# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>3</td>
</tr>
<tr>
<td>Purpose</td>
<td>3</td>
</tr>
<tr>
<td>Current Events</td>
<td>5</td>
</tr>
<tr>
<td>Current Conditions</td>
<td>5</td>
</tr>
<tr>
<td>Regional Trends</td>
<td>5</td>
</tr>
<tr>
<td>System Growth</td>
<td>5</td>
</tr>
<tr>
<td>Planning Initiatives</td>
<td>6</td>
</tr>
<tr>
<td>Service &amp; Operations</td>
<td>6</td>
</tr>
<tr>
<td>Service Classification</td>
<td>6</td>
</tr>
<tr>
<td>Transit &amp; Technology &amp; Facilities</td>
<td>7</td>
</tr>
<tr>
<td>Service Guidelines</td>
<td>23</td>
</tr>
<tr>
<td>Transit-Supportive roadway design</td>
<td>24</td>
</tr>
<tr>
<td>Bus Stop Design</td>
<td>24</td>
</tr>
<tr>
<td>Design Elements</td>
<td>25</td>
</tr>
<tr>
<td>Goals</td>
<td>26</td>
</tr>
<tr>
<td>Techniques</td>
<td>26</td>
</tr>
<tr>
<td>Design</td>
<td>27</td>
</tr>
<tr>
<td>Spacing</td>
<td>28</td>
</tr>
<tr>
<td>Stop Placement &amp; Configuration</td>
<td>28</td>
</tr>
<tr>
<td>Sidewalk Stop Turnout</td>
<td>30</td>
</tr>
<tr>
<td>Sidewalk Stop Curbside</td>
<td>30</td>
</tr>
<tr>
<td>Curb Extension</td>
<td>32</td>
</tr>
<tr>
<td>In-Street Boarding Island</td>
<td>33</td>
</tr>
<tr>
<td>Sidewalk Boarding Island</td>
<td>36</td>
</tr>
<tr>
<td>Amenities</td>
<td>36</td>
</tr>
<tr>
<td>Public Art</td>
<td>37</td>
</tr>
<tr>
<td>Signage</td>
<td>38</td>
</tr>
<tr>
<td>Lighting</td>
<td>38</td>
</tr>
<tr>
<td>Street Furniture</td>
<td>39</td>
</tr>
<tr>
<td>Transit Shelters</td>
<td>39</td>
</tr>
<tr>
<td>Seating</td>
<td>39</td>
</tr>
<tr>
<td>Bicycle Racks &amp; Parking Shelters</td>
<td>39</td>
</tr>
<tr>
<td>Wayfinding</td>
<td>40</td>
</tr>
<tr>
<td>Information Technology</td>
<td>42</td>
</tr>
<tr>
<td>Forms &amp; Binders</td>
<td>43</td>
</tr>
<tr>
<td>Advertising</td>
<td>43</td>
</tr>
<tr>
<td>Passenger Facility Management</td>
<td>43</td>
</tr>
<tr>
<td>Transit Street Design</td>
<td>44</td>
</tr>
<tr>
<td>Design Elements</td>
<td>45</td>
</tr>
<tr>
<td>Design Flexibility</td>
<td>45</td>
</tr>
<tr>
<td>Multi-modal Access to Transit Facilities</td>
<td>45</td>
</tr>
<tr>
<td>Transit Conflicts</td>
<td>47</td>
</tr>
<tr>
<td>Transit Street Types</td>
<td>49</td>
</tr>
<tr>
<td>Neighborhood Transit Streets</td>
<td>49</td>
</tr>
<tr>
<td>Corridor Streets</td>
<td>50</td>
</tr>
<tr>
<td>Destination Streets</td>
<td>50</td>
</tr>
<tr>
<td>Transit Lane Configuration</td>
<td>51</td>
</tr>
<tr>
<td>Transit Priority Lanes/HOV Lanes</td>
<td>51</td>
</tr>
<tr>
<td>Design Control</td>
<td>53</td>
</tr>
<tr>
<td>Lane Width &amp; Buffers</td>
<td>53</td>
</tr>
<tr>
<td>Obstructions &amp; Driveway Placement</td>
<td>54</td>
</tr>
<tr>
<td>Turn Radius</td>
<td>54</td>
</tr>
<tr>
<td>Design speed</td>
<td>55</td>
</tr>
<tr>
<td>Markings &amp; Signage</td>
<td>55</td>
</tr>
<tr>
<td>Lane Markings &amp; Colors</td>
<td>55</td>
</tr>
<tr>
<td>Signs &amp; Signals</td>
<td>57</td>
</tr>
<tr>
<td>Separation Elements</td>
<td>58</td>
</tr>
<tr>
<td>Sustainable Design</td>
<td>59</td>
</tr>
<tr>
<td>BRT Implementation</td>
<td>61</td>
</tr>
<tr>
<td>Platform Design</td>
<td>61</td>
</tr>
<tr>
<td>Platform Height</td>
<td>61</td>
</tr>
<tr>
<td>Platform Length</td>
<td>62</td>
</tr>
<tr>
<td>Platform Width</td>
<td>63</td>
</tr>
<tr>
<td>Universal Design &amp; Accessibility</td>
<td>63</td>
</tr>
</tbody>
</table>
## TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Pedestrian Access</th>
<th>65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transit Platforms</td>
<td>65</td>
</tr>
<tr>
<td>Walking Area</td>
<td>65</td>
</tr>
<tr>
<td>Bus Pads</td>
<td>65</td>
</tr>
<tr>
<td>Pavement Materials</td>
<td>65</td>
</tr>
<tr>
<td>Traffic Calming &amp; Shared Space</td>
<td>65</td>
</tr>
<tr>
<td>Bus &amp; Bicycle Interactions</td>
<td>70</td>
</tr>
<tr>
<td>Rail Station Design</td>
<td>72</td>
</tr>
<tr>
<td>Platforms</td>
<td>72</td>
</tr>
<tr>
<td>Location</td>
<td>72</td>
</tr>
<tr>
<td>Dimensions</td>
<td>72</td>
</tr>
<tr>
<td>Access</td>
<td>73</td>
</tr>
<tr>
<td>Crossing</td>
<td>73</td>
</tr>
<tr>
<td>Amenities</td>
<td>74</td>
</tr>
<tr>
<td>Stations</td>
<td>74</td>
</tr>
<tr>
<td>Spacing</td>
<td>75</td>
</tr>
<tr>
<td>Shelters</td>
<td>75</td>
</tr>
<tr>
<td>In-Station Paths</td>
<td>75</td>
</tr>
<tr>
<td>Landscaping</td>
<td>76</td>
</tr>
<tr>
<td>Park &amp; Ride Design</td>
<td>77</td>
</tr>
<tr>
<td>Location</td>
<td>77</td>
</tr>
<tr>
<td>Size</td>
<td>77</td>
</tr>
<tr>
<td>Multi-Modal Access</td>
<td>79</td>
</tr>
<tr>
<td>Parking</td>
<td>79</td>
</tr>
<tr>
<td>Landscaping</td>
<td>79</td>
</tr>
<tr>
<td>Evaluation Criteria</td>
<td>80</td>
</tr>
<tr>
<td>Agency Policy</td>
<td>81</td>
</tr>
<tr>
<td>Security</td>
<td>81</td>
</tr>
<tr>
<td>Transit-Oriented Development</td>
<td>83</td>
</tr>
<tr>
<td>Street Front Experience</td>
<td>85</td>
</tr>
<tr>
<td>Placemaking</td>
<td>86</td>
</tr>
<tr>
<td>Resources for Further Reading</td>
<td>87</td>
</tr>
<tr>
<td>Bibliography</td>
<td>87</td>
</tr>
<tr>
<td>Appendix: Errata Sheet</td>
<td>91</td>
</tr>
<tr>
<td>Maps</td>
<td>92</td>
</tr>
<tr>
<td>Preliminary Project Connect System Plan</td>
<td>96</td>
</tr>
<tr>
<td>System Map</td>
<td>96</td>
</tr>
<tr>
<td>TOD Typology Map</td>
<td>96</td>
</tr>
<tr>
<td>TOD Readiness Map</td>
<td>96</td>
</tr>
<tr>
<td>Illustrations</td>
<td>96</td>
</tr>
</tbody>
</table>

### Purpose

This manual is a collection of standards and best practices for designing transit-supportive roadways and facilities, and for enhancing transit service and operations for bus and rail, improving transit time and reliability, increasing ridership, and minimizing operating costs are all important considerations for Capital Metro and are influenced by factors such as project design, land use, roadway use, and travel behavior. Topics addressed include stop spacing, placement, and configuration; designing streets that are well-integrated with transit; and create better environments for walking and cycling, and making it safe to walk and ride. They also include traffic calming, fares and boarding techniques, and transit street design.

### Regional Trends

The Central Texas region continues to experience rapid population and economic growth, with over 110 people moving to Austin every day and private sector investment generating a multitude of new jobs. Austin has led the top 20 US Metro areas in population growth and has been consistently one of the top 10 fastest growing metropolitan communities for the last decade, according to the U.S. Census data (Austin, 2016). Through this growth has brought many benefits, it has also contributed to a significant increase in traffic congestion, lack of affordable housing supply, and rising income inequality. As the 11th most congested metropolitan area in the United States, Austin is struggling to alleviate the pressure on the region’s transportation system, as traffic has grown more than 30 percent faster than the growth in road capacity in the Austin metro area over the past 25 years (Austin, 2016). Rising housing costs and limited supply have caused many Austin residents to seek more affordable housing in surrounding suburb communities, including Pflugerville, Manor, Buda, Round Rock, and Georgetown. The City of Austin and regional transportation agencies have developed long-term plans and strategic goals for addressing these mobility and development challenges, which require a multi-modal system that works seamlessly to provide transportation options, address congestion, and increase mobility throughout the community while supporting and enhancing economic development opportunities within the established “preferred growth centers” (Austin, 2016). Capital Metro is a valuable partner in these efforts as the agency continues to improve and expand its system to offer an affordable alternative to driving and alleviate mobility challenges the region faces.

[Source: Austin, 2016]
Capital Metro's Fleet Characteristics

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>Classification</th>
<th>Capacity</th>
<th>Age</th>
<th>Seating Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>MetroBus (35-ft)</td>
<td>Core Services</td>
<td>40-80</td>
<td>1-99</td>
<td>21 seats</td>
</tr>
<tr>
<td>MetroRapid (40-ft)</td>
<td>Core Services</td>
<td>60-120</td>
<td>10-13</td>
<td>40 seats</td>
</tr>
<tr>
<td>MetroRapid (60-ft)</td>
<td>Core Services</td>
<td>60-120</td>
<td>10-13</td>
<td>64 seats</td>
</tr>
<tr>
<td>MetroExpress (40-ft)</td>
<td>Core Services</td>
<td>40-80</td>
<td>15-16</td>
<td>34 seats</td>
</tr>
<tr>
<td>MetroRail</td>
<td>Core Services</td>
<td>200-299</td>
<td>29</td>
<td>120 seats</td>
</tr>
<tr>
<td>MetroAirport</td>
<td>Core Services</td>
<td>100</td>
<td>10</td>
<td>16 seats</td>
</tr>
<tr>
<td>MetroRail Connector</td>
<td>Core Services</td>
<td>100</td>
<td>10</td>
<td>16 seats</td>
</tr>
<tr>
<td>Ebus</td>
<td>Core Services</td>
<td>20-40</td>
<td>1-2</td>
<td>14 seats</td>
</tr>
<tr>
<td>UT Shuttle</td>
<td>Core Services</td>
<td>10-20</td>
<td>1-2</td>
<td>14 seats</td>
</tr>
<tr>
<td>MetroRapid (40-ft)</td>
<td>Special Services</td>
<td>40-80</td>
<td>10-13</td>
<td>40 seats</td>
</tr>
<tr>
<td>MetroExpress (40-ft)</td>
<td>Special Services</td>
<td>40-80</td>
<td>15-16</td>
<td>34 seats</td>
</tr>
<tr>
<td>MetroRapid (60-ft)</td>
<td>Special Services</td>
<td>60-120</td>
<td>10-13</td>
<td>64 seats</td>
</tr>
<tr>
<td>MetroRail</td>
<td>Special Services</td>
<td>200-299</td>
<td>29</td>
<td>120 seats</td>
</tr>
<tr>
<td>MetroAirport</td>
<td>Special Services</td>
<td>100</td>
<td>10</td>
<td>16 seats</td>
</tr>
<tr>
<td>MetroRail Connector</td>
<td>Special Services</td>
<td>100</td>
<td>10</td>
<td>16 seats</td>
</tr>
<tr>
<td>Ebus</td>
<td>Special Services</td>
<td>20-40</td>
<td>1-2</td>
<td>14 seats</td>
</tr>
<tr>
<td>UT Shuttle</td>
<td>Special Services</td>
<td>10-20</td>
<td>1-2</td>
<td>14 seats</td>
</tr>
</tbody>
</table>

Source: Capital Metro, Service Guidelines
Transit Vehicle Design (select representations)

MetroRapid (NovaBus, 40-ft)

Examples of Vehicle Design (source: Capital Metro)

Source: NovaBus (reproduced)
Andrew Murphy
MetroBus (Gillig, 40-ft)

MetroRail (Stadler, 134-ft)

Source: Gillig (reproduced)
Source: Stadler (reproduced)

AMurphy: Two(s) touch pads on each center-facing 3-passenger W/C flip-up seats.
Bus Stop Design (select representations)

Capital Metro's Local Bus Stop Design (source: Capital Metro)
Park & Ride Design (select representations)

Howard Station Park & Ride Design (source: Capital Metro)

Lakeline Station Park & Ride Design (source: Capital Metro)

Local and MetroRapid Pole Signs (source: Capital Metro)

Signage (select representations)

Local Urban Pole Sign

MetroRapid Urban Pole Sign

Local Routes:
Routes: 1, 15, 203, 402, & 630-639

Premier Routes:
Routes: 100-101 & 606-900

Commuter Routes:
Routes: 500-599 & 700-999
Strip Signs (6.25" X 25")

Every Capital Metro bus stop is equipped with a Strip Sign that is usually attached to the bus stop pole. This sign is intended to be read at eye-level and to convey several key pieces including:

• **Location:** At the very top of each Strip Sign is the intersection and the unique Stop ID which assures customers that they are at the correct stop.

• **Next Bus:** This section provides a unique QR code, phone numbers and URLs for customers to use to find out when their next bus is arriving.

• **What to Pay:** This section is an overview of fare levels and which routes are included in each category.

• **Braille:** Capital Metro is committed to providing accessible information wherever possible. Which is why bus stops include Braille for the blind and low-vision community. This information is attached on the bottom half of each sign.

Large Strip Signs (8.75" x 35.375)

For stops with Urban Pole signs, Large Strip Signs are used. These follow the exact design as regular Strip Signs, only difference is their larger size.

---

**Service Guidelines**

Service standards provide a framework for the provision, design, and allocation of service. In 2015, Capital Metro revised its Service Guidelines and Standards, which established a set of design criteria including route directness, span, frequency, schedule reliability, and ridership performance. As the provision of a high level of transit mobility that is affordable to passengers and taxpayers often involves trade-offs between the costs and the benefits achieved by providing the service, these service standards provide a formal mechanism for making these trade-offs in an objective and equitable way (SEPTA, 2014). Capital Metro’s standards include the following:

- Routes should be designed to operate as directly as possible to minimize travel time while maintaining access to key destinations and making multi-leg connecting trips efficient.
- Deviations off the primary alignment of a fixed route should be minimized whenever possible and should result in an overall ridership increase.
- Service should be designed to operate in two directions on the same street whenever possible in order to minimize passenger confusion and maximize service effectiveness.

TRB’s TCRP Report 146: Transit Capacity and Quality of Service Manual, 3rd Edition (TCQSM) provides guidance on transit capacity and quality of service issues and the factors influencing both. The manual provides a framework for measuring transit availability, comfort, and convenience, containing quantitative techniques for calculating the capacity and other operational characteristics of transit, including stops, stations, and terminals (TRB, 2013).
Transit-Supportive Roadway Design

Improving bus travel times and travel time reliability are key considerations for transit, planning, and roadway agencies, as these issues directly impact the cost of providing service, are important for attracting new riders and retaining existing riders, and support sustainable and multi-modal communities. To solidify these roadway strategies may be used to improve transit speed and reliability on urban and suburban streets, helping buses move more quickly and with more consistent travel times. In 2015, TRB defines four main categories of strategies, which are summarized in the diagram below:

1. **Bus operations strategies**: Changes made by the transit agency in the way it provides service, such as relocating bus stops, consolidating bus stops, and changing the way fares are paid.
   - Traffic control strategies: Changes to the way traffic is regulated, for the benefit of transit; examples include changing traffic signal operations to prioritize bus movements and changes to traffic regulations to improve traffic flow and/or reduce bus movements specifically (e.g., prohibiting left turns where no left-turn lane is provided, or exempting buses from right-turn-only requirements).
   - Infrastructure and bus lane strategies: Changes to physical elements of the roadway, such as extending a sidewalk space into the parking lane (curb extensions) or constructing bus lanes.

Though transit-supportive roadway strategies focus on bus mode including bus rapid transit (BRT) and commuter bus service, many of these categories are applicable to demand-responsive transit, streetcars, and portions of light rail transit systems operating on-street. Some of these strategies work best when part of a package of strategies, where multiple strategies are implemented at the same time. Some may be considered as “supportive strategies,” that “do not necessarily provide a bus travel time benefit on their own, but help another strategy achieve its maximum effectiveness” (TRB, 2015). Various transit-supportive roadway strategies are referred to in this manual. See 799, 2015 for further guidance, including key benefits, costs, and issues associated with each strategy.

Bus Stop Design

Bus stop design affects many aspects of the transit system and the built environment, such as ridership, public health, and experience, multi-modal connectivity, and safety. Because riders expect a good deal of the time, energy, and patience outside of buses while waiting or transferring (Taylor, Iseki, Miller, & Smart, 2007), enhanced passenger amenities are greatly valued by passengers (Jenks, 1998). Alternatively, lack of adequate design leads to commuters feeling undervalued and thereby view the waiting experience as an impediment to choosing transit (Nixx, 2012; Wardman, 2001). The following sections will examine several important elements and goals of bus stop design, including spacing, placement, and amenities.

**Design Elements**

Stations and stops play a key role in defining the transit system and the system’s performance. As stated in APTA, 2015, good station or stop design can do the following:

- Attract new riders
- Promote visibility and facilitate branding of the system
- Provide shelter from the weather
- Ensure safe accessibility for all, including people with disabilities
- Provide passengers with information, including system maps and real-time arrival information
- Provide passengers with a safe and secure environment by including such items as fencing, CCTV cameras, a public address system, public and security telephones, lighting and fencing
- Enable passengers to board through multiple doors
- Enable precise berthing at designated stopping points
- Enable passengers to pay their fares before boarding using off-board fare payment equipment
- Provide passengers with amenities such as newspaper boxes, signage, waste recycling, special lighting, waiting and bicycle parking
- Provide passengers with an attractive environment, using features such as landscaping and public art
- Create a sense of place within the community, encouraging development and other activities to occur near the station or stop
- Ensure easier access to users of other modes, including bicyclists, pedestrians and automobile drivers
- Ensure easy connectivity with other local and intercity modes of transportation

Transit stops are nodes of exchange between all users of the street and great stops must negotiate the complex and often conflicting movements of these users. Stops and stations should integrate spatial and temporal strategies to optimize transit streets and simplify rider experience, including signalization, dedicated lanes, and stop location (WACTC, 2016).
Goals
The urban realm and mode choice are strongly linked. Better environments for walking, cycling, and waiting lead to higher active transportation and transit mode shares, as improvements to sidewalks, bus shelters, pedestrian and cycling networks, lighting, and amenities are implemented (NRG Research Group, 2010). Such incremental improvements build off one another and have long-term benefits for transit users and the entire neighborhood (Van Dyck, Deforche, Cardon, & De Bourdeaudhuij, 2009). The effect of the built environment on ridership is often broken down into 5 Ds: density of development, diversity of land uses, design of the environment, destination accessibility, and distance to transit (Tзав & Cervero, 2010). There are seven main goals linked to the built environment that should guide decisions when designing bus stops: safety, thermal comfort, visual comfort, acoustic comfort, wind protection, visual comfort, and integration (Zhang, 2012). See Zhang (2012) for more information on these goals.

Techniques
There are several factors that influence transit user preferences and ridership. Walkability is one factor and walkable environments are often identified as areas that have more pedestrian traffic, environmental and social safety, pleasing aesthetics, natural features, pedestrian amenities, and land use diversity (Brown, Werner, Antrop, & Sisk, 2007). A survey of transit user preferences in Los Angeles (Taylor et al., 2011) found that commuters required the stations to be, in order of importance:

- Easy to get around
- Feel safe during day
- Easy to find
- Walks at night
- Clean
- Sheltered
- Have places to sit
- Have food and washrooms nearby

Another survey of transit riders in Ottawa (Taylor & Fink, 2011) found that factors that influence ridership are, in order of importance:

- Bus information
- On-street service
- Bus stop
- Customer service
- Safety en-route
- Reduced fare
- Cleanliness
- General attitudes towards transit

In identifying which amenities to focus on first, studies have shown that paving, lighting, and vegetation have the most pedestrian-perceived benefit per dollar over their life spans (Fukahori & Kubota, 2003). There are 9 key bus stop design techniques that help achieve the goals outlined in the previous section: lighting, seating, cover, amenities, information, vegetation, traffic management, pedestrian infrastructure, and bicycle infrastructure (Zhang, 2012). See Zhang (2012) for more information on these techniques.
Spacing

The greatest predictor of transit use is proximity (Cervero, 2002; Gutiérrez & García-Palomares, 2009). The closer one lives to a transit stop, the more likely one will take transit (Ulrike, Brennan, Ramiez, Elliott, & boyfriend, 2005). The typical catchment for a bus stop is contained within a 1,200-meter (approximately 3,900-feet) radius around the stop and can be larger for faster forms of transit (Gutiérrez & García-Palomares, 2011).

Stop spacing is determined by several factors including customer convenience, rideability, demand, and service type. Customer convenience involves a trade-off between proximity to stops and travel time. Closer spaced stops reduce customer walking distance but result in slower transit speeds, reducing operating efficiency and cost effectiveness. Though few stops further apart increase walking distance, faster, more reliable service is often the result.

Bus stops serving downtown Austin or major activity centers should be spaced more than 800 feet apart. For reference, the average block size in downtown Austin ranges between 300 and 400 feet, so essentially means a bus stop may occur every other block for local stop services. Regular local stops on arterial streets should be spaced every 800–1,200 feet. In sub-urban and other low-density areas, stops may be spaced over 1,200 feet apart.

Sufficient rideability demand is necessary to support the investment of stops. Specific service types such as limited stop, rapid, and express require increased stop spacing to maintain higher speeds, while radial and crosstown services have frequent stops along with transit stops serving downtown Austin or major activity centers.

Near-side Stop

Near-side stops occur when the bus stops before the intersection. Advantages are that passengers can board and alight closer to intersection crosswalks, which may facilitate better transfers. Near-side stops also eliminate the potential oflighting pedestrians walking through a red light.

Far-side Stop

Far-side stops occur when the bus stops after proceeding through the intersection. These stops are preferred at intersections in which buses make left turns, and intersections with a high volume of right turning vehicles. Far-side stops are also preferred on corridors with transit signal priority (TSP) and encourage pedestrians to cross behind the bus.

Mid-block Stop

Mid-block stops occur when the bus stops in between intersections, usually in a well-defined area. They should be considered when pedestrian crosswalks are present. Pedestrian crossings are not present, Capital Metro will work with appropriate entities to address the potential of installing headstands, like flashing pedestrian beacons, to accommodate this issue. Mid-block stops may be the only option at major intersections with dedicated turn lanes.

Stop Placement & Configuration

 Determining where to locate stops and stations is one of the chief governing factors of effective transit operation. Bus stop placement involves a balance of customer safety, accessibility, comfort, and operational efficiency. Stop access is described based on lateral placement relative to the curb and location along the block relative to the nearest intersection.

There are different configurations for stop access, each with its own opportunities, benefits, challenges, and street context (NACTO, 2016). The three main types of stop configuration most applicable to the Capital Metro system are sidewalk stops: near-side, far-side, and mid-block. Typical dimensions for sidewalk stops are shown in the following tables. Though an additional 20 feet (6.1m) should be provided for articulated buses, plus appropriate transition zones where traffic speeds are higher (TPSP, 2012; TRB Report 19; IT/FRM, 1996) and the Platform Length section of NACTO 2016 provides further information on design considerations for various stop types.

All bus stops should be fully accessible with a concrete landing and access to sidewalk or pathway. Bus stops should optimally be placed at intersections to maximize pedestrian safety, be compatible with adjacent land use, and minimize adverse impacts on the built and natural environment. Far-side stops are generally preferred over near-side and mid-block stops, though specific rideability generators may determine the placement of a bus stop. This section provides general design guidelines for common stop configurations. See SEPTA, 2012; NACTO, 2016; and TRB, 2015 for more detailed guidance on stop placement, recreation, and additional stop configurations.

Bus Stop Design

Spacings

<table>
<thead>
<tr>
<th>Area Type</th>
<th>Bus Stop Configurations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Near-side Stop</td>
<td>Allows passengers to board and alight closer to intersection crosswalks, which may facilitate better transfers. Near-side stops also eliminate the potential oflighting pedestrians walking through a red light.</td>
</tr>
<tr>
<td>Far-side Stop</td>
<td>This stop type is used when the bus stops after proceeding through the intersection. These stops are preferred at intersections in which buses make left turns, and intersections with a high volume of right turning vehicles. Far-side stops are also preferred on corridors with transit signal priority (TSP) and encourage pedestrians to cross behind the bus.</td>
</tr>
<tr>
<td>Mid-block Stop</td>
<td>This stop type is used when the bus stops in between intersections, usually in a well-defined area. They should be considered when pedestrian crosswalks are present. Pedestrian crossings are not present, Capital Metro will work with appropriate entities to address the potential of installing headstands, like flashing pedestrian beacons, to accommodate this issue. Mid-block stops may be the only option at major intersections with dedicated turn lanes.</td>
</tr>
</tbody>
</table>
**Bus Stop Design**

The bus bay or turnout is a location off-line with respect to the travel lanes, with a special curbed pull-out for buses. For lay-bys or inter-modal transfer points, buses may dwell for extended periods, the bus bay maintains traffic flow, allowing general traffic to pass around a loading bus and interferes less with right-turning vehicles at the intersection. It can be effectively incorporated into a site design where high-volume loading is anticipated, such as an apartment complex. Typical dimensions are 110 feet (33.5m) long by 10 feet (3.0m) wide (SEPTA, 2012).

![Near-side Bus Bay Example (source: DVRPC, 2012)](image)

**Far-side Bus turnout on City Avenue (source: SEPTA, 2012)**

**Near-side Bus Bay Example (source: DVRPC, 2012)**

**Far-side In-lane Stop with Shared Bus-Bicycle Lane (NACTO, 2016)**

The bus zone is generally located in a parking and/or loading lane area in the road, with a typical width of 10 feet. The parking lane should be marked in order to identify the loading and maneuvering area for transit vehicles and the bus zone treatment should include painted roadway markings and a sign marking the area as a “no stopping” or “no parking” location (NACTO, 2016). Queue jumps and pre-signals can be used to create a “virtual bus lane” when a physical curbed bus lane needs to end due to downstream constraints on the use of the curb space (TRB, 2010).

Further design considerations for curbside stops include the following:

- **Stop zone must be 10 feet clear of the crosswalk or curb return whether near- or far-side.**
- **Stop length must equal the length of the bus, and curbside boarding area should pass a stopped bus** (NACTO, 2016). Queue jumps and pre-signals can be used to create a “virtual bus lane” when a physical curbed bus lane needs to end due to downstream constraints on the use of the curb space (TRB, 2010).

A key constraint is the potentially large number of competing users that also have a stake in the curb space in use, including bus stops, right-turning traffic, deliveries, passenger pick-up and drop-off, parking, deliveries, taxi stands, bicycles, service and maintenance vehicles, and users as a temporary sidewalks when an adjacent building is under construction (AASHTO, 2014). Though some of these competing users may be accommodated in other locations, such as the opposite side of the street, or on side streets, or off the street, enforcement is an important consideration due to unauthorized use of the space by competing users, particularly when the lanes converting to parking during off-peak hours (TRB, 2011).

In constrained conditions where the width of the transit lane prevents dedicated bicycle and transit facilities from being provided separately (13 feet or less), place advisory bicycle lanes on the left of the bus stop and place the concrete passing pad to either side of the advisory lane, as seems and racks pose a hazard to bicycle wheels. Shared-lane markings should be positioned to the left side of the bus-bicycle lane (WACO, 2016).

In-lane curbside stops often occur along curbside running ways in either dedicated transit lanes, or in mixed traffic streets with low to moderate transit frequency and speeds of 30 mph or lower. Curbside stops allow passengers to board and alight directly from the sidewalk and are typically the lowest-cost treatment, requiring only signage and an ADA boarding area to receive transit passengers on the existing curb. Buses save time and reduce wear, while improving pedestrian space, where pull-out bus bays for lay-bys can be filled in to create in-lane curbside stops (WACO, 2016).

For walk-in Lane Stop with Shared Bus Bicycle Lane (NACTO, 2016)

![Far-side In-lane Stop with Shared Bus-Bicycle Lane (NACTO, 2016)](image)
Curb Extension

A curb extension is a bus bulb modified for Capital Metro’s fleet, as appropriate.

The table below illustrates bus bay dimensions for various vehicle/door configurations cited by the Delaware Valley Regional Planning Commission’s (DVRPC) which can be modified for Capital Metro’s fleet, as appropriate.

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Length (in)</th>
<th>Door Lanes</th>
<th>Bay Length (in)</th>
<th>Bus Length (ft)</th>
<th>On-street parking distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>All vehicle types: front doors only (min. length)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>12</td>
<td>4</td>
<td>12</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>C</td>
<td>16</td>
<td>4</td>
<td>16</td>
<td>4</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Further considerations for installing curb extensions include:

- **Ease of access:** Provide a wheel-friendly bus bulb, which can be modified for Capital Metro’s fleet, as appropriate.

| Other types of bus bulbs include tiered and level boarding stops, which are discussed further in NACTO. 2015. Bicycle lanes behind floating boarding buses can be at either street grade or sidewalk grade. TRB, 2015 discusses additional standards for designing curb extensions, including the use of a traffic analysis and Transit and Capacity of Street (TACIS) model to determine typical level at queuing and vehicle travel time savings and delay expected as a result of buses stopping a stop with a curb extension. The table below illustrates bus bay dimensions for various vehicle/door configurations cited by the Delaware Valley Regional Planning Commission’s (DVRPC) which can be modified for Capital Metro’s fleet, as appropriate.

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Length (in)</th>
<th>Door Lanes</th>
<th>Bay Length (in)</th>
<th>Bus Length (ft)</th>
<th>On-street parking distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>All vehicle types: front doors only (min. length)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>12</td>
<td>4</td>
<td>12</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>C</td>
<td>16</td>
<td>4</td>
<td>16</td>
<td>4</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Further considerations for installing curb extensions include:

- **Ease of access:** Provide a wheel-friendly bus bulb, which can be modified for Capital Metro’s fleet, as appropriate.

| Other types of bus bulbs include tiered and level boarding stops, which are discussed further in NACTO. 2015. Bicycle lanes behind floating boarding buses can be at either street grade or sidewalk grade. TRB, 2015 discusses additional standards for designing curb extensions, including the use of a traffic analysis and Transit and Capacity of Street (TACIS) model to determine typical level at queuing and vehicle travel time savings and delay expected as a result of buses stopping a stop with a curb extension. The table below illustrates bus bay dimensions for various vehicle/door configurations cited by the Delaware Valley Regional Planning Commission’s (DVRPC) which can be modified for Capital Metro’s fleet, as appropriate.

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Length (in)</th>
<th>Door Lanes</th>
<th>Bay Length (in)</th>
<th>Bus Length (ft)</th>
<th>On-street parking distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>All vehicle types: front doors only (min. length)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>12</td>
<td>4</td>
<td>12</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>C</td>
<td>16</td>
<td>4</td>
<td>16</td>
<td>4</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Further considerations for installing curb extensions include:

- **Ease of access:** Provide a wheel-friendly bus bulb, which can be modified for Capital Metro’s fleet, as appropriate.

| Other types of bus bulbs include tiered and level boarding stops, which are discussed further in NACTO. 2015. Bicycle lanes behind floating boarding buses can be at either street grade or sidewalk grade. TRB, 2015 discusses additional standards for designing curb extensions, including the use of a traffic analysis and Transit and Capacity of Street (TACIS) model to determine typical level at queuing and vehicle travel time savings and delay expected as a result of buses stopping a stop with a curb extension. The table below illustrates bus bay dimensions for various vehicle/door configurations cited by the Delaware Valley Regional Planning Commission’s (DVRPC) which can be modified for Capital Metro’s fleet, as appropriate.

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Length (in)</th>
<th>Door Lanes</th>
<th>Bay Length (in)</th>
<th>Bus Length (ft)</th>
<th>On-street parking distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>All vehicle types: front doors only (min. length)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>12</td>
<td>4</td>
<td>12</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>C</td>
<td>16</td>
<td>4</td>
<td>16</td>
<td>4</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Further considerations for installing curb extensions include:

- **Ease of access:** Provide a wheel-friendly bus bulb, which can be modified for Capital Metro’s fleet, as appropriate.

| Other types of bus bulbs include tiered and level boarding stops, which are discussed further in NACTO. 2015. Bicycle lanes behind floating boarding buses can be at either street grade or sidewalk grade. TRB, 2015 discusses additional standards for designing curb extensions, including the use of a traffic analysis and Transit and Capacity of Street (TACIS) model to determine typical level at queuing and vehicle travel time savings and delay expected as a result of buses stopping a stop with a curb extension. The table below illustrates bus bay dimensions for various vehicle/door configurations cited by the Delaware Valley Regional Planning Commission’s (DVRPC) which can be modified for Capital Metro’s fleet, as appropriate.

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Length (in)</th>
<th>Door Lanes</th>
<th>Bay Length (in)</th>
<th>Bus Length (ft)</th>
<th>On-street parking distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>All vehicle types: front doors only (min. length)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>12</td>
<td>4</td>
<td>12</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>C</td>
<td>16</td>
<td>4</td>
<td>16</td>
<td>4</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Further considerations for installing curb extensions include:

- **Ease of access:** Provide a wheel-friendly bus bulb, which can be modified for Capital Metro’s fleet, as appropriate.

| Other types of bus bulbs include tiered and level boarding stops, which are discussed further in NACTO. 2015. Bicycle lanes behind floating boarding buses can be at either street grade or sidewalk grade. TRB, 2015 discusses additional standards for designing curb extensions, including the use of a traffic analysis and Transit and Capacity of Street (TACIS) model to determine typical level at queuing and vehicle travel time savings and delay expected as a result of buses stopping a stop with a curb extension. The table below illustrates bus bay dimensions for various vehicle/door configurations cited by the Delaware Valley Regional Planning Commission’s (DVRPC) which can be modified for Capital Metro’s fleet, as appropriate.

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Length (in)</th>
<th>Door Lanes</th>
<th>Bay Length (in)</th>
<th>Bus Length (ft)</th>
<th>On-street parking distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>All vehicle types: front doors only (min. length)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>12</td>
<td>4</td>
<td>12</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>C</td>
<td>16</td>
<td>4</td>
<td>16</td>
<td>4</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Further considerations for installing curb extensions include:

- **Ease of access:** Provide a wheel-friendly bus bulb, which can be modified for Capital Metro’s fleet, as appropriate.

| Other types of bus bulbs include tiered and level boarding stops, which are discussed further in NACTO. 2015. Bicycle lanes behind floating boarding buses can be at either street grade or sidewalk grade. TRB, 2015 discusses additional standards for designing curb extensions, including the use of a traffic analysis and Transit and Capacity of Street (TACIS) model to determine typical level at queuing and vehicle travel time savings and delay expected as a result of buses stopping a stop with a curb extension. The table below illustrates bus bay dimensions for various vehicle/door configurations cited by the Delaware Valley Regional Planning Commission’s (DVRPC) which can be modified for Capital Metro’s fleet, as appropriate.

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Length (in)</th>
<th>Door Lanes</th>
<th>Bay Length (in)</th>
<th>Bus Length (ft)</th>
<th>On-street parking distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>All vehicle types: front doors only (min. length)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>12</td>
<td>4</td>
<td>12</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>C</td>
<td>16</td>
<td>4</td>
<td>16</td>
<td>4</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Further considerations for installing curb extensions include:

- **Ease of access:** Provide a wheel-friendly bus bulb, which can be modified for Capital Metro’s fleet, as appropriate.

| Other types of bus bulbs include tiered and level boarding stops, which are discussed further in NACTO. 2015. Bicycle lanes behind floating boarding buses can be at either street grade or sidewalk grade. TRB, 2015 discusses additional standards for designing curb extensions, including the use of a traffic analysis and Transit and Capacity of Street (TACIS) model to determine typical level at queuing and vehicle travel time savings and delay expected as a result of buses stopping a stop with a curb extension. The table below illustrates bus bay dimensions for various vehicle/door configurations cited by the Delaware Valley Regional Planning Commission’s (DVRPC) which can be modified for Capital Metro’s fleet, as appropriate.

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Length (in)</th>
<th>Door Lanes</th>
<th>Bay Length (in)</th>
<th>Bus Length (ft)</th>
<th>On-street parking distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>All vehicle types: front doors only (min. length)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>12</td>
<td>4</td>
<td>12</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>C</td>
<td>16</td>
<td>4</td>
<td>16</td>
<td>4</td>
<td>1.5</td>
</tr>
</tbody>
</table>
Boarding islands support bus-only signal phases, queue jumps, and most forms of bus lanes (TRB, 2015). It is important to provide a safe and accessible route connecting to a pedestrian crosswalk leading away from the island, in the form of connected facilities (left turn stops or approach area) without curb cuts or to the sidewalk. Platforms must be either level or near-level boarding and provide a safe and accessible route connecting to a pedestrian crosswalk leading away from the island, in the form of connected facilities (left turn stops or approach area) without curb cuts or to the sidewalk. Platforms may require nine-foot moving lane or other track or lane realignment to bring vehicles close to the platform.

Consider potential sight distance issues created by a bus shelter or stopped buses when placing stops on right turn channelization islands.

Side boarding islands are dedicated boarding areas that are separated from the sidewalk by a bicycle lane, mitigating conflicts between transit vehicles and bicycles at stops. Similar to bus bays, side boarding islands streamline transit service, improve accessibility by enabling in-lane stops with near or level boarding, and reduce transit vehicle dwell times, particularly on busy streets, where in-lane stops may reduce stop delay between five and 20 seconds per location. Boarding islands eliminate bus “leapfrogging” conflict at stops, as both buses and bicycles can move straight at the stop, or their own dedicated space. These stops provide more space for transit passengers and amenities and operators are able to deploy a ramp or bridge plate, as needed, onto the island without disrupting pedestrian flow (NACTO, 2016). The most applicable locations for side boarding islands are streets “with moderate to high transit frequency, transit ridership, pedestrian or bicycling volume, which can use boarding islands to maintain in-lane stops and provide more separation for users” (NACTO, 2016). Design considerations for side boarding islands include:

- An accessible boarding area, typically eight feet wide by five feet long, must be provided to permit boarding maneuvers by a person using a wheelchair (ADA Std. 810.2.2) (see page 67). For low-floor vehicles using bridge plates, near-level boarding can usually be achieved with a 0.5- to 1.0-inch platform. Higher (1-inch) platforms are possible when there is no slope or step that could be designed for level boarding, and may be incompatible with some buses.
- When a bicycle lane or cycle track requires bicyclists to yield at a crosswalk from the sidewalk onto the island, the BICYCLES YIELD TO PEDESTRIANS sign (the Manual for Uniform Traffic Control Devices (MUTCD R9-6) and yield triangle markings must be installed.
- Bicycle signals can enhance clarity of intersection movements and should be considered for far-side and near-side boarding islands to provide a dedicated bicycle and pedestrian through phase.
- H designs should consider near-side moving lane or other track or lane realignment in cases with right-side mixed-traffic operations.
- Platform access ramp may have a maximum slope of 1:12 at a crosswalk or other crossing point, at the sidewalk and onto the platform (ADA Std. 805.2.2.2).
- Reflective signage or other visible raised elements at the intersection and on the leading corner (back left corner) of the intersection must be presented by left-turn movements. The following diagrams illustrate three potential applications for boarding islands located at intersections:

Design considerations for in-street boarding islands include:

- Stops for rail vehicles may require a nine-foot moving lane next to the island, or other track or lane nudging to bring vehicles close to the platform.
- An accessible boarding area, typically eight feet wide by five feet long, must be provided to permit boarding maneuvers by a person using a wheelchair (ADA Std. 810.2.2) (see page 67). Generally requiring islands to be at minimum eight feet wide with railings along the rear side will require an extra foot of space, making the total width nine feet.
- Center island platforms must be either level or near-level boarding and provide the minimum required ADA clear area for each bus loading area.
Amenities

Transit stop amenities improve customer comfort, convenience, and safety. They also have the potential to increase ridership and promote system-wide equity. Stop features that provide added convenience and comfort to the trip and passenger-experience include benches, shelters, signage and system information, trash receptacles, public art, bicycle racks and lighting. Collectively, passenger amenities help enhance the visibility of transit in a corridor. Risk-based awareness of transit as a mobility option, may reflect a visual identity treatment for a locality, and are viewed as a community asset (SEPTA, 2012).

As stated by NACTO, incorporating high-quality transit stop design and amenities “can expand pedestrian capacity and promote transit streets as a desirable “place” in the urban environment. Creating a simple, legible, and pleasant experience at the transit stop grows the capacity of the whole system, and can help transform transit from a basic coverage service to a sought after mobility option” (NACTO, 2016).

The location of passenger amenities should not interfere with normal passenger flow. When considering and placing amenities, it is important to take into account adjacent land-uses, programming, non-commuters who may use these items, and microclimatic conditions of the site (Zhang, 2012).

Capital Metro's service guidelines detail specific requirements that must be met for the provision of certain amenities, such as bus shelters, benches and litter containers. For example, bus stops generating at least 15 boardings per weekday qualify for a bench. Bus stops generating 50 daily boardings qualify for a shelter (though some exceptions exist). All bus stops with shelters or benches should also have a litter container, and bicycle racks may be installed at stops in areas of high demand or in concert with other local entities.

MetroRapid transit station amenities include:
- Cantilever transit shelter with MetroRapid branding
- Real time arrival display
- Aluminum seating and lean bars
- MetroRapid specific route maps for routes departing from station

Level of Service (LOS) classifications, determined in direct relation to P&R lot capacity, are used by Capital Metro to generate rough order-of-cost estimates for future P&R facilities and specify the types of amenities that should be incorporated into transit facilities to meet safety, security, comfort, and convenience needs. The table below illustrates the stop amenities that are provided for P&R facilities meeting a certain LOS rating. Capital Metro’s service guidelines provide further information.

The visual quality of public transit systems has a profound impact on transit riders, the community at large, and the image of a city, with implications for a city’s livability and economy. Capital Metro strives to integrate public art into its transit facilities, redevelopment projects, and vehicles. “High-quality public art and design improve the appearance and safety of a facility, add esthetics to public spaces, and make passengers feel welcome, often resulting in higher usage of the facility” (APTA, 2013). Other benefits of incorporating art in transit include:
- Encouraging ridership
- Improving perception of transit
- Conveying customer care
- Enhancing community livability
- Improving customer experience
- Improving organizational identity
- Decreasing vandalism
- Increasing safety and security
devices, such as efficient lamps, solar power, and daylight sensing equipment, should be used. (SEPTA, 2012) Bus stop signage should be illuminated and bus stop fixtures or nearby street lights can provide additional lighting.

Lighting

The bus stop area should contain lighting that enhances safety by improving driver and child passenger visibility. In addition to providing a sense of security and defining the waiting area, areas around stops should be kept adequately lit at night and during certain times of the day. Pedestrian scale lighting, typically includes lamps less than 25 feet high. It is important for creating a safe and comfortable environment for the commuter and is more likely to integrate into the surroundings than standard street lights. Pedestrian scale lighting is characterized by lights that are:

- Lower, smaller, less intense, spaced closer together throughout the stop, and usually more visually interesting. Such lighting should be spaced at 10 feet (approximately 3 meters) intervals for maximum pedestrian benefit to cost ratio and may be integrated with the bus stop sign (SEPTA, 2012).

Shelters

Shelters protect passengers from weather conditions while waiting and should be constructed of durable, architecturally sound materials to withstand heavy use and continuous exposure to the elements. They should be oriented to protect against exposure to wind and rain, and be highly visible areas to deter theft (Tan et al., 2007). If viable, seating should be seamlessly integrated with the shelter design, though flexible and context-sensitive design may be allowed in certain circumstances (e.g., Mi Jardin Plaza and 38th St/Medical Station).

All information provided on the sign is designed to be ADA compliant and most sign materials are made with durable, weather-resistant material to withstand continual exposure to the elements. They should be oriented to protect against exposure to wind and rain, and be highly visible areas to deter theft (Tan et al., 2007). If viable, seating should be seamlessly integrated with the shelter design, though flexible and context-sensitive design may be allowed in certain circumstances (e.g., Mi Jardin Plaza and 38th St/Medical Station).

Seating

Stops should have a variety of seating options, where possible, including benches, leisure seating, or low seating such as stools. The amount of seating should be determined by the number of commuters simultaneously occupying the stop, given that it does not impede pedestrian thorough-paths and should be oriented toward the point of origin or destination secure. It is important to provide bicycle racks and parking shelters to meet the needs of commuters who use bicycles to access transit. Bicycle parking should be placed in well-lit and highly visible areas to deter theft (SEPTA, 2012). Capital Metro provides secure bicycle shelters at several of its PMR facilities and rail stations, which include space for its bicyclists, have gated entry access via key card, and include camera surveillance, maintenance repair stands and air pumps.

Shelters should be constructed of durable, architecturally sound materials to withstand heavy use and continuous exposure to the elements. They should be oriented to protect against exposure to wind and rain, and be highly visible areas to deter theft (Tan et al., 2007). If viable, seating should be seamlessly integrated with the shelter design, though flexible and context-sensitive design may be allowed in certain circumstances (e.g., Mi Jardin Plaza and 38th St/Medical Station).
Provide area maps at all stations. 

Wayfinding is the science of navigation in public spaces. Transit stops serve as a gateway to the neighborhood and should be recognizable landmarks that enhance rider experience, which includes decision-making and transit access. Easy-to-navigate wayfinding signage makes it easier to locate bus stops and connecting routes, particularly where stops for opposing travel directions are not located immediately nearby one another (NACTO, 2016). Maps, schedule and route details, real-time arrival information, directional signage to key destinations, and relevant station names are all components of high-quality station facilities that enhance wayfinding and increase ridership. The Metropolitan Transportation Commission (MTC) has developed comprehensive wayfinding guidelines and standards, which illustrate wayfinding best practices (MTC, 2012).

The following guidelines are recommended for effective wayfinding (NACTO, 2016):

- Locate wayfinding in predictable locations, such as on overhead or eye-level, place at regular intervals, and disclose necessary information at decision points.
- Include relevant transportation connections and services, such as regional routes and bike share stations, to expand rider options.
- To direct riders to and from stations to destinations in the station area, indicate travel direction and times in easily understood units, such as walking time.
- Provide area maps at all stations.
- Wayfinding should include clear, simple guidance to nearest street intersections, landmarks, and points of interest.

Wayfinding signage can also be provided to direct vehicles to permitted turns or recommended diversion paths and should be consistent with regional or agency brand; using consistent logos, colors, and fonts to reinforce visibility. For stops in less densely populated areas, wayfinding signs directing the commuter towards the stop should be labeled and include the remaining distance to the stop, so it is helpful to seniors who may plan their stop choice based on the walking time required (Hess, 2012).
Information Technology

Information plays an important role in the performance of a bus stop and schedule information will likely be greatest where it is clear and visible (Finnan et al., 2001). A variety of media ensure that information is accessible to everyone and tactile wayfinding and audible information should be utilized where possible. Arrival information is best suited for digital display, while transit maps are best presented in print format, especially for those without smart devices. Urban, pedestrian, cycling, and green infrastructure maps for the specific neighborhood increase the sense of ownership of a public space and may be included where possible (McKenna & Kornreich, 2011).

An updating static information like flags, system maps, and placards require enormous time and financial resources for a transit agency. Digital information technology allows for wayfinding information to be presented to transit users in a quick, up-to-date, and easy-to-understand format that is also a cost-effective investment for the agency. In order to be successful, it is important that wayfinding technology balances the provision of detailed information for transit users and cognitive load, which refers to the intellectual pressure placed on a person during decision-making situations. Wayfinding should provide the transit user with the minimum amount of information needed to find their way at the right time and place.

ConnectPoint® interactive kiosks used by Dallas Area Rapid Transit’s (DART) provide interactive wayfinding messages, information, and maps in an easy to read and understand manner. As stated by DART, these kiosks integrate with transit and local systems, scheduling systems, and other DART information systems to provide comprehensive information to customers. Touchscreen technology allows for intuitive interaction with the information to explore transit options and to create specific routes, including an overview of entire routes, real-time departure times as well as detailed bus, train, and bike maps for each stop. The planning tools include detailed travel directions for public transportation, cars, bicycling, and walking, and information and simulations are also included for easy transfer to a mobile device. The kiosk also has the ability to push out route deviations as they happen, generate revenue via location-based advertising and leverages smartphone applications, and smartpens.

For those with disabilities (including visual impairment), there are several wayfinding strategies. As updating static information like flags, system maps, and placards require enormous time and financial resources for a transit agency. Digital information technology allows for wayfinding information to be presented to transit users in a quick, up-to-date, and easy-to-understand format that is also a cost-effective investment for the agency. In order to be successful, it is important that wayfinding technology balances the provision of detailed information for transit users and cognitive load, which refers to the intellectual pressure placed on a person during decision-making situations. Wayfinding should provide the transit user with the minimum amount of information needed to find their way at the right time and place.

ConnectPoint® interactive kiosks used by Dallas Area Rapid Transit’s (DART) provide interactive wayfinding messages, information, and maps in an easy to read and understand manner. As stated by DART, these kiosks integrate with transit and local systems, scheduling systems, and other DART information systems to provide comprehensive information to customers. Touchscreen technology allows for intuitive interaction with the information to explore transit options and to create specific routes, including an overview of entire routes, real-time departure times as well as detailed bus, train, and bike maps for each stop. The planning tools include detailed travel directions for public transportation, cars, bicycling, and walking, and information and simulations are also included for easy transfer to a mobile device. The kiosk also has the ability to push out route deviations as they happen, generate revenue via location-based advertising and leverages smartphone applications, and smartpens.

For those with disabilities (including visual impairment), there are several wayfinding strategies. As updating static information like flags, system maps, and placards require enormous time and financial resources for a transit agency. Digital information technology allows for wayfinding information to be presented to transit users in a quick, up-to-date, and easy-to-understand format that is also a cost-effective investment for the agency. In order to be successful, it is important that wayfinding technology balances the provision of detailed information for transit users and cognitive load, which refers to the intellectual pressure placed on a person during decision-making situations. Wayfinding should provide the transit user with the minimum amount of information needed to find their way at the right time and place.

ConnectPoint® interactive kiosks used by Dallas Area Rapid Transit’s (DART) provide interactive wayfinding messages, information, and maps in an easy to read and understand manner. As stated by DART, these kiosks integrate with transit and local systems, scheduling systems, and other DART information systems to provide comprehensive information to customers. Touchscreen technology allows for intuitive interaction with the information to explore transit options and to create specific routes, including an overview of entire routes, real-time departure times as well as detailed bus, train, and bike maps for each stop. The planning tools include detailed travel directions for public transportation, cars, bicycling, and walking, and information and simulations are also included for easy transfer to a mobile device. The kiosk also has the ability to push out route deviations as they happen, generate revenue via location-based advertising and leverages smartphone applications, and smartpens.

For those with disabilities (including visual impairment), there are several wayfinding strategies. As updating static information like flags, system maps, and placards require enormous time and financial resources for a transit agency. Digital information technology allows for wayfinding information to be presented to transit users in a quick, up-to-date, and easy-to-understand format that is also a cost-effective investment for the agency. In order to be successful, it is important that wayfinding technology balances the provision of detailed information for transit users and cognitive load, which refers to the intellectual pressure placed on a person during decision-making situations. Wayfinding should provide the transit user with the minimum amount of information needed to find their way at the right time and place.

ConnectPoint® interactive kiosks used by Dallas Area Rapid Transit’s (DART) provide
Passenger Queue Management

High-speed boarding procedures can make the boarding process more efficient, reducing the major delay on high-volume transit routes that occurs where large numbers of passengers board and alight in a constrained space, especially curbside bus and BRT stop, which speeds boarding times. Mobile technology for fare and payment purchases can significantly reduce the need for on-board fare payment or ticket vending, as electronic tokens can be purchased via smart phone and presented to the driver or fare control officers upon request. Smart payment systems can be integrated across transit types and agencies, or with bicycle share. Integrated fare payment compensates for payment between transit systems, especially for passengers who must frequently transfer between systems (NACTO, 2016). Further streamlining strategies for bus boarding and fare can be found in NACTO, 2017.

Design Elements

Streets that are well-integrated with transit are active streets, providing safe, low- stress, pleasant spaces along transit corridors, including comfortable sidewalks and bike lanes, and orderly motor traffic moving at safe speeds. They are designed as a one-way street in less space than other modes of transportation, creating nodes of activity around stations and along routes. These “transit streets” are designed to prioritize transit at every scale and support future growth, drastically improving transit travel time, reliability and capacity in addition to generally providing a better, safer experience for pedestrians and bicyclists (FHWA, 2016).

Transit streets that are designed as linear public spaces with bicycle and pedestrian facilities, mixed land uses, and a transit stop amenities can enhance ridership. In addition to its ability to support healthy urbanism, it is clear that dedicated infrastructure was found to be most strongly correlated with transit use, frequency, accessibility, and route frequency reductions. The transit street also means intuitive travel pathways with frequent crossings and shifting vehicular priority from cars to transit, which creates a unique space for pedestrians, places, sidewalks, bicycles, and transit (NACTO, 2016).

Further strategies for designing high-quality transit streets include providing dedicated lanes using bus exclusively or shared transit-only lanes at high-speed streets (FHWA, 2016); installing bike lanes, creating bike-share networks, and coordinating signals. Investments in transit-supportive infrastructure attract new riders, reveal demand for better transit service, and demonstrate the value of dedicating space to transit through new-term projects to support long-term plans. Research from around the world shows that rededicating lanes to transit use has a strong safety impact, reducing crashes by 12-15 percent for exclusive transit lanes and more than 15 percent for other transit priority designs (MW Rhode Center, 2015).

Design Flexibility

It is important for the designer to be flexible in selecting design or form for transit streets that are based on a context-sensitive understanding of the needs of the local context and function of the roadway. Flexible design allows for the consideration of multiple types of users and their unique mobility concerns, improving first-last mile connectivity to transit stops and stations and reducing conflicts between different modes of travel for maximum benefits among modes, enable a comfortable trip from beginning to end, and encourage higher levels of walking and bicycling for all ages and abilities. Disconnected street networks, highways or rapid transit, high- or low-cost urban environments, and difficult mid-block crossings must be addressed to allow pedestrians and bicyclists to access transit stations and stops, mixed-use developments, commercial districts, residential areas, employment centers, and other destinations, particularly those located in close proximity that make short trips (FHWA, 2016).

To reduce conflicts, pedestrian and bicycle networks should be safe, accommodating, comfortable, coherent, predictable, context sensitive, and allow for innovation. Pedestrian and bicycle facilities should be appropriate to the surrounding environment; allow travel on predictable, defined facilities that are delineated and connected; and allow for innovative solutions to connect transit networks, particularly at crossing locations where conflicts are more likely and on higher-speed streets (FHWA, 2016).
For transit stations, modal conflicts differ depending on station size and transit services provided. Pedestrians and bicyclists may conflict with buses at access points to analyze bus bays or along on-street bus stops. Where passenger car parking garages or lots are provided, car/bike and car/pedestrian conflicts are typical. On station sites and at approaches, conflicts between pedestrians and bicyclists can occur because these users frequently share the same facilities, including sidewalks, pathways, and crosswalks (FHWA, 2016). To address potential conflict areas through station design, retrofits, and pedestrian and bicyclist transits and catchment zones in the station’s service area should be identified. Desire lines and travel lanes to and from each catchment zone can be evaluated for safety, comfort, and convenience (FHWA, 2016).

In order to mitigate these conflicts, improve user safety, and increase multi-modal transit access, the following principles should be adopted: "pedestrians and bicyclists seek the most direct route possible. Bicycle parking options should be secure and convenient, and infrastructure improvements should address on-site, off-site, and approachability through agency and inter-jurisdictional coordination. Conflicts between vulnerable road users, personal vehicles, and transit buses should be reduced through the separation of modes and on and around transit stations." (FHWA, 2016). Access to and from the station should be provided along a clear path of travel for each mode. "The station and its surroundings should support community health, economic, and livability goals (FHWA, 2016). An bicycling networks are an important first- and last-mile connection for many station visitors. Stations should provide sufficient parking to accommodate both short- and long-term needs by:"

- Providing a variety of parking options, such as high-quality access-controlled parking areas, demand-based pricing, and enclosed bicycle racks.
- Locating bicycle parking along or easily visible from the bicycle access routes leading to the station entrance.
- Distributing bicycle parking equipment on the station site to conveniently serve all modes.
- Aligning grade-separated crossing structures with pedestrian and bicycle desire lines where management of all grade crossings is feasible.
- Enhancing pedestrian crossings such as raised crosswalks, mitigation of poor sight lines, and provision of slip lanes and crossing islands to accommodate bus turning movements.
- Providing bicycle and pedestrian accommodations and wayfinding across station surface parking areas and sidewalks from accessible parking and loading to accessible station entrances are as direct as possible.
- Providing designated crossing areas at bus loading, pick-up and drop-off areas, and motor vehicle access approaches.
- Aligning grade-separated crossing structures with pedestrian and bicycle desire lines where management of all grade crossings is feasible.
- Tightening curb radii to reduce vehicle turning speeds or provide slip lanes and crossing islands to accommodate bus turning movements.
- Providing bicycle and pedestrian accommodations and wayfinding across station surface parking areas and sidewalks from accessible parking and loading to accessible station entrances are as direct as possible.
- Providing designated crossing areas at bus loading, pick-up and drop-off areas, and motor vehicle access approaches.
- Aligning grade-separated crossing structures with pedestrian and bicycle desire lines where management of all grade crossings is feasible.
- Tightening curb radii to reduce vehicle turning speeds or provide slip lanes and crossing islands to accommodate bus turning movements.
- Providing bicycle and pedestrian accommodations and wayfinding across station surface parking areas and sidewalks from accessible parking and loading to accessible station entrances are as direct as possible.
- Providing designated crossing areas at bus loading, pick-up and drop-off areas, and motor vehicle access approaches.
- Aligning grade-separated crossing structures with pedestrian and bicycle desire lines where management of all grade crossings is feasible.
- Tightening curb radii to reduce vehicle turning speeds or provide slip lanes and crossing islands to accommodate bus turning movements.
- Providing bicycle and pedestrian accommodations and wayfinding across station surface parking areas and sidewalks from accessible parking and loading to accessible station entrances are as direct as possible.
- Providing designated crossing areas at bus loading, pick-up and drop-off areas, and motor vehicle access approaches.
- Aligning grade-separated crossing structures with pedestrian and bicycle desire lines where management of all grade crossings is feasible.
- Tightening curb radii to reduce vehicle turning speeds or provide slip lanes and crossing islands to accommodate bus turning movements.
- Providing bicycle and pedestrian accommodations and wayfinding across station surface parking areas and sidewalks from accessible parking and loading to accessible station entrances are as direct as possible.
- Providing designated crossing areas at bus loading, pick-up and drop-off areas, and motor vehicle access approaches.
- Aligning grade-separated crossing structures with pedestrian and bicycle desire lines where management of all grade crossings is feasible.
- Tightening curb radii to reduce vehicle turning speeds or provide slip lanes and crossing islands to accommodate bus turning movements.
- Providing bicycle and pedestrian accommodations and wayfinding across station surface parking areas and sidewalks from accessible parking and loading to accessible station entrances are as direct as possible.
- Providing designated crossing areas at bus loading, pick-up and drop-off areas, and motor vehicle access approaches.
- Aligning grade-separated crossing structures with pedestrian and bicycle desire lines where management of all grade crossings is feasible.
- Tightening curb radii to reduce vehicle turning speeds or provide slip lanes and crossing islands to accommodate bus turning movements.
- Providing bicycle and pedestrian accommodations and wayfinding across station surface parking areas and sidewalks from accessible parking and loading to accessible station entrances are as direct as possible.
- Providing designated crossing areas at bus loading, pick-up and drop-off areas, and motor vehicle access approaches.
- Aligning grade-separated crossing structures with pedestrian and bicycle desire lines where management of all grade crossings is feasible.
- Tightening curb radii to reduce vehicle turning speeds or provide slip lanes and crossing islands to accommodate bus turning movements.
- Providing bicycle and pedestrian accommodations and wayfinding across station surface parking areas and sidewalks from accessible parking and loading to accessible station entrances are as direct as possible.
- Providing designated crossing areas at bus loading, pick-up and drop-off areas, and motor vehicle access approaches.
- Aligning grade-separated crossing structures with pedestrian and bicycle desire lines where management of all grade crossings is feasible.
- Tightening curb radii to reduce vehicle turning speeds or provide slip lanes and crossing islands to accommodate bus turning movements.
- Providing bicycle and pedestrian accommodations and wayfinding across station surface parking areas and sidewalks from accessible parking and loading to accessible station entrances are as direct as possible.
- Providing designated crossing areas at bus loading, pick-up and drop-off areas, and motor vehicle access approaches.
- Aligning grade-separated crossing structures with pedestrian and bicycle desire lines where management of all grade crossings is feasible.
- Tightening curb radii to reduce vehicle turning speeds or provide slip lanes and crossing islands to accommodate bus turning movements.
- Providing bicycle and pedestrian accommodations and wayfinding across station surface parking areas and sidewalks from accessible parking and loading to accessible station entrances are as direct as possible.
- Providing designated crossing areas at bus loading, pick-up and drop-off areas, and motor vehicle access approaches.
- Aligning grade-separated crossing structures with pedestrian and bicycle desire lines where management of all grade crossings is feasible.
- Tightening curb radii to reduce vehicle turning speeds or provide slip lanes and crossing islands to accommodate bus turning movements.
- Providing bicycle and pedestrian accommodations and wayfinding across station surface parking areas and sidewalks from accessible parking and loading to accessible station entrances are as direct as possible.
- Providing designated crossing areas at bus loading, pick-up and drop-off areas, and motor vehicle access approaches.
- Aligning grade-separated crossing structures with pedestrian and bicycle desire lines where management of all grade crossings is feasible.
- Tightening curb radii to reduce vehicle turning speeds or provide slip lanes and crossing islands to accommodate bus turning movements.
- Providing bicycle and pedestrian accommodations and wayfinding across station surface parking areas and sidewalks from accessible parking and loading to accessible station entrances are as direct as possible.
- Providing designated crossing areas at bus loading, pick-up and drop-off areas, and motor vehicle access approaches.
- Aligning grade-separated crossing structures with pedestrian and bicycle desire lines where management of all grade crossings is feasible.
- Tightening curb radii to reduce vehicle turning speeds or provide slip lanes and crossing islands to accommodate bus turning movements.
- Providing bicycle and pedestrian accommodations and wayfinding across station surface parking areas and sidewalks from accessible parking and loading to accessible station entrances are as direct as possible.
- Providing designated crossing areas at bus loading, pick-up and drop-off areas, and motor vehicle access approaches.
- Aligning grade-separated crossing structures with pedestrian and bicycle desire lines where management of all grade crossings is feasible.
- Tightening curb radii to reduce vehicle turning speeds or provide slip lanes and crossing islands to accommodate bus turning movements.
- Providing bicycle and pedestrian accommodations and wayfinding across station surface parking areas and sidewalks from accessible parking and loading to accessible station entrances are as direct as possible.
- Providing designated crossing areas at bus loading, pick-up and drop-off areas, and motor vehicle access approaches.
- Aligning grade-separated crossing structures with pedestrian and bicycle desire lines where management of all grade crossings is feasible.
- Tightening curb radii to reduce vehicle turning speeds or provide slip lanes and crossing islands to accommodate bus turning movements.
- Providing bicycle and pedestrian accommodations and wayfinding across station surface parking areas and sidewalks from accessible parking and loading to accessible station entrances are as direct as possible.
- Providing designated crossing areas at bus loading, pick-up and drop-off areas, and motor vehicle access approaches.
- Aligning grade-separated crossing structures with pedestrian and bicycle desire lines where management of all grade crossings is feasible.
- Tightening curb radii to reduce vehicle turning speeds or provide slip lanes and crossing islands to accommodate bus turning movements.
- Providing bicycle and pedestrian accommodations and wayfinding across station surface parking areas and sidewalks from accessible parking and loading to accessible station entrances are as direct as possible.
- Providing designated crossing areas at bus loading, pick-up and drop-off areas, and motor vehicle access approaches.
- Aligning grade-separated crossing structures with pedestrian and bicycle desire lines where management of all grade crossings is feasible.
- Tightening curb radii to reduce vehicle turning speeds or provide slip lanes and crossing islands to accommodate bus turning movements.
- Providing bicycle and pedestrian accommodations and wayfinding across station surface parking areas and sidewalks from accessible parking and loading to accessible station entrances are as direct as possible.
- Providing designated crossing areas at bus loading, pick-up and drop-off areas, and motor vehicle access approaches.
- Aligning grade-separated crossing structures with pedestrian and bicycle desire lines where management of all grade crossings is feasible.
- Tightening curb radii to reduce vehicle turning speeds or provide slip lanes and crossing islands to accommodate bus turning movements.
- Providing bicycle and pedestrian accommodations and wayfinding across station surface parking areas and sidewalks from accessible parking and loading to accessible station entrances are as direct as possible.
- Providing designated crossing areas at bus loading, pick-up and drop-off areas, and motor vehicle access approaches.
- Aligning grade-separated crossing structures with pedestrian and bicycle desire lines where management of all grade crossings is feasible.
- Tightening curb radii to reduce vehicle turning speeds or provide slip lanes and crossing islands to accommodate bus turning movements.
- Providing bicycle and pedestrian accommodations and wayfinding across station surface parking areas and sidewalks from accessible parking and loading to accessible station entrances are as direct as possible.
- Providing designated crossing areas at bus loading, pick-up and drop-off areas, and motor vehicle access approaches.
- Aligning grade-separated crossing structures with pedestrian and bicycle desire lines where management of all grade crossings is feasible.
- Tightening curb radii to reduce vehicle turning speeds or provide slip lanes and crossing islands to accommodate bus turning movements.
- Providing bicycle and pedestrian accommodations and wayfinding across station surface parking areas and sidewalks from accessible parking and loading to accessible station entrances are as direct as possible.
- Providing designated crossing areas at bus loading, pick-up and drop-off areas, and motor vehicle access approaches.
- Aligning grade-separated crossing structures with pedestrian and bicycle desire lines where management of all grade crossings is feasible.
- Tightening curb radii to reduce vehicle turning speeds or provide slip lanes and crossing islands to accommodate bus turning movements.
- Providing bicycle and pedestrian accommodations and wayfinding across station surface parking areas and sidewalks from accessible parking and loading to accessible station entrances are as direct as possible.
- Providing designated crossing areas at bus loading, pick-up and drop-off areas, and motor vehicle access approaches.
- Aligning grade-separated crossing structures with pedestrian and bicycle desire lines where management of all grade crossing..."
Rail track and bicycle conflicts are possible in certain situations. Tracks often contain a gap, called the flangeway, which can be a hazard for bicycle tires. Tracks may be slippery in wet conditions, causing bicyclists to lose control. Design considerations for mitigating track-bicycle conflicts include:

- Consider using the best track surface material for safe bicycle travel especially when the surface may be regularly wet and consider reducing the flangeway or using a flangeway filler product.
- Provide pavement markings such as bicycle lane lines, bicycle symbols, and green colored pavement surfaces to direct bicyclists to cross the tracks between 60 and 90 degrees to reduce the risk of getting bicycle tires caught in the flangeway.
- Consider a median to force deflection of bicyclists to cross the tracks at the appropriate angle and prevent illegal parking by motorists.
- Provide advance track warning signs to alert bicyclists of the tracks ahead.

Neighborhood streets can benefit from increased street legibility by better organizing pedestrian and bicycle infrastructure and clustered local destinations enhances access and capacity for multi-modal users along the corridor. Further guidance on integrating pedestrian and bicycle infrastructure is presented in NACTO, 2016.

Transit Street Types
Three basic transit street configurations, each with their own distinct design needs, are discussed below: Neighborhood Main Streets, Corridor Streets, and Destination Streets.

Neighborhood Transit Streets
Neighborhood transit streets are important multi-modal routes and urban living spaces. These streets, including both mixed-use main streets and residential streets, are generally no wider than one lane in each direction with moderate pedestrians and bicycle traffic and low-speed vehicular traffic (< 25 mph). Successful neighborhood transit streets are lively, serving as the nexus of neighborhood life, and provide all-week access to a human-scale built environment, comfortable sidewalks, and reliable transit service providing moderately frequent service to neighborhood destinations and beyond. Main streets have moderate or high amounts of walking and congregating on sidewalks or public spaces (NACTO, 2010).

Challenges to neighborhood transit streets include limited parking; vehicles doubleparking and loading frequently blocking the travel lane; transit delay and operational difficulties caused by buses and automotive vehicles waiting to turn, particularly at small intersections; potential conflicts between buses and bicycles at pull-out stops; and difficulties experienced by transit vehicles attempting to make lateral shifts at stops, where pulling back into traffic requires waiting for signal change and where stops are frequently blocked (NACTO, 2010).

As neighborhood transit streets are desirable bicycle routes and have moderate or high amounts of walking and congregating on sidewalks and in public spaces, quality pedestrian and bicycle infrastructure and clustered local destinations enhance access and capacity for multi-modal users along the corridor. Further guidance on integrating bicycle lanes with neighborhood transit streets is presented in NACTO, 2010.

Design treatments for neighborhood transit streets include small improvements that make service more reliable and improve station and stop quality without dramatic changes to the street section. Design considerations include:

- Curbside management to improve transit and general traffic conditions. Designating space for deliveries and managing delivery times reduces common sources of delay.
- Upgrading bicycle facilities can draw more spending, while cutting vehicle parking needs.
- Neighborhood streets can benefit from increased street legibility by better organizing traffic flows, such as using left turn lanes where space permits.
- Sidewalks should be widened where pedestrian volumes or density of destination spaces.


Neighborhood Main Street
Neighborhood Main Streets are lively, serving as the nexus of neighborhood life, and provide all-week access to a human-scale built environment, comfortable sidewalks, and reliable transit service providing moderately frequent service to neighborhood destinations and beyond. Main streets have moderate or high amounts of walking and congregating on sidewalks or public spaces (NACTO, 2010).

Challenges to neighborhood transit streets include limited parking; vehicles double-parking and loading frequently blocking the travel lane; transit delay and operational difficulties caused by buses and automotive vehicles waiting to turn, particularly at small intersections; potential conflicts between buses and bicycles at pull-out stops; and difficulties experienced by transit vehicles attempting to make lateral shifts at stops, where pulling back into traffic requires waiting for signal change and where stops are frequently blocked (NACTO, 2010).

As neighborhood transit streets are desirable bicycle routes and have moderate or high amounts of walking and congregating on sidewalks and in public spaces, quality pedestrian and bicycle infrastructure and clustered local destinations enhance access and capacity for multi-modal users along the corridor. Further guidance on integrating bicycle lanes with neighborhood transit streets is presented in NACTO, 2010.

Design treatments for neighborhood transit streets include small improvements that make service more reliable and improve station and stop quality without dramatic changes to the street section. Design considerations include:

- Curbside management to improve transit and general traffic conditions. Designating space for deliveries and managing delivery times reduces common sources of delay.
- Upgrading bicycle facilities can draw more spending, while cutting vehicle parking needs.
- Neighborhood streets can benefit from increased street legibility by better organizing traffic flows, such as using left turn lanes where space permits.
- Sidewalks should be widened where pedestrian volumes or density of destination spaces.

Wider streets or streets with heavier or faster traffic can create a hostile pedestrian environment. Wide one-way streets may have low street legibility, creating confusion where or when traffic is lighter.

Four-to-three lane conversions, which can be done strategically to minimize degradation of transit service, can only be done at select times, using methods such as dynamic signs to inform road users of lane restrictions, and allowing private vehicles to enter transit lanes must be done in select cases.

There are several constraints to designing high-quality transit corridor streets, as they have often been designed as highway like arterials, with minimal or substandard pedestrian and bicycle facilities and dangerously high motor vehicle speeds. Buildings along corridor streets have been designed to face away from the street or with limited setbacks and parking lots, though density in the transit-shed may be high. (NACTO, 2016)

Transit corridor streets serve as the spine of a city’s mobility network, providing connections between neighborhoods, downtowns, emerging urban centers, and major destination and employment clusters. They have high frequency and existing or potential ridership, offer multiple transit service types, with limited, local, and express service often sharing the corridor. Transit corridor streets accommodate frequent curbside activities without impacting transit operation.

Transit Priority Lanes can provide reliable and efficient transit service, reducing the delay that occurs when buses must share a lane with other traffic and "allow buses to avoid traffic delays waiting for a gap when exiting bus stops, to bypass queues of through vehicles stopped at a traffic signal and, with some types of lanes, to avoid the delay that occurs when buses must share a lane with other traffic and ‘allow buses to avoid traffic delays waiting for a gap when exiting bus stops, to bypass queues of through vehicles stopped at a traffic signal and, with some types of lanes, to avoid the delay that occurs when buses must share a lane with other traffic and...” (TRB, 2015). In addition, providing dedicated lanes or a transitway along a central median provides a high-capacity, high-quality transit facility.
In situations where the number of buses proposed to use the lanes initially is
NACTO, 2016
NACTO, 2016
NACTO, 2016
TRB, 2015.

Bus lanes may be 11 feet wide when offset, and 11 feet when configured
Measures that increase the visibility of a bus lane, such as overhead signage and red

Decisions involving converting a lane to bus use should consider whether some
bottleneck, or to move to the front of a queue

Transit Priority Lanes are flexible, operating either full time or only during peak times
(e.g., taxis, bicycles) to share the lane, or allow other vehicles to enter the lane to make

Designate lanes using a single or double solid white line, as well as a stenciled "BUS ONLY"

There are a variety of configurations for Transit Priority Lanes, including offset, curbside, rail lane, contraflow, and shared bus-bicycle lanes. These are discussed further in NACTO, 2016. General design considerations for designated lanes include the

<table>
<thead>
<tr>
<th>Lane Type</th>
<th>Lane Width</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus Lane</td>
<td>11-12 ft</td>
<td>Vehicles have both clearly defined vehicle spaces (the size of the vehicle itself) as well as permitted user (e.g. &quot;TAXI, LRT, BUS ONLY&quot;). These are discussed in more detail in NACTO, 2016. The following table provides recommended guidelines for general lane configurations:</td>
</tr>
<tr>
<td>Bus-Bicycle Lane</td>
<td>11 ft</td>
<td>In-street vehicles, including conventional trucks, and mid-block LUTS may operate in transit lanes 11 ft wide. Where lane widths are inadequate, or when other vehicle operations (police, emergency, etc.) may be impeded, narrower lanes are appropriate.</td>
</tr>
<tr>
<td>Bus-Bike Lane</td>
<td>11 ft</td>
<td>In-street vehicles, including conventional trucks, and mid-block LUTS may operate in transit lanes 11 ft wide. Where lane widths are inadequate, or when other vehicle operations (police, emergency, etc.) may be impeded, narrower lanes are appropriate.</td>
</tr>
</tbody>
</table>

Design Control

The width of vehicle lanes affects safety and travel speeds. Slower travel speeds and increased safety interest for all users are often a result of narrower lanes, while wider mixed-traffic lanes increase the number and severity of total crashes involving transit vehicles. Providing safe pedestrian linkages across travel lanes is an important consideration in choosing an appropriate lane width. As axles are among the largest vehicles operating on city streets, with mirror widths often exceeding available lane space, adjacent lanes in a street section should be able to accommodate full width of bus and general traffic volumes, where many buses and their passengers are subject to delay. In corridors with MBTA for other public mass transit, where maximizing bus speeds and reliability is a priority; or an shorter stretches of roadway, allowing buses to bypass a bottleneck, or an merge to the front of a queue (TRB, 2015).

Converting a lane to bus use should consider whether some

Vehicles have both clearly defined vehicle spaces (the size of the vehicle itself) as well as a bus-bus lane (or operating space) which defines the space needed to operate comfortably at a moderate speed. Where space is available, buffers should be used rather than widening lanes to reduce side-swipe risks to bicyclists, motorists, and pedestrians, without increasing design speed. Overlapping buffer zones can be safely accommodated at slower speeds and added width may be assigned to buffer zones in mixed-traffic lanes to visually narrow them. Parking buffers or wider curbside buffers can provide additional maneuvering space and variance for buses to avoid wide trucks parking or loading in a parallel parking lane (NACTO, 2016).

Lane width considerations for specific facilities, such as curbside lanes and offset transit lanes are discussed in more detail in NACTO, 2016. The following table provides recommended guidelines for general lane configurations:
Aside from recommended clearances, strategies for reducing the occurrence of obstructions include dedicated transit lanes and pavement coloring. Dedicated transit lanes can reduce double parking and other obstructions. TRB, 2012 cites a recent study that found “red colored pavement significantly reduced the occurrence of obstructions on the roadway area legally or illegally entering the lane for interurban buses.” In addition, the same study found the bus driver used red-lanes 52 percent more often than non-red lanes, indicating a greater degree of bus driver confidence in red-colored lane markings (Safran et al., 2014).

Red transit lanes enhance motorist and pedestrian awareness of curbside transit lanes and transit vehicles (NACTO, 2014). NACTO provides detailed clearance recommendations for specific stop typologies and configurations, e.g., front-of-stop, island stop, transit stop, and boarding islands and buildings.

Driveway placement and design should consider the effect of the bus stop on sight lines for entering and leaving the ROW. TriMet guidance states that “adequate distance between buses and driveways is important to prevent buses from blocking driveway traffic or sight lines. In constrained situations, buses may stop at driveways except where this would block property’s access or severely restrict sight distances.”

**Turn Flats**

Designing turn geometry for transit routes can be challenging, as a result of tight corner curbs and returns and because the bus and train vehicles in the Capital Metro fleet have varying turn radii. Often, buses must encroach on adjacent or oncoming travel lanes when turning, which causes delays in bus operations and adds to potential conflicts with other modes of transportation. Properly designed corner curbs help minimize conflicts among buses, cars, pedestrians, and bicyclists at intersections. Improvements in bus operating speed and a reduction of travel time are additional benefits.

Intersection curb radii vary from 15 to 50 feet, depending on site constraints, on-street parking locations, 12-foot travel lanes, desirable operations, and assuming no motorcycles or adjacent lanes (NACT). Encroachment on adjacent lanes may be allowed on certain low-volume streets or where ROW is limited. Standard 40’ buses have a minimum 43’ turning radius at intersections; articulated buses have a 55.5-foot design layout. In-Transit network analyses (TriMet, 2016) indicate a general rule to permit comfortable bus movements, corners should be designed for 50 feet outside and 30 feet inside turning radii (Safran et al., 2014). As a general rule to permit comfortable bus movements, corners should be designed for 50 feet outside and 30 feet inside turning radii (Safran et al., 2014). As a general rule to permit comfortable bus movements, corners should be designed for 50 feet outside and 30 feet inside turning radii (Safran et al., 2014). As a general rule to permit comfortable bus movements, corners should be designed for 50 feet outside and 30 feet inside turning radii (Safran et al., 2014). As a general rule to permit comfortable bus movements, corners should be designed for 50 feet outside and 30 feet inside turning radii (Safran et al., 2014). As a general rule to permit comfortable bus movements, corners should be designed for 50 feet outside and 30 feet inside turning radii (Safran et al., 2014). As a general rule to permit comfortable bus movements, corners should be designed for 50 feet outside and 30 feet inside turning radii (Safran et al., 2014). As a general rule to permit comfortable bus movements, corners should be designed for 50 feet outside and 30 feet inside turning radii (Safran et al., 2014). As a general rule to permit comfortable bus movements, corners should be designed for 50 feet outside and 30 feet inside turning radii (Safran et al., 2014). As a general rule to permit comfortable bus movements, corners should be designed for 50 feet outside and 30 feet inside turning radii (Safran et al., 2014).

The pedestrian crossing distance will increase as the intersection radius increases. Where larger radii are developed, longer walking time at signalized intersections must be accommodated. In addition, guidance from NACTO specifies that turn radius allowances should be made under special circumstances, such as the following:

- **Bus speeds greater than 10 mph:**
  - Reverse turns
  - Eight or nine stop stations
  - Changes in pavement grade
  - Restrictions to bus turnover
  - Width of roadway

For capital Metro’s bus turning path, lane width, and clearance requirements differ depending on bus length.

**Roadway Clearances for Buses** (source: Tri-Met)
In selecting the design speed basis for such values as signal progression speed, lane width, and transition taper length to transition to a speed lower than the speed limit, unless the limit can be lowered to safely do the desired speed. Reducing speeds to under 15 mph increases driver reaction time and improves accident outcomes. Significance of speed limits relies on the use of these limits and comparison of their benefits. Altering or applying red color to entire road segments include providing a solid red stripe to highlight stops or sections of a transit lane with turn prohibitions, which help reduce conflicts at intersection, or applying red thermoplastic or painted backing around the "BUS ONLY" lane markings to improve the visibility of the restriction (NACTO, 2016).

Markings & Signage
Lane elements such as the use of solar and marking material, as well as regulatory signage and pavement color contribute to pedestrian safety, and the success of transitways. Colored pavement can enhance the visibility of the transit lane, reducing vehicle incursions and improving on-time performance, in addition to other benefits. Signs and signals relate required or prohibited vehicle movements, enhance overall and other regulatory signage, and alert other street users of approaching transit vehicles.

Lane Markings & Color
Red-colored pavement may be used to improve the conspicuity of the bus lane, visually enforcing dedicated transit space and thereby reducing the number of non-authorized vehicle incursions. Red-colored pavement can be considered anywhere a roadway lane is reserved exclusively or primarily for buses and can be applied safely at the start of a lane leg, at grade crossing transitions away from the bus lane, and in the sections where only permits are allowed (i.e., to indicate where vehicles may enter the lane to make right turns) or for the full length of the lane, including sections where other vehicles are permitted to use the lane to briefly enter the lane (e.g., to enter or cross the lane at the start to make a right turn, to stop to immediately pick up or drop off passengers); however, it should be applied consistently within a jurisdiction (TRB, 2015). "Red carpet" treatments to the use of these materials and comparison of their benefits. Alternating or applying red color to entire road segments include providing a solid red stripe to highlight stops or sections of a transit lane with turn prohibitions, which help reduce conflicts at intersection, or applying red thermoplastic or painted backing around the "BUS ONLY" lane markings to improve the visibility of the restriction (NACTO, 2016).

Color and size variations of pavements and concrete can subtly suggest street space and modal zones while increasing the use of space by people on foot in shared environments can help maintain a cooler, more comfortable street environment due to the lower albedos of lighter colored pavements and concrete, and can be used in on-street railbeds to designate the streetcar path and discourage other vehicles from entering or blocking the transit-way (Sist, 2015). Pavement must be laid over a 12'' concrete base. Large paving blocks can be used on non-fixed path routes, as smaller pavers may shift under the weight of busses. Concrete or large pavers can be used for fixed path routes for the path of the bus wheels, with smaller paving blocks adjacent to the running way and between the two running courses, forming a visual barrier (NACTO, 2016).
Select appropriate plantings; in dry climates, drought-resistant

Various Signs and Signals (source: NACTO, 2016)

Choose green infrastructure based on pedestrian volume

| TRANSIT LANE |

As required, install a perforated pipe at the base of

and reflective elements to improve visibility of the curb, and can be installed for limited

curbs are generally four-six inches in height, should include curb ramps at crossings

The placement and height of vertical separation elements should maintain the integrity

planters assist with stormwater management (NACTO, 2016).

or block length sections to physically provide separation into the roadway. Mountable

can be used on corners or roundabouts where a small curb radius is desired for

design vehicles, while allowing larger control vehicles like buses to mount the curb, creating a larger effective curb radius, and should include a curb slope of no more than 2.3:1 (less than 1:4 to be mountable by bicycles); a non-mountable beveled curb with a 1.1:1 slope is recommended for limited access. Rumble strips are a low-cost treatment to reduce vehicle incursions, providing drivers with a tactile cue when they encroach upon a transit lane, and are typically reserved for

Rumble strips are a low-cost treatment to reduce vehicle incursions, providing drivers

Separation Elements

Vertical separation elements can be used to increase separation and prevent penetration of transitways by unauthorized vehicles. The level and application of separation strategies depends on speed, loading, and parking activities, as well as

Some considerations for integrating green infrastructure into sidewalks, medians, curbs, and other features include the following:

Some considerations for integrating green infrastructure into sidewalks, medians, curbs, and other features include the following:

Integrating green infrastructure into transit design has many benefits, including

Capital Metro is committed to incorporating sustainability best practices throughout the design and operation of its facilities, as referenced throughout this document. Electric vehicles, low-impact development (LID), green building design, transit-supportive land use, climate resilience, and sustainable infrastructure rating tools are some examples of sustainable principles that are applicable to transit systems.

Sustainable Design

Campaign image: NACTO (2016)

and reflective elements to improve visibility of the curb, and can be installed for limited

planters assist with stormwater management (NACTO, 2016).

or block length sections to physically provide separation into the roadway. Mountable

can be used on corners or roundabouts where a small curb radius is desired for

design vehicles, while allowing larger control vehicles like buses to mount the curb, creating a larger effective curb radius, and should include a curb slope of no more than 2.3:1 (less than 1:4 to be mountable by bicycles); a non-mountable beveled curb with a 1.1:1 slope is recommended for limited access. Rumble strips are a low-cost treatment to reduce vehicle incursions, providing drivers with a tactile cue when they encroach upon a transit lane, and are typically reserved for

Rumble strips are a low-cost treatment to reduce vehicle incursions, providing drivers

Separation Elements

Vertical separation elements can be used to increase separation and prevent penetration of transitways by unauthorized vehicles. The level and application of separation strategies depends on speed, loading, and parking activities, as well as

Some considerations for integrating green infrastructure into sidewalks, medians, curbs, and other features include the following:

Some considerations for integrating green infrastructure into sidewalks, medians, curbs, and other features include the following:

Integrating green infrastructure into transit design has many benefits, including

Capital Metro is committed to incorporating sustainability best practices throughout the design and operation of its facilities, as referenced throughout this document. Electric vehicles, low-impact development (LID), green building design, transit-supportive land use, climate resilience, and sustainable infrastructure rating tools are some examples of sustainable principles that are applicable to transit systems.

Sustainable Design

Campaign image: NACTO (2016)

and reflective elements to improve visibility of the curb, and can be installed for limited

planters assist with stormwater management (NACTO, 2016).

or block length sections to physically provide separation into the roadway. Mountable

can be used on corners or roundabouts where a small curb radius is desired for

design vehicles, while allowing larger control vehicles like buses to mount the curb, creating a larger effective curb radius, and should include a curb slope of no more than 2.3:1 (less than 1:4 to be mountable by bicycles); a non-mountable beveled curb with a 1.1:1 slope is recommended for limited access. Rumble strips are a low-cost treatment to reduce vehicle incursions, providing drivers with a tactile cue when they encroach upon a transit lane, and are typically reserved for

Rumble strips are a low-cost treatment to reduce vehicle incursions, providing drivers

Separation Elements

Vertical separation elements can be used to increase separation and prevent penetration of transitways by unauthorized vehicles. The level and application of separation strategies depends on speed, loading, and parking activities, as well as

Some considerations for integrating green infrastructure into sidewalks, medians, curbs, and other features include the following:

Some considerations for integrating green infrastructure into sidewalks, medians, curbs, and other features include the following:

Integrating green infrastructure into transit design has many benefits, including

Capital Metro is committed to incorporating sustainability best practices throughout the design and operation of its facilities, as referenced throughout this document. Electric vehicles, low-impact development (LID), green building design, transit-supportive land use, climate resilience, and sustainable infrastructure rating tools are some examples of sustainable principles that are applicable to transit systems.

Sustainable Design

Campaign image: NACTO (2016)

and reflective elements to improve visibility of the curb, and can be installed for limited

planters assist with stormwater management (NACTO, 2016).

or block length sections to physically provide separation into the roadway. Mountable

can be used on corners or roundabouts where a small curb radius is desired for

design vehicles, while allowing larger control vehicles like buses to mount the curb, creating a larger effective curb radius, and should include a curb slope of no more than 2.3:1 (less than 1:4 to be mountable by bicycles); a non-mountable beveled curb with a 1.1:1 slope is recommended for limited access. Rumble strips are a low-cost treatment to reduce vehicle incursions, providing drivers with a tactile cue when they encroach upon a transit lane, and are typically reserved for

Rumble strips are a low-cost treatment to reduce vehicle incursions, providing drivers

Separation Elements

Vertical separation elements can be used to increase separation and prevent penetration of transitways by unauthorized vehicles. The level and application of separation strategies depends on speed, loading, and parking activities, as well as

Some considerations for integrating green infrastructure into sidewalks, medians, curbs, and other features include the following:

Some considerations for integrating green infrastructure into sidewalks, medians, curbs, and other features include the following:

Integrating green infrastructure into transit design has many benefits, including

Capital Metro is committed to incorporating sustainability best practices throughout the design and operation of its facilities, as referenced throughout this document. Electric vehicles, low-impact development (LID), green building design, transit-supportive land use, climate resilience, and sustainable infrastructure rating tools are some examples of sustainable principles that are applicable to transit systems.

Sustainable Design

Campaign image: NACTO (2016)
An example of LID, Green guideways can be used to complement transit investments cost-effectively, creating an attractive human and natural environment by providing large planted areas along and between transit tracks. Benefits of planted guideways include the noise dampening-effects of soil on transit vehicles; substantially improved stormwater infiltration and retention provided by a large permeable surface; green guideways can support rain gardens and other higher biomass or high absorption areas; enhanced public space along the street provided by large areas of green space (NACTO, 2016). These guideways can be used for stormwater management and can be used for both center- and side-running fully separated bus or rail guideways. Design considerations for green guideways include:

- Continuous green space should be provided between tracks and adjacent road beds. Green space should be discontinuous at intersections and pedestrian crossings and accessible paths for pedestrians through the guideway should be provided.
- For buses, grass can be planted between and adjacent to concrete running paths or guideways for bus lanes. For rail, tracks can be completely set within a surface covered with grass or other low-maintenance, low-lying, non-shrinking and non-rutting plants such as sedum. But rail or concrete bus guideways should be anchored on solid material under the surface. Tracks should be enclosed in a noise absorber. Filled with a porous base layer, covered with a non-resin membrane, and covered with a porous paving grid that is then planted.

- Plant types should be chosen based on durability, geographic and location-specific climate conditions, and water absorption capacity.
- Green guideways can be designed asTanks that store stormwater from the street with the surface at a lower grade than the adjacent roadway. In this case, deeper water penetration should be permitted through. In most climates, rails must be plant material with the swale surface at a lower grade than the adjacent roadway. In this case, deeper water penetration should be permitted through. In most climates, rails must be anchored on solid material under the surface. Tracks should be enclosed in a noise absorber. Filled with a porous base layer, covered with a non-resin membrane, and covered with a porous paving grid that is then planted.

An example of LID, Green guideways can be used to complement transit investments cost-effectively, creating an attractive human and natural environment by providing large planted areas along and between transit tracks. Benefits of planted guideways include the noise dampening-effects of soil on transit vehicles; substantially improved stormwater infiltration and retention provided by a large permeable surface; green guideways can support rain gardens and other higher biomass or high absorption areas; enhanced public space along the street provided by large areas of green space (NACTO, 2016). These guideways can be used for stormwater management and can be used for both center- and side-running fully separated bus or rail guideways. Design considerations for green guideways include:

- Continuous green space should be provided between tracks and adjacent road beds. Green space should be discontinuous at intersections and pedestrian crossings and accessible paths for pedestrians through the guideway should be provided.
- For buses, grass can be planted between and adjacent to concrete running paths or guideways for bus lanes. For rail, tracks can be completely set within a surface covered with grass or other low-maintenance, low-lying, non-shrinking and non-rutting plants such as sedum. But rail or concrete bus guideways should be anchored on solid material under the surface. Tracks should be enclosed in a noise absorber. Filled with a porous base layer, covered with a non-resin membrane, and covered with a porous paving grid that is then planted.

- Plant types should be chosen based on durability, geographic and location-specific climate conditions, and water absorption capacity.
- Green guideways can be designed asTanks that store stormwater from the street with the surface at a lower grade than the adjacent roadway. In this case, deeper water penetration should be permitted through. In most climates, rails must be anchored on solid material under the surface. Tracks should be enclosed in a noise absorber. Filled with a porous base layer, covered with a non-resin membrane, and covered with a porous paving grid that is then planted.

- Plant types should be chosen based on durability, geographic and location-specific climate conditions, and water absorption capacity.
- Green guideways can be designed asTanks that store stormwater from the street with the surface at a lower grade than the adjacent roadway. In this case, deeper water penetration should be permitted through. In most climates, rails must be anchored on solid material under the surface. Tracks should be enclosed in a noise absorber. Filled with a porous base layer, covered with a non-resin membrane, and covered with a porous paving grid that is then planted.

---

**BRT Implementation**

The integration of quality BRT corridors is an essential component of a quality transit system. As stated by the Institute for Transportation Development Policy (ITDP), BRT is a high-quality bus-based transit system that delivers fast, comfortable, and cost-effective services at metro-level capacities. It does this through the provision of dedicated lanes (minimum length of 7 miles) with busways and iconic stations (typically aligned to the center of the road, off-road face collection and frequent and fast operations). The BRT Gold Standard, a set of scored criteria to rate BRT corridors, was developed by an international committee of experts as an evaluation tool for world-class BRT. According to the Gold Standard, there are five essential elements of BRT:

- **Dedicated Right-of-Way**: Lanes off-limits to other traffic, allowing for uninterrupted travel.
- **Busway Alignment**: Center of roadway or bus-only corridors keep buses from traffic and curb activity, minimizing delays.
- **Platform- level Boarding**: Stations should be at level with the bus for quick and easy passenger boarding delay.
- **Intersection Treatments**: Prohibiting turns for traffic across the bus lane reduces delays caused to buses by turning traffic.
- **Platform-level Boarding**: Stations should be at level with the bus for quick and easy passenger boarding delay.

Platform-level Boarding: Stations should be at level with the bus for quick and easy passenger boarding delay.

---

**Platform Height**

Platform height effects ease of boarding and route efficiency, as raised platforms enable easier and more accessible passenger boarding and alighting by decreasing step-down distances and gap between vehicle floor and platform. Level and near-level platform stops allow vehicles to enter and exit stops more quickly, increasing route efficiency (NACTO, 2014). Different platform configurations have different platform heights, and include sidewalk level, near-level, and level boarding stops. Platform height design considerations for these platform types are discussed briefly in the following table. Further information and additional configurations can be found in NACTO, 2014.
At least three feet width should be completely clear along the platform edge between 45 degrees on the platform and the kerb, Especially near the loading area clearances, and any furnishings that may be part of the stop (e.g., newspaper boxes, trash receptacles, long benches, waiting shelters, or trees). Provide 5 feet of width between each adjacent board vehicle expected to be boarding the platform consistently throughout the day.

Design building land or islands and shelter areas to accommodate proper drainage and sweeping. Light rail, streetcar, or retrofitted low-floor buses may require temporary agreements to ensure bulbs are properly cleaned and maintained. Provide 5 feet of width between each adjacent board vehicle expected to be boarding the platform consistently throughout the day.

When designing the single platform extension (void of a second platform or median), Design Build a sidewalk ramp with at least 10 feet of clear distance from the curb to allow for a variety of vehicles that may be used. This is important when considering the pedestrian travel path to the transit stop, which includes seniors, people with disabilities, women, and families with children. Special attention should be placed on the pedestrian zone of the sidewalk generally when both pedestrian volumes and the number of transit passengers are relatively low, though only with careful consideration for capacity and mobility. When separating the boarding platform from the pedestrian zone of the sidewalk, boarding platforms, bus, or median platforms can provide additional space from amenities and highlights great transit service (NACTO, 2016).

Design considerations for platform width include:

- The platform must receive deployed ramps or bridge plates to provide easy boarding.
- Minimum width is eight feet from platform edge for a platform boarding passengers from one direction.
- Platform serving two directions should be 12 feet wide minimum to accommodate two-way traffic.
- Platform configurations accommodate transit vehicles typically 10–14 feet in street level or near-street level vehicles. Sidewalk/Curb Level platforms allow passengers to light rail, streetcar, or retrofitted low-floor buses kneel, reducing delay and adding convenience. Can apply to high-floor, center, and multimodal low-floor buses.

Source: NACTO, 2016.

Pull-Out Stop Transition Space (source: NACTO, 2016)

White diagonal hatch line markings may be striped to delineate the entry and exit area, or if rail transit vehicle at rail line.

Locate stop zone with at least 10 feet of clear distance from the curb. Measure to transit stop pole at near-side, or rear of transit vehicle at far-side.

While diagonal hatch line markings may be striped to delineate the entry and exit ramps and discourage blocking.

Locate platform with at least 10 feet of clear distance from crosswalk or curb return. Measure to transit stop pole at near-side, or rear of transit vehicle at far-side.
Tactile, visual, and audible design elements should be employed together to guide people of all abilities through the street environment by consistently using detectable surfaces, color contrast, audible warnings, or other methods to assist all users, enhance safety and accessibility. Signalized crossings may include accessible pedestrian signals (APS), which utilize audible cues to inform pedestrians of signal phases, including announcements or rapid periodic tones (NACTO, 2016). Universal street design considerations include:

- Detectable warning strips may be used to indicate door locations at sidewalk-level stops and must be at least 3½ inches wide and should be applied at curb-level ramps for their entire width, or at any location where pedestrians cross another modal zone (i.e., bicycle lanes or vehicle lanes) along a flush transition (DOT 54b, 464b, 18). Detectable warning strips should visually contrast with adjacent surfaces to alert pedestrians that they are crossing into a new modal zone such as a transitway, bicycleway, or vehicle roadway.

- Where passengers using wheelchairs are directed to specified doors, ensure the design of passenger facilities. See NACTO, 2016 for further design guidance on accessibility and amenities, however, the following are some general considerations for appropriate design of passenger facilities.

- Where passenger access to stops, a minimum four-foot-wide clear pedestrian travel path should be provided to connect the bus stop waiting area and loading area to adjacent sidewalks, which should be located near the curb ramp for each crossing direction and, for an easy, accessible ramp at least one curb ramp.

- For pedestrian access to stops, a minimum four-foot-wide clear pedestrian travel path should be provided to connect the bus stop waiting area and loading area to adjacent sidewalks. The bus stop’s road surface must be durable, slip resistant, and free of horizontal or vertical obstructions or tripping hazards (SEPTA, 2012). The Transit Capacity and Quality of Service Manual (TCRP Report 100) provides guidance on space allocation for detailed waiting area calculations. A standing waiting area should consist of seven square feet (0.65 m²) per person net area to achieve a level of service between C and D. The net area is defined as the area remaining after subtracting areas reserved for pedestrian pathways and the bus loading pad from the total area. Excluding the ADA-specified clearances for the loading pad and other street furnishings, additional space for obstructions by local barriers, such as poles or hydrants, should be evaluated.

Bus Pads
Roadways should be designed to accommodate the wear and tear of constant vehicle traffic and passenger unloading, which can disrupt traffic flow and affect customer convenience and safety. It is important that “a transit stop’s road surface be durable enough to withstand heavier loads than average daily traffic under normal conditions” (SEPTA, 2012). Roadway pavement design must be assessed using the American Association of State Highway and Transportation Officials’ (AASHTO) Guide for the Design of Pavement Structures and the local version of this standard should be used to determine appropriate design for a particular site. Roadway design must conform to the basic steps for evaluating paving surface requirements for bus stop location (SEPTA, 2012). Bus stop dimensions and specifications can be tailored to meet a community-specific need; however, the minimum loading pad should be maintained. Each stop type includes the basic building block of a five foot (1.5 m) long platform by eight foot (2.4 m) deep bus pad connected to a pedestrian path that is four feet (1.2 m) wide or wider, which is the ADA standard (SEPTA, 2012). The width includes five feet for a wheelchair loading area, plus additional width to deploy a wheelchair ramp to serve the waiting area (generally five feet wide). Although larger ramps may require additional length (SEPA&D 5012.2, NACTO, 2016).

Waiting Area
A well-defined waiting area should be sized to reflect expected passenger volumes and, at a minimum, should be wide enough at the curbline to provide a safe place for passengers to wait outside the loading area. In addition, the surface must be durable, stop resistant, and free of horizontal or vertical obstructions or tripping hazards (SEPTA, 2012). The Transit Capacity and Quality of Service Manual (TCRP Report 100) provides guidance on space allocation for detailed waiting area calculations. A standing waiting area should consist of seven square feet (0.65 m²) per person net area to achieve a level of service between C and D. The net area is defined as the area remaining after subtracting areas reserved for pedestrian pathways and the bus loading pad from the total area. Excluding the ADA-specified clearances for the loading pad and other street furnishings, additional space for obstructions by local barriers, such as poles, hydrants, should be evaluated.
As specified by SEPTA, “a reinforced concrete pad is recommended for bus stop areas, particularly in P&R or depot situations, where multiple routes and heavier loads can be expected. A concrete pad can be incorporated or retrofitted into the roadway design to provide a heavy-duty surface that will handle constant heavy vehicle stress; however local conditions must be evaluated to determine the best design for a particular site” (SEPTA, 2012). The expanse of the concrete bus pad should be placed on either side of a bicycle lane (if present), as threads and cracks pose a hazard to bicycle wheels, and stop amenities should not block boarding pads or walking path (NACTO, 2010). At a minimum:

- Ensure that the cross-slope of the bus pad does not exceed two percent.
- In build-up areas, construct the bus pad of concrete at least 12 inches in depth, in uncurbed shoulder areas, an asphalt bus pad is acceptable.
- For most buses, locate bus pads at least 23.5 feet from the bus stop sign. For buses with rear lifts, locate the landing 23.5 feet from the bus stop sign.

Continuous bus pads from the front to the rear door areas are appropriate at bus stops that have a high number of passenger loadings and unloadings, where such pads could improve the connections to the adjacent sidewalk system, or where landscaped buffer are located between the sidewalk and the street (SEPTA, 2012).

Pavement Materials

The use of appropriate pavement materials is important for minimizing roadway damage caused by transit vehicles. Asphalt is the most common street material, and is the least expensive to implement, however it is not expected to shift less under the weight of a bus, especially during acceleration and braking” (NACTO, 2010). Though concrete street surfaces are more expensive than asphalt, these surfaces are stronger, last longer, generally shift less under the weight of heavy buses, and can have a lower life cycle cost than asphalt, particularly in warm weather locals.

All pavements that pedestrians access should be firm, stable, and slip resistant regardless of material selection (US Access Board, Department of Education, 2011). Installing a concrete bus pad at bus stops can minimize pavement deformation, which negatively affects bicyclists and drivers, though thin courses of asphalt may also be considered. Concrete bus pads are also recommended for locations where buses brake, particularly in P&R or depot situations, where multiple routes and heavier loads can be expected. As specified by SEPTA, “a reinforced concrete pad is recommended for bus stop areas, including stops, signs, and traffic signals. Rail should be embedded in concrete, where feasible, to avoid track shifting and service interruptions due to resurfacing and other maintenance.

Traffic Calming & Shared Space

Traffic calming is one traffic management strategy that can be used to make the area surrounding bus stops safer for commuters. As defined by the Institute of Transportation Engineers, “traffic calming involves changes in street alignment, installation of barriers, and other physical measures to reduce traffic speeds and/or cut through volumes, in the interest of street safety, livability, and other public purposes. Many of these strategies focus on reducing the speed of vehicles that are in close proximity to pedestrians to around 30 kph (Hammond-Ball, 2004; Hamilton-Ball & Jones, 2005; Kaparias et al., 2012) which significantly reduces the risk of fatal accidents and allows pedestrians to be less fearful to walk close to the margins of the street (Sanderson et al., 2011; Robin & Sander, 2009). Traffic calming elements such as chokers, round (cruiseways), and bicycle bypasses are already popular in many major European cities (Sheng, 2008). The description and application of some of these elements are described in the following table.

Traffic calming measures can be designed to slow general traffic while having little negative impact on transit vehicle operation (NACTO, 2010). Where traffic cannot be slowed down, physical separation and crossing lights greatly increase the comfort of pedestrians (Lin et al., 2011). These, and shocks lower than 4 meter (approximately 20 feet) are recommended because they not only provide visual and acoustic separation, but they also add to the attractiveness and contribute to the thermal comfort of the setting (Fukahori & Kubota, 2003). See http://www.trafficcalming.org for further information on traffic calming strategies, including design considerations, effectiveness, and typical implementation costs.

Shared space, another strategy for creating a more pedestrian friendly environment, is a design concept for public spaces that encourages the separation between modes of transport by removing ground markings for traffic. Though the removal of these markings, which were painted in the name of safety, may seem counter intuitive, the result is more eye contact, slower speeds, and heightened awareness. The implementation of shared space in a region that has never had such urban features may be a challenge, as people’s familiarity with shared spaces largely determines their success (Kaparias, Bell, Miri, Chan, Mount, 2012). Therefore, considerable work from all parties involved in the implementation of shared spaces is important, including the provision of adequate driver education to ensure the safety of pedestrians in these areas and heightened driver awareness (Zheng, 2015).

Traffic calming and shared space need to be considered in the design of any transit center or station. As defined by the Institute of Transportation Engineers, “traffic calming involves changes in street alignment, installation of barriers, and other physical measures to reduce traffic speeds and/or cut through volumes, in the interest of street safety, livability, and other public purposes. Many of these strategies focus on reducing the speed of vehicles that are in close proximity to pedestrians to around 30 kph (Hammond-Ball, 2004; Hamilton-Ball & Jones, 2005; Kaparias et al., 2012) which significantly reduces the risk of fatal accidents and allows pedestrians to be less fearful to walk close to the margins of the street (Sanderson et al., 2011; Robin & Sander, 2009). Traffic calming elements such as chokers, round (cruiseways), and bicycle bypasses are already popular in many major European cities (Sheng, 2008). The description and application of some of these elements are described in the following table.

Traffic calming measures can be designed to slow general traffic while having little negative impact on transit vehicle operation (NACTO, 2010). Where traffic cannot be slowed down, physical separation and crossing lights greatly increase the comfort of pedestrians (Lin et al., 2011). These, and shocks lower than 4 meter (approximately 20 feet) are recommended because they not only provide visual and acoustic separation, but they also add to the attractiveness and contribute to the thermal comfort of the setting (Fukahori & Kubota, 2003). See http://www.trafficcalming.org for further information on traffic calming strategies, including design considerations, effectiveness, and typical implementation costs.

Shared space, another strategy for creating a more pedestrian friendly environment, is a design concept for public spaces that encourages the separation between modes of transport by removing ground markings for traffic. Though the removal of these markings, which were painted in the name of safety, may seem counter intuitive, the result is more eye contact, slower speeds, and heightened awareness. The implementation of shared space in a region that has never had such urban features may be a challenge, as people’s familiarity with shared spaces largely determines their success (Kaparias, Bell, Miri, Chan, Mount, 2012). Therefore, considerable work from all parties involved in the implementation of shared spaces is important, including the provision of adequate driver education to ensure the safety of pedestrians in these areas and heightened driver awareness (Zheng, 2015).

Traffic calming and shared space need to be considered in the design of any transit center or station.

Traffic calming and shared space need to be considered in the design of any transit center or station. As defined by the Institute of Transportation Engineers, “traffic calming involves changes in street alignment, installation of barriers, and other physical measures to reduce traffic speeds and/or cut through volumes, in the interest of street safety, livability, and other public purposes. Many of these strategies focus on reducing the speed of vehicles that are in close proximity to pedestrians to around 30 kph (Hammond-Ball, 2004; Hamilton-Ball & Jones, 2005; Kaparias et al., 2012) which significantly reduces the risk of fatal accidents and allows pedestrians to be less fearful to walk close to the margins of the street (Sanderson et al., 2011; Robin & Sander, 2009). Traffic calming elements such as chokers, round (cruiseways), and bicycle bypasses are already popular in many major European cities (Sheng, 2008). The description and application of some of these elements are described in the following table.

Traffic calming measures can be designed to slow general traffic while having little negative impact on transit vehicle operation (NACTO, 2010). Where traffic cannot be slowed down, physical separation and crossing lights greatly increase the comfort of pedestrians (Lin et al., 2011). These, and shocks lower than 4 meter (approximately 20 feet) are recommended because they not only provide visual and acoustic separation, but they also add to the attractiveness and contribute to the thermal comfort of the setting (Fukahori & Kubota, 2003). See http://www.trafficcalming.org for further information on traffic calming strategies, including design considerations, effectiveness, and typical implementation costs.

Shared space, another strategy for creating a more pedestrian friendly environment, is a design concept for public spaces that encourages the separation between modes of transport by removing ground markings for traffic. Though the removal of these markings, which were painted in the name of safety, may seem counter intuitive, the result is more eye contact, slower speeds, and heightened awareness. The implementation of shared space in a region that has never had such urban features may be a challenge, as people’s familiarity with shared spaces largely determines their success (Kaparias, Bell, Miri, Chan, Mount, 2012). Therefore, considerable work from all parties involved in the implementation of shared spaces is important, including the provision of adequate driver education to ensure the safety of pedestrians in these areas and heightened driver awareness (Zheng, 2015).

Traffic calming and shared space need to be considered in the design of any transit center or station.
<table>
<thead>
<tr>
<th>Traffic Calming Measures</th>
<th>Description</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chicane</strong></td>
<td>A series of narrowings or curb extensions that alternate from one side of the street to the other forming S-shaped curves.</td>
<td>• Appropriate for mid-block locations only • Most effective with equivalent volumes on both approaches • Typically is a series of at least three curb extensions • Can use on-street parking to create chicane</td>
</tr>
<tr>
<td><strong>Choker</strong></td>
<td>Curb extensions at mid-block or intersection corners that narrow a street by extending the sidewalk or widening the planting strip.</td>
<td>• Local and collector streets • Pedestrian crossings • Main roads through small communities • Work well with speed humps, speed tables, raised intersections, textured crosswalks, curb radius reductions, and raised median islands</td>
</tr>
<tr>
<td><strong>Center Island Narrowing</strong></td>
<td>Raised islands located along the centerline of a street that narrow the travel lanes at that location.</td>
<td>• Are often nicely landscaped to provide visual amenity and neighborhood identity • Can help pedestrianize streets by providing a mid-point refuge for pedestrian crossings • Sometimes used on wide streets to narrow travel lanes • Work well when combined with crosswalks</td>
</tr>
<tr>
<td><strong>Speed Hump</strong></td>
<td>Rounded raised areas of pavement typically 12 to 14 feet in length. Often placed in a series (typically spaced 300 to 600 feet apart).</td>
<td>• Residential streets • Not typically used on major roads, bus routes, or primary emergency response routes • Mid-block placement, not at an intersection • Not on grades greater than eight percent • Work well with curb extensions</td>
</tr>
<tr>
<td><strong>Speed Table</strong></td>
<td>Long raised speed humps with a flat section in the middle (thus reducing the length of a vehicle). Often made of concrete or asphalt and built with both or either lane forced downward on the flat section. Heights: under 4 inches, lengths: 22 feet.</td>
<td>• Local and collector streets • Work well in combination with back-in curb extensions, curb extensions, and curb cuts in medians • Also work well on medians</td>
</tr>
<tr>
<td><strong>Raised Intersection</strong></td>
<td>Flat raised areas covering entire intersections, with ramps on all approaches and often with a raised median or islands in the flat section and corners.</td>
<td>• Local and collector streets • Work well with curb extensions and brick and concrete • Often part of an area-wide traffic calming scheme involving both intersecting streets. • In dense developed areas where additional land at the corner would be dramatic</td>
</tr>
<tr>
<td><strong>Neighborhood Traffic Circle</strong></td>
<td>Raised islands located along the centerline of a street that narrow the travel lanes at that location.</td>
<td>• Are often used to provide visual identity and neighborhood identity • Can help pedestrianize streets by providing a mid-point refuge for pedestrian crossings • Can include back-in curb extensions, brick and concrete, or islands in medians, and work well in medians</td>
</tr>
</tbody>
</table>
Bus & Bicycle Interactions

Well-designed transit streets provide diverse mobility options, including walking and bicycling, which complement strong transit ridership and create animate streetscapes. Streets used by transit vehicles often make desirable corridors for bicycle traffic, as these roadways often provide direct access to destinations, with relatively few stops required. Accommodating both bicycle and bus traffic on streets and at bus stops can be challenging, as the need to serve bicycle traffic may constrain the options available for implementing transit-supportive roadway strategies due to limited ROW to allocate among various modes of travel (NACTO, 2016). The interactions between and among different forms of transportation should avoid conflict and ensure that bicyclists, pedestrians, and transit riders can move safely, freely, and comfortably. Safe and side-by-side paths for pedestrians and bicyclists with open sightlines and lighting should be provided on transit streets, allowing for the most direct access to destinations and the public realm. Vulnerable users like bicyclists should always be given sufficient space to operate safely, at a comfortable distance from fast-moving traffic or from larger vehicles like buses and trucks, outside of the door zone (NACTO, 2016). Where space permits, a transit lane adjacent to bicycle lanes, both bus and bicycle operational comfort are enhanced by providing a buffer space between them where width is available. The following table illustrates a number of design configurations for managing on-street bus and bicycle interactions.

<table>
<thead>
<tr>
<th>Technique</th>
<th>Description</th>
<th>Situational Considerations</th>
</tr>
</thead>
</table>
| Bike Box | Bike boxes, designated areas at the head of a traffic lane | Allow for the most direct access to destinations, with relatively few stops required. This treatment can be an effective way to minimize conflicts and delays. Buses travel more quickly than in a mixed-traffic environment; bicyclists thus experience reduced conflicts arising from pedestrians crossing the bicycle lane or queuing in bus boarding areas. This technique is suitable for rapid transit systems where space is available for development of separate facilities. This is not the preferred option when others are available due to potential bus and bicycle conflicts. These are preferred for implementing transit-supportive roadway strategies due to limited ROW to allocate among various modes of transport (NACTO, 2012). The interactions between and among different forms of transportation should avoid conflict and ensure that bicyclists, pedestrians, and transit riders can move safely, freely, and comfortably. Safe and side-by-side paths for pedestrians and bicyclists with open sightlines and lighting should be provided on transit streets, allowing for the most direct access to destinations and the public realm. Vulnerable users like bicyclists should always be given sufficient space to operate safely, at a comfortable distance from fast-moving traffic or from larger vehicles like buses and trucks, outside of the door zone (NACTO, 2016). Where space permits, a transit lane adjacent to bicycle lanes, both bus and bicycle operational comfort are enhanced by providing a buffer space between them where width is available. The following table illustrates a number of design configurations for managing on-street bus and bicycle interactions.

Special consideration should be given at transit stops to manage bicycle and pedestrian interactions. Design on-street bus lanes includes moving the cycle track to sidewalk level or wrapping it behind the transit stop at mid-block or signal protected intersections. On one-way streets, an additional option for providing separation is to locate the bus lane on the right side of the street. Where ROW permits, it may be possible to provide separate bus and bicycle lanes. Except when bus volumes are high enough that bicyclists are frequently passed or when bicyclists are frequently forced to enter the bus lane to enter or exit the bus, the bus lane is intended to be a buffer between bicyclists and vehicles, including near transit vehicle doors, on adjacent sidewalks and through long-term storage facilities (NACTO, 2016). See NACTO, 2012 and NACTO, 2016 for further information on bicycle facility design and coordination with transit.

Consideration in the bus zone should also be given to the loading and unloading of bicycles from the front-of-bus rack, which adds an additional six feet (1.8m) to the loading area. Where bicycles are allowed on transit vehicles, level boarding platforms should be provided, along with signage and markings to direct bicyclists to prefered platform doors. Sleeper and long-term bicycle parking and access to destinations should be considered near stations and stops, yet parked bicycles should not impede access paths to and from transit vehicles or along walking routes. There should be clear wide access paths around bicycle parking to avoid impeding traffic, including near transit vehicle doors, an adjacent sidewalk and through long-term storage facilities (NACTO, 2016). See NACTO, 2012 and NACTO, 2016 for further information on bicycle facility design and coordination with transit.

Bus, bicycle and pedestrian interactions should be accommodated at bus stops to provide safe and legible through paths for pedestrians and bicyclists with open sightlines and lighting should be provided on transit streets, allowing for the most direct access to destinations and the public realm. Vulnerable users like bicyclists should always be given sufficient space to operate safely, at a comfortable distance from fast-moving traffic or from larger vehicles like buses and trucks, outside of the door zone (NACTO, 2016). Where space permits, a transit lane adjacent to bicycle lanes, both bus and bicycle operational comfort are enhanced by providing a buffer space between them where width is available. The following table illustrates a number of design configurations for managing on-street bus and bicycle interactions.

<table>
<thead>
<tr>
<th>Technique</th>
<th>Description</th>
<th>Situational Considerations</th>
</tr>
</thead>
</table>
| Bus Box | Bus boxes, designated areas at the head of a traffic lane | Allow for the most direct access to destinations, with relatively few stops required. This treatment can be an effective way to minimize conflicts and delays. Buses travel more quickly than in a mixed-traffic environment; bicyclists thus experience reduced conflicts arising from pedestrians crossing the bicycle lane or queuing in bus boarding areas. This technique is suitable for rapid transit systems where space is available for development of separate facilities. This is not the preferred option when others are available due to potential bus and bicycle conflicts. These are preferred for implementing transit-supportive roadway strategies due to limited ROW to allocate among various modes of transport (NACTO, 2012). The interactions between and among different forms of transportation should avoid conflict and ensure that bicyclists, pedestrians, and transit riders can move safely, freely, and comfortably. Safe and side-by-side paths for pedestrians and bicyclists with open sightlines and lighting should be provided on transit streets, allowing for the most direct access to destinations and the public realm. Vulnerable users like bicyclists should always be given sufficient space to operate safely, at a comfortable distance from fast-moving traffic or from larger vehicles like buses and trucks, outside of the door zone (NACTO, 2016). Where space permits, a transit lane adjacent to bicycle lanes, both bus and bicycle operational comfort are enhanced by providing a buffer space between them where width is available. The following table illustrates a number of design configurations for managing on-street bus and bicycle interactions.

Special consideration should be given at transit stops to manage bicycle and pedestrian interactions. Design on-street bus lanes includes moving the cycle track to sidewalk level or wrapping it behind the transit stop at mid-block or signal protected intersections. On one-way streets, an additional option for providing separation is to locate the bus lane on the right side of the street. Where ROW permits, it may be possible to provide separate bus and bicycle lanes. Except when bus volumes are high enough that bicyclists are frequently passed or when bicyclists are frequently forced to enter the bus lane to enter or exit the bus, the bus lane is intended to be a buffer between bicyclists and vehicles, including near transit vehicle doors, on adjacent sidewalks and through long-term storage facilities (NACTO, 2016). See NACTO, 2012 and NACTO, 2016 for further information on bicycle facility design and coordination with transit.
Rail Station Design

As commuter rail differs from local and rapid bus service in terms of vehicle technology and passenger services, rail stations should be designed to offer safe, attractive, and well maintained facilities that meet the needs of this service. Many of the guidelines and standards discussed in this chapter are relevant to all stations and should be incorporated, if applicable. This section summarizes some general guidance obtained from other U.S. transit agencies, including information on platform design, station design, and security. Capital Metro has prepared guidelines for platform design and operations, including Capital Metro, 2007; CMTY, 2014; and CMTY, 2015. See Metra, 2007; Capital Transit, 2011; and FTTA, 2017 for more information on rail station design.

Platforms

Station platform design must address four key issues: location, dimensions, access, and amenities. The location addresses the relationship of the platform to the station buildings and the preference for avoiding locating platforms on curves. The width and length of the platform is dictated by the operational needs of Capital Metro and includes issues concerning platform features and material costs affected by the location of the station buildings, the type and size of the platform, the location of the parking lots, and may also be governed by various local codes, state codes, and federal regulations. The platform design includes the fixtures, furnishings, and equipment which provide convenience to riders (Metra, 2007).

The platform design section for further information on platform dimensions, as applicable.

Cured platform and boarding trains across active tracks is to be avoided in order to provide the conductor with a full view of passengers and to allow full passenger view of incoming trains and safe crossings.

Dimensions

Dimension criteria for rail platforms vary according to a transit agency’s operational needs, vehicle technology, and platform configuration. The following tables provide dimensions criteria obtained from Metro guidance and should be examined and adjusted to match Capital Metro’s needs. The platform length of 135 feet is based on a car length of 125 feet. Actual platform length may vary due to site constraints and may be based upon projected peak day riders and trauma operational requirements (Metra, 2007).

The length of the platform should be the greater length of either the inbound or the outbound platform. The platform should be lengthened where platform lengths are shorter than required, if possible, and specific line operations and individual site conditions such as controlled crossings, station buildings, or street walls will determine the new length of the platform. If conditions require shortening a platform length, the excess platform should be removed rather than abandoned (Metra, 2007). The Platform Design section for further information on platform dimensions, as applicable.

The Platform Design section for further information on platform dimensions, as applicable.

Ramps

Ramps should provide safe and easy access for the elderly and individuals with disabilities. Sides should be no less than 2:12 (16.7°) and shall have a flip plate to bridge between the platform and the car. Where public access and ramps should conform to all applicable accessibility requirements (Metra, 2007). See Metra, 2007 for ramp design specifications for ramps and stairs.

Crossings

Capital Metro recognizes the importance of coordinating with regional and municipal agencies to create a safe pedestrian network that accommodates pedestrian or bicycle access or crossings along its rail tracks in a consistent, appropriate, and context-sensitive manner, accommodating all ages and abilities. Pedestrian crossings should include infrastructure that meets safe crossing standards in a way that can be replicated throughout the service area. Caution is needed when requiring infrastructure that, although accepted in the industry, may not be needed to appropriately respond to the safety needs called for on-the-ground. Completing the pedestrian network with an appropriate level of crossing infrastructure establishes safety mechanisms and encourages pedestrian paths that otherwise would not exist at all.

Pedestrian safety at rail crossings can be improved by selectively using passive and/or active devices. Passive devices include fencing, gates, channelization, pedestrian barriers, fixed message signs, and pavement markings/striping. Active devices include flashers, automated pedestrian gates, pedestrian signals, audible warning devices, and variable message signs. A combination of audible and visual devices should be used to serve the accessibility needs of hearing-impaired and visually-impaired pedestrians. (TRANPA, 2017).

Access

Platforms should provide a clear path to direct commuters to and from the platform and should be designed to provide handicapped access into a car. True cars generally have a flip-plate bridge between the platform and the car. Where public access and ramps are at different elevations, ramps or stairs, or a combination of both, should be provided. “Platform edges bordering a drop-off and not protected by platform screens or guards shall have a detectable warning strip that shall be 21 inches wide running the full length of the platform edge drop-off.” (Metra, 2007).

Ramps provide safety and ease of access for the elderly and individuals with disabilities. Sides should be no less than 2:12 (16.7°) and shall have a flip plate to bridge between the platform and the car. Where public access and ramps should conform to all applicable accessibility requirements (Metra, 2007). See Metra, 2007 for ramp design specifications for ramps and stairs.

Crossings

Capital Metro recognizes the importance of coordinating with regional and municipal agencies to create a safe pedestrian network that accommodates pedestrian or bicycle access or crossings along its rail tracks in a consistent, appropriate, and context-sensitive manner, accommodating all ages and abilities. Pedestrian crossings should include infrastructure that meets safe crossing standards in a way that can be replicated throughout the service area. Caution is needed when requiring infrastructure that, although accepted in the industry, may not be needed to appropriately respond to the safety needs called for on-the-ground. Completing the pedestrian network with an appropriate level of crossing infrastructure establishes safety mechanisms and encourages pedestrian paths that otherwise would not exist at all.

Pedestrian safety at rail crossings can be improved by selectively using passive and/or active devices. Passive devices include fencing, gates, channelization, pedestrian barriers, fixed message signs, and pavement markings/striping. Active devices include flashers, automated pedestrian gates, pedestrian signals, audible warning devices, and variable message signs. A combination of audible and visual devices should be used to serve the accessibility needs of hearing-impaired and visually-impaired pedestrians. (TRANPA, 2017).

Access
As stated in the Amenities section, passenger amenities, such as benches, trash receptacles, advertising displays, and telephones provide added convenience and improve the trip and pedestrian experience. Specific types and quantity of amenities will vary from station to station and are discussed in Capital Metro’s service guidelines. See the Amenities section and Metra, 2007 for additional guidance on station amenities, including salt box locations, fencing and guardrails, intertrack fencing, and advertising displays.

Shelters
New and existing stations must comply with ADA, accessibility, and agency standards. Station design may vary by station depending upon factors, such as passenger volume, unusual site conditions, or community involvement, though such deviations from planning guidelines should be discussed with Capital Metro prior to design and implementation. Metra, 2007 provides detailed guidance on station area design, including waiting areas, depots, restrooms, accessibility of station buildings, auxiliary spaces, shelters, and security considerations. Highlights of this guidance are briefly summarized below. Station facilities should be permanent, safe, durable, easily and economically maintained, and energy efficient (Metra, 2007).

Seating
Station platform shelter should follow the guidance established by SEPTA, including where employment densities are greater than population densities, in which case station locations will be governed based on a number of factors such as location, municipal zoning and related comprehensive plans, surrounding land uses, highway and pedestrian access, P&R and transfer opportunities with other Capital Metro services (SEPTA, 2016).
Materials for Slope Stabilization & Erosion Control

<table>
<thead>
<tr>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete block paving</td>
</tr>
<tr>
<td>Brick paving</td>
</tr>
<tr>
<td>Cut Stone</td>
</tr>
<tr>
<td>Stone, rip-rap</td>
</tr>
<tr>
<td>Myrtle, pachysandra, etc.</td>
</tr>
<tr>
<td>Grass</td>
</tr>
</tbody>
</table>

Overview of the Site Selection Process

1. Determine the site's proximity to other major corridors or critical junctions.
2. Assess if the site is served by transit or other transportation modes.
3. Evaluate the intensity, concentration, and location of employment centers.
4. Assess the distance between major residential areas and employment or activity centers.
5. Consider the anticipated future development activity at both the trip origin and destination.
6. Examine the density and location of residential areas.
7. Analyze existing and future transportation-related improvement plans and programs.
8. Determine the local political will to plan and enable transit services that would otherwise be cost-effective, and are designed to transfer commuters from low-occupancy modes (personal car) to high-occupancy modes (bus, van, and car pools). (TAMU, Mobility).

The site selection process is based on a long-term strategic plan, existing and project land use and economic conditions, and other factors. The process should include the following steps:

1. Conduct a needs assessment of the target area.
2. Analyze the demography of the target area.
3. Evaluate the existing transportation system.
4. Identify the potential facilities that will be needed.
5. Determine the appropriate facility type.
6. Develop space allowances for landscaping, setbacks, and other design criteria.
7. Calculate additional space needs for bus facilities, turn radii, and other design criteria.
8. Develop additional space needs for roadways, sidewalks, drainage, and other design criteria.

The site selection process should be as follows:

1. Compute the number of materials that will be used in the facility.
2. Convert the number of materials to the number of parked vehicles.
3. Adjust the number of vehicles to account for fluctuations in demand created by seasonal factors.
4. Compute the maximum accumulation of shared ride vehicles.
5. Calculate the number of accessible spaces required.
6. Convert the total estimated number of spaces to an area measure.
7. Calculate additional space needs for bus facilities, turn radii, and other design criteria.
8. Develop additional space needs for roadways, sidewalks, drainage, and other design criteria.


Site Location

Site location is based on a number of factors:

1. Proximity to other major corridors or critical junctions
2. Served by transit
3. Intensity, concentration and location of employment centers
4. Distance between major residential areas and employment or activity centers
5. Metra, 2007
7. Dimensions:
8. Anticipated future development activity at both the trip origin and destination
9. Density and location of residential areas
10. Site visibility and accessibility
11. Current and future levels of service on sub-area and corridor level roadways
12. Existing and future transportation-related improvement plans and programs
13. Park & Ride Design

Park & Ride Design

Park & Ride (P&R) facilities are specialized parking lots generally located on the suburban fringe of urbanized areas outside of the "ring of congestion" on major commuter corridors. P&Rs are an important component of the transit system, concentrating transit demand and enabling transit services that would otherwise be not cost-effective, and are designed to transfer commuters from low-occupancy modes (personal car) to high-occupancy modes (bus, van, and car pools). (TAMU, Mobility). This section provides general guidance on P&R location, accessibility, parking, and landscaping. Capital Metro is in the process of developing P&R design guidelines. For further information on P&R design, see amenities section; Capital Metro’s service guidelines; Sound Transit, 2007; and FDOT, 2012 for additional information.

Location

When designing a P&R, surface and/or structure facilities should be located as close as possible to major streets and freeways serving a site. In addition, Sound Transit, 2007 states that:

Where possible, the maximum distance between the farthest slab of the P&R site and the boarding area should be 1/4 mile. The design should provide uninterrupted flow between all areas of the P&R site and the boarding areas wherever possible. Connections between the P&R area and boarding area should be as direct as possible and include walking paths conveying in the boarding area. To assist the wayfinding experience of customers, these paths should generally be at a higher floor level than surrounding parking areas.

The site selection process is based on a long-term strategic plan, existing and project land use and economic conditions, and other factors. The process should include the following steps:

1. Compute the number of materials that will be used in the facility.
2. Convert the number of materials to the number of parked vehicles.
3. Adjust the number of vehicles to account for fluctuations in demand created by seasonal factors.
4. Compute the maximum accumulation of shared ride vehicles.
5. Calculate the number of accessible spaces required.
6. Convert the total estimated number of spaces to an area measure.
7. Calculate additional space needs for bus facilities, turn radii, and other design criteria.
8. Develop additional space needs for roadways, sidewalks, drainage, and other design criteria.


Additional space may be needed to include areas for community art, security, vendors, waiting areas, and passenger drop off and pick up areas.

Leander Station P&R (source: Capital Metro)
PARK & RIDE DESIGN

Establish visual screening of parking areas from adjacent properties while allowing for integration of design elements with adjacent areas. Vehicle entrances and exits should occur away from street corners. Parking lots should be located at least 50 feet from the frontage line of any street. Portions of a reserved right-of-way (RORW) occupied by the line of road, employed by the public and used by the public, should be set back from the line of the road a distance equal to the width of the roadway and, in any event, a distance of at least 10 feet from the crosswalk or curb line. The space occupied by the parking lot should be the width of the roadway plus 10 feet on either side for a distance of at least 100 feet. This distance should be increased to a width of 200 feet where one or both of the sides of the premises are used for public streets. These requirements for storm water management and critical areas.侃侃而谈

PARK & RIDE DESIGN

Where feasible and given site constraints, construction work should be reserved to maximize usage. Parkers tend to use the first lot encountered. Parking lots should be designed so as to avoid the use of earth-retaining structures. Additional design considerations for landscaping at P&R sites include:

- Pedestrian walkways may also be required to minimize vehicular travel distances, to reduce the number of points where pedestrians cross, and to shorten irregular routes through successive aisles. Where practical, speed bumps may be considered to reduce vehicle speeds for pedestrian safety (Sound Transit, 2007). P&R facilities should accommodate first and last mile transit/bicycle connections from adjacent roadways. In addition, P&R should provide long-term bicycle storage.

- Vehicular access points at P&R facilities should consider adjacent land uses and avoid large unplanned or paved areas that are cut into scale with those uses. Vehicular access form local residential streets should be avoided and access directly from major highways/arterials into a P&R facility should be minimized due to relatively high speeds and traffic volumes. Access locations should minimize potential vehicle, pedestrian, and traffic conflicts and site layout and facility design features should allow for potential management of access. Curb cuts should also be minimized and "access roadways to the P&R facility" should be designed with sufficient traffic capacity to meet expected transit patronage at peak times and to prevent traffic backing-up onto public streets." (Sound Transit, 2007).

The following design considerations should also be followed to ensure a multi-modal access to P&R lots:

- Vehicle access to and from the lots should minimize interference with street traffic.
- To reduce impacts on local streets or to ensure P&R lots are located in major streets (although avoiding high-speed arterials if possible). Secondary access points may be located in minor streets.
- When designing a surface parking facility, public streets should be kept within Sound Transit’s rights-of-way.
- Parking lots and garages should be appropriately illuminated.

Source: Sound Transit, 2007

Parking

Surface parking structures are to be placed at select transit facilities as determined by Capital Metro. Parking facility design should consider potential expansion that may occur and identifying locations for a temporary P&R lot while expansion takes place. It is recommended that parking facilities with over 500 stalls should be in a structure, including when expansion of existing P&R facilities result in a net total of more than 500 stalls (Sound Transit, 2007). Sound Transit, 2007 provides detailed guidance on open parking design, including information on dimensions of parking stalls and garages. Some design considerations for parking at P&R locations include:

- Where feasible, design for green roofs, construction work should be reserved to maximize usage.
- Carpooling services may be provided at or near parking lots located on or near a major or minor street.
- Curbs should be kept within Sound Transit’s rights-of-way (Sound Transit, 2007).

Surface parking structures are to be placed at select transit facilities as determined by Capital Metro. Parking facility design should consider potential expansion that may occur and identifying locations for a temporary P&R lot while expansion takes place. It is recommended that parking facilities with over 500 stalls should be in a structure, including when expansion of existing P&R facilities result in a net total of more than 500 stalls (Sound Transit, 2007). Sound Transit, 2007 provides detailed guidance on open parking design, including information on dimensions of parking stalls and garages. Some design considerations for parking at P&R locations include:

- Where feasible, design for green roofs, construction work should be reserved to maximize usage.
- Carpooling services may be provided at or near parking lots located on or near a major or minor street.
- Curbs should be kept within Sound Transit’s rights-of-way (Sound Transit, 2007).

Surface parking structures are to be placed at select transit facilities as determined by Capital Metro. Parking facility design should consider potential expansion that may occur and identifying locations for a temporary P&R lot while expansion takes place. It is recommended that parking facilities with over 500 stalls should be in a structure, including when expansion of existing P&R facilities result in a net total of more than 500 stalls (Sound Transit, 2007). Sound Transit, 2007 provides detailed guidance on open parking design, including information on dimensions of parking stalls and garages. Some design considerations for parking at P&R locations include:

- Where feasible, design for green roofs, construction work should be reserved to maximize usage.
- Carpooling services may be provided at or near parking lots located on or near a major or minor street.
- Curbs should be kept within Sound Transit’s rights-of-way (Sound Transit, 2007).

Surface parking structures are to be placed at select transit facilities as determined by Capital Metro. Parking facility design should consider potential expansion that may occur and identifying locations for a temporary P&R lot while expansion takes place. It is recommended that parking facilities with over 500 stalls should be in a structure, including when expansion of existing P&R facilities result in a net total of more than 500 stalls (Sound Transit, 2007). Sound Transit, 2007 provides detailed guidance on open parking design, including information on dimensions of parking stalls and garages. Some design considerations for parking at P&R locations include:

- Where feasible, design for green roofs, construction work should be reserved to maximize usage.
- Carpooling services may be provided at or near parking lots located on or near a major or minor street.
- Curbs should be kept within Sound Transit’s rights-of-way (Sound Transit, 2007).

Surface parking structures are to be placed at select transit facilities as determined by Capital Metro. Parking facility design should consider potential expansion that may occur and identifying locations for a temporary P&R lot while expansion takes place. It is recommended that parking facilities with over 500 stalls should be in a structure, including when expansion of existing P&R facilities result in a net total of more than 500 stalls (Sound Transit, 2007). Sound Transit, 2007 provides detailed guidance on open parking design, including information on dimensions of parking stalls and garages. Some design considerations for parking at P&R locations include:

- Where feasible, design for green roofs, construction work should be reserved to maximize usage.
- Carpooling services may be provided at or near parking lots located on or near a major or minor street.
- Curbs should be kept within Sound Transit’s rights-of-way (Sound Transit, 2007).
An urban parabola is approximately half the size of a suburban parabola at 4 miles long and 8 miles wide. TTI methodology states that a parabola that is 7 miles long and 8 miles wide is an effective size for capturing suburban P&R demand. An urban parabola is approximately 1 mile in front of the P&R. Riders will travel up to 2010 Census Tract Flows (percent of population living to activity center at different times of day) in the following criteria to assess demand for new P&R facilities in suburban and urban locations: approximately 1 mile in front of the downtown area. Riders will travel up to 2010 Census Tract Flows (from catchment area to activity center of CBD, Capital Complex and UT) in the following criteria to assess demand for new P&R facilities in suburban and urban locations:

**Security**

The physical safety of passengers is vital to the success of any transit system—not only to retain existing riders but also to encourage new riders. This is true both while passengers are on board a transit vehicle as well as when they are accessing the system (FHWA, 2008). There are multiple strategies for improving passenger safety on and off the transit vehicle, some of which have been discussed previously (camera surveillance, security telephones, lighting, fencing, and landscaping). These and other best practices are presented in more detail in FHWA (2008). This section focuses on a multi-dimensional approach to addressing safety at transit facilities known as Crime prevention through environmental design (CPTED). CPTED is “the application of designing and security into the natural environment of a specific area. Specifically, CPTED concepts and strategies use the three intertwined principles of natural surveillance, natural access and territoriality, plus activity support and maintenance. By using the behavior of people, a knowledge of crime or the generators, the physical environment, and the space of an area, CPTED can provide benefits and safety if it is applied in the conceptual design and planning phases of a project” (APTA, 2013).

**Future Facility Policies**

1. Capital Metro will consider potential future park-and-ride facilities every five years during its Service Plan update process.
2. Capital Metro will evaluate the cost and benefits of future park-and-ride facilities, including user benefits and ridership impacts. Proposed plans included a high-capacity transit corridor during the corridor-level study, environmental review processes or through an independent planning process.
3. Capital Metro will coordinate with affected jurisdictions on proposed park-and-ride facilities during the corridor-level study, environmental review processes or independent planning process.
4. Capital Metro will coordinate with other regional transportation providers for input on purpose and need, goals and objectives, and financial resources necessary to construct and service future park-and-ride facilities. These providers may include City of Austin, Capital Metropolitan Planning Organization (CAMP), Greater Central Texas Regional Mobility Authority (CTRMA), Texas Department of Transportation (TxDOT), and Capital Area Rural Transportation System (CARTS).
Remote surveillance can also be provided at the station and are particularly useful in locations without direct surveillance. Design and planning of all remote surveillance systems should be coordinated with local and Capital Metro police and the policing of notices indicating the presence of remote surveillance is recommended as a criminal deterrent. Closed circuit television (CCTV) cameras may be installed as a deterrent and should be located for maximum visual coverage and protection from vandalism. The effectiveness of any remote surveillance system is dependant upon a timely response to any observed incident (Metro, 2007).

Territoriality

Territoriality notifies users and non-users of the boundaries of a space/area or facility. It carries a psychological deterrent to crime by notifying users of the space/area/facility that they are being watched and that the community in the space/area/facility is interested in its protection. Five strategies are involved in CPTED: natural surveillance; natural access control; natural protection; natural control, and natural security. This concept denies access to crime targets and creates a perception of risk for offenders. By encouraging authorized activities in public spaces, the visibility of paths, paving materials, and the creation of distinct visual zones can complement other activities in the same space.

Natural Surveillance

Natural surveillance involves protecting a space through visual cues (direct or indirect). Should the visibility of behavior or other elements indicate criminal activity, the presence of personnel, or an employee of a specified organization (includ
Strategies for Transit Station/Stop Areas

1. Establish and maintain partnerships for the development and promotion of plans and policies that encourage appropriate development in transit-rich areas.

2. Encourage transit-supportive development around MetroRail and MetroRapid Stations, and other selected transit facilities.

3. Ensure the creation of safe direct pedestrian and bicycle connections to stations and stops from proximate development.

The biggest challenge in a development is to accurately determine how much parking is needed. Too much parking makes a development less pedestrian-friendly, wastes valuable real estate, and leads to higher exactions and development costs. To answer this question, many engineers and planners consult the Institute of Transportation Engineers’ (ITE) Trip Generation and Parking Generation guides. Though these publications represent data collected from mostly isolated suburban land uses - not walkable urban places served by transit - the findings show an overabundance of parking at TODs and the limitations of current engineering standards to accommodate the type of development. Six engines for better aligning industry standards with current parking needs include:

- Incorporate shared parking, unbundled residential parking, and paid commercial parking into development.

- Reduce zoning code to allow reduced parking ratios for mixed-use developments by-right, including unbundled parking, and shared parking.

- Ensure proper connectivity of P&R with TOD development.

- Ensure that transit-oriented development opportunities are appropriately considered in all acquisitions of new properties, location of new transit facilities, and design of all transit facilities.

Strategies for Capital Metro Property

1. Pursue creation of transit-oriented developments on appropriate sites.

2. Build transit facilities to support transit-oriented development. Ensure safe multi-modal connectivity with pedestrian and bicycle infrastructure.

3. Ensure that transit-oriented development opportunities are appropriately considered in all acquisitions of new properties, location of new transit facilities, and design of all transit facilities.

There are several strategies for estimating TOD parking demand. If a TOD already exists and is being expanded, or if new developments are going to near existing TODs, counts and intercept surveys similar to those conducted in NITC, 2017 should be initiated to estimate the performance characteristics of the expanded TOD or new development. For planned TODs, the statistics applied in NITC, 2017 may be used in conjunction with regional level travel model forecasts for a particular TOD or its respective affinity zone. Also, one could estimate minimum and maximum parking ranges by finding the best matches to a particular TOD being proposed from among the sample TODs studied in NITC, 2017.

Strategies for better aligning industry standards with current parking needs include:

- Incorporate shared parking, unbundled residential parking, and paid commercial parking into development.

- Reduce zoning code to allow reduced parking ratios for mixed-use developments by-right, including unbundled parking, and shared parking.

- Ensure proper connectivity of P&R with TOD development.

- Educate developers, financiers, and stakeholders that TODs do not require as much parking as standard development.

- Establish a well-defined vision of transit's capability to energize an area.

- Ensure that transit-oriented development opportunities are appropriately considered in all acquisitions of new properties, location of new transit facilities, and design of all transit facilities.
Placemaking

Placemaking is an important element of well-designed transit facilities. Founded on principles advanced by revolutionary figures in urban planning, such as Jane Jacobs and William H. Whyte, it centers on the premise that cities should be designed for people and not just cars or shopping centers and should create inviting public spaces. As defined by Project for Public Spaces, “Placemaking refers to a collaborative process by which we can shape our public realm in order to maximize shared value. More than just promoting better urban design, an effective Placemaking process capitalizes on a local community’s assets, inspiration, and potential, and it results in the creation of quality public spaces that contribute to people’s health, happiness, and well-being.” The principles of Placemaking should be incorporated in designing a transit facility and integrating the stop/station area with the surrounding community. For more information on Placemaking, see: pps.org/reference/what_is_placemaking.

Placemaking is:

- Transformative
- Flexible
- Collaborative
- Sociable
- Dynamic
- Trans-disciplinary
- Community-driven
- Visionary
- Function before form
- Inclusive
- Creative Destinations
- Context-specific

Resources for Further Reading

- APTA: apta.com/resources/standards/Pages/default.aspx
- Capital Metro: service-guidelines-and-standards.capmetro.org
- Transit-Oriented Development: capmetro.org/TOD
- TRB: trb.org/Main/Blurbs/173932.aspx

Placemaking

Placemaking is an important element of well-designed transit facilities. Founded on principles advanced by revolutionary figures in urban planning, such as Jane Jacobs and William H. Whyte, it centers on the premise that cities should be designed for people and not just cars or shopping centers and should create inviting public spaces. As defined by Project for Public Spaces, “Placemaking refers to a collaborative process by which we can shape our public realm in order to maximize shared value. More than just promoting better urban design, an effective Placemaking process capitalizes on a local community’s assets, inspiration, and potential, and it results in the creation of quality public spaces that contribute to people’s health, happiness, and well-being.” The principles of Placemaking should be incorporated in designing a transit facility and integrating the stop/station area with the surrounding community. For more information on Placemaking, see: pps.org/reference/what_is_placemaking.

Placemaking is:

- Transformative
- Flexible
- Collaborative
- Sociable
- Dynamic
- Trans-disciplinary
- Community-driven
- Visionary
- Function before form
- Inclusive
- Creative Destinations
- Context-specific

Resources for Further Reading

- APTA: apta.com/resources/standards/Pages/default.aspx
- Capital Metro: service-guidelines-and-standards.capmetro.org
- Transit-Oriented Development: capmetro.org/TOD
- TRB: trb.org/Main/Blurbs/173932.aspx

Bibliography


Capitol Metro Rail and NMT (2017, Apr.). System Special Instructions.


USA Department of Transportation. (2006). “810.2.2, Bus Boarding and Alighting Areas.”


Appendix: Errata Sheet

This section will contain a list of future revisions made to the document.


Estação Xaxim, Curitiba (source: BostonBrt)

Casa Voyageurs Station, Casablanca (source: Andy Nash)

Pampulha, Belo Horizonte (source: BostonBrt)

Avenida Jiménez Station, Bogotá (Karl Fjellstrom)

BRT Transit Center: Concept (source: BostonBrt)

Enclosed BRT Station: Concept (source: BostonBrt)

Dedicated BRT Lane: Concept (source: BostonBrt)

Complete Streets Separation Elements: Concept (BostonBrt)