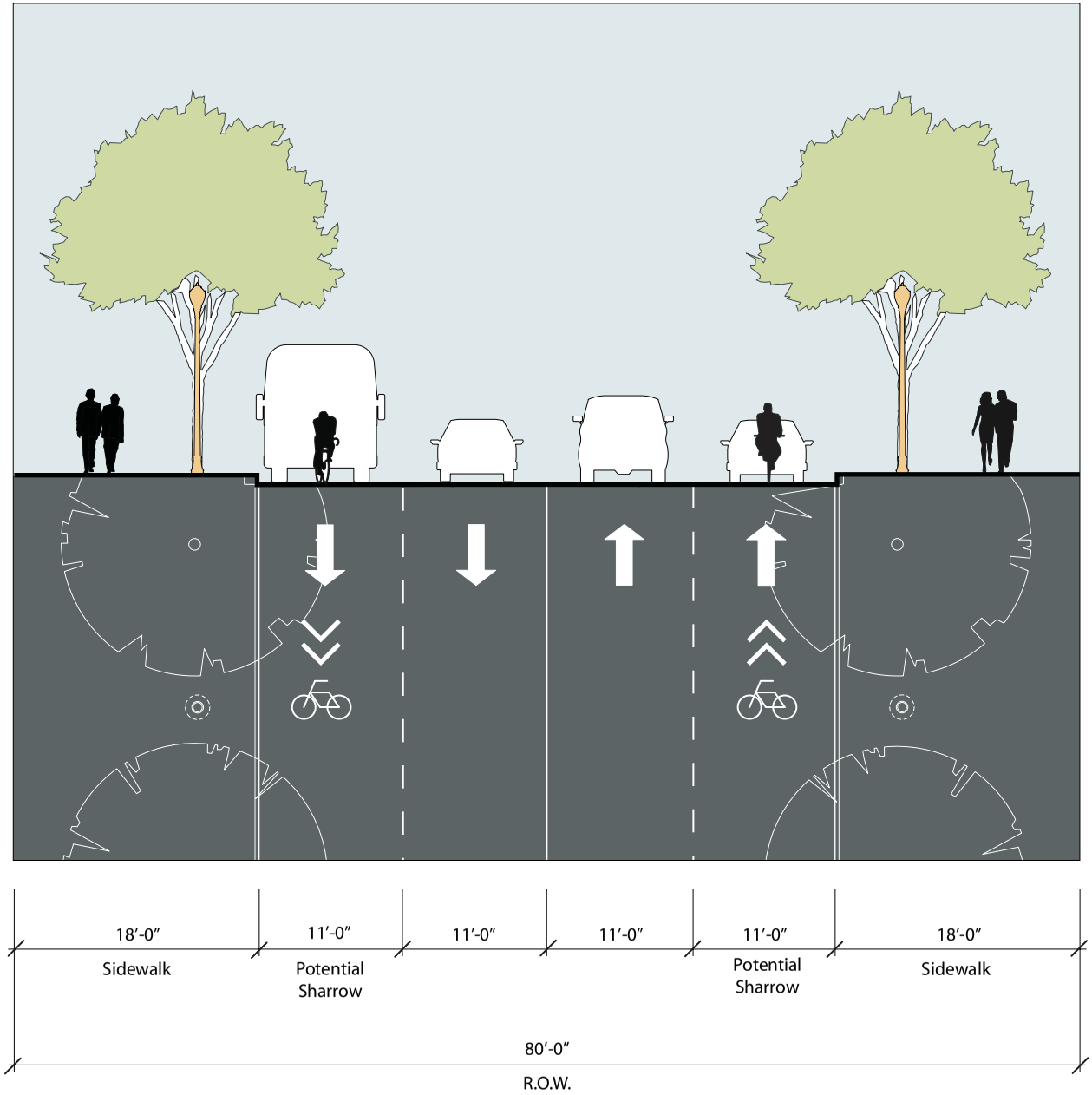
Trinity Street: Two-Way with Bike Lanes (Seventh Street to MLK Boulevard Segment Looking North)

DOWNTOWN AUSTIN PLAN

Prepared by ROMA Austin for the City of Austin

September 26, 2008



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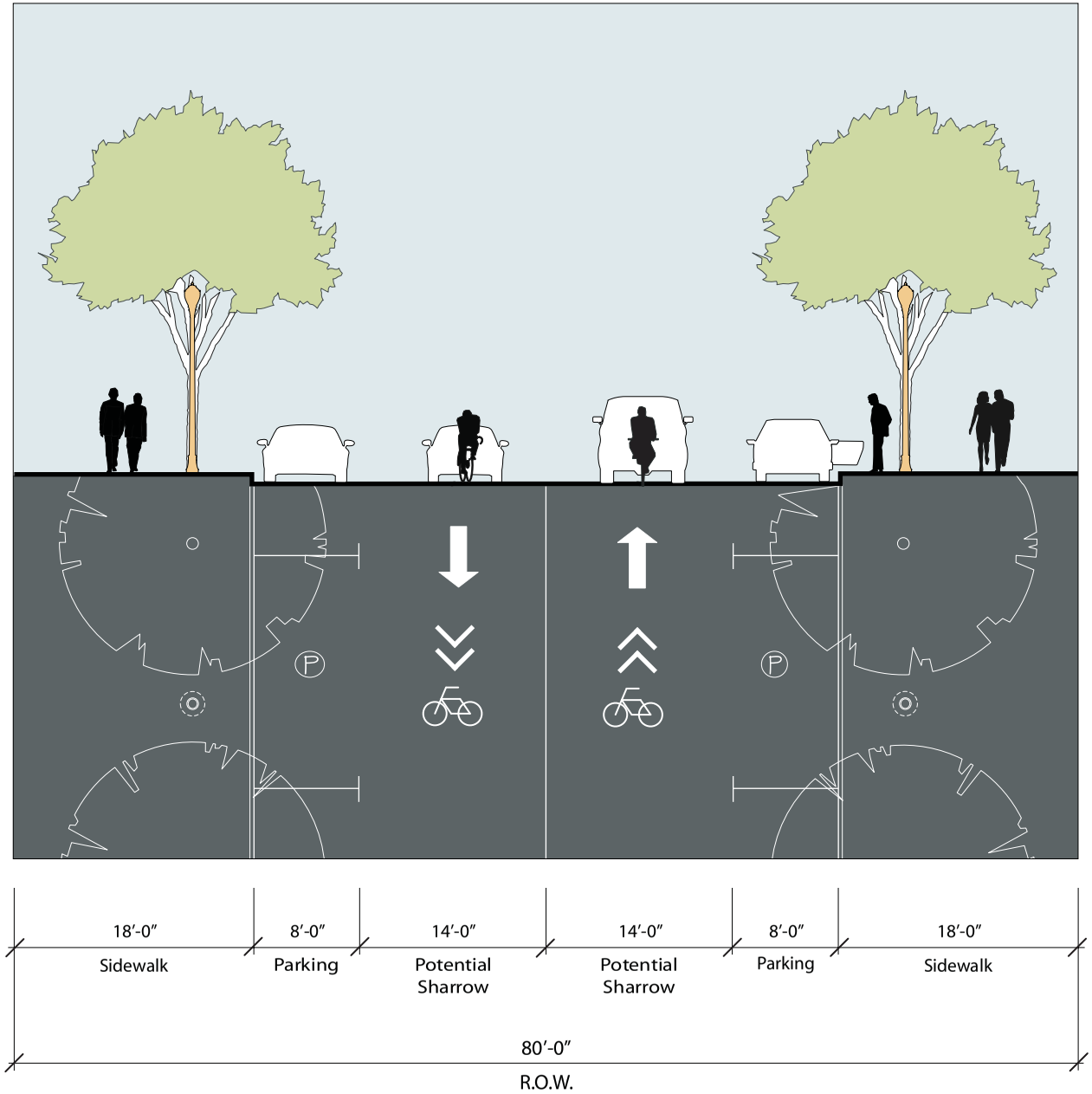
Brazos Street: Two-Way with Potential Sharrows

DOWNTOWN AUSTIN PLAN

Prepared by ROMA Austin for the City of Austin

September 19, 2008



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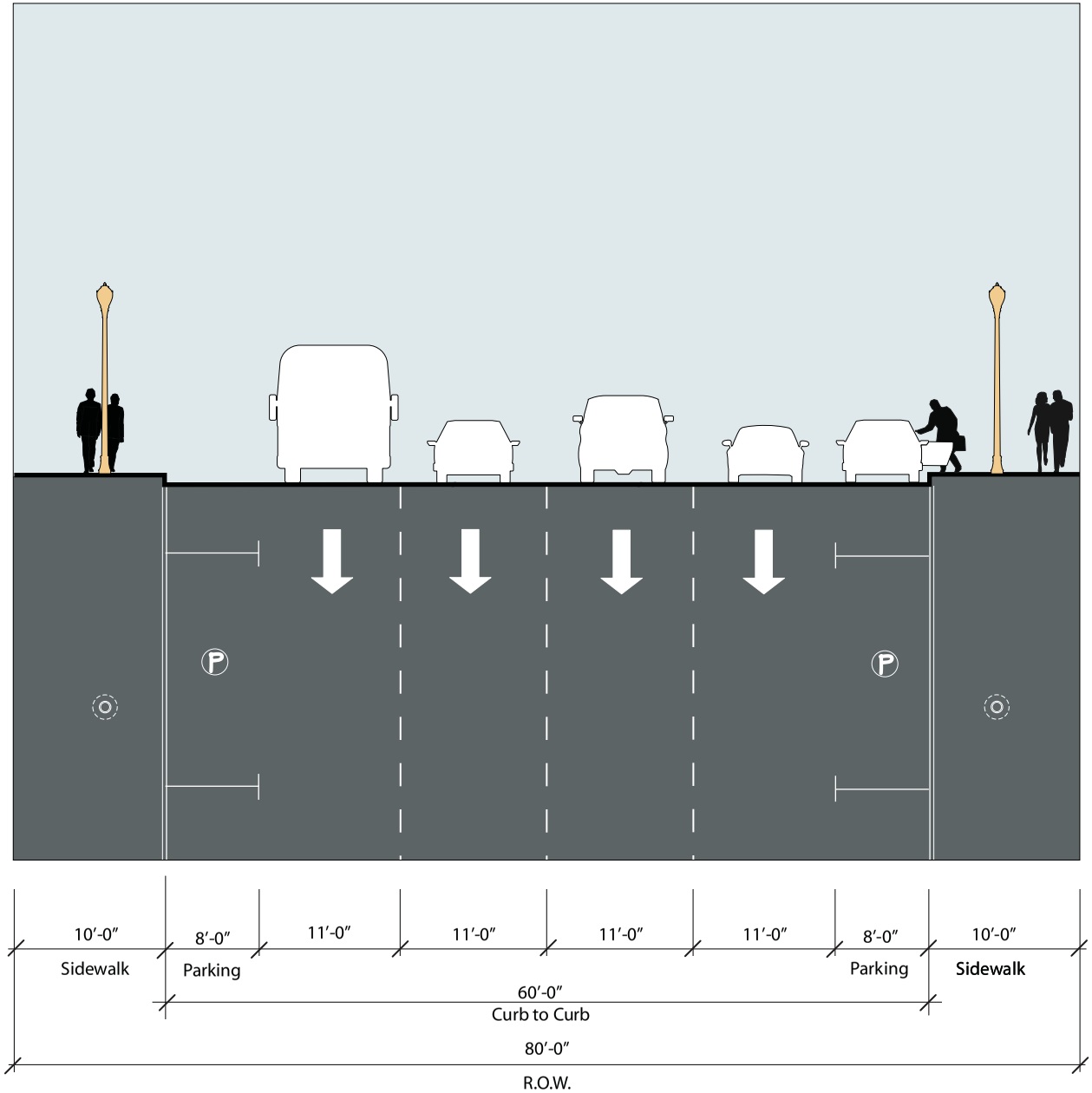
Ninth and Tenth Streets: Two-Way with Potential Sharrows (Non-Rail Segments)

DOWNTOWN AUSTIN PLAN

Prepared by ROMA Austin tudio Ar hite ts for the City of Austin

September 18, 2008



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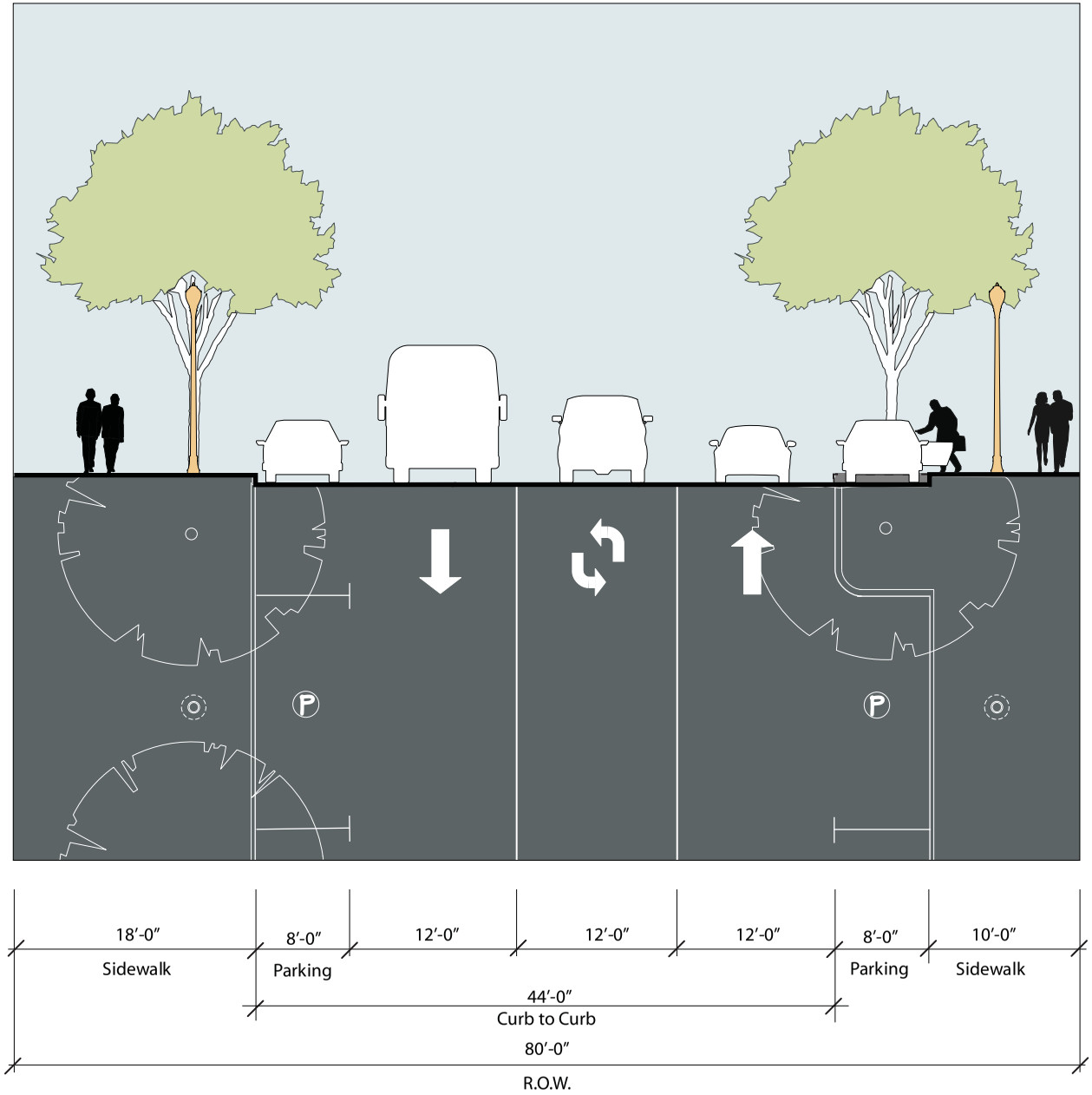
Typical Existing 80’ Right of Way

DOWNTOWN AUSTIN PLAN

Prepared by ROMA Austin for the City of Austin

September 18, 2008



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Typical Great Streets 80-Foot Right-of-Way with Three Lanes

DOWNTOWN AUSTIN PLAN

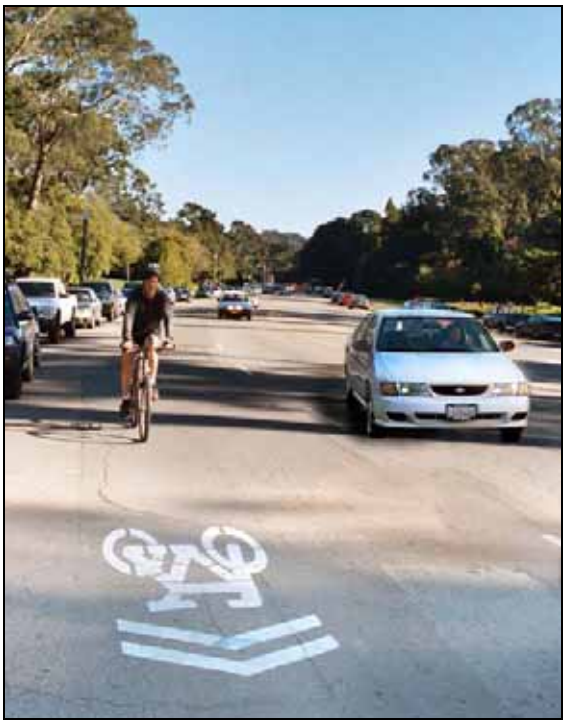
Prepared by ROMA Austin for the City of Austin

October 2, 2008

Appendix 2

“San Francisco’s Shared Lane Pavement Markings: Improving Bicycle Safety”

San Francisco's Shared Lane Pavement Markings: Improving Bicycle Safety



FINAL REPORT
February 2004

Prepared for:

San Francisco Department of Parking & Traffic

Prepared by:

Alta Planning + Design

Acknowledgements

San Francisco Department of Parking & Traffic

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Special thanks to James Mackay, Denver Bicycle Planner, for introducing and championing the shared lane marking concept.

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Project Need

Traffic curb lanes on signed/shared Class III bikeways (a.k.a. "signed shared roadways" in other states) are often too narrow to be safely shared side-by-side by cyclists and passing motorists. On these routes, cyclists wishing to stay out of the way of drivers often ride too close to parked cars and risk being struck by a suddenly opened car door (being "doored"). To avoid this, experienced cyclists ride further to the left and position themselves closer to the center of narrow lanes. This is permitted by the California Vehicle Code (C.V.C. 21202), but it often irritates motorists who are not aware that this is permitted. To address this and other problems, the San Francisco Bicycle Plan recommends that Class III bike routes be delineated with on-road markings. However, no approved standard pavement marking exists for this purpose. As a result, the following problems have arisen, particularly on higher traffic volume roadways:

- High incidence of "dooring",
- Wrong-way riding,
- Sidewalk riding, and
- Motorist squeezing cyclists against the curb or parked cars, or exhibiting other aggressive behaviors.

Paris, France

Many cities have experimented with a "shared lane marking" as a potential solution. The marking does not connote a separated bicycle lane, but instead directs the bicyclist to travel outside the car door zone and encourage safe co-existence. Such cities include Denver (CO), Gainesville (FL), Cambridge (MA), Portland (OR), Oakland (CA), Paris (France), Brisbane (Australia), Zurich (Switzerland), Buenos Aires (Argentina) and others (see Appendix A for details of these and other efforts.) The only city to study the effectiveness of such markings is Gainesville (FL), which found that the markings caused cyclists to shift their positions by a few inches, a positive result.

Denver, Colorado

The City and County of San Francisco has in particular experienced a high frequency of complaints and problems due to increasing volumes of bicyclists on streets with high traffic volumes and heavily-used on-street parking. In 1998, San Francisco began experimenting with a green* pavement marking, referred to as "bike-in-house," similar to that of Denver (CO), on various streets. While cyclist feedback was generally positive, there was concern about the marking's low visibility. As other jurisdictions began using varying marking designs, questions also arose about the need for a standard application of spacing, size, and location, as well as whether the marking was effective, safe, and beneficial.

Portland, Oregon

Thus, the San Francisco Department of Parking and Traffic (SF DPT) undertook this study to determine the effectiveness of shared lane pavement markings in encouraging safe bicyclist and motorist coexistence. The process ideally

* San Francisco used green as its marking color for the "bike-in-house" marking because it was not in use as a standard color for on-street traffic control devices.

will lead the California Traffic Control Device Committee (CTCDC) to formally approve and effective shared lane marking for use throughout the state.

Goals

The purpose of this study is to determine the effectiveness of shared-lane markings in achieving three distinct goals.

Goal 1: Improve the position of both motorists and bicyclists on roadways without bicycle lanes

Measure of Effectiveness:

- Distance of bicyclist from adjacent parked cars.
- Distance of motorist when passing a bicyclist.

Note: All study streets have on-street parking; however, if there is no parked car at the study site the measurement shall be to the curb face.

Goal 2: Reduce aggressive motorist behavior

Measure of Effectiveness:

- Observable hostile behaviors such as honking, gestures or other behaviors when passing or waiting to pass a bicyclist.

Goal 3: Encourage correct bicyclist riding behavior

Measure of Effectiveness:

- Number of bicyclists riding on the sidewalk.
- Number of bicyclists riding wrong-way on the street.

Additional Objectives

Shared-lane markings may also have the following effects:

- Inform motorists to expect bicyclists on the roadway.
- Inform motorists that bicyclists may indeed legally ride further to the left in the travel lane, even if that means blocking the lane at times.
- Inform bicyclists how to position themselves in the lane with respect to the curb or parked cars to avoid hazards.
- Increase the number of cyclists as people may feel more comfortable riding on streets with markings.

Arrow Designs

Human Factors Survey: Findings

The marking design in other cities is quite varied, as seen in Appendix A. Recognizing that an infinite number of possible design variations exist (size, color, shape, etc.), SF DPT undertook a human factors survey of the three most commonly used marking designs in the U.S.. The study compared driver and bicyclist comprehension of three alternative designs for the shared-use marking. Staff presented 120 bicycling commuters and 120 motorist commuters with one of three photographs (Figure 1) showing a typical urban street with a different kind of shared lane marking. They then asked a series of open-ended questions to determine:

- What they felt they should do in that scenario if they were bicycling/driving,
- Why they would react that way, and
- What they thought the pavement marking in particular meant they should to do.

Key results included:

- All three markings encouraged motorists to be more aware of bicycles.
- The bike-and-separate-arrow marking frequently conveyed the incorrect message "bike straight only at the intersection ahead."
- The bike-and-chevron marking was more likely to elicit the response to slow down than the bike-in-house symbol.
- Significantly more respondents thought the bike-and-chevron marking indicated a shared use lane than the bike-and-separate-arrow marking.
- About half of the surveyed bicyclists thought they should stay in the right lane and follow the arrow.

Bike-and-chevron marking *Bike-and-separate-arrow marking* *Bike-in-house marking*

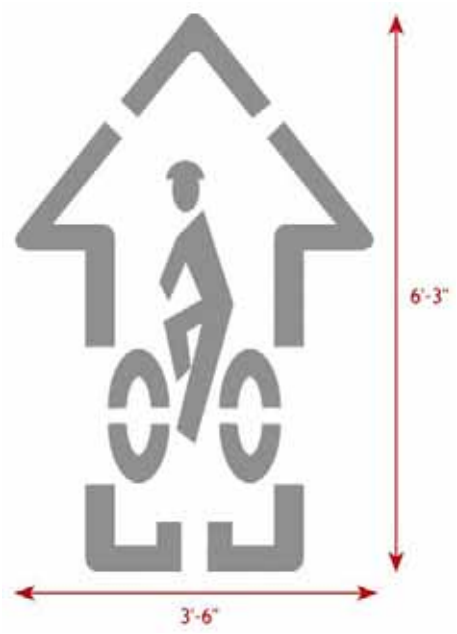
Figure 1. Survey Exhibits: Photographic Renderings

Selected Designs

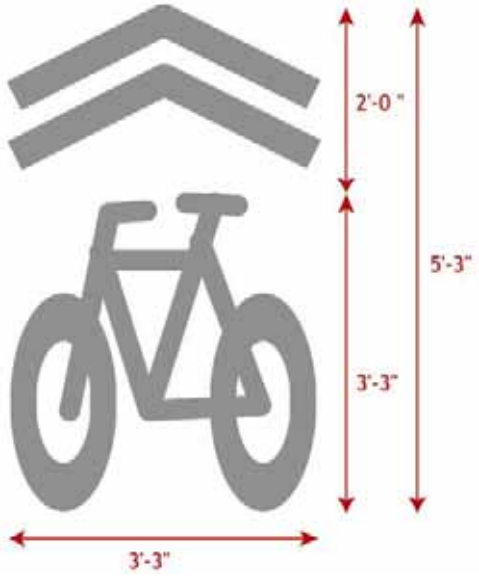
As a result of this research, as well as review from a Technical Advisory Committee, SF DPT chose to study the two designs shown in Figure 2.

The **modified bike-in-house** is 42 inches (3'-6") wide at the arrow points, 28 inches (2'-4") wide at the bottom channel, and 75 inches (6'-3") long. The rider is 28 inches wide at the wheels and 48 inches tall. Compared to the original bike-in-house used on various streets, the bicyclist is twice as large, the overall marking is 3 inches longer, and the overall width remains the same. In addition, a bike wheel channel was created at the bottom to encourage cyclists to ride on the arrow.

The **bike-and-chevron** marking is used in Paris and Chicago. Technical advisory committee members also strongly recommended studying the bike-and-chevron marking.



Modified "bike-in-house" marking



Bike-and-chevron marking

Figure 2. Selected Designs for the Study

e ore n A er i eo e An sis

The primary approach used to evaluate cyclist and driver behavior was a before/after videotape study. In addition, the consultant team and the San Francisco Bicycle Coalition (SFBC) administered surveys to cyclists and drivers to gauge their perceptions about the effectiveness of the markings. This document presents the findings of both the video study and surveys.

The consultant team collected more than 140 hours of video, primarily during the weekday commute, at six locations (see photos starting on page 7):

- Polk Street
- 17th Street
- 2nd Street
- Market Street (weekday/midday location)
- JFK Drive (weekend/weekday location)
- Stanyan Street (weekend location)

The locations are heavily-used bicycle routes for both utilitarian and recreational cyclists. The streets have on-street parking with relatively narrow (≤22 feet) outside shared lanes (including parking) and no bicycle lanes. They have varied traffic volumes and roadway width characteristics (see Table 1). The markings were placed so that the centerline is 11 feet from the curb, or about 4 feet from parked cars (see Figure 3).

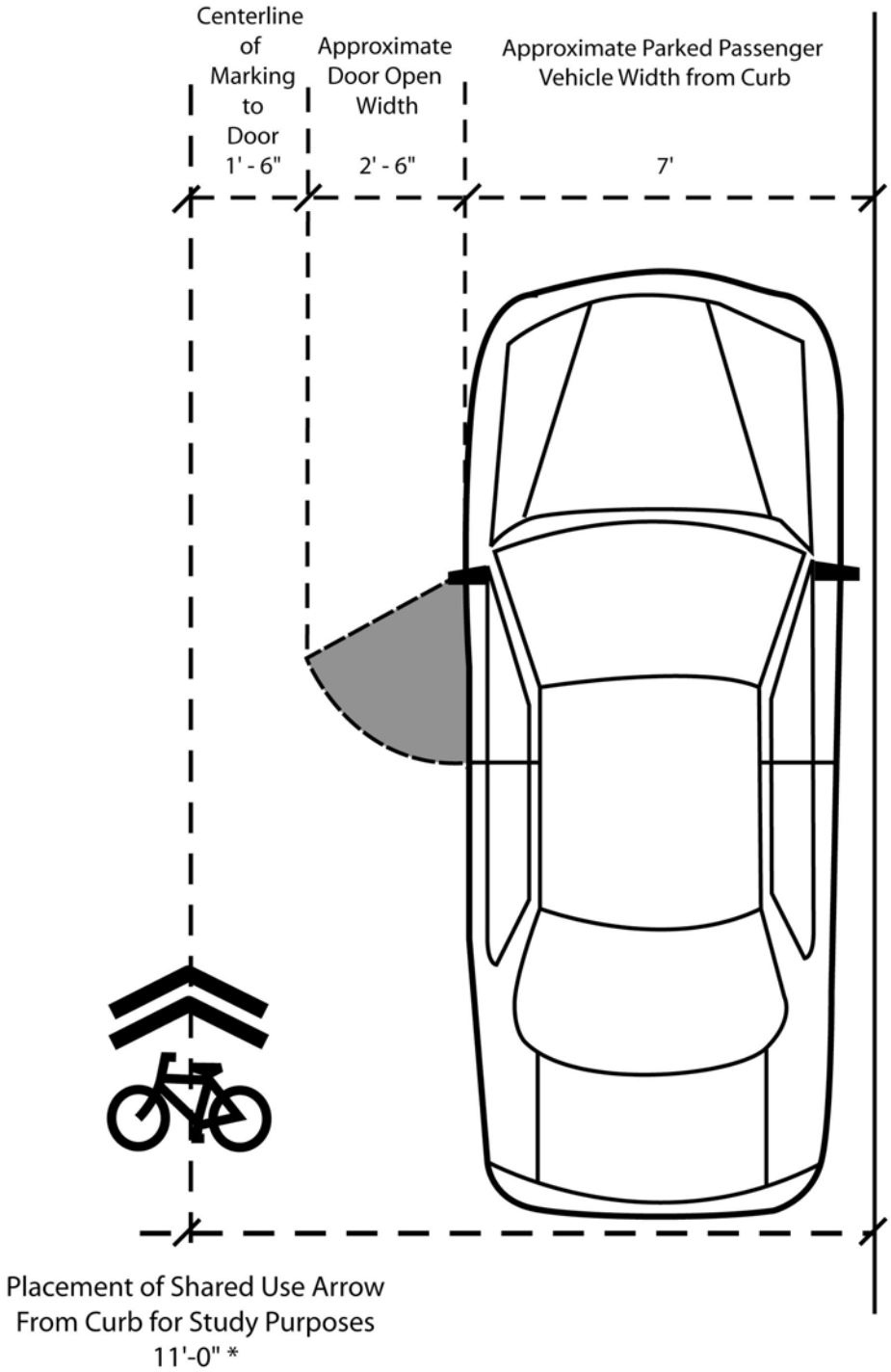
Table 1. Characteristics of Marking Locations

Street	Location	# of Lanes	Curb Lane Width (includes parking)	ADT[1] (Volume)
Polk Street	between Washington and Sacramento	two-lane road	22'	high ADT/lane
17th Street	between S. Van Ness and Dolores[2]	two-lane road	22'	moderate ADT/lane
Second Street	between Mission and Howard	four-lane road	17'	moderate ADT/lane
Market Street	between Van Ness and Octavia[2]	four-lane road	18' to 19'	high ADT/lane
JFK Drive	between 8th and 10th Ave.	four-lane road	17' to 19'	moderate ADT/lane
Stanyan Street	between Haight and Frederick	four-lane road	16'-10"	moderate ADT/lane

[1] Heavy ADT is defined as more than 4000 vehicles per day per lane of traffic. Moderate ADT is defined as between 2000 and 4000 vehicles per day per lane of traffic.

[2] 17th Street (between Dolores and Valencia) and Market Street (between Octavia and Gough) were marked by DPT with green pavement arrows years prior to the Before/After Study. These green test arrows were removed prior to the initiation of the "Before" video documentation.

Note: Other streets–Fell St., 8th Ave., Transverse St., Page St. –were considered but not selected for analysis as the budget allowed for only six streets. The selected streets offer a good range of comparable issues.



* This placement is based on the following:
- 85th percentile of car doors observed opened to 9'6" from curb (per DPT field observations).
- Average width of bicycles is 2'.
- 6" clearance from door to bicycle handlebar is desired minimum "shy distance".

Figure 3. Plan View of Marking Placement

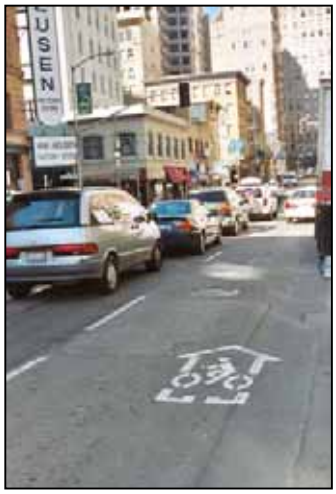
Locations of Study Markings

17th Street

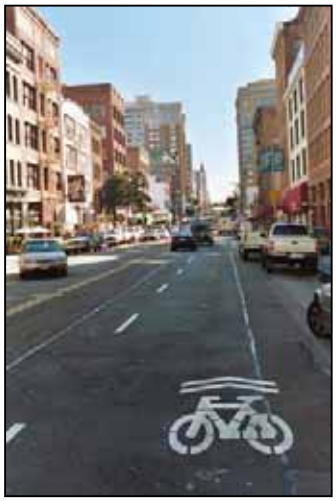
eastbound

westbound

2nd Street



northbound



southbound

Market Street

westbound

eastbound

Polk Street

southbound

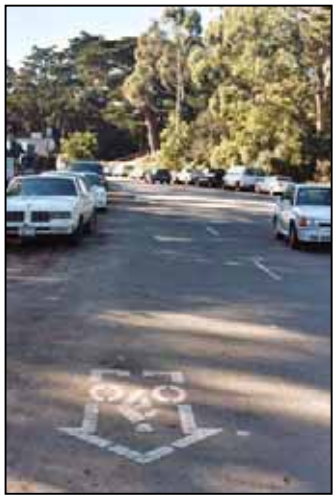
northbound

Stanyan Street

northbound

southbound

JFK Drive



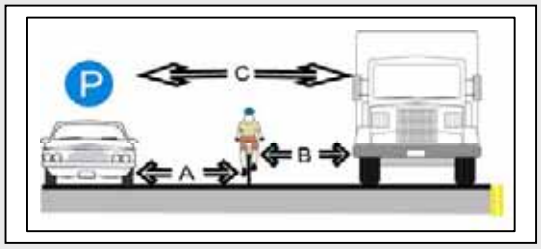
eastbound

westbound

Summary of Data Collection

Sample Size

- 6 locations
- 140 hours of videotaping
- "Before" study:
  - 1100 cyclists
  - 1000 motor vehicles
- "After" study:
  - 1300 cyclists
  - 1400 motor vehicles



Time of Study

- Spring-Summer 2003
- Various times during the day, depending on street

Variables Studied

- Number of travel lanes
- Traffic volume
- Curb lane width
- Location
- Time of day
- Marking type

Recorded Behaviors

- Cyclists' positions (A and B in the above diagram)
- Motorists' positions (B and C in the above diagram)
- Cyclist direction
- Cyclist location (street vs. sidewalk)
- Visible conflicts between cyclists and motorists

Note: Distances were measured to and from the tires of the car or bicycle. Based on review of the videotapes and the videographer's perceptions, the presence of the video camera did not seem to alter cyclists' or drivers' behaviors. However, the use of a video camera angled at oncoming cyclists did present a potential measurement error of up to 3 inches due to the inherent distortion of the view field. This measurement error could be eliminated in future studies through the use of an overhead-mounted camera or laser measurement device.

Results

Technical Results

Overall, the stencil markings significantly* improved both motorists' and cyclists' positions in the roadway (using the median average positions). The markings also reduced sidewalk and wrong-way riding.

Goal 1: Position of bicyclists and motorists

- Finding 1: Overall, the presence of a marking **increased the distance of cyclists to parked cars by 8 inches.** The effect of each marking on position was similar (see Figure 4).

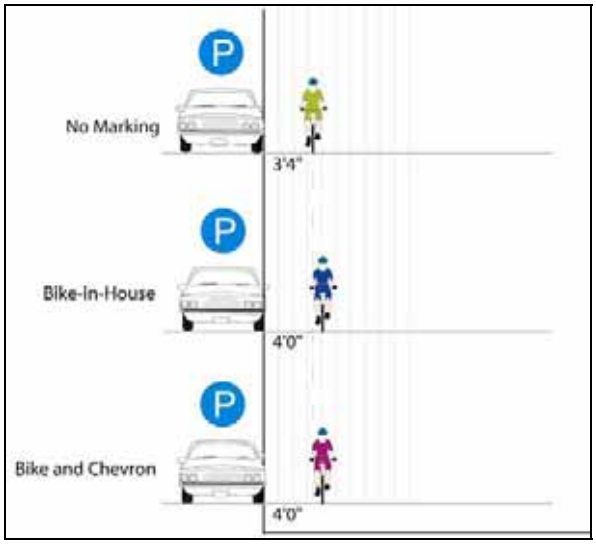


Figure 4. Effect on Bicycle to Parked Car Spacing

- Finding 2: When passing vehicles were present, the markings caused an **increase of 3 to 4 inches in the distance between cyclists and parked cars.** In addition, the markings caused an **increase of over 2 feet in the distance between cyclists and passing vehicles.** The bike-and-chevron had a greater effect (by 3 inches) on the distance between cyclists and passing vehicles (See Figure 5).

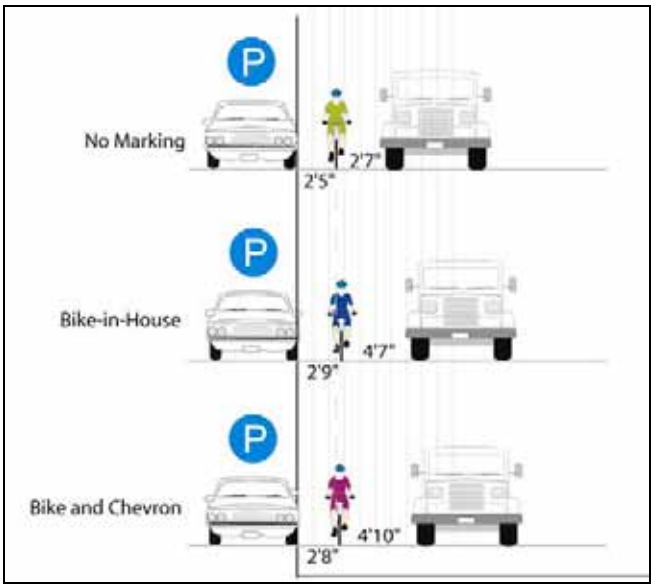


Figure 5. Effect on Motorist and Bicyclist Spacing

* The use of the term, "significant" means that the observed change was the result of a change in the variable (i.e., the pavement marking), as opposed to normal variance in the measurements. Significance has been determined through the use of a variety of statistical tests and tools including χ^2 (chi-squared) tests and multiple linear regression where appropriate. The χ^2 tests were used to compare the before/after results for behaviors such us cyclists' location and direction. Linear regression was used to analyze the measured results in relation to the markings.

(Goal 1 Continued)

- Finding 3: When no cyclists were present, both of the markings had a significant positive effect of about one foot on the distance between passing vehicles and parked cars (see Figure 6).

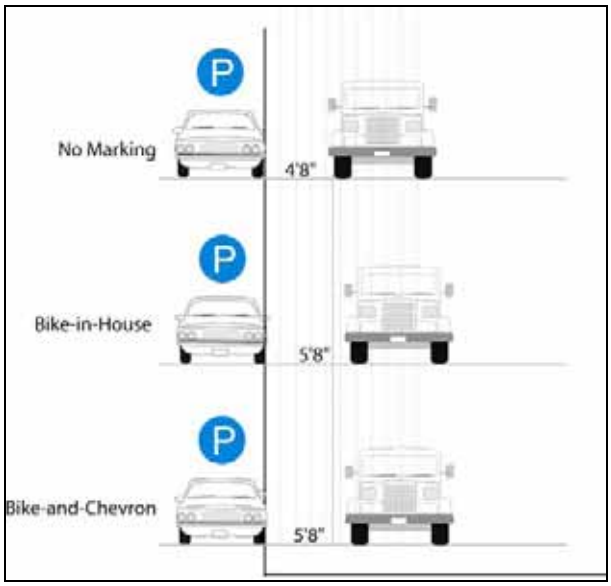


Figure 6. Effect on Motor Vehicle to Parked Car Spacing

Goal 2: Reduction in aggressive motorist behavior

- The markings neither significantly reduced nor increased the number of observable hostile behaviors between bicyclists and motorists. This was primarily due to the low number of aggressive behaviors recorded in the "before" videotapes.

Goal 3: Reduction in improper bicycle behavior

- Both the markings significantly reduced the number of sidewalk riders: the bike-and chevron by 35% and the bike-in house by 25%.
- The bike-and-chevron marking significantly reduced the number of wrong-way riders by 80%. The bike-in-house marking did not have any significant impact on the percentage of wrong-way riders.

Table 2 provides a summary of these findings. Complete results are on file with the San Francisco Department of Parking and Traffic's Bicycle Program.

Table 2. Summary of Bicyclists' and Motorists' Behavior

Behaviors	Before (No marking) sample size=1158	After: Bike-in-House sample size=570	After: Bike-and-Chevron sample size=794
Sidewalk riders	6.5%	**4.9%**	**4.2%**
Wrong-way riders	3.0%	3.3%	**0.60%**
Hostile behaviors	0.15%	0.17%	0.12%
Distance of cyclists to parked cars	3'-4"	**4'-0"**	**4'-0"**
Distance of cyclists to cars in travel lanes	2'-7" sample size=150	**4'-7"** sample size=59	**4'-10"** sample size=150
Distance of cars in travel lane to parked cars (no bike present)	4'-8"	**5'-8"**	**5'-6"**

Significant differences are indicated in **boldface**.

Variables Influencing Results

Various factors contributed to these study results, including:

- Number of travel lanes
- Traffic volume
- Curb lane width
- Time of day (AM Peak/PM Peak/weekday midday/weekend)

Each variable was classified in two groups (such as high/low, narrow/wide, or AM/PM). The median and mean average distances were isolated and cross-tabulated for different factors and were compared to see if the variables had an effect on distances between cyclists, parked cars, and passing cars. Table 3 summarizes the characteristics' effects on cyclists and motorist positions. A complete listing of the cross-tabulated results is on file with the SF DPT Bicycle Program.

Table 3. With Markings in Place, Significant Street Characteristics Affecting Behavior

Factor	Effect on Distance between Bicyclists and Parked Cars	Effect on Distance between Bicyclists and Passing Vehicles
More lanes (4 vs. 2)	increase	decrease
Higher traffic volume	no effect	no effect
Wider curb lane	decrease	increase
AM vs. PM	no effect	no effect
Peak Periods	decrease	decrease

In comparing the effects of the markings on rider position on streets with different characteristics, the study found that:

- The markings have a **greater effect on distance** between cyclists and parked cars **on four lane roads** than on two lane roads.
- The markings have a **greater effect on distance** between cyclists and parked cars on **heavy volume roads** than on moderate volume roads lane roads.
- Curb-lane width and time of day did not have a significant effect on how much the markings changed behavior.

Table 4 summarizes the findings of each of the markings.

Table 4. Summary Comparison of Markings

Study Issues	Bike-in-House	Bike-and-Chevron
1. Did the marking increase the distance of bicyclists from adjacent parked cars?	YES	YES
2. Did the marking increase the distance between passing motorists and cyclists?	YES	YES
3. Did the marking reduce observable hostile behaviors?	UNDETERMINED [1]	UNDETERMINED [1]
4. Did the marking reduce incidences of sidewalk riding?	YES	YES
5. Did the marking reduce incidences of wrong-way riding?	NO	YES

[1] There were too few incidents to reach a statistical conclusion.

Cyclist and Driver Survey Results

Staff and volunteers surveyed 103 San Francisco cyclists and 23 motorists about the bicycle markings at three locations: Polk Street, 2nd Street, and Market Street*. Approximately equal numbers of surveys were collected for both kinds of markings (see Table 5).

Table 5. Surveys Completed

Location	Marking Type				Sub-Totals		Totals
	Chevron		Bike-in-House				
	Cyclists	Drivers	Cyclists	Drivers	Chevron	Bike-in-House	
Market St.	20	--	45	--	20	45	**65**
Polk St.	7	11	8	12	18	20	**38**
2nd St.	23	--	0	--	23	0	**23**
Totals	**50**	**11**	**53**	**12**	**61**	**65**	**126**[1]

[1] **While the grand total of cyclists surveyed is 128, two cyclist surveys returned did not include location or marking type information, and thus are not included in this chart.**

The survey queried bicyclists' and drivers' understanding and perception of the markings. The results were coded in Microsoft Excel and analyzed using SPSS Statistical Software. Complete results are on file with the San Francisco DPT Bicycle Program.

In summary, the bicyclists surveyed see the markings as a step in the right direction and felt that the markings increased their sense of safety. However, the intended message of the markings was not fully understood. This could be remedied through a public information campaign.

The majority of the drivers surveyed claimed not to notice the markings. Since the sample size of drivers was so small, the results do not provide conclusive findings. Of the drivers that noticed the markings, there was no significant advantage of one marking over the other, but the drivers did not seem to confuse the markings with bike lanes.

* Surveys were administered roughly a half-block "downstream" of the markings during weekday peak travel times. The surveyors asked approaching cyclists if they would fill out the surveys on the spot (no surveys were mailed). Small warning signs (with the words, "Bike Surveys") were placed about 50 feet before the surveyors. About 25% of passing cyclists filled out the survey, which took an average of three to four minutes to complete. Drivers were surveyed as they arrived to their respective destinations along Polk Street.

Location and Rider Characteristics

Since most of the surveys were conducted on major commute routes during peak times, recreational and beginner cyclists are under-represented. Practically all of the interviewed cyclists categorized themselves as either intermediate (25%) or advanced (74%) urban cyclists. Typically, these cyclists are more likely to "take the lane" in urban traffic situations. Most of the cyclists were commuting to/from work (63%) or riding for utilitarian purposes (25%). Practically all of the cyclists were between the ages of 19-60 (60% 19-35 years old, 38% 36-60 years old).

Message

- Many cyclists believed that the markings indicated that the right lane served as a bike route or lane or that bikes have priority (30%) (see Figure 7).
- About 15% of cyclists felt that the marking indicated that bicyclists were allowed full use of the travel lane. 75% of these "take the lane" respondents had ridden over the bike-in-house marking.
- A few cyclists thought that the marking signified that a bike lane would be installed at the location in the future (2%).
- Of the motorists that responded, two out of the seven that noticed the markings understood that the marking indicate that they should allow more room for cyclists.

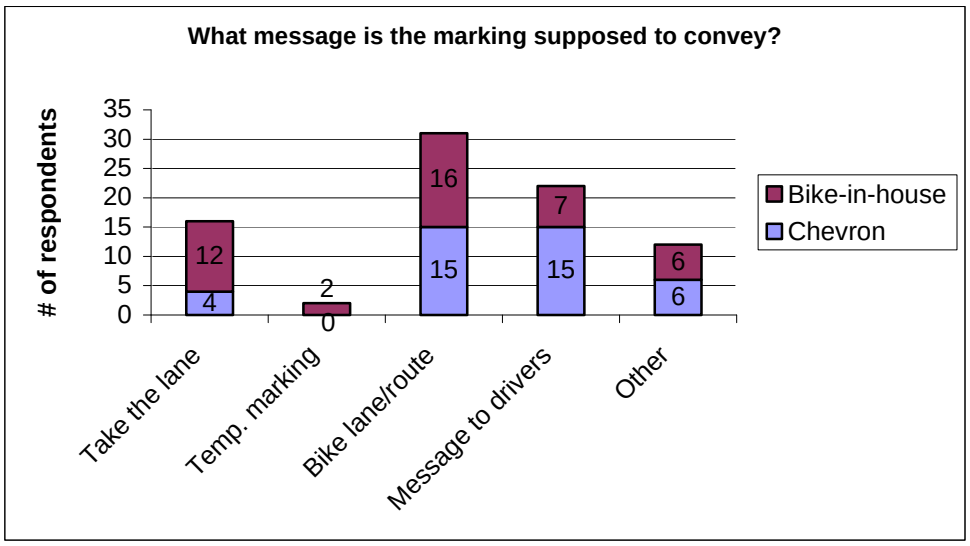


Figure 7. Cyclists' Responses to Survey - Message

Perception of Impact on Behavior

- Of the riders who noticed the markings, 33% felt that they did not change their position.
- Of the 33% of cyclists that felt that the marking affected their position (See Figure 8), 100% said that they rode closer to the center of the lane, often over the center of the marking.
- 60% of cyclists felt that the markings increased their sense of safety (See Figure 9).
- 35% felt that the marking improved driver behavior, 36% felt that the marking had no impact on driver behavior, and 29% were unsure (See Figure 10).
- One-third of drivers felt that the markings improved their behavior.

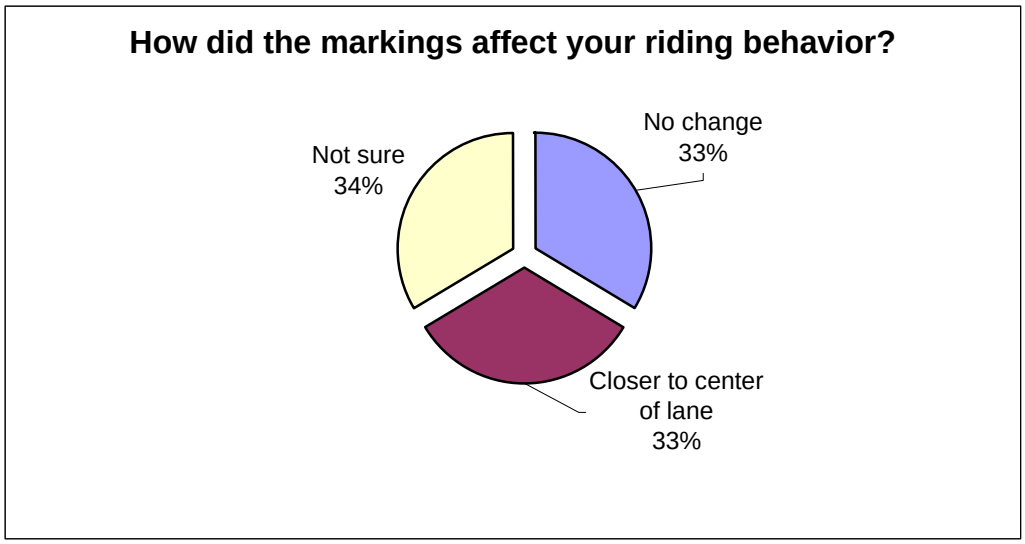


Figure 8. Cyclists' Responses to Survey - Riding Behavior

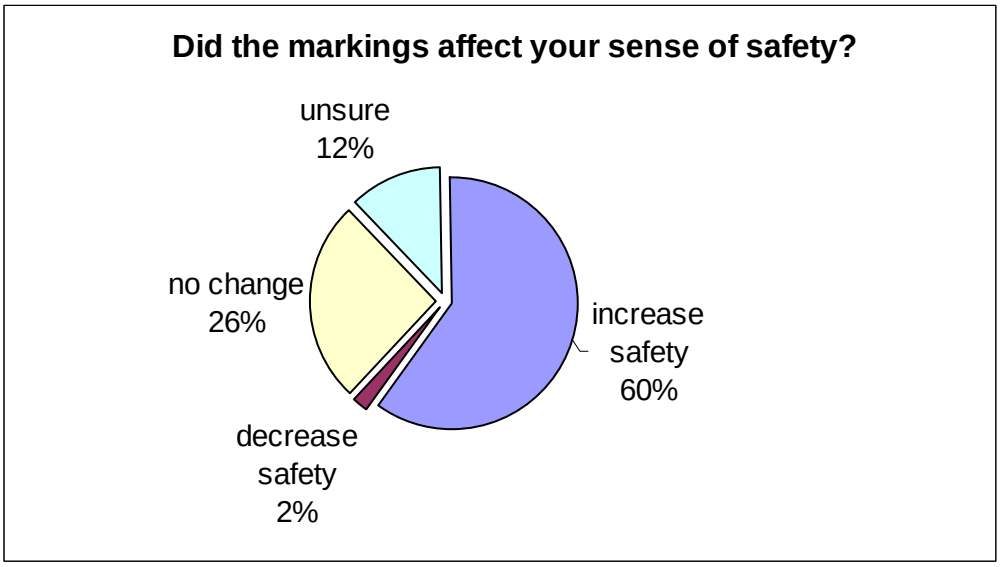


Figure 9. Cyclists' Responses to Survey - Sense of Safety

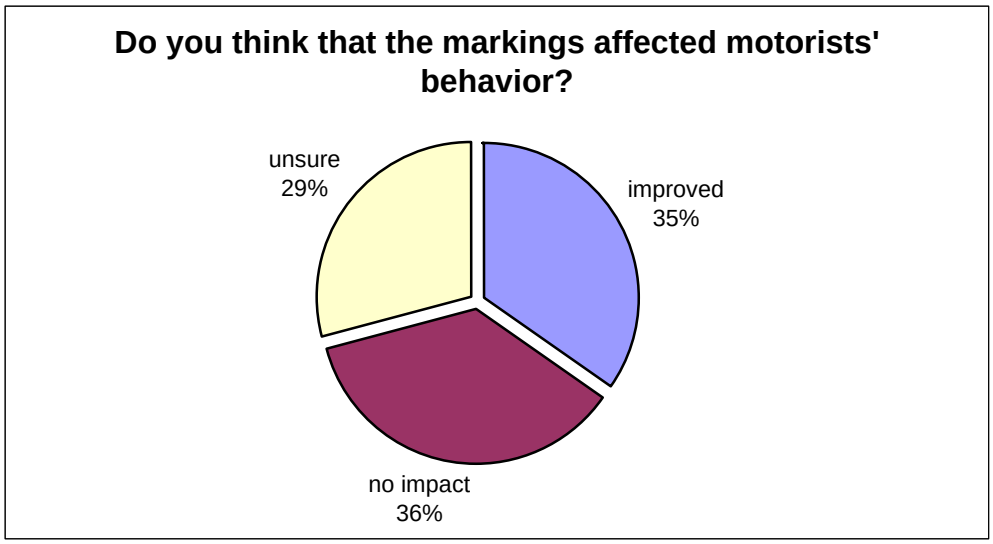


Figure 10. Cyclists' Responses to Survey - Motorists' Behavior

Visibility

- Of the 105 surveyed cyclists, 76 (72%) noticed the markings. About the same percentage of cyclists noticed each of the markings. When prompted, cyclists preferred the bike-and-chevron marking over the bike-in-house marking by a two to one ratio.
- Many cyclists also commented that the large, white markings are more visible and preferable to the green bike-in-house markings painted on San Francisco streets in the past.
- Of the 23 motorists that were surveyed on Polk Street, only seven (30%) noticed the markings. None of the respondents mentioned a preference for either marking. It should be noted that from the perspective of the driver, the chevrons appear "flat." Several cyclists made this comment as well. Many of the motorists felt that there was not enough room for cyclists on Polk Street.

Conclusion

This research has proven that shared lane pavement markings in San Francisco have a positive impact on motorist and cyclist behavior, positions, and safety. These results are complementary to a 1999 Florida study (Florida Department of Transportation, *Evaluation of the Shared-Use Arrow*). While both studies found that such markings significantly reduce wrong-way and sidewalk riding, the Florida study found a much smaller impact on cyclists' positions. In contrast to San Francisco, the Florida study measured rider positions on roadways with no on-street parking, and on streets where cyclists were less likely to "take the lane".

The bike-and-chevron marking had a stronger impact on motorist positioning and in reducing wrong-way riding and is preferred by cyclists surveyed. **Based on these findings, the project team recommends the bike-and-chevron marking be used as a standard marking for shared-use lanes on appropriate streets in San Francisco.** Based on comments received, the pitch of the chevron should be increased by approximately 6 inches (see Figure 11.) The project team also recommends that the California Traffic Control Devices Committee adopt this marking as an optional marking for Class III bikeways throughout California.

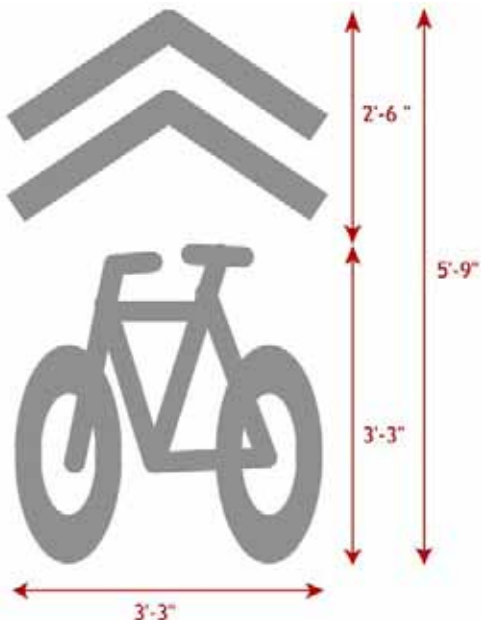


Figure 11. Recommended Modified Bike-and-Chevron

Appendix A: Pavement Markings in Other Cities

Various symbols have been tried by cities in the U.S., Europe and Australia. The symbols have been installed where bike lanes cannot be installed for various reasons including:

- Not enough cyclists;
- Too expensive;
- Requires loss of parking; and/or
- Requires road widening or other unacceptable trade-off.

To better understand these bicycle pavement symbol efforts, staff gathered information regarding (a) their use, (b) their effectiveness, (c) preferred installation locations, and (d) types of material, size, and color used. This report is a summary of the information gathered from:

- Brisbane, Australia
- Chicago, Illinois
- Oakland, California
- Denver, Colorado
- Cambridge, Massachusetts
- Paris, France
- Portland, Oregon
- Gainesville, Florida
- Warren and Waitsfield, Vermont
- Las Vegas, Nevada.

Location:	**Brisbane, Australia**
Photo:	
Size/Shape:	The idea is derived from the 4'0" wide Denver arrow, but instead Brisbane adopted a 1200-1500 mm wide yellow bicycle symbol as shown above.
Color:	Yellow (was considered an advisory color; distinguishable from the mandatory white bike lane symbols also in use)
Material:	Paint
Source:	Michael Yeates, Convener, Cyclists Urban Speed limit Taskforce, An initiative of the Bicycle Federation of Australia Inc ph +61 7 3371 9355, michaelm@myoffice.net.au , www.yeatesit.biz/transfiles/bfaurbanspeedlimits.pdf
Other Sources:	Bicycle Federation of Australia. Associated report "Towards A Safe Urban Speed Limit: Report Of The Cyclists Urban Speed Limit Task Force": www.bfa.asn.au/cyclist/201speed.htm City of Brisbane, Australia. "Making Space For Cyclists By Sharing The Road: Brisbane City Council's "Bicycle Friendly Zone" report: www.brisbane.qld.gov.au/getting_around/bikes/bikeways/signs.shtml www.ourbrisbane.com/brisbane/traffictrans/bicycles.htm
How Used:	A yellow bike symbol system has been under development on Brisbane streets since 1995. They are called Bicycle Friendly Zones (BFZ). On existing roads where there is not enough space to provide a bike lane, BFZs are created to alert motorists of "the likely travel corridor for bicyclists". These zones are marked with a yellow bicycle symbol that warns other road users that cyclists commonly use the route. The intention is to clearly delineate the parking

areas so that the areas between the parked vehicles and the through traffic can be utilized by cyclists. The reduced speed (50km/h) and the bike symbols show where cyclists are expected.

The yellow symbols are placed (using standard road-marking stencils) 1800-2000 mm from the curb where parking is allowed, and closer to the curb where there is no parking. On single lane roads where edge lines are installed, the lines are regularly broken to accommodate the yellow bike symbols (see photo). In all cases, the symbols are repeated at regular intervals on the road.

According to the Bicycle Federation of Australia, the major benefit of the BFZ is adaptability. It can be used to "make room for the cyclists" in combinations of lower speed areas in areas such as shopping strips to reduce traffic speed by integrating all relevant urban design elements. Used in various combinations, it preserves space for cyclists without "separation", an example of "sharing the road". From a technical perspective, correct placement of the BFZ allows its use on roads that, if bike lanes were used, would require widening traffic lanes that, according to traffic design theory, results in increased speed of the adjoining traffic. The development and use of the BFZ illustrates the relationship between speed limits, speeding, perceptions of safety and provision of facilities. Despite not being able to reduce the speed limit on main roads from 60 to 50km/h, reduced traffic speeds when cyclists are present have been achieved by use of the BFZ.

Effectiveness: Brisbane's use of the bike symbols has been an ongoing "trial" without any specific evaluation processes. To see if the concept worked intuitively or subjectively, no education was provided before or after the installation of the symbols. Michael Yates believes that they appear to be working intuitively and no negative effects have been identified.

Location: **Chicago, Illinois**

Photo:

Size/ Shape: 5' 9" high by 3' 3" wide bicycle above 1' 8" high by 3' 3" wide double chevron. Randy Neufeld modeled it after a design photographed in Paris a couple of years ago by a Chicagoland Bicycle Federation member. (Bike-in-House symbols previously installed in 1999 were considered too small to be understood by cyclists.)

Color: White

Material: They upgraded their symbols to an intersection grade quality material in 2002. In general, their 3M thermoplastic symbols have lasted 5 years or more, depending on wear.

Source: Nick Jackson, Director of Planning, Chicagoland Bicycle Federation
(312) 427-3325 x 27, nick@biketraffic.org

How Used: The symbol has been used by the Chicago DOT Bike Program in two places for shared lanes, both short connections between bike lanes. It is also planned for use in conjunction with directional signage to lead cyclists across large intersections to a facility in an area where many cyclists ride on the sidewalk.

Effectiveness: unknown at this time

Location: **Oakland, California**

Photo: Not available

Size/ Shape: Not available

Color: White

Material: Paint

Source: Kathryn Hughes, City of Oakland Public Works Agency, Transportation Services Division ph 510-238-6493, khughes@oaklandnet.com

How Used: White bike stencils were placed on a shared-use connecting link between two bike lanes on Grand Avenue in Oakland. The project is called the Grand Avenue Commuter Bikeway. The bike lanes extend from El Embarcadero to Webster, then the stencils/shared lane from Webster to Broadway, and bike lanes from Broadway to Market. SG 45 signs were also installed on the entire route and Share the Road signs on the stenciled portion.

Effectiveness: unknown at this time

Location: **Denver, Colorado**

Photo:

Size/ Shape: Bike-in-a-house design (the original, designed by James Mackay), 4' 3" long x 4' 0" wide, with a left-bound cyclist

Color: White

Material: One of the reasons for the "Bike in the House" symbol was to reinforce the correct direction of travel. Additionally, there was a desire to reduce the typical pavement marking costs of bike lanes. The original symbols were painted, but since the paint abraded away quickly from winter sanding operations, they have been replaced with thermoplastic solid outlined symbols as shown above (cost is $50 each).

Source: James Mackay, P.E., Denver Bicycle Planner, 201 West Colfax Avenue, Department 509, Denver, CO 80202, ph 720-865-3171, fax 720-865-2676, James.Mackay@ci.denver.co.us http://www.denvergov.org/Bicycle_Program/59810116template3jump.asp

How Used: As part of Denver's 1993 Bicycle Master Plan development, a "Shared Use Lane Pavement Marking Arrow", commonly called the "Bike in the House", was designed. The symbols are used in shared use lane conditions where bike lanes are not provided, but where it is desired to define the likely travel corridor for bicyclists. Symbols are placed approximately every 180 feet on-center along roads, often with "Share the Road" signs. They are placed so the center of the arrow is 9' 6" off the curb line with an adjoining 7 foot parking stall.

Effectiveness: Not available

Location: **Cambridge, Massachusetts**

Photo:

Size/ Shape: Bicycle stencil placed in a break of a continuous white line

Color: White

Material: Paint

Source: Cara Seiderman, cseiderman@Spike.CI.Cambridge.MA.US
Wayne Amaral, Cambridge Traffic Department, (617) 349-4723
Bryce Nesbitt, Bicycle Committee member, bryce2@obviously.com

How Used: Pavement markings have been installed on Mt. Auburn Street in Cambridge. The travel lane is 11 feet and the guideline is 10' out from the curb.

Effectiveness: No formal study completed yet, but these comments were passed on:
"I find this lane treatment highly appropriate for intermediate width streets (too narrow for a full bike lane, too wide for cyclists to take the entire lane). In particular I find:
"1. It seems to keep cyclists out of the door zone. Cyclists ride within inches of the line.
"2. Motorists don't seem to get mad when a cyclist deviates from the line. With conventional double-stripe bike lanes, motorists often seem to insist that bikes stay within the bike lane. This does not happen on Mt. Auburn."

Location: **Paris, France**

Photo:

Size/ Shape: Similar to the Chicago, IL symbol (5' 9" high by 3' 3" wide bicycle above 1' 8" high by 3' 3" wide double chevron)

Color: White

Material: Thermoplastic

Source: Marc Jolicoeur, Research Coordinator, Velo Quebec
tel.: (514) 521-8356 #394, fax: (514) 521-5711, marc_jolicoeur@velo.qc.ca

How Used: The city of Paris is using arrows and bike symbols repeated along the line of travel of cyclists in intersections, about the same way colored lanes have been used in Portland and Montreal.

Effectiveness: unknown at this time

Location: **Portland, Oregon**

Photo:

Size/ Shape: Standard markings for inside bike lane

Color: White

Material: Thermoplastic

Source: Mia Birk, Principal, Alta Planning + Design, 144 NE 28th Avenue, Portland OR 97232
ph (503) 230-9862, fax (503) 230-9864, cell (503) 238-4745, miabirk@altaplanning.com

How Used: Portland used the bike lane marking without the bike lane line in one case in February 1998. This case involves a street with bike lanes that lead up to a 26' wide bridge, on which there is not adequate room for bike lanes. The city retained the marking on the outer 3' of each of the

	13' lanes to encourage motorists to travel toward the left of the lane.
Effectiveness:	No specific study. Anecdotal evidence suggests that motorists are indeed giving cyclists room: the markings are still there after almost five years of application and show little signs of motorists' driving on them.

Location:	**Gainesville, Florida**
Photo:	
Size/ Shape:	bike-in-a-house, 4' 0" wide x 6' 0" long
Color:	White
Material:	Paint
Source:	Dennis Scott, Florida Pedestrian and Bicycle Coordinator ph (850) 410-4927, dennis.scott@dot.state.fl.us
How Used:	Their shared-use arrow was intended to address deficiencies in wide outside curb lane bike facilities. The wide curb lanes are frequently not recognized as a facility by bicyclists. The shared-use arrow informs the cyclists about where to ride and in which direction. The symbols were put down as part of a November 1999 usage evaluation, performed by the University of North Carolina Highway Safety Research Center (HSRC), to compare the riding positions of bicyclists and the position of motorists on sections marked with the shared-use arrow to unmarked sections. The arrow was placed by Gainesville Public Works at 3.5 feet from the curb face at four locations along 13th Street (US 441). In this study area, 13th Street has 4 lanes, a 30 mph speed limit, and carries approximately 35,000 vehicles per day. The four locations were examined using videotaping equipment to record bicycles and motor vehicles.
Effectiveness:	For this evaluation, the measures of effectiveness pertained to before and after measurements of bicycles and motor vehicles from the curb and from each other. Bicycle to Curb was the only measurement that showed a statistically significant difference between the BEFORE and AFTER conditions. Although the difference between the BEFORE mean measurement of 1.58 feet and the AFTER of 1.83 feet was statistically significant, this .25 feet (1.83 - 1.58), or 3 inches, is not practically significant. This does not represent enough of a meaningful shift in distance for real world application. Furthermore, this amount may fall within the measurement error of the software/data reducer, especially considering that BEFORE measurements were made with the bicyclist farther from the camera. More trials in other locations are recommended and should result in more conclusive findings.

Location:	**Warren and Waitsfield, Vermont**
Photo:	Not available
Size/ Shape:	Bike-in-a-house design (4' x 4' approximately – some maybe smaller due to narrow shoulders of 3' or less)
Color:	White
Material:	Paint
Source:	Amy Bell, Vermont Bicycle and Pedestrian Coordinator, ph (802) 828-5799
How Used:	Symbols were placed experimentally along the shoulders of a scenic tourist 4.5 mile stretch of US Route 100. Share the Road signs were installed with the pavement symbols. The symbols have not been replaced since their first application, and many are worn away, covered over or scraped off from winter equipment. The signs are still in place.
Effectiveness:	No specific study. Casual verbal survey of approximately 200 local citizens and 50 bicyclists led to conclusion that bicyclists felt the symbols were too small to be effective and local drivers rarely noticed them. The Vermont DOT decided to not encourage their use, to not replace them, and to not include them in future plans

Location:	**Las Vegas, Nevada**
Photo:	Not available

Size/ Shape:	MUTCD standard bicyclist and arrow symbol
Color:	White
Material:	Retroreflective film with glass beads
Source:	Mike Colety, P.E., Kimley-Horn and Associates ph (702) 862-3609, fax (702) 735-4949, mike.colety@kimley-horn.com
How Used:	Pavement stencil markings are only used with bicycle lanes (not shared lanes
Effectiveness:	Not available

Location:	**Sacramento, California**
Photo:	Not available
Size/ Shape:	Not available
Color:	White
Material:	Paint
Source:	Ed Cox, Alternative Modes Coordinator, City of Sacramento, ph (916) 264-8434, fax (916) 264-8357, ecox@cityofsacramento.org
How Used:	For several years Sacramento has been using a painted arrow and legend that says "Bike Route". It is almost identical to markings used for bike lanes (Highway Design Manual figure 1004.3) that says "Bike Lane". Sacramento's symbols are used for streets that are on their Bikeway Master Plan, primarily on Class 3 routes where they are combined with the Green and White Bike Route signs (California State Department of Transportation, Caltrans, G93). They have also put them on streets where it was not possible to install Class 2 bike lanes.
Effectiveness:	No study. They do provide route guidance to bicyclists.

Other Locations

Freiburg, Germany

Buenos Aires, Argentina

San Anselmo, California

Appendix 3

Downtown On-Street Parking Counts

DRAFT

Downtown On-Street Parking Counts:

Gains and Losses by Affected Street Segment per October 2008 DAP Transportation Framework Plan

Prepared by ROMA for the City of Austin

10/6/2008

	Existing Parking Spaces	per DAP Transportation Plan	Assumed "Duck-In"/Other Parking (1,2)	Gained/ Lost Spaces (with 1,2)
NORTH-SOUTH STREETS				
Guadalupe (Cesar Chavez to MLK)[1]	252	0	142	-110
Lavaca (Cesar Chavez to MLK)[1]	264	0	144	-120
Colorado (Cesar Chavez to 11th)[2]	136	0	80	-56
Congress (Cesar Chavez to 11th)[4]	148	182		34
Trinity (Cesar Chavez to MLK)	309	136		-173
San Jacinto (10th to MLK)[1]	197	0	72	-125
EAST-WEST STREETS				
3rd (Trinity to Nueces)	117	86		-31
4th (IH 35 to San Antonio)	223	0		-223
5th (IH 35 to Brazos)[3]	102	132		30
5th (Brazos to Lamar)[1]	143	0	88	-55
E. 6th (IH 35 to Brazos)	119	132		13
6th (Brazos to Lamar)[1]	157	0	84	-73
7th (IH 35 to Guadalupe)[1]	155	0	80	-75
8th (IH 35 to Guadalupe)[1]	153	0	72	-81
9th (IH 35 to Lamar)	302	368		66
10th (Congress to Lamar)	187	209		22
E. 10th (IH 35 to Congress)	121	104		-17
11th (IH 35 to Nueces)	51	0		-51
18th (Trinity to Rio Grande)	188	101		-87
TOTAL Parking Spaces on Above Streets	3324	1450		
TOTAL Parking Spaces Gained/Lost				-1002
TOTAL Spaces Gained: "Duck-In"/Other (1,2)			762	

Existing Parking Assumptions: Parking counts on block faces without recorded counts were calculated using an approximation of one parallel parking space per 25 linear feet. Blocks with obviously incorrect information were counted the same as the nearest correct block.

[1] Limited parking along corridors could be provided in "duck-ins": 4 spaces assumed per blockface.
[2] Limited parking along corridors could be provided by eliminating center turn lanes.
[3] 66 spaces along the north curb of 5th Street between IH 35 and Brazos are within a managed lane: spaces are available during non-peak hours.
[4] Congress Avenue gains 3 spaces in the Exclusive-Running Option and 34 spaces in the Shared-Running Option

Base Map Source: Consultants, Wilbur Smith and Land Design Studio, completed the initial GIS shapefile in early 2001 for Tranportation, Planning and Sustainability Department (TPSD). TPSD updated some of the shapefile in 2002 and 2003 for use in the Downtown Access and Mobility Study and Great Streets Project.