

ACCESSING TRANSIT

Design Handbook for Florida Bus Passenger Facilities

Version III, 2013



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DESIGN HANDBOOK FOR FLORIDA BUS PASSENGER FACILITIES

Version III

Prepared for

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CHAPTER 1: INTRODUCTION AND USER GUIDE.....	1
Introduction.....	3
User Guide.....	5
CHAPTER 2: TRANSIT SERVICE TYPES AND FACILITY PROTOTYPES.....	9
2.1 Implementation and Maintenance of Transit Facilities - Roles and Responsibilities.....	15
2.2 On-Line Bus Stop.....	17
2.3 Primary Stop.....	19
2.4 Transit Mall.....	21
2.5 Transfer Center.....	23
2.6 University Transfer Center.....	25
2.7 BRT Station.....	27
2.8 Park-and-Ride Facility.....	29
2.9 Intermodal Transfer Centers.....	31
CHAPTER 3: CURB-SIDE FACILITIES.....	39
3.1 Bus Stop Boarding and Alighting Areas.....	41
3.2 Bus Stop Signs.....	49
3.3 Bus Stop Shelters.....	57
3.4 Bus Stop Benches.....	69
3.5 Other Components.....	75
3.6 Landscaping.....	89
3.7 “Green” Building Facilities.....	93
CHAPTER 4: STREET-SIDE FACILITIES.....	105
4.1 Transit Vehicle Characteristics.....	107
4.2 Bus Stop Placement.....	115
4.3 Bus Bays, Bus Bulbs and Nubs.....	129
4.4 Traffic Signals and Transit Priority.....	139
4.5 Pedestrian and Bicycle Access to Bus Stops.....	147
4.6 Transit and Bus Stop Provisions During Construction.....	155
4.7 Roadway.....	159
CHAPTER 5: EXCLUSIVE/SPECIAL USE LANES.....	167
5.1 Locating Bus Stops on Exclusive/Special Use Lanes.....	169
CHAPTER 6: BRT AND RAIL STATION DESIGN.....	179
6.1 BRT Station Design.....	181
6.2 Rail Station Design.....	197
CHAPTER 7: AGENCY COORDINATION.....	209
7.1 Agency Coordination.....	211
INDEX OF RESOURCES.....	223
Index of Resources.....	223
APPENDICES.....	
Appendix A Glossary.....	229
Appendix B Quick Reference Guide.....	243
Appendix C Bus Stop Checklist.....	257

CHAPTER 1



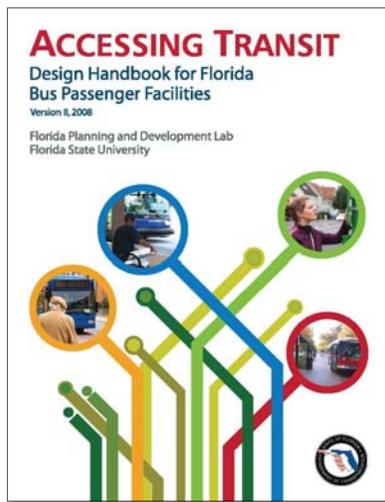
Introduction and User Guide

CHAPTER 1

Introduction and User Guide

Introduction

The purpose of this handbook is to provide guidance to state and local governments and transit agencies in the design, location, and installation of transit facilities consistent with state and federal laws, regulations, and best practices. The FDOT Public Transit Office



initially prepared and published Version I of the handbook in 2004, and the last update was published as Version II in 2008. The purpose of this update is to identify and incorporate new and revised federal and state standards, criteria, and guidelines as well as best practices relating to the design and implementation of transit facilities along roadways in Florida. In addition, the new update incorporates guidance and materials from national and FDOT District transit design guidelines to ensure statewide consistency.

FORMAT CHANGES

The format of the *Accessing Transit* handbook has been revised to include new, easy-to-read Quick Reference Guides with standards and minimum requirements in an effort to provide fast access to relevant information in each chapter. Additionally, detailed engineering drawings are included, where applicable, at the end of each section to enhance the illustration of appropriate design for the applicable standards.

The new layout also includes the use of text formats to help readers identify differences between standards and best practices or to identify reference

materials. These formatting criteria are intended to make the subject matter easier to read and follow. While most of the graphics and other visuals are in color, a concerted effort has been made to use visuals that are also legible in black-and-white to accommodate printing or viewing preferences.

Examples of information noted by the use of formatting include:

- Importance of a critical standard or a best practice
- Difference between a state regulation and a federal regulation

The formatting used herein is clear and easy to decipher and is used so the reader does not have to refer back to a legend while reviewing the text.

THE BASICS

A transit agency provides a network of services and facilities that require coordination among multiple agencies, users, and the local community. Developing transit services and facilities requires a long-term outlook on short-term problems, and developing even the most basic transit stop requires more than just incorporating the engineering standards required for the poured concrete for a bus stop sign post.

This handbook is designed to provide basic guidelines and best practices for making transit accessible. By providing guidance and best practices for multiple bus components, agency coordination, safety and security, and Americans with Disabilities Act (ADA) guidelines, as well as a quick reference to the most basic guidelines, it is anticipated that state and local transportation agencies will find this tool useful and informative.

Successfully providing transit that is accessible to all individuals requires a balanced mix of local and state agency coordination and consideration of needs, costs, location, federal and state

regulations, public relations, and transit-dependent populations. For example, Figure 1.1 shows the key considerations for transit agencies when locating a bus stop. Agencies need to consider the “big picture” to help fully develop a functioning and successful transit system. These guidelines may also be used by a developer or builder that is interested in developing a project that is transit-supportive.

NEED FOR UPDATE

Since the last update of *Accessing Transit* in 2008, a number of existing key resources applicable to locating and designing transit facilities have been updated, and new resources have been introduced. These revised and new standards and regulations from both federal and state agencies, the heightened interest in transit due to steadily-increasing ridership nationwide, and emerging trends such as “go-green” concepts have necessitated an update to *Accessing Transit*. At the federal level, ADA guidelines have been revised/updated or are in the process of being

updated. For example, the Access Board’s Draft Proposed Public Rights-of-Way Accessibility Guidelines (PROWAG) have been introduced. At the state level, the Florida Accessibility Code for Building Construction and the *Plans Preparation Manual (PPM)* have recently been updated. At the time of this writing, the U.S. Department of Justice’s (DOJ) ADA Standards for Accessible Design (2010), the U.S. Department of Transportation’s ADA Standards for Transportation Facilities (2006), and the Florida Accessibility Code (2012) have been used as the most current and up-to-date standards. Where applicable, PROWAG has been noted as anticipated future guidelines.

EMERGING TRENDS

New trends involving innovative solutions to safety, operational, and maintenance problems related to transit facilities are constantly being developed. Agencies are using Geographic Information Systems (GIS) to catalogue, monitor, and prioritize amenities at their bus stops, such as

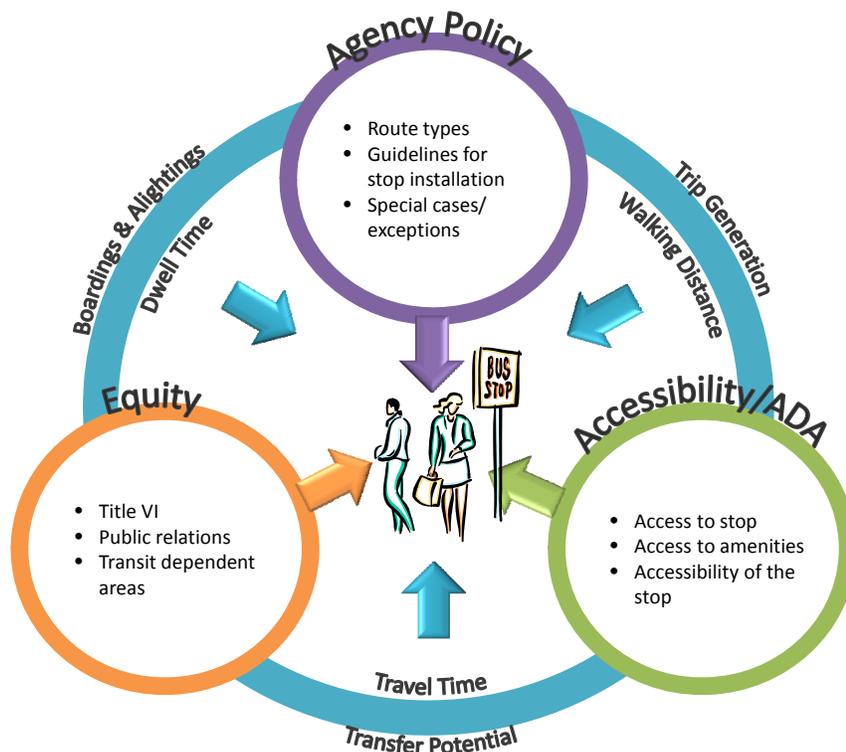


Figure 1.1 | Considerations for transit agencies when locating a bus stop.

FDOT’s Automated Transit Stop Inventory Model (ATSIM). This is a free software program designed to capture bus stop inventories and details, prepare maintenance work orders, and easily prepare asset management reports. See more on ATSIM at www.ftis.org; <http://www.ftis.org/atsim.html>. Bicycle lanes indicated by colored pavement are being used to draw attention to safety hazards at the intersection of bus bays and bicycle lanes. “Smart” bus bays provide temporary signal lighting phases that allow buses to merge into heavily-trafficked areas safely. Bus-on-Shoulder programs allow the bypassing of congested sections of highways during peak travel periods.

Transit agencies also are embracing social media, the Internet, and smart phone technology to seamlessly provide better, more up-to-the-minute bus tracking information. Many agencies employ real-time bus tracking systems for customers who use mobile devices to track the arrival time of the next bus. Google Maps allows users to map a transit trip using data provided by registered transit agencies; available information includes bus stop locations, bus arrival times, and the route number of buses that serve the stop. Some agencies are providing Wi-Fi service at their stations and on their buses. These methods appeal to riders seeking more reliability and information on their transit route.

A major trend developing within the last few years is the embracing of environmentally-sensitive—“green”—practices and technology to make transit as carbon-neutral as possible. While transit’s very nature lends itself to being green and agencies are seeking more readily-available alternative fuel systems and Leadership in Energy and Environmental Design (LEED®) certifications for facilities, they also are embracing green efforts and technologies to cut costs during cash-strapped times.

Through the use of geothermal designs and recycling practices, transit agencies are finding alternative ways of supplying energy and reducing costs, such as installing solar-powered charging stations for electric vehicles at parking facilities and recycling water at their wash facilities. While these

are large-scale examples, agencies are also finding small ways to reduce their carbon footprint: recycled concrete reduces waste at a new bus pad, and solar-powered LED lights in a shelter reduce the energy needed for night-time lighting. Alternative fuel and hybrid buses provide ample opportunity for reducing fuel costs and carbon footprint. Green practices are covered more in depth throughout this handbook. While still developing, being “green” seems here to stay for transit agencies.

With these trends, public transit is constantly evolving. Many organizations in the transit industry are dedicated to researching and developing best practices and standards to facilitate this evolution, including the Transit Cooperative Research Program (TCRP) (www.TCRPonline.org) and the American Public Transportation Association (APTA) (www.apta.com), which offer a wide variety of materials and resource manuals on the latest transit research and practices. Local, state, and national agencies publish their own guidelines, best practices, and experimental treatments. In Florida, the FDOT Public Transit Office and other organizations strive to provide transit agencies with the best possible resources for planning and operation.

User Guide

USER FEATURES

Requirements vs. Best Practices

This guidebook uses text formatting to differentiate, where feasible, requirements in state or federal law or rules from industry best practices. Requirements are indicated by statements using “shall” and “must” and are shown using underlined text. Industry best practices are indicated by statements using “should” or similar language. The most convenient method of identifying the requirements for all components of a transit facility is the Quick Reference Guide (QRG) contained in Appendix A of this report. In addition, relevant parts of the QRG have been included at the end of chapters, where applicable.

This handbook includes a vast collection of requirements and best practices and is intended to be used as a comprehensive guide in this evolving transit industry. It is provided as part of a concerted effort by the FDOT Public Transit Office to provide Florida transit agencies and other interested parties with the best possible design handbook for bus facilities to ensure accessibility.

ORGANIZATION OF THE HANDBOOK

Chapter 1: Introduction and User Guide

This user guide and introduction are considered Chapter 1. Covered herein are “big-picture” emerging trends, how to use this handbook as a tool, and a discussion of the organization of the rest of the handbook.

Chapter 2: Transit Service Types and Facility Prototypes

Chapter 2 provides a discussion regarding the roles and responsibilities of transit agencies in implementing and maintaining bus stop facilities and a general overview of facility layouts and design concepts based on the most recent data available. Bus passenger facilities must meet a wide variety of passenger needs, operational arrangements, and community goals and can be located on public right-of-way or on private property. Most facilities have common traits or functions, including the provision of interconnection to and from bus or other public transportation services. This chapter also discusses the basic functions of different transit services, from basic fixed-route service to more enhanced services such as light rail and heavy rail.

Chapter 2 is organized into the following sections:

- Section 1: Implementation and Maintenance of Transit Facilities—Roles and Responsibilities
- Section 2: On-Line Bus Stop
- Section 3: Primary Stop
- Section 4: Transit Mall

- Section 5: Transfer Center
- Section 6: University Transfer Center
- Section 7: BRT Station
- Section 8: Park-and-Ride Facility
- Section 9: Intermodal Transfer Center

Chapter 3: Curb-Side Facilities

Chapter 3 presents guidelines for improving passenger accessibility to buses and passenger mobility in the right-of-way, including the coordination of bus stop elements such as bus stop signs, benches, and shelters. Additional elements or components such as boarding and alighting areas, lighting, leaning rails, trash receptacles, and bicycle racks are also presented. This information is relevant to planners, engineers, and other transit professionals involved in bus stop siting and design within public rights-of-way and on private property.

Chapter 3 has been revised from previous versions to help users more easily find the information needed to make decisions and is organized into the following sections:

- Section 1: Bus Stop Boarding and Alighting Areas
- Section 2: Bus Stop Signs
- Section 3: Bus Stop Shelters
- Section 4: Bus Stop Benches
- Section 5: Other Components
- Section 6: Landscaping
- Section 7: Green Building Facilities

Chapter 4: Street-Side Facilities

Chapter 4 presents guidelines for improving the bus passenger experience at the street level, including special use lanes, transit preferential treatments, and connections to pedestrian and bicycle facilities. This information is relevant to planners, engineers, and transportation professionals involved in facility layout, connections, and circulation.

Chapter 4 also has been revised from previous versions to help users more easily find the information needed to make decisions and is organized into the following sections:

- Section 1: Transit Vehicle Characteristics
- Section 2: Bus Stop Placement
- Section 3: Bus Bays, Bus Bulbs, and Nubs
- Section 4: Traffic Signals and Transit Priority
- Section 5: Pedestrian and Bicycle Access to Stops
- Section 6: Transit and Bus Stop Provisions During Construction
- Section 7: Roadway

Chapter 5: Exclusive/Special Use Lanes

Chapter 5 includes a brief overview of special use transit lanes. It also briefly discusses key considerations of locating transit stops alongside special use lanes.

Chapter 6: BRT and Rail Station Design

Chapter 6 is new to the handbook and recognizes that public transportation programs and services are evolving and that federal funding has expanded to include more rail and Bus Rapid Transit (BRT) alternatives. The chapter provides a review of station design guidelines related to BRT and rail.

Chapter 7: Agency Coordination

Also new to this handbook, Chapter 7 includes information on coordinating with transit stakeholders, including FDOT, local municipalities, transit agencies, business owners, and private citizens, in the planning, design, and placement of transit facilities on the roadway system.

Index of Resources

The Index of Resources provides a compilation of the key resources used to develop this handbook. Each resource provides a live Web link for users accessing this handbook via the Internet, linking them to the listed resource. The list of resources and Web links, where applicable, is intended to provide access to additional as well as updated standards and best practices not included in this handbook.

Appendices

The appendices provide a glossary of key terms used in the handbook, a quick reference guide of standards and minimum requirements, and a checklist for locating and designing bus stops:

- Appendix A: Glossary
- Appendix B: Quick Reference Guide
- Appendix C: Bus Stop Checklist

RESOURCES

While this publication attempts to address the most current standards, it should be noted that it is also a “living” document. From the time of writing of the handbook to when agencies use it to design a facility, standards may change or develop. **To ensure that agencies are accurately following the latest standards and guidelines, the most recent standards documents should be consulted prior to any planned projects.**

Where applicable, suggestions related to industry trends for best practices are included herein; while these practices are not necessarily standard, they can offer insightful guidance. In particular, the Access Board’s Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way, which are included in the draft PROWAG, has been addressed. These are standards that the DOJ has not yet adopted and are still in development; they are more stringent than existing USDOT and DOJ guidelines.

CHAPTER 2



Transit Service Types and Facility Prototypes

Transit Service Types and Facilities

Overview

This chapter presents the types of transit services and prototypes of bus transit facilities that are typically available and/or emerging in Florida. It also includes a summary of the roles and responsibilities of various agencies in implementing and maintaining bus stop facilities.

While some of these facilities consist of unique features, all offer a diverse combination of components. Specific component combinations depend on the site, facility function, transit agency operational plans, land availability, and level of investment. This handbook emphasizes relatively low-cost facilities that incorporate interchangeable elements to allow for easy maintenance. Environmental protection and energy efficiency approaches are also discussed in each applicable transit station design prototype. It is also important to note that FDOT has adopted some of the criteria in the PROWAG as “standards” for facilities on state roads. Cities, counties, and transit agencies must comply with the requirements of the FDOT criteria when transit facilities are planned or constructed on state roads.

Prior to designing facilities that will be located on or that will access state roadways, all applicable resources from FDOT and federal or local guidelines should be reviewed. Some key state and federal resources are listed on this page. The FDOT Public Transit Office, in its continuing effort to enhance transit attractiveness and use in Florida, also offers on-line resources with up-to-date guidelines and best practices. Agencies are encouraged to partner with FDOT related to the planning and development of transit facilities.

Key State and Federal Resources for Transit Facility Planning and Design

Plans and Preparation Manual (PPM)

<http://www.dot.state.fl.us/rddesign/PPMManual/PPM.shtm>

Project Development and Environment (PD&E) Manual

<http://www.dot.state.fl.us/emo/pubs/pdeman/pdeman1.shtm>

Guidelines for Enhancing Intermodal Connections at Florida Transit Stations

<http://www.dot.state.fl.us/transit/Pages/EnhancingIntermodalConnections.pdf>

FDOT State Park-and-Ride Guide

<http://www.dot.state.fl.us/transit/Pages/FinalParkandRideGuide20120601.pdf>

FDOT Transit-Oriented Development Clearinghouse

<http://fltod.com>

FDOT Manual of Uniform Minimum Standards for Design, Construction, and Maintenance for Streets and Highways (Florida Greenbook)

<http://www.dot.state.fl.us/rddesign/FloridaGreenbook/FGB.shtm>

FDOT Design Standards

<http://www.dot.state.fl.us/rddesign/DesignStandards/Standards.shtm>

2012 Florida Accessibility Code for Building Construction

[http://www.floridabuilding.org/fbc/committees/accessibility/aac/Changes to Law/Florida Accessibility Code 2012 ICC FINAL.pdf](http://www.floridabuilding.org/fbc/committees/accessibility/aac/Changes%20to%20Law/Florida%20Accessibility%20Code%202012%20ICC%20FINAL.pdf)

2010 ADA Standards for Accessible Design (ADAAG)

http://www.ada.gov/2010ADASTandards_index.htm

2006 ADA Standards for Transportation Facilities (ADA Standards)

<http://www.access-board.gov/ada-aba/ada-standards-doj.cfm>

Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Rights of Way (PROWAG)

<http://www.access-board.gov/prowac/nprm.htm>

ADA Accessibility Specifications for Transportation Vehicles

<http://www.gpo.gov/fdsys/pkg/CFR-2011-title49-vol1/pdf/CFR-2011-title49-vol1-part38.pdf>

TYPES OF TRANSIT SERVICES

Prior to a detailed review of transit facility types, a review of the various types of transit modes is provided below. These service types represent the key modes that generally serve the hierarchy of transit facilities discussed throughout the rest of this chapter.

Local Bus

Local bus service is the most basic of transit modes and typically operates in mixed traffic within service areas of low to moderate density. Local bus routes have fixed stops and service frequency typically depends on the level of ridership served. In some applications, local bus service may be provided using rubber-tired trolleys, typically to connect downtown historic areas to the rest of the community and/or circulate within the downtown area. Express bus service typically provides limited-stop or non-stop service from residential areas into a central business district or between two major areas/activity centers. It is primarily intended to serve the commuter market. Frequency is generally high during peak traffic hours, and buses operate efficiently in mixed traffic or on special/exclusive use lanes. Florida has 29 urban agencies and 5 rural agencies that provide fixed-route and fixed-guideway transit services. See the *Florida Transit Handbook* (<http://www.dot.state.fl.us/transit/Pages/NewTransitInformationManagement.shtm>) for more information on these agencies.

Bus Rapid Transit (BRT)

BRT service is a fast, frequent, rubber-tired bus service in either mixed traffic or dedicated/exclusive right-of-way. It typically is an enhanced transit service with its own type of branding and station design, as well as a range of premium operational elements. BRT operates in more densely-populated urban areas and has greater station spacing than local bus. Because of its rail-like infrastructure and service configurations, BRT service may be established as the first step in a long-term plan for implementing rail service.

Examples of BRT in Florida include LYNX Lymmo, HART Metrorapid, and South Miami-Dade Busway.

Light Rail

Light rail is used in high-density areas with heavy transit ridership. The technology consists of smaller cars with lower passenger capacity compared to heavy rail and commuter rail. Light rail can operate along dedicated rail or in a shared right-of-way. Light rail stations are typically spaced closer together than other rail modes and emphasize walk access. Light rail may also include streetcar systems. Streetcar is a less costly type of light rail service that has more specific applicability in terms of length and operating environment. It typically runs in the street at-grade on embedded rails, stopping every several blocks. In addition, “skyway” or urban “people mover” systems are sometimes considered light rail modes. These systems typically operate on an elevated guideway. Examples of streetcar or people mover systems in Florida include TECO Line Streetcar in Tampa, Metromover in Miami, and Jacksonville’s Automated Skyway Express.

Commuter Rail

Commuter rail is used to serve a much wider regional area for longer, primarily work-related trip purposes. It is typically operated by diesel train engines or overhead electrical catenary. Commuter rail requires exclusive right-of-way, which can be shared with an already-existing freight rail track. The stations are usually served by feeder bus routes and often include park-and-ride facilities. Commuter rail uses higher passenger capacity cars and realizes operational efficiency through its larger passenger volumes. Examples of commuter rail in Florida include SunRail in Orlando and Tri-Rail in Miami, Fort Lauderdale, and West Palm Beach.

Heavy Rail

Heavy rail also operates longer distances but tends to serve a smaller area/region than commuter rail. It is operated by electrified tracks, which greatly increase the expense of installing the

infrastructure.¹ Heavy rail stations also require specific rail platforms/station configurations. Similar to commuter rail, heavy rail also realizes operational efficiency through larger passenger volumes. An example of heavy rail in Florida is Metrorail in Miami.

TYPES OF TRANSIT FACILITIES

Transit facilities range from simple, unsheltered bus stops to large, expensive facilities such as intermodal centers and major transit terminals that accommodate passengers transferring between buses and other transportation modes. While construction of major facilities generally involves the services of an architect and/or structural engineer and represents a significant investment that often includes leveraging federal grants through partnerships with local and state governments, this handbook does not address the complex process of design, architectural programming, and transit planning necessary for construction. However, coordination among agencies for any transit facility should be considered and is discussed in Chapter 7.

Most transit systems consider the development and construction of bus passenger facilities within a hierarchy based on the number of passengers, bus routes served, and overall intensity of use, which also determines amenity placement and additional service conditions. This chapter includes information for local on-line bus stops, primary stops, transit malls, transfer centers, university transfer centers, BRT stations, park-and-ride lots, and intermodal transfer centers. Information on the construction or design of the most basic bus stop—one with no amenities—can be found in Chapter 3. Information on each prototypical facility includes a description of the facility and the site, the required site area, a description of pedestrian connections and connections to other modes of transportation, and an inventory of the individual design elements.

2.1 Implementation and Maintenance of Transit Facilities - Roles and Responsibilities

Bus stops are placed to assist transit customers in their access to bus services. The primary entities responsible for choosing the locations where bus stops are placed are transit systems. Other agencies and entities may be involved, but the responsibility to ensure safe and convenient access to their bus services is part of the customer service needs addressed by transit agencies. Chapter 7, Agency Coordination, goes into much more detail on the level and various entities that should coordinate on locating bus stops, but included below are some key aspects to consider when deciding on development of new bus stops.

As mentioned, transit agencies have the primary responsibility on where bus stops should be located and whether they meet the ADA requirements for bus stops. However, cities, counties, FDOT, and even private land owners or developers have a role in the location and placement of stops. Because transit stops are located on the roadway rights-of-ways owned by the state, or local jurisdictions, the transit agencies must coordinate with the appropriate agency to obtain a permit for the stop placement. In a fully coordinated effort, state and local jurisdictions can assist in providing sidewalks, crosswalks, traffic signals and other roadside features that improve the safety and accessibility of the transit patrons. Even in these instances, though, close coordination with the transit service provider is necessary to ensure that the stops being considered can be served by the bus system and that operational impacts are given due consideration and resolved before deciding to proceed. In many cases, the stops can meet the needs of the bus patrons, as well as the nearby property or business owners.

Additionally, all bus stops need a certain level of on-going and routine maintenance to ensure that

Quick Facts

ADA Requirements for the Boarding and Alighting (B&A) Areas at Bus Stops

1. Firm, stable surface
2. Minimum clear length of 96 inches
3. Minimum clear width of 60 inches (measured parallel to the vehicle roadway)
4. Connected to streets, sidewalks or pedestrian paths
5. The slope of the pad parallel to the roadway be the same as the roadway
6. Maximum slope: (2%) perpendicular to the roadway

customers can safely and conveniently use the stops. Transit agencies are responsible for maintaining their stops. Within certain jurisdictions and/or areas, additional care is needed to maintain higher levels of desired or mandated customer service or aesthetics. In many cases, transit agencies will engage services from contractors or volunteers to assist them in their efforts to maintain stops, especially those with more stringent requirements.

Additionally, in some jurisdictions, developers and property owners are encouraged or even mandated to assist in stop development and/or maintenance. Any number of requirements or arrangements could be instituted, but it should never negate the need for or practice of coordinating with the transit service provider. Interlocal agreements may be necessary and can help outline the necessary standards for implementing and maintaining bus stops in compliance with federal, state, and/or local requirements.

Many transit agencies have developed checklists for use in placing and maintaining bus stops, whether doing so jointly or when undertaken solely by other entities. Early and routine coordination with the local transit service provider will ensure successful placement and on-going maintenance of bus stops in an acceptable manner and that will best serve the customers of the bus system as well

as nearby interests. As mentioned previously, Chapter 7, Agency Coordination, provides much more detail on the subject of implementing and maintaining bus stops and many other issues where interagency coordination is required.

2.2 On-Line Bus Stop

On-line bus stops provide access to transit in a variety of locations, such as within rights-of-way of arterial roadways or collector streets as well as along local roads, and are adjacent to a variety of land uses. These stops connect pedestrian ways with bus waiting areas and sidewalks, and provide connections to nearby passenger destinations.

The minimum requirements of a bus stop are a sign and a clear, firm, and stable slip-resistant surface for boarding and alighting (B&A). When additional amenities are added to a bus stop, such as a shelter, bench, or bike rack, state and federal ADA requirements are very important in the placement and design of these facilities. Any such amenities at on-line bus stops should comply with all accessibility guidelines and must comply with the most stringent standards. Table 2.2.1 lists characteristics associated with a typical on-line bus stop. Figures 2.2.1 through 2.2.4 show examples of on-line bus stops.



Figure 2.2.1 | Layout of a basic on-line bus stop.

Table 2.2.1
Characteristics Associated with a Typical On-Line Bus Stop

Adjacent Land Use	Commercial and residential land uses.
Approximate Site Area/Dimensions	200 square feet each.
Street Characteristics	Collector or arterial street with stop signs, sidewalks on both sides of street, and no street-side parking.
Street-Side Elements	Far-side or near-side curb-side bus stop.
Curb-Side Elements	Sheltered stop with bench, bus B&A area, trash receptacle, bicycle rack.
Bicycle/Pedestrian Connections	Accessible path to bus B&A area and other connecting sidewalks and accessible pathways, bicycle parking area, access to bicycle lanes/shared use paths.

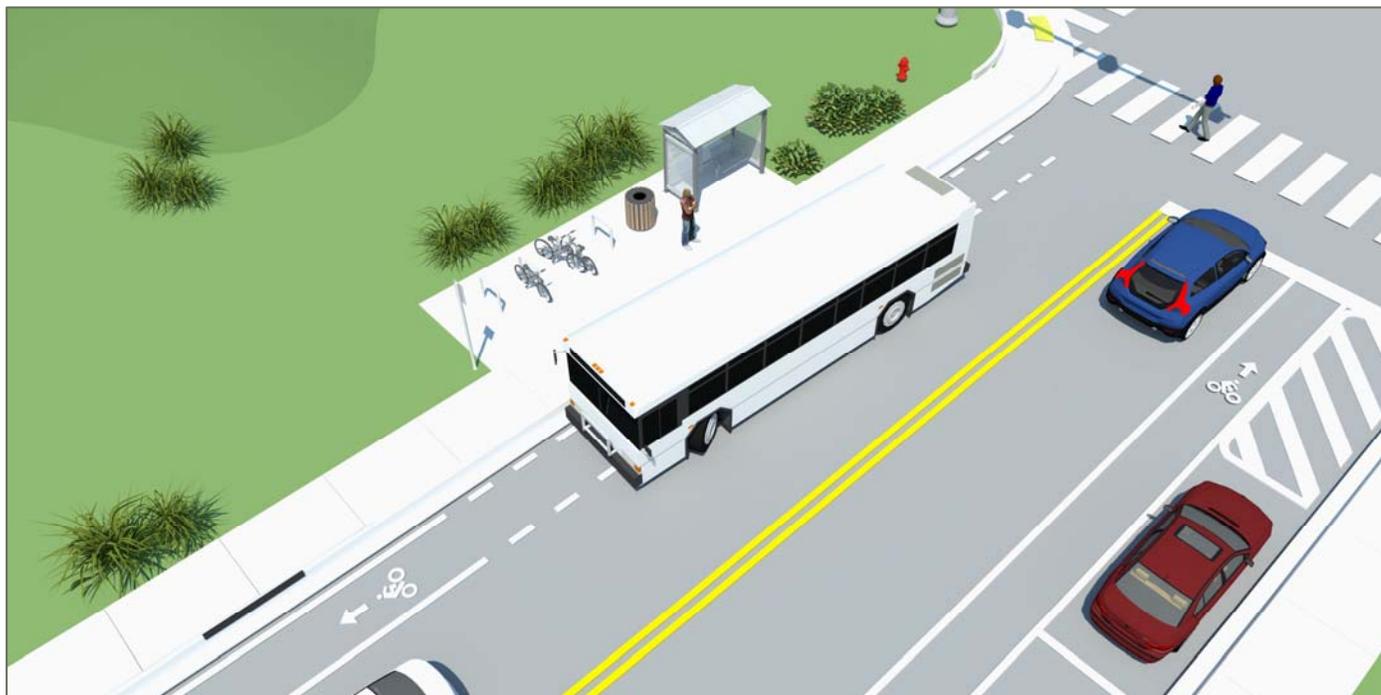


Figure 2.2.2 | Typical curb-side, on-line sheltered bus stop located at the far side of an intersection.



Figure 2.2.3 | On-line bus stop, Manatee County, Florida.



Figure 2.2.4 | On-line bus stop, Hillsborough County, Florida.

2.3 Primary Stop

Primary bus stops are off-line bus stops with a special zone on the side of the main roadway to allow buses to stop and load/unload passengers. Primary bus stops provide transit access to destinations where the density of employees or residents results in either high regular or peak-hour use several times a day. They may also serve as connection points for passengers transferring between routes. Table 2.3.1 shows typical characteristics of a primary bus stop. Figures 2.3.1 through 2.3.4 show examples of primary stops.



Figure 2.3.1 | Primary bus stop, Pinellas County, Florida.

Table 2.3.1 Characteristics Associated with a Typical Primary Stop	
Adjacent Land Use	Office park employment center, central business district, major shopping mall, or high density commercial zone.
Approximate Site Area/Dimensions	600 linear feet per side by 400 feet deep.
Street Characteristics	Limited-access arterial with signalized intersections, sidewalks on both sides, no street-side parking.
Street-Side Elements	Bus bay.
Curb-Side Elements	Sheltered stop with bench and trash receptacle, bus B&A area, and bicycle parking facility.
Bicycle/Pedestrian Connections	Accessible path connections to bus B&A area, connected to building entrances, bicycle parking area, access to bicycle lanes/shared use paths.



Figure 2.3.2 | Layout of a typical primary bus stop with bus bay.



Figure 2.3.3 | Primary bus stop with bus bay, Gainesville, Florida.



Figure 2.3.4 | Primary bus stop with a bus bay, Hillsborough County, Florida.

2.4 Transit Mall

Transit malls are created by removing automobile and truck access on sections of existing streets, usually on principal urban networks; only buses, pedestrians, bicycles, taxis, and/or light rail are allowed into the mall, and parking is generally prohibited. They function as a link between activities along a corridor and typically are most successful in places where land use is dedicated to diverse uses and significant ridership demands are nearby.²

Transit malls provide greater opportunities for bus

riders who need to transfer to buses that serve different transit routes and modes, and provide transit access to traditional downtowns and commercial centers, serving as a base for local circulator service, express routes, and other special modes of bus transit. Some transit malls also integrate downtown circulator, light rail, or streetcar modes in addition to bus service. A transit mall may also serve as the first element in a BRT mode of service provision. (See Chapter 6, “BRT and Rail Station Design.”) Table 2.4.1 shows characteristics associated with a typical transit mall. Figures 2.4.1 through 2.4.3 show examples of transit malls.

Table 2.4.1
Characteristics Associated with a Typical Transit Mall

Adjacent Land Use	Mixed uses in a traditional downtown or urban city center.
Approximate Site Area/Dimensions	40-foot-wide dedication of total right-of-way.
Street Characteristics	Dedicated two-way busway located within a major arterial street.
Street-Side Elements	Curb-side stops in a dedicated busway.
Curb-Side Elements	Sheltered stop with benches and trash receptacles, bus B&A areas, bicycle parking facilities, and landscaping.
Bicycle/Pedestrian Connections	Accessible routes connecting bus B&A areas and other bus loading areas along the transit mall with building entrances via textured crosswalks with pedestrian refuges, bicycle parking area, access to bicycle lanes/shared use paths.

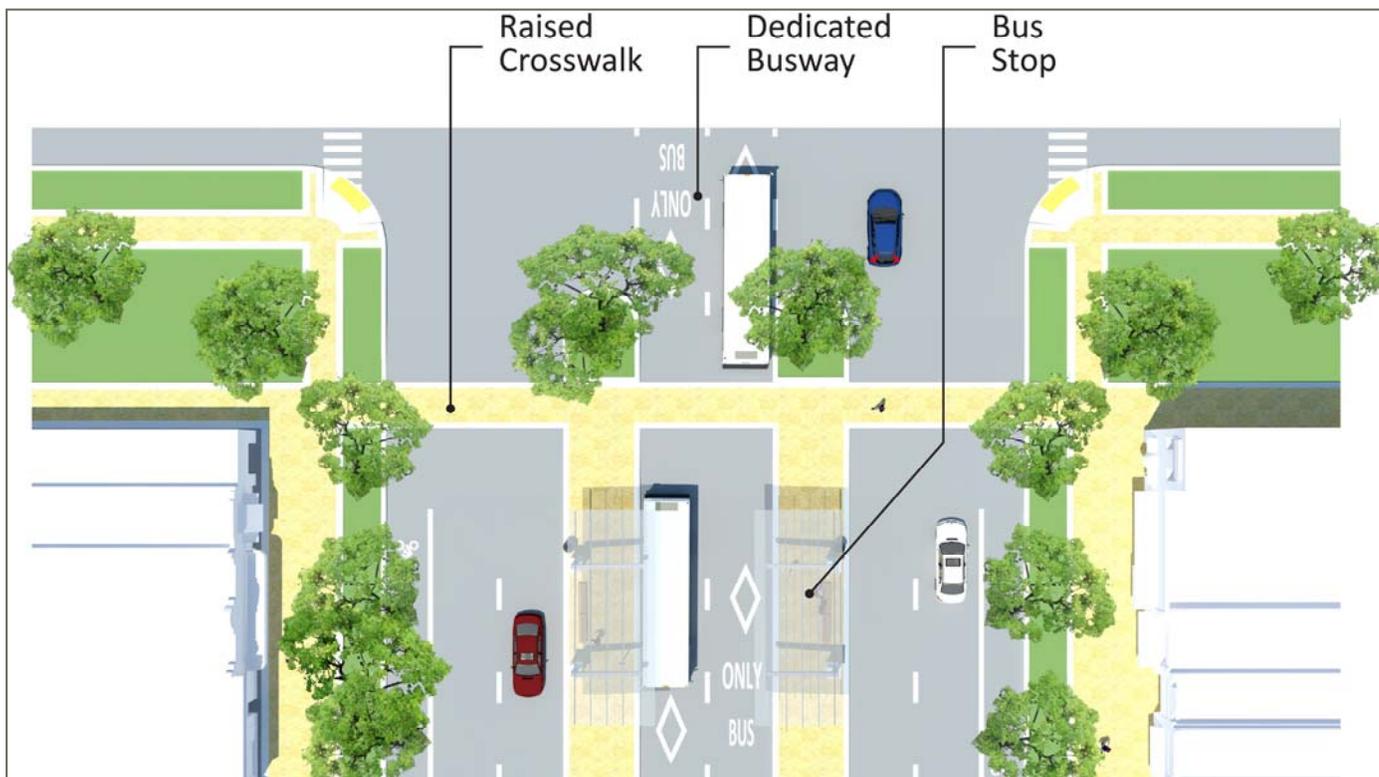


Figure 2.4.1 | Downtown transit mall with a dedicated busway.

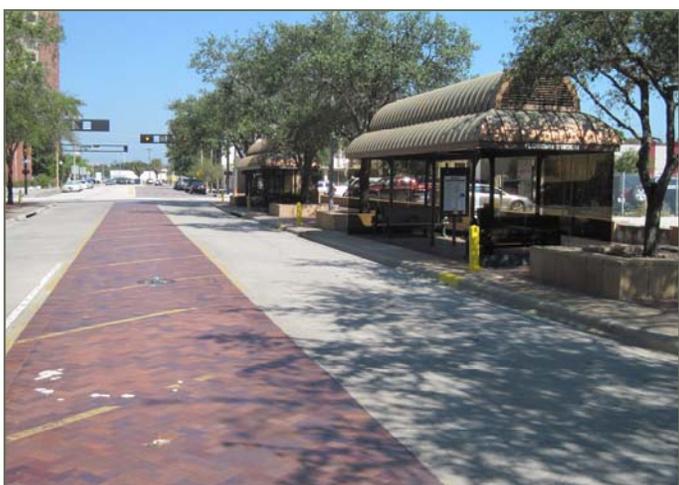


Figure 2.4.2 | Downtown transit mall with a dedicated busway, Tampa, Florida.



Figure 2.4.3 | Prototypical transit mall, Portland, Oregon.

2.5 Transfer Center

Transfer centers serve as major nodes in the transit network, connecting various regional and local bus lines, express routes, and circulator services. They are designed specifically to ease transferring between bus routes and between bus transit and other travel modes. They may also work as passenger drop-off/pick-up or park-and-ride facilities and often are located within major activity centers.

Because they accommodate transferring passengers and multiple bus routes, transfer centers operate most successfully if good wayfinding devices are in place. Transfer centers also may have additional ticketing options and more amenities, such as larger vending areas and/or public restrooms. These additional amenities must follow ADA Standards. Table 2.5.1 shows characteristics of a typical transfer center. Figure 2.5.1 shows a typical layout of a bus transfer, and Figures 2.5.2 and 2.5.3 show examples of transfer centers.

Table 2.5.1
Characteristics Associated with a Typical Transfer Center

Adjacent Land Use	Commercial or mixed-use zones in a major retail activity center.
Approximate Site Area/Dimensions	1.25 acres.
Street Characteristics	Intersection of major arterials, highway interchange.
Street-Side Elements	Off-line center with dedicated bus travel lanes and half-sawtooth bus bays.
Curb-Side Elements	Sheltered stop with benches and trash receptacles, bus B&A areas, bicycle parking facilities, landscaping, and public art.
Bicycle/Pedestrian Connections	Accessible routes connected to bus B&A areas and surrounding infrastructure, bicycle parking areas, access to bicycle lanes/shared use paths.



Figure 2.5.1 | Layout of a typical transfer center.

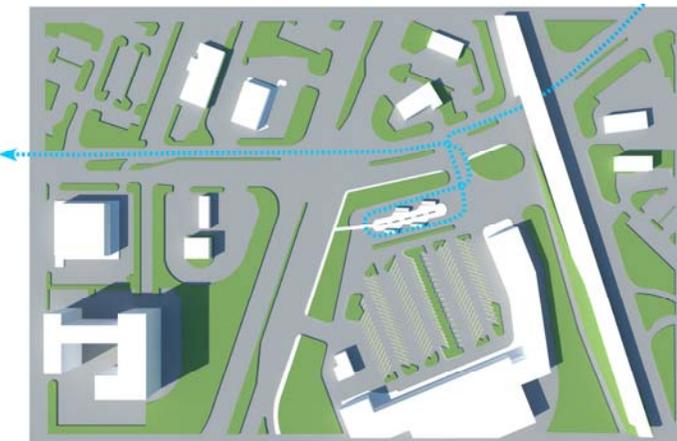


Figure 2.5.2 | Transfer center located within a retail center near a highway interchange.



Figure 2.5.3 | Transfer center, Lakeland, Florida.

2.6 University Transfer Center

University transfer centers allow students and other riders to connect to several regional, local, or campus bus transit systems. Many universities collaborate with local and regional transit authorities or, in some cases, run their own transit systems in the absence of city and regional transit systems. They often invest in the passenger facility infrastructure necessary to support transit by providing bus shelters, transfer facilities, real-time displays, and dedicated bus lanes. Locating such facilities near academic buildings, a destination for most university transit riders, is often preferred. This arrangement frequently requires multi-agency coordination. (See Chapter 7, “Agency Coordination.”) Table 2.6.1 shows typical characteristics of a university transfer center.

Within university campuses or adjacent to them, stops should be located to integrate the bus system campus circulator network, transfer

facilities, parking, pedestrian access, bicycle access, and bicycle storage facilities. Stops should be located in areas within walking distance of attractors to encourage the highest ridership in places where alternative shelters are not available, where weather exposure is likely to make patrons uncomfortable, and where there is adequate sidewalk width, visibility, and natural surveillance.

College students primarily are pedestrians and have limited vehicle access; therefore, it is also important to provide accessible pedestrian pathways as well as additional bicycle parking and seating at stops. Also, additional security should be included at campus bus stops, particularly during evening hours. High levels of lighting should be maintained, and electronic surveillance should be integrated with the security systems of adjacent university activity centers, whenever possible. Alternative energy sources such as solar power can be used to provide lighting at bus stops to enhance security at stops.

Table 2.6.1
Characteristics Associated with a Typical University Transfer Center

Adjacent Land Use	Major academic facilities, student housing, and other locations that are near local activity centers or pedestrian attractors.
Approximate Site Area/ Dimensions	For a transfer center, 1.25 acres. For an on-line bus stop, follow prototype discussed previously.
Street Characteristics	Campus and city service routes located on secondary and primary collector roads that provide access into and through campus; routes served by bus shelters and pull-out bays.
Street-Side Elements	Well-defined and conflict-free vehicle rights-of-way; each mode has its own distinct right-of-way; dedicated transit lanes provided to areas on campus that may otherwise be accessible only to pedestrians and bicycles.
Curb-Side Elements	Sheltered stop with bench and trash receptacle, bus B&A area, bicycle parking facilities, landscaping, schedule information, and vending machines.
Bicycle/Pedestrian Connections	Accessible connections to bus B&A areas; connected to surrounding academic facilities and buildings; access to shared use paths, pedestrian paths, and bicycle lanes, particularly in areas near high numbers of potential passengers.



Figure 2.6.1 | University transfer center, Polk State College, Polk County, Florida.

Because of the unique nature of a university campus, bus shelters and stops should be designed with the larger campus design theme in mind. Facilities should be located so they can be seen and identified from a distance. Stops should follow the design guidelines set forth throughout this handbook and should also follow the bus stop hierarchy presented in this chapter. Figures 2.6.1 and 2.6.2 show examples of university transfer centers, and Figure 2.6.3 shows a typical layout of a university transfer center.



Figure 2.6.2 | University transfer center, University of Florida, Gainesville.



Figure 2.6.3 | Layout for a typical university transfer center.

2.7 BRT Station

BRT is a bus-based rapid transit service that combines the quality of rail transit with the flexibility of buses and preferably includes dedicated right-of-way with on-line stops. It is a stylized, branded system similar to rail, with characteristics that differentiate it from regular bus service. BRT service is often integrated with other regional transportation systems, enhancing mobility and promoting intermodal connectivity, thereby minimizing walking distances from trip origins and destinations. Headways are generally short, sometimes eliminating the need for passengers to consult a schedule. BRT works well in physically-constrained environments where hills, tunnels, and water crossings result in frequent congestion, and which make freeway and rail construction costly, difficult, and impractical. Table 2.7.1 shows the characteristics of a typical BRT station.

The number of customers using a BRT station is typically higher than at local bus stops. As a result, passenger facilities often resemble those provided at fixed-route surface transit stations. Stations consist of level boarding (usually supplemented with bridge plates or ramps), off-board fare payment, exclusive running ways, and ITS technologies such as precision docking, vehicle guidance, and real-time passenger information systems.

BRT stations can function as development nodes in a BRT corridor, with stations introducing new activity centers into a community or reinforcing existing activity centers in an urban area. They benefit developers by attracting new markets (people who either do not have automobiles or people who may not want to pay for parking) and by reducing the parking requirements for new development. Enhanced BRT stations may attract

Adjacent Land Use	High-density business corridors and residential areas; densely-populated developments are most supportive of a BRT corridor.
Approximate Site Area/ Dimensions	For an on-line bus stop, 200 square feet; for a larger system or more intensely-developed stop, more space is required.
Street Characteristics	Varies with intensity of BRT service development, anywhere from bus nubs/ bays in mixed traffic to grade-separated transit ways or median roadways.
Street-Side Elements	Along or parallel to major arterial roadways that have a high density of residential or commercial development.
Curb-Side Elements	Sheltered stop with bench and trash receptacle, bus B&A area, bicycle parking facilities; branding and landscaping for on-line stop; advanced fare collection; raised platform or curb for level boarding; distinctive look and feel; passenger information, lighting, and security for a premium or enhanced station; bike sharing facilities.
Bicycle/Pedestrian Connections	Accessible connections to bus B&A area, whether on a raised platform or a more basic stop; connections to additional activity centers, business centers, and high-density residential areas; access to shared use paths/bicycle lanes, bicycle parking, and bike sharing facilities.

economic investments more than basic bus stops due to their unique appeal and their more permanent nature.⁴ Pedestrians may also be willing to walk farther for BRT service compared to more conventional transit because of its higher-order service components.⁵

For an example of a BRT station, see Figure 2.7.1. For typical BRT route alignments, see Figure 2.7.2. For a more detailed discussion and figures of BRT facilities, see Chapter 6, “BRT and Rail Station Design.”



Figure 2.7.1 | BRT station, Cleveland, Ohio.

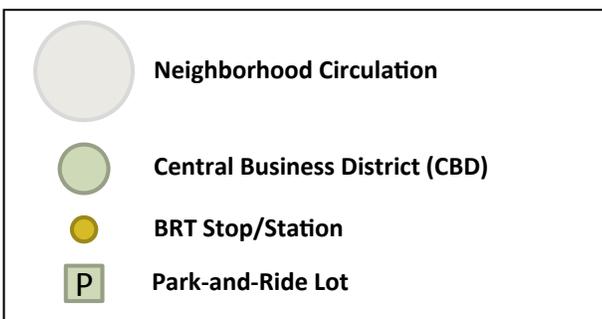
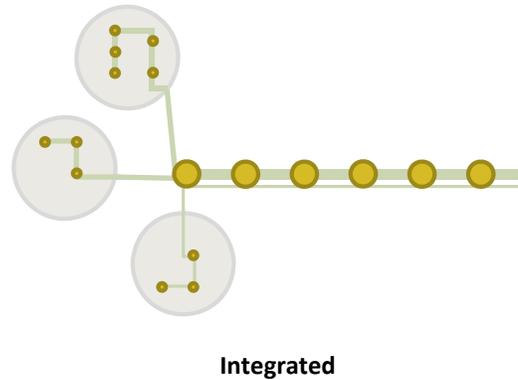
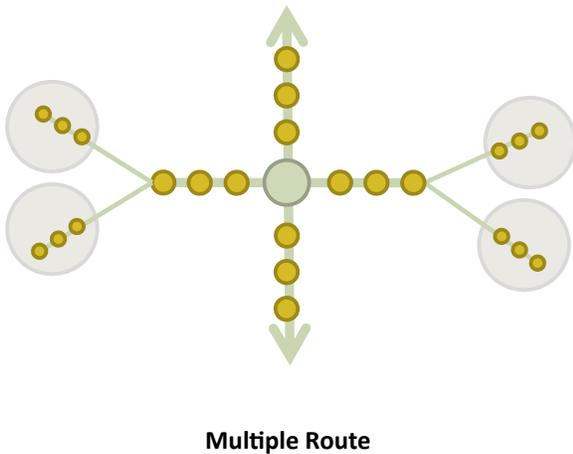
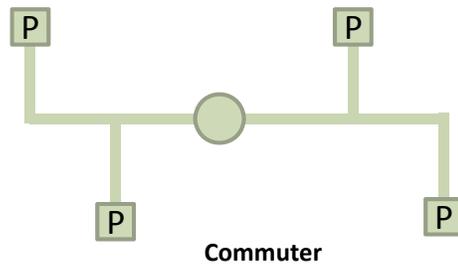
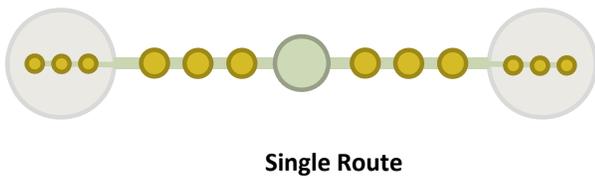


Figure 2.7.2 | Typical BRT route alignments.

2.8 Park-and-Ride Facility

Typical park-and-ride lots include suburban lots, peripheral lots, and joint-use lots. Suburban lots usually are served by express routes that collect transit passengers near their homes, are located in suburbs, and are likely to be used for long-haul trips. Some suburban lots may be used for car/vanpooling and may not necessarily have access to transit facilities. These lots can be located near highway on-ramps to allow employees living in remote communities to meet and then travel together to work on the interstate facilities for a major part of their trip. Peripheral lots are generally located at the edges of an activity center. Joint-use lots are located near developments such as libraries, meeting halls, sports facilities, theaters, and commercial land uses along major corridors that are not generally used during the workday. Table 2.8.1 shows the typical characteristics of a park-and-ride facility.

Park-and-ride facilities that serve local transit routes are generally smaller and often require fewer amenities. Facilities that serve express routes are often larger and require shelters, bus idling areas, and passenger drop-off areas.

Automobiles should be able to access a park-and-ride lot from collector or access roads intersecting arterials, and bus turning movements should be in the direction opposite incoming traffic. Lots should be connected to multiple streets and ensure minimum conflict with other traffic. Locating facilities on the passenger side of larger traffic streams can avoid conflicts with buses flowing in the opposite direction when they attempt to enter the facility. Area traffic patterns should be taken into consideration and adequate queuing space for motorists to wait in cars before parking and transferring to transit should be provided. Lots should be located and designed such that passenger safety, accessibility, and convenience are maximized.

Adjacent Land Use	Within existing developments, providing ease of access to transit in a car-friendly manner, developed by state or local government, or on private properties such as churches, schools, or recreation and community centers.
Approximate Site Area/Dimensions	Area connected by multiple streets in a method to ensure minimal conflict with other traffic with consideration of traffic patterns and commuter patterns. Provide enough space for motorists to park cars based on the demand needed for transferring to transit or van/carpooling. Maximize passenger comfort, safety, and accessibility, and reduce conflicts with congestion and traffic.
Street Characteristics	Major arterial that serves a commuting corridor.
Street-Side/Bus-Side Elements	Bus idling area, off-line bus stop, bus bay, half-sawtooth bay, vehicle access points.
Curb-Side Elements	Sheltered stop with benches and trash receptacles, transit B&A areas, bicycle parking facilities, trash receptacles, and route information.
Bicycle/Pedestrian Connections	Access for all-day vehicle parking; access to bicycle and pedestrian pathways and transit B&A areas.



Figure 2.8.1 | Electric car charging station at a park-and-ride lot serving transit riders in Seattle, Washington.



Figure 2.8.2 | Bus facilities located next to a park-and-ride facility.

Park-and-ride lots require all-day parking for commuters and should be located within 300 feet of bus loading zones. The number of parking spots is determined on the basis of current and future ridership; approximately 90 to 100 spaces per acre are reasonable for such facilities. Designated spaces for ADA-accessible parking must be located closest to the loading area and must include accessible connections to amenities throughout the facility. Some agencies are installing electric car charging stations at their park-and-rides. Figures 2.8.1, 2.8.2, and 2.8.3 provide examples of park-and-ride facilities.



Figure 2.8.3 | Park-and-ride facility, Miami-Dade County, Florida.

The *FDOT State Park-and-Ride Guide* (<http://www.dot.state.fl.us/transit/Pages/FinalParkandRideGuide20120601.pdf>) provides more detailed guidance to agencies seeking to implement park-and-ride facilities, including information on site assessment and design. It has recently been updated by FDOT; agencies should use this updated version of the document when planning park-and-ride facilities.

2.9 Intermodal Transfer Center

Intermodal transfer centers provide connections between various modes of travel and facilitate the transfer of passengers in a seamless, efficient manner. To begin the process of enhancing intermodal activity, planners should attempt to identify the various arrival modes, intermodal movements, user groups, and user group mobility needs before designing a station to address all intermodal movements.⁶

Figure 2.9.1 is a graphical presentation of a recommended process to follow when designing an intermodal transit facility.⁶

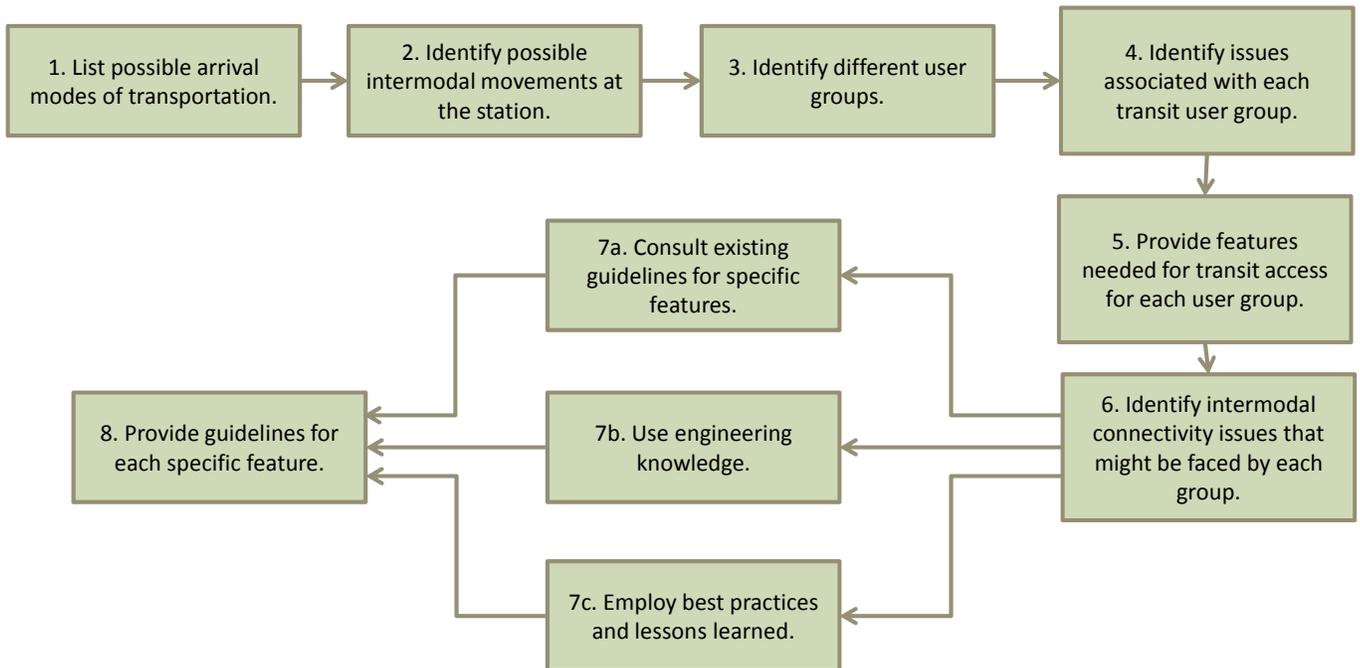
There are two predominant types of intermodal facilities: rail-bus intermodal transfer centers and

air-bus intermodal transfer centers. These types of transfer centers are most common in very large urban areas with high-density population and commercial activity.

RAIL-BUS INTERMODAL STATION

Commuter rail and bus intermodal transit stations offer easy transition between these two modes of travel. The rail line brings passengers into an area and buses help to disperse them and get them closer to their final destination. These intermodal stations provide a new transportation alternative, linking passengers' daily activity destinations with their homes and complementing existing transit, automobile, and bicycle mobility options.

Intermodal stations should function as the entry and exit points to important activity centers. It is important for rail-bus intermodal transit stations to



Source: Guidelines for Enhancing Intermodal Connections at Florida Transit Stations.

Figure 2.9.1 | Intermodal transit facility design process.

be located in more densely-urbanized areas to maximize ridership. The station types vary depending on land use, architectural character, and natural amenities. Table 2.9.1 shows the typical characteristics of an intermodal transfer center. Figures 2.9.2 through 2.9.5 show examples of rail-bus intermodal stations.

Town Center Station

Town center stations are transfer centers serving more than one mode and containing a diverse mix of residential, commercial, and civic uses, often within a valued historic building and in a pedestrian-friendly atmosphere. These stations vary in scale, visibility, and function, supporting existing development and acting as a catalyst for new development. Typically, these stations serve express bus, local bus, or light rail or commuter rail lines that serve high-density downtown centers of smaller urban communities.¹

If acting as the end-point or start-point of a route, they may anchor BRT service if local housing and

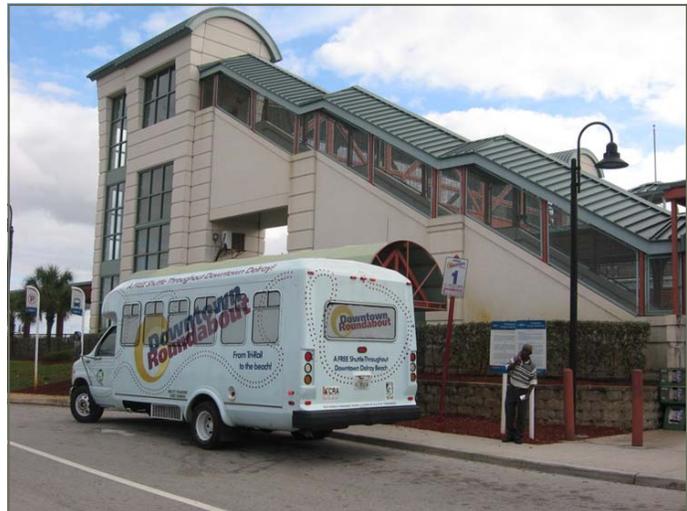


Figure 2.9.2 | Rail-bus intermodal station, Delray Beach, Florida.

employment density are BRT-supportive. They may also integrate light or heavy rail stations in many different ways to fit the local environment.

Town center stations are located in the traditional town centers of smaller urban areas and serve

Table 2.9.1
Characteristics Associated with a Typical Rail-Bus Intermodal Transfer Center

Adjacent Land Use	Tends to be concentrated downtown mixed-use commercial areas.
Approximate Site Area/ Dimensions	1/2 to 2 acres, depending on local needs; may be incorporated into a joint development project.
Street Characteristics	Located on urban collectors in smaller urban areas.
Street-Side Elements	Local bus services, express services, possible connections to light rail, commuter rail, or BRT.
Curb-Side Elements	Completely sheltered waiting areas, benches, bicycle racks, trash receptacles, information areas, off-board fare collectors may be necessary at high-volume stations.
Bicycle/Pedestrian Connections	Elevators, escalators, stairs, and ramps to connect pedestrians to multiple modes; accessible connections to local activity centers, retail, and other nearby destinations; bicycle parking and possible bike sharing.



Figure 2.9.3 | Proposed rail-bus-air intermodal station, Miami-Dade County, Florida.

local residents and commuters, providing access to downtown retail facilities. They are designed to fit into the built environment of the town center¹ and frequently represent the community personality of the specific downtown area, encompassing historical building styles or architectural design.

Activity Center/Central Business District Station

Central business districts, universities, airports, and other regional activity centers provide the setting for a range of transit stations. These stations generate high customer usage due to the range and intensity of surrounding land uses. As destination stations, they serve as intense pedestrian-oriented developments. Enhancements at activity center stations should provide opportunities for future development, creating public open spaces, plazas, and squares.

Frequently, the draw of these activity centers can be tied into the design of the local stations through murals or a particular style, with local art and cultural references creating a unique and welcoming environment. This type of station can be tied into a transit mall as an anchor for the start or end of BRT or express bus service.

Platform Station

A single platform shared between bus and rail stations creates a safe and easy transfer between modes of transportation. These stations provide vehicular access in some form, ranging from small drop-off/pick-up facilities to mixed-use park-and-ride structures. The function of the station and site (size and shape) both determine parking capacity. The design of the station and parking can minimize impacts on surrounding properties and maximize development opportunities around each station. (Refer to Chapter 6, “BRT and Rail Station



Figure 2.9.4 | Rail-bus intermodal station in south Florida.

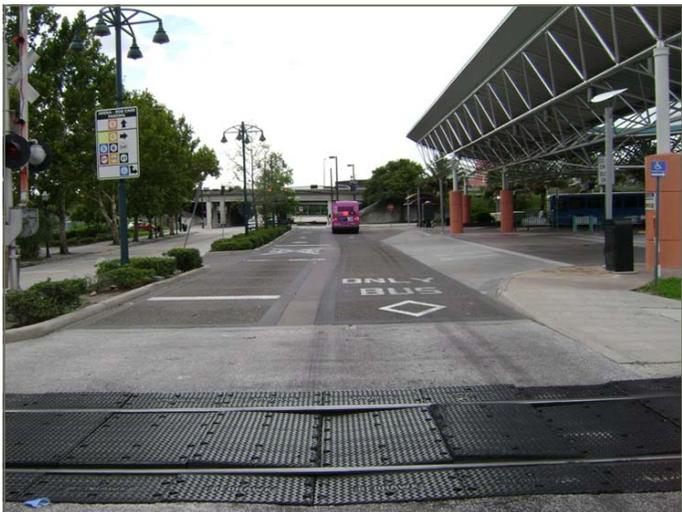


Figure 2.9.5 | Rail-bus intermodal station, Orlando, Florida.

Design,” for accessibility and design characteristics of platform stations.)

- **Interstate Station:** Interstate stations are located within a median when interstate highways are used for rail alignments. Structural sound walls and extended canopies should be provided to ensure security for these stations. Interstate station platforms are often separated from direct pedestrian access, bus transfer facilities, and parking areas, complicating convenient access to the station. 14-20.003(3) FAC states that “shelters are

prohibited in medians and on limited access facilities.” Unless and until this law is changed or modified, Florida will not have shelters in the median or on interstates.

- **Center Platform Station:** A center platform station allows transit customers to be distributed for boarding light or heavy transit vehicles traveling in either direction from a single location. It is the most customer-friendly and cost-effective platform configuration.
- **Side Platform Station:** This configuration uses separate platforms to distribute passengers for each direction of travel and accommodates large volumes of customers.
- **Split Platform Station:** This type of station also has two platforms, arranged as side platforms servicing each direction, and is typically used at the intersection of streets with medians. This configuration minimizes the right-of-way necessary by locating platforms opposite left-turn lanes.

AIR-BUS INTERMODAL TRANSFER CENTER

Bus transit systems that serve airports are an integral part of larger intermodal transportation networks. These facilities are generally housed in permanent facilities and provide a full set of passenger amenities. Table 2.9.2 shows characteristics for a typical air-bus intermodal transfer center.

Figure 2.9.6 shows an example of an air-bus intermodal station. Air-bus transit facilities generally are of two types: proximate facilities and remote facilities. Proximate facilities typically attempt to minimize physical distances between travel modes. At an airport, curb-side space often provides the fastest and easiest link between buses and airplanes.

Remote facilities provide connections between circulator bus service and the airport terminal. Automated people movers, circulator buses, and moving sidewalks are all commonly used for enabling connections between air-bus intermodal

Adjacent Land Use	Varies depending upon converging modes, but tends to be commercial and travel-related cargo services.
Approximate Site Area/Dimensions	One acre or larger, but varies tremendously based on size of airport, number of transit agencies serving airport, and amount of land available for development.
Street Characteristics	Along major arterials with close access to highways.
Street-Side Elements	On-line stops and half-sawtooth bays are most common.
Curb-Side Elements	Completely-sheltered waiting areas, benches, bicycle racks, trash receptacles, bathrooms, information areas, retail areas, and adequate passenger waiting areas for passengers and their luggage.
Bicycle/Pedestrian Connections	Elevators, escalators, stairs, and ramps are all used so that pedestrians can avoid confronting vehicles while walking. Transit facilities must be accessible and connect with exterior sidewalks, crosswalks, and parking facilities.



Figure 2.9.6 | Example schematic of air-bus intermodal station.

and 2.9.8 show proximate and remote model air-bus intermodal stations.

It is important to design air-bus intermodal transfer centers with efficient modal transfers in mind. Poorly-planned centers may slow traffic for multiple modes both on and off site. To avoid curb-side congestion, many air-bus transfer centers connect passengers to the airport and the bus passenger facilities with grade-separated covered corridors.

The management of airport ground access often impacts traveler access to air-bus intermodal centers. Two types of access are generally recognized. Full access allows any licensed transportation operator to pick up and drop off passengers outside a terminal building. Exclusive concession agreements, on the other hand, permit only those with concessions to serve an intermodal center.

centers and airport terminals. Intermediary movement that does not add additional traffic to curb-side facilities is preferred. When such improvements are not feasible, other measures may be taken to reduce congestion.

Amenities such as bus connection sites, passenger waiting areas, transit information desks, and proper wayfinding are recommended for efficient functioning of an intermodal center. Figures 2.9.7

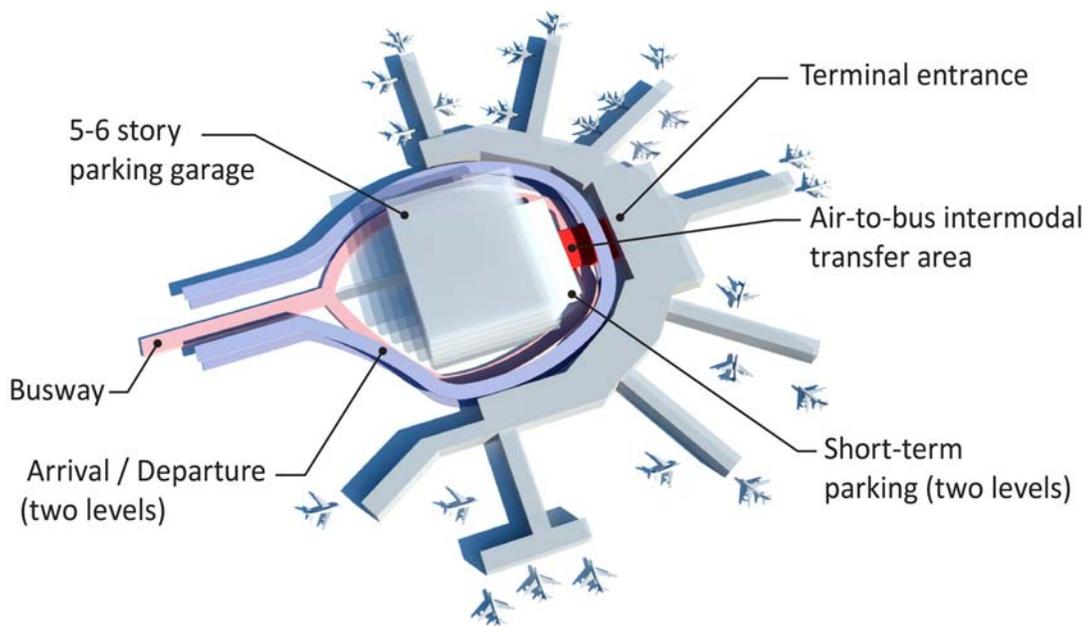


Figure 2.9.7 | Typical proximate model intermodal center.

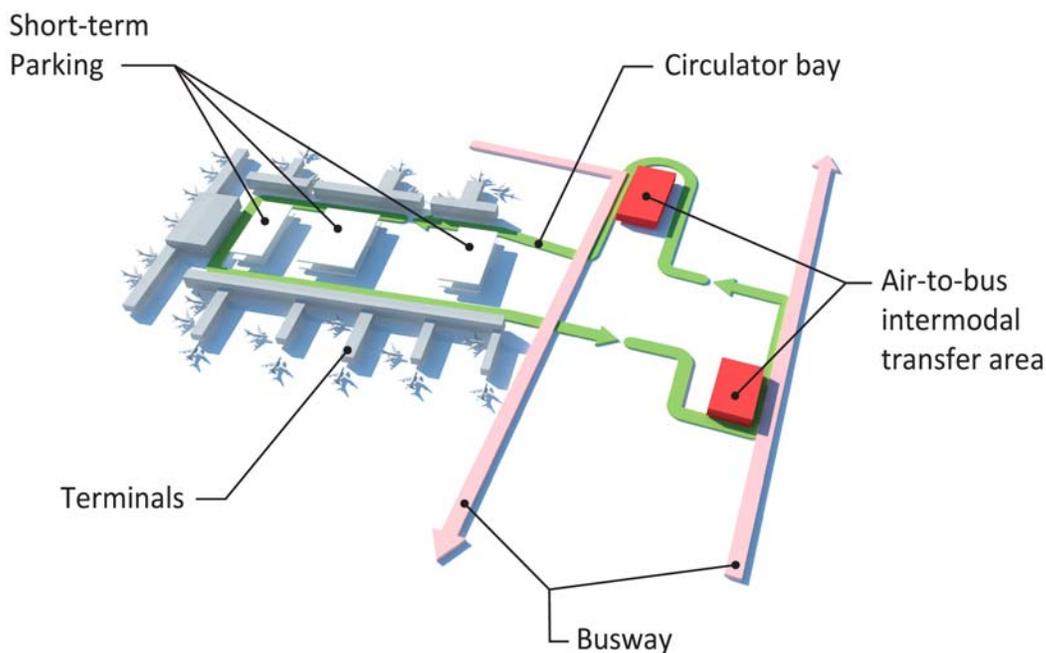


Figure 2.9.8 | Typical remote model intermodal center.

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CHAPTER 3



Curb-Side Facilities

CHAPTER 3

Curb-Side Facilities

3.1 Bus Stop B&A Areas

OVERVIEW

Providing a designated bus stop boarding and alighting (B&A) area benefits all transit users, especially mobility aid (wheelchair and scooter) users, who will have less difficulty boarding and alighting the bus when there is a firm, stable, and slip-resistant area to operate their mobility aid.

The minimum requirements for a bus stop are a bus stop sign and B&A area that provides a well-drained, non-slippery surface with adequate space for passenger movement on and off buses. While not required, an area the length of the bus for transit purposes provides a comfortable waiting, alighting, and boarding area for both front and rear doors and improves the transit agency's presence and access to transit vehicles. A transit agency should consider providing concrete B&A areas at bus stops if there are water drainage issues or the stop is regularly used by patrons using mobility aids.

It is important to note that ADA regulations require that, when establishing a new or altered route with new bus stop locations, the public transit provider, if not constructing them with the current bus stop plan, must take into account the future construction of B&A areas. An agency should try to locate each bus stop so that the B&A area will fit in the selected location and an accessible route can be provided to it sometime in the future. The public transit service/facility provider should coordinate with the public right-of-way owner to determine locations to provide appropriate access to the bus stops. (See 49 CFR 37, Appendix A, Section 810.2.2 for federal guidance on the ADA Standards.)

FDOT allows placement and maintenance of shelters, benches, and other transit bus stop amenities on the right-of-way of a state highway pursuant to written approval by the appropriate city or county government within whose jurisdiction the stop is to be located. The location and placement of

these facilities must be consistent with the State regulations provided in the *Florida Greenbook* and *PPM*. Bus stop location and design guidelines are applicable to both public- and private-sector benches located at a transit stop location. The local government is responsible for location and permitting approvals for bus stop amenities, compliance with ADA, and maintenance. For facilities located within the state right-of-way, if FDOT determines that the bus stop or stop amenities are a safety hazard or are not compliant with ADA, the Department may remove the amenities consistent with 14-20 of the Florida Administrative Code (FAC).

ACCESSIBILITY

Better accessibility to and within the bus stop area ensures a comfortable and safe movement of passengers at a bus stop. At bus stops where a shelter is provided, the B&A area can be located either within or outside of the shelter as long as any B&A area included within the shelter is not obstructed.¹ The B&A area on flush shoulder roadways must use a Type E curb (5-inch curb height) and be connected to the sidewalk along the roadway, or to the roadway when no sidewalk is present.² Detectable warnings are required where a sidewalk associated with a B&A area connects to the roadway at grade.

Individuals who use mobility aids, older adults, individuals with disabilities, and passengers needing assistance (such as parents with strollers and shoppers with bags) will have less difficulty boarding and alighting the bus when there is a stable, level, and unobstructed B&A area to operate the wheelchair lift or ramp.

LOCATION

ADA Standards require all bus stops to have sufficient space for a B&A area that has a firm, stable, and slip-resistant surface to accommodate boarding and alighting at the stop. For a bus stop

designated by only a sign on a post and no other amenities (shelter, bench, trash can, etc.) and where complementary ADA paratransit service is provided, the B&A area is still required, but it may not have to be a concrete pad. If provided, the B&A area concrete pad must be located within the specified clear zone for the roadway environment being used according to *FDOT Design Standards, Index 700*. If any bus stop amenities in addition to a bus stop sign are provided, the bus stop B&A area shall be connected to the amenities, streets, sidewalks, and/or existing pedestrian infrastructure by an accessible route complying with ADA Standards and 2012 Florida Accessibility Code (Section 402).¹

DESIGN

The dimensions of bus stop B&A areas may be adjusted as necessary to accommodate site conditions. However, the minimum size of B&A areas, per ADA Standards, shall be 8 feet (perpendicular to roadway) by 5 feet (parallel to roadway).³ Buses operating in more urban areas today often have two doors that require B&A areas. Rather than building two separate 5-foot-by-8-foot B&A pads, for driver and passenger ease of operation, a minimum 30-foot-long area along the roadway is recommended.

Figures 3.1.1 through 3.1.4 show examples of alternative bus stop B&A area designs. Parallel to the roadway, the slope of the bus stop B&A area shall be the same as the roadway, to the maximum extent practicable. Perpendicular to the roadway, the slope of the bus stop B&A area shall not be steeper than 1:48.¹ B&A areas for sheltered stops may include conduits and junction boxes for utilities.

B&A areas also may be sized according to the dimensions of the shelter if a shelter is planned for the location. In urban areas, and where right-of-way permits, the ideal is to provide a continuous 8-foot-wide concrete pad along the entire length of the bus stop (40 feet to accommodate a standard bus and 60 feet for an articulated bus) adjacent to the curb and gutter. An additional 50-foot length is recommended for each additional bus expected to stop at the bus stop at the same time.

A sidewalk and/or ramp provided with the B&A area shall be a minimum of 60 inches in width, and the ramp shall not exceed a slope of 1:12 (8.33%). A detectable warning surface is required where a sidewalk associated with a B&A area connects to the roadway at grade. Except for the area adjacent to the 5-inch curb, the areas surrounding the B&A area shall be flush with the adjacent shoulder and

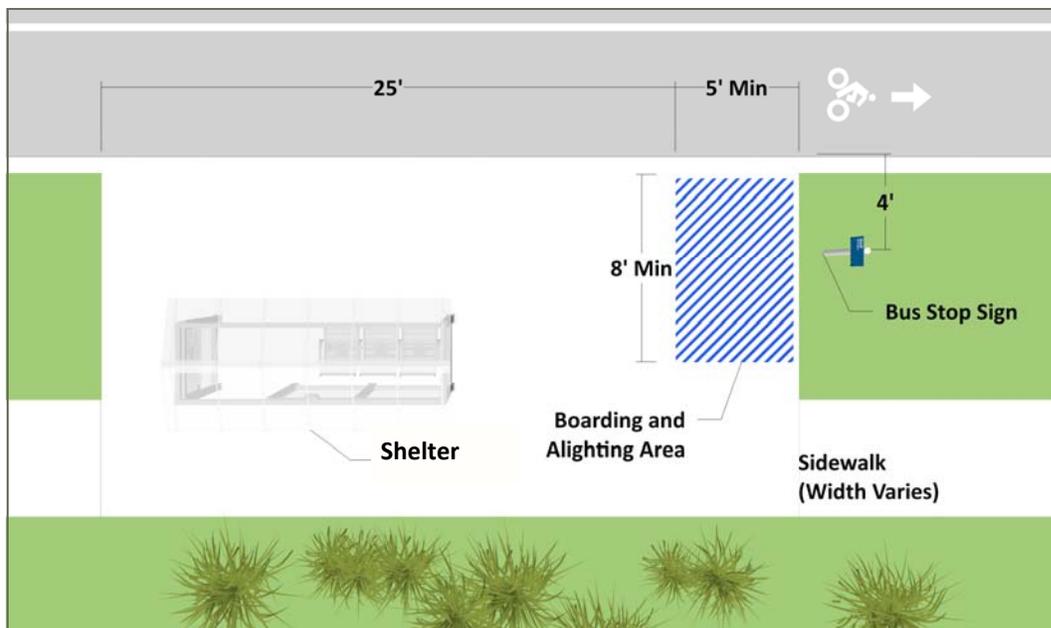


Figure 3.1.1 | Bus stop B&A with a shelter.

side slopes and designed to be traversable by errant vehicles² (see Figure 3.1.5). B&A areas must be positioned to coordinate with transit vehicles to minimize the vertical and horizontal gaps encountered when boarding the vehicle.⁴ The B&A area concrete pad should extend 6 inches beyond the area under the shelter canopy to prevent soil erosion caused by run-off.

Any easement or right-of-way obtained for installing a B&A area concrete pad should extend 2 feet beyond the pad. ADA regulations require that accessible routes to bus stop B&A areas must be designed to maintain a minimum clear width of 36 inches (48 inches per FAC, 60 inches per PPM) and vertical clearance of 80 inches (84 inches per

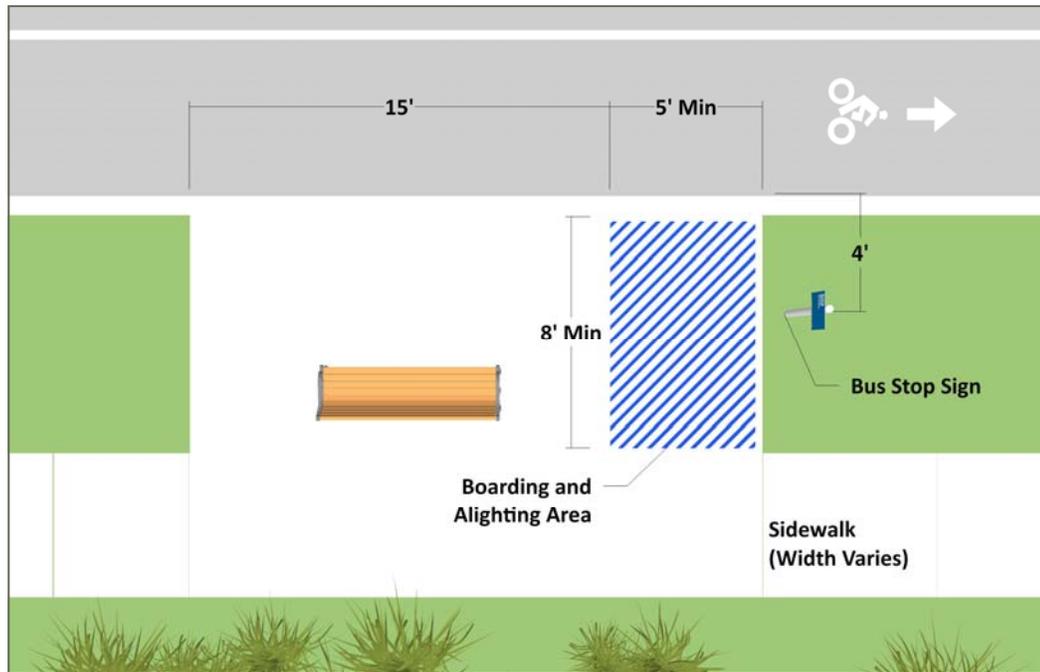


Figure 3.1.2 | Bus stop B&A area with an adjacent bench.

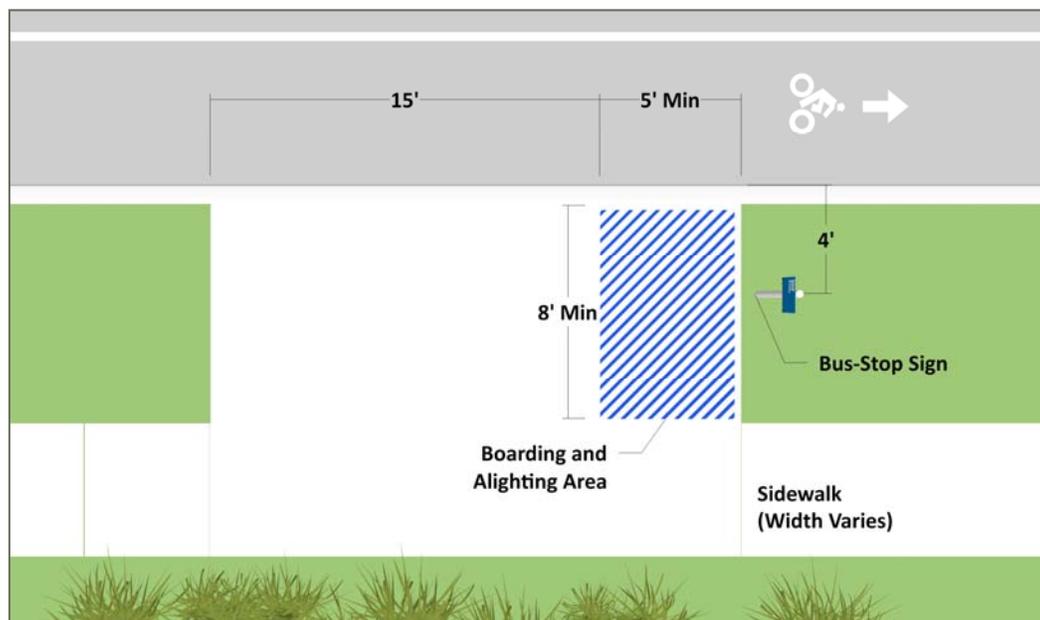


Figure 3.1.3 | Bus stop B&A without a shelter and bench.

FAC) minimum along the pedestrian access route.

To create an accessible bus stop on flush shoulder roadways (roadways without curb and gutter where the shoulder and the roadway are at the same level), bus stops with a raised, clear, 5-foot- by-8-foot B&A area may be constructed at the shoulder point (or edge of shoulder pavement on roadways with a design speed of 45 mph or less).²

For rural bus stops, typically on flush shoulder roadways, when a B&A area for a shelter exists, care should be taken to not visually obstruct the shelter with any bus stop sign or road sign. (See Figures 3.1.6, 3.1.7, and 3.1.8 for flush shoulder bus stops.) Sidewalks must always meet ADA criteria.

If a concrete B&A area (and ramp and level landing, if needed) are to be constructed, requirements include 6-inch-thick concrete on flush shoulder roadways owned by the State.² Bus stop B&A areas should be constructed of reinforced concrete over an aggregate base or, alternatively, they may be made of recycled plastic or rubber aggregate. The installed B&A area concrete pad thickness will vary according to the design of the anchoring required for various bus stop elements as affected by expected wind loads. Free edges of pavement should be strengthened with reinforcement.

For more details on accessibility and design of B&A areas, refer to the most recent versions of ADA Standards, *PPM, 2012 Florida Accessibility Code*, and draft *PROWAG*.

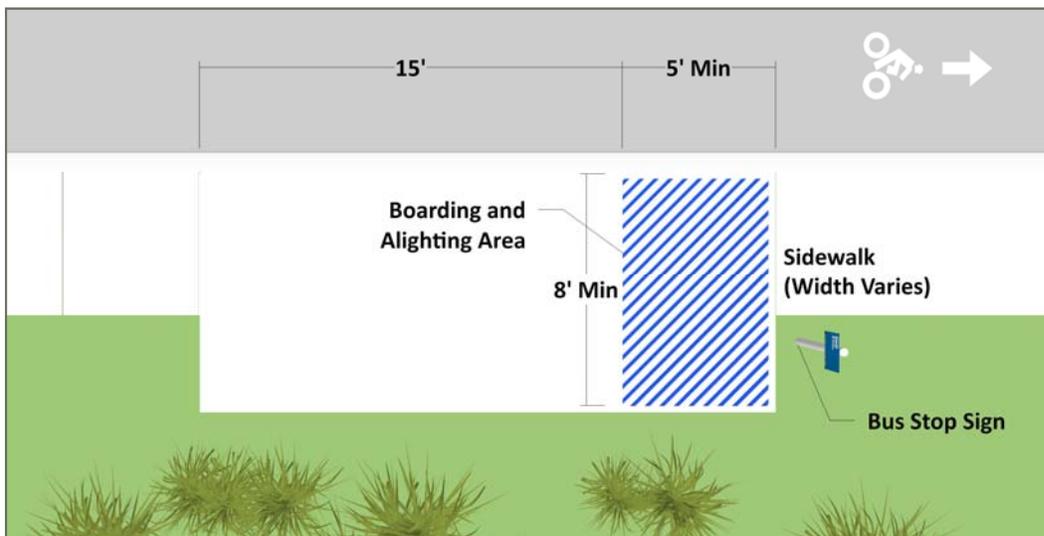


Figure 3.1.4 | Bus stop B&A configuration when the sidewalk is directly adjacent to curb.



Figure 3.1.5 | Bus B&A area with curb.



Figure 3.1.6 | Bus stop along a flush shoulder roadway, Pasco County, Florida.

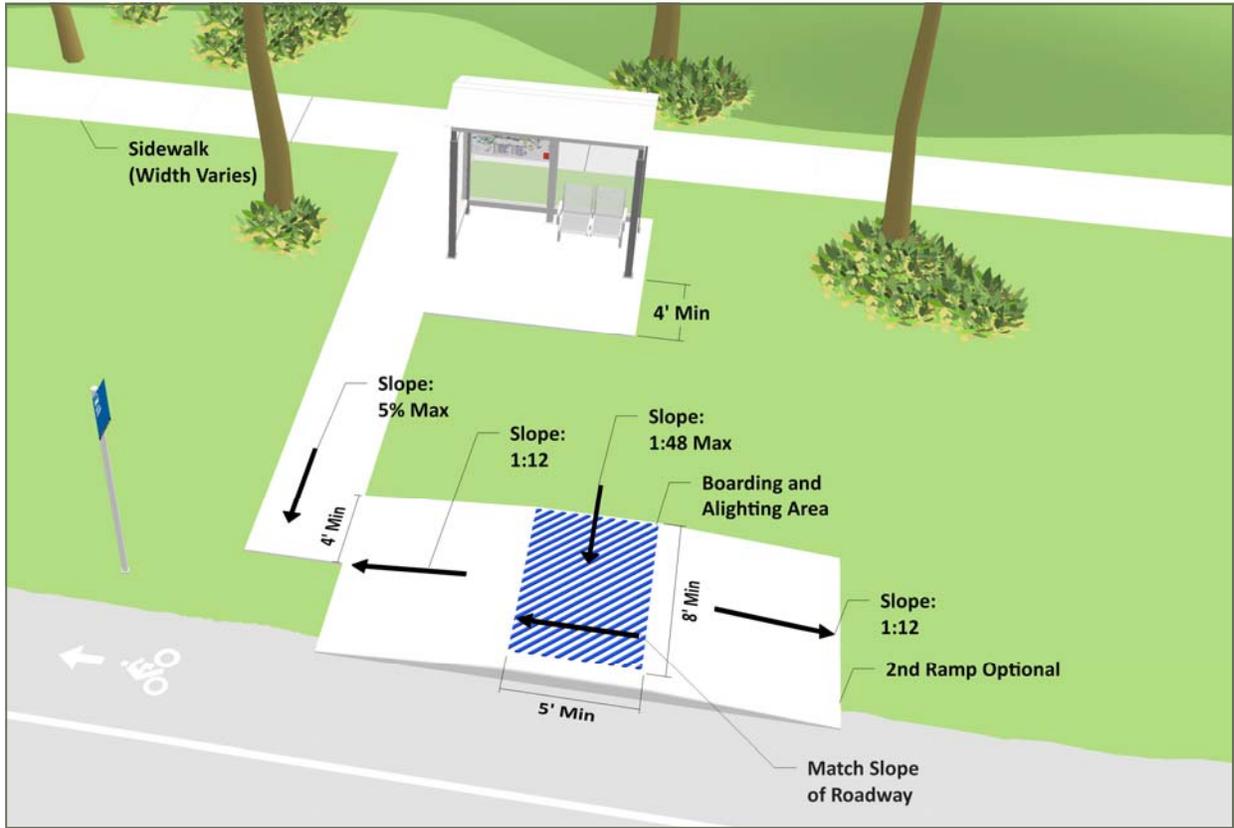


Figure 3.1.7 | Layout of B&A area with a suburban bus stop.

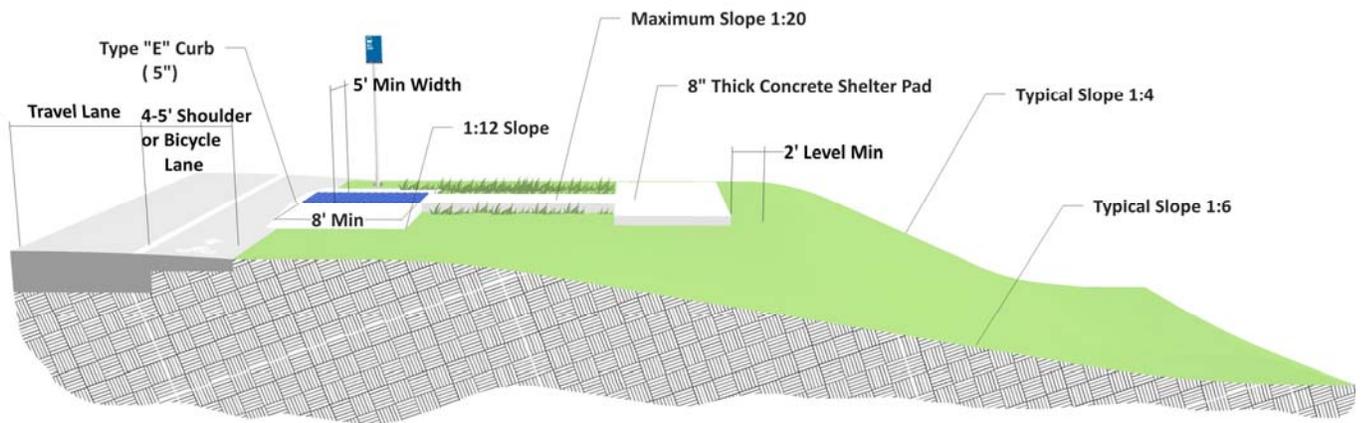


Figure 3.1.8 | Cross-section of a rural bus stop B&A area configuration at a bus stop.

GREEN BUILDING/ ENERGY EFFICIENCY

Ensuring environmentally-friendly elements surrounding a B&A area is a good practice that a transit agency can take toward meeting modern “green” practices. Some opportunities include ensuring that the materials used to construct the B&A areas are from recycled components and the surrounding landscape consists of local drought-resistant plants.

Traditionally, demolished concrete and asphalt are treated as waste. However, if crushed and sorted, demolished concrete can serve as an effective source of aggregate with equivalent or better engineering properties than traditional aggregates. Reclaimed Portland cement concrete crushed into a coarse granular material can be used as a substitute for traditional crushed rock. Several transit agencies have used this environmentally-friendly initiative in the construction of circulation roads, park-and-ride lots, and sidewalks.⁵

One alternative to traditional concrete or asphalt sidewalk is the use of modern, flexible sidewalk

systems made of recycled rubber. A long-term cost benefit in using recycled rubber sidewalks is that they require less maintenance than those of traditional materials. The flexible material promotes pedestrian traffic while reducing noise levels, and the porous nature and flexibility can benefit adjacent tree roots and minimize the need for root cutting. Recycled rubber materials retain less heat, limiting the heat island effect found in many urban areas, and can be more easily replaced than traditional materials.

ADDITIONAL RESOURCES

Engineering Design Templates

Figures 3.1.9 and 3.1.10 present engineering drawings for a bus stop B&A area on flush shoulder roadways. For more information, refer to *PPM*, Volume 1.

Figures 3.1.11 and 3.1.12 present engineering drawings for a bus stop B&A area on flush shoulder roadways with connection to a sidewalk. For more information, refer to FDOT’s *PPM*, Volume 1.

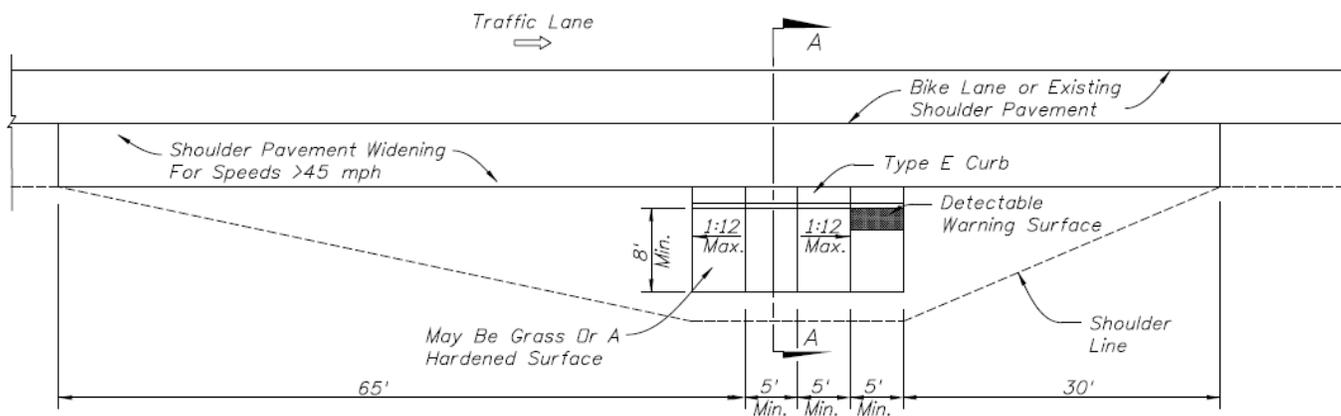


Figure 3.1.9 | Accessible B&A area for flush shoulder roadways with connection to roadway (plan view).

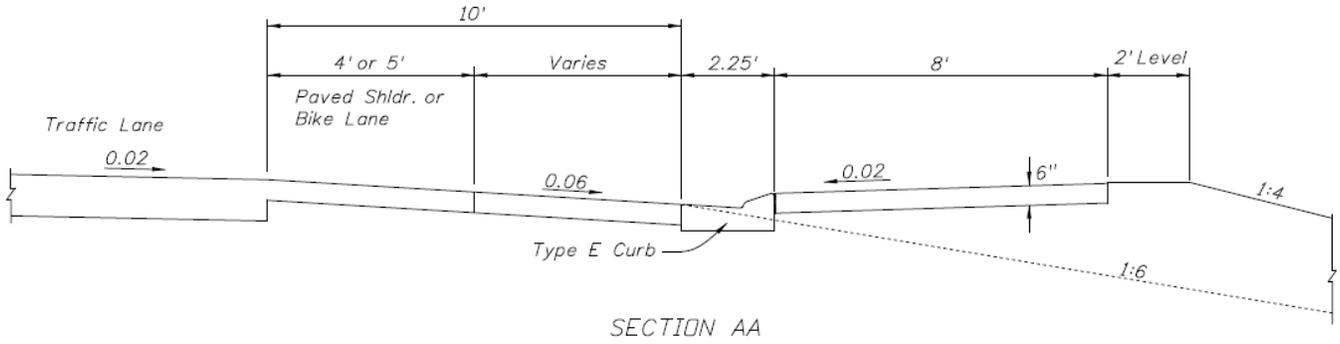


Figure 3.1.10 | Accessible B&A area for flush shoulder roadways with connection to roadway (cross-section).

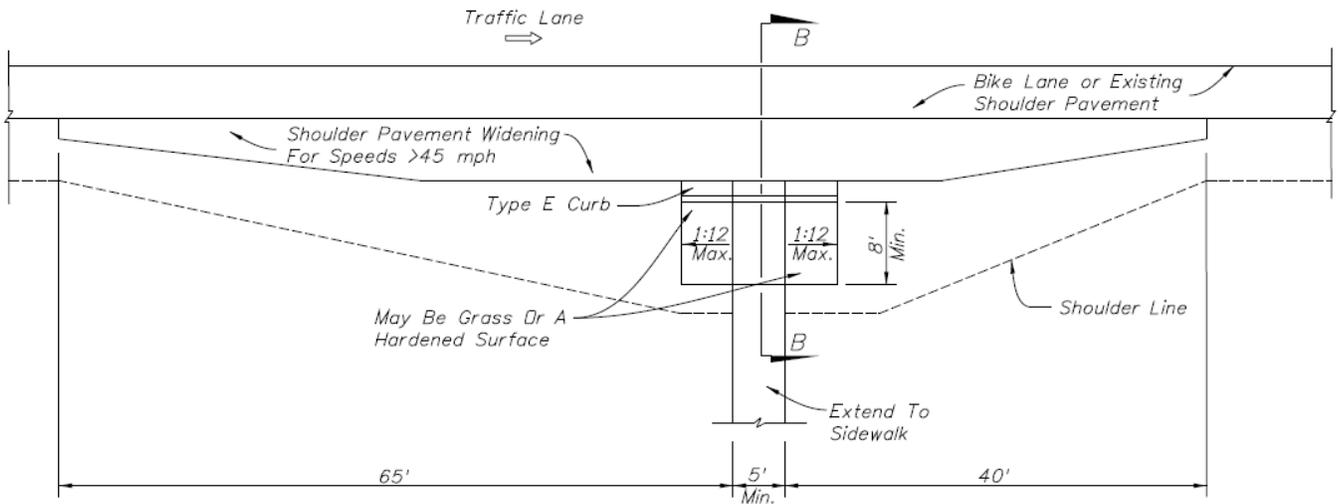


Figure 3.1.11 | Accessible boarding and alighting area for flush shoulder roadways with connection to a sidewalk (plan view).

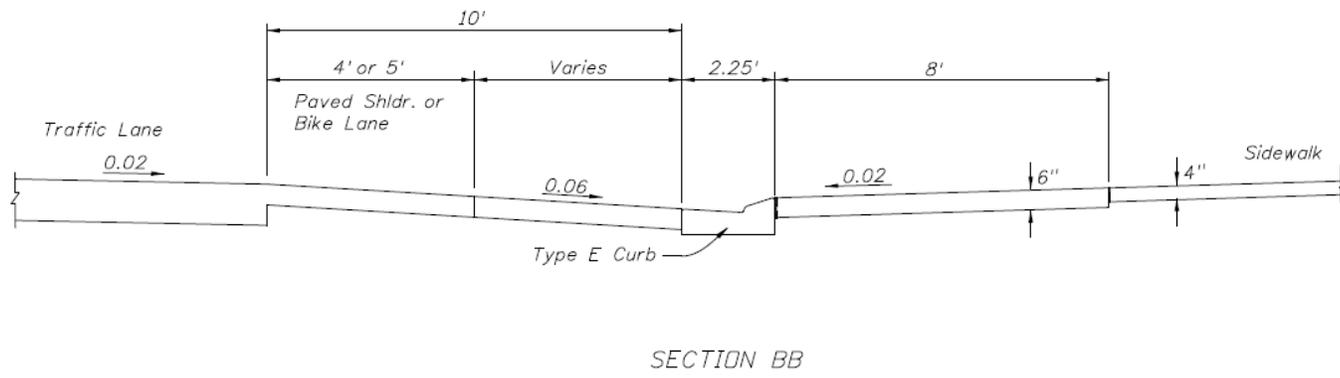


Figure 3.1.12 | Accessible B&A area for flush shoulder roadways with connection to a sidewalk (cross-section).

REFERENCES: SECTION 3.1

1. Florida Building Code Online, 2012. *Florida Accessibility Code for Building Construction*. http://www.floridabuilding.org/fbc/committees/accessibility/aac/Changes_to_Law.Florida_Accessibility_Code_2012_ICC_FINAL.pdf, accessed February 22, 2012.
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3.2 Bus Stop Signs

OVERVIEW

Bus stop signs are necessary to identify safe and convenient locations for passengers to board and alight a bus. This element is the single most important element in designating a bus stop. There is no bus stop without a sign! Therefore, the most important aspects to be considered in placing transit signs are passenger convenience, public safety, and bus stop visibility. The bus stop sign marks the area where passengers should stand while waiting for the bus and serves as a guide for the bus operator in positioning the vehicle at the stop.¹ Bus stop signs must be posted at all bus stops and bus passenger facilities. Bus stop signs are frequently the only kind of communication that a passenger has with a transit facility. Passengers rely on signs to effectively communicate route information, timing, location, and other basic characteristics of a transit facility. Figures 3.2.1, 3.2.2, and 3.2.3 show examples of bus stop signs.

ACCESSIBILITY

Accessible signs are essential to creating an environment free of travel hazards to passengers with disabilities. Transit signs should be located in a place where they are visually accessible to passengers. For patrons using wheelchairs, the bus stop pole should indicate where to access the vehicle wheelchair lift or ramp. It is a visual queue for both the passenger and driver for where the safest B&A area is located.

Non-discrimination requirements of ADA pertaining to visual signage requirements specify that route indicators must be present on bus stop signs. If desired to highlight the accessibility of a bus stop, bus stop signs could include the international symbol of accessibility (wheelchair logo). Sign panels must be located (outside the accessible path) to provide a minimum sidewalk clearance of 4 feet.² This clearance is to maintain the ADA- and State-mandated clear width required across all pedestrian pathways. Per the PPM, 5 feet is the requirement, but if the area is constrained, 4 feet can be an acceptable variance. Restricting



Figure 3.2.1 | Bus stop sign, Tampa, Florida.



Figure 3.2.2 | Bus stop sign with information on real-time bus information, Pinellas County, Florida.



Figure 3.2.3 | Bus stop sign, Miami-Dade County, Florida.

sidewalk width by mounting signs in the sidewalk is discouraged.

Signs at stops also need to be accessible to those with little or no vision. Signs are more legible for persons with low vision when characters contrast as much as possible with their background.

ADA Standards state that characters on signs shall contrast either light on dark backgrounds or dark on light backgrounds. Black & white contrast is the most effective. Additional factors affecting the ease with which the text can be distinguished from its background include shadows cast by lighting sources, surface glare, and the uniformity of the text and its background colors and textures.

Unique features of the transit system should be incorporated into the design of each bus stop sign so that passengers with visual disabilities can distinguish a bus stop from other street furniture. Stops that have shelters are more readily-identifiable due to the unique features of the shelter. However, bus stops that are identified only with a signpost or that have the sign mounted on a utility pole can be difficult to identify. To address this issue, a pole design that is unique to bus stops should be provided at all locations. For example, the pole may be square with holes running down its length¹ or have a tactile collar to act as a non-visual queue. An agency may also choose a differently-colored post as a visual queue for persons who have low vision. If a unique pole is provided, the transit agency should educate customers who have visual impairments about this feature. Effective communication and education of transit customers is essential to successfully creating an accessible system.

DESIGN

Sign design helps a transit agency brand its bus stops. A sign branded with a transit agency color or design helps passengers recognize where a bus stop is located. A clear sign with an efficient design helps an agency effectively communicate to transit users.

All signs must comply with the requirements set forth in the *Manual on Uniform Traffic Control*

Devices (MUTCD.) These requirements state that signs shall provide a minimum 7-foot vertical clearance from the paved surface (sidewalk or roadway pavement). If the vertical clearance is less than 7 feet and is placed along an accessible route, a barrier to warn people with visual impairment should be provided. Signs that have a vertical clearance of less than 7 feet, but a leading edge greater than 27 inches, must not protrude into the circulation path more than 12 inches from the post. The aforementioned barrier prevents visually-impaired individuals from seriously harming themselves on protruding objects. The sign dimensions depicted in Figure 3.2.4 are typical, but not mandatory, dimensions for rectangular bus stop signs.

Specific standards for visual characters are federally-mandated through the ADA. These standards create an easily-readable sign for all individuals that can be seen in clear, crisp text. Visual characters must comply with the following:³

- Sign characters shall be selected from fonts where the width of the uppercase letter "O" is 55 percent minimum and 110 percent maximum of height of uppercase letter "I."
- Characters shall be uppercase or lowercase or a combination of both.

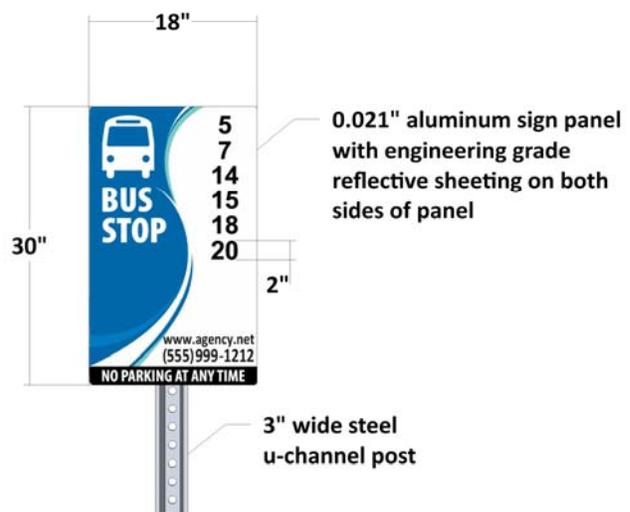


Figure 3.2.4 | Typical dimensions for a rectangular bus stop sign.

- Characters shall be conventional in form. Characters shall not be italic, oblique, script, highly decorative, or other unusual forms.
- Characters and their background shall have a non-glare finish and shall contrast with their background with either light characters on a dark background or dark characters on a light background.
- To the maximum extent practicable, minimum character height shall comply with Table 3.2.1. Viewing distance shall be measured as the horizontal distance between the character and an obstruction preventing further approach toward the sign. Character height shall be based on the uppercase letter “I.”

Bus stop signs should be double-sided for visibility from both directions and reflectorized or illuminated for nighttime visibility. They should be placed near where people board the front door of the bus.

Additionally, bus stop signs should be designed with a uniform size and shape and coordinate with the agency’s identity package. By coordinating signs with the rest of the agency identity, transit passengers are more able to clearly identify their specific bus stops and routes. Signs should clearly display information. When possible, easily-understood symbols should be used in lieu of written information. Finally, high-contrast colors on bus stop signs can be employed to enhance readability.

Although at a minimum, only the system and route(s) served at the stop are required to be displayed on the sign, other suggested information includes the transit agency telephone number, hours of operation, and schedule information. Expanded information, including schedules in a format that is easy to update and system maps with the bus stop location highlighted, can be added along high-volume routes. However, bus schedules, timetables, and maps that are posted at the bus stop or bus bay shall not be required to comply with the guidelines for bus stop signs.³

Post-mounted signs shall be crashworthy (breakaway when struck leaving a stub of no more than 4 inches above the ground, yielding, or shielded with a longitudinal barrier or crash cushion) if within the clear zone⁵ (a clear zone is roadside that is traversable and unobstructed by fixed objects to allow vehicles that leave the roadway to recover safely). All sign supports, except overhead cantilever, truss type or bridge, or barrier wall-mounted, shall be breakaway as defined in the American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, and the AASHTO Roadside Design Guide. Sign supports shall be of an acceptable and crashworthy design as described in the FDOT Design Standards. Supports not meeting the breakaway criteria should not be installed within

**Table 3.2.1⁴
Bus Stop Sign Visual Character Heights Based on Height of the Sign and Horizontal Viewing Distance**

Height to Finish Floor or Ground From Baseline of Character	Horizontal Viewing Distance	Minimum Character Height
40" to less than or equal to 70"	Less than 72"	5/8"
	72" and greater	5/8", plus 1/8" per foot of viewing distance above 72"
Greater than 70" to less than or equal to 120"	Less than 180"	2"
	180" and greater	2", plus 1/8" per foot of viewing distance above 180"
Greater than 120"	Less than 21'	3"
	21' and greater	3", plus 1/8" per foot of viewing distance above 21"

the clear zone. Sign supports not meeting these requirements that must be installed within the clear zone shall be protected by a barrier or crash cushion.⁶

The bus stop sign must neither block jurisdictional signs nor be blocked by other signs, trees, or buildings. Signs shall not be installed where signing interferes with the functions or visibility of existing traffic control devices. Transit bus stop signs shall be attached to supports meeting the location, height, and lateral placement requirements established in the *FDOT Design Standards*, Index 17302. The sign panel must be securely mounted at an angle perpendicular to the street.

On designing park-and-ride signs at bus stops, reference should be made to the *MUTCD*, as it provides detailed information on minimum national standards for park-and-ride sign design. In



Figure 3.2.5 | Park-and-ride sign with a transit agency logo, Miami, Florida.

addition, reference should be made to the *FDOT State Park-and-Ride Guide* for additional guidelines. Figure 3.2.5 shows an example of a park-and-ride sign with a transit agency logo at a bus stop.

LOCATION

Locations of bus stop signs play a key role in generating the desired ridership for a bus route. It is required that bus stop signs be posted at all bus stops and passenger facilities. Sign and signpost placement should conform to ADA and State requirements for height, width, visibility, and other design criteria. Bus stop signs should be placed downstream of the bus stop such that they do not block the view of passengers or bus operators. Existing signs may also be used to include bus stop information, depending on the policies of the sign-maintaining agency and the transit agency's design specifications.⁷ Figures 3.2.5, 3.2.6 and 3.2.7 show examples of typical bus stop signpost installations.

Additionally, the *FDOT Design Standards* apply on all state roads. *FDOT Design Standards*, Index 700, requires a minimum clearance of 4 feet from the face of the curb to frangible signposts.⁸ For curb and gutter sections in business or residential areas, *FDOT Design Standards*, Index 17302 requires a minimum 2-foot distance from the face



Figure 3.2.6 | Bus stop sign located on a flush shoulder roadway, Pasco County, Florida.



Figure 3.2.7 | Bus stop sign located in a grass divider strip, Volusia County, Florida.

of the curb to the nearest edge of the sign. On flush shoulder roadways, clearance is measured from the edge of the travel lanes or paved shoulders. Index 17302 of the *FDOT Design Standards* stipulates that the lateral offset from the nearest edge of the sign itself must be at least 12 feet from any travel lanes and at least 6 feet from the edge of any paved shoulder. The minimum distance will vary according to the design speed of the road. Figures 3.2.8 through 3.2.11 illustrate dimensions for various bus stop signpost location configurations.

On non-state roads, according to *MUTCD*, a minimum offset of 1 foot from the face of the curb to the nearest edge of the sign may be used in urban areas where the sidewalk width is constrained or where other vertical structures (e.g., utility poles) are located close to the curb. Otherwise, signposts should be located farther away from the face of the curb in order to be visible to the bus operator. Additionally, sign panels must be located to provide a minimum sidewalk clearance of 4 feet.²

Use of existing poles should also be considered to minimize the number of posts and poles in the roadway right-of-way. Signposts placed near

intersections must be of an omni-directional design, meaning that the support is symmetrical and will break safely when struck from any direction.

Transit bus stop signs shall be attached to supports meeting the location, height, and lateral placement requirements established in *FDOT Design Standards, Index 17302.* Figure 3.2.12 shows an example of the use of existing poles/posts.

GREEN BUILDING/ ENERGY EFFICIENCY

Bus stop signage offers an opportunity for agencies to reduce their carbon footprint by incorporating energy-efficient features into bus stops. For example, bus stop signs can be enhanced to include solar power to illuminate the bus stop sign and power an attached digital screen to inform waiting passengers of the estimated time of arrival of the expected buses. Figure 3.2.13 shows an example of a solar-powered bus stop sign with bus signaling and lighting features.

Some agencies have started using solar-powered LED lighting to illuminate both shelters and bus stop signs. Figure 3.2.14 shows an example of a bus stop shelter using solar-powered LED lighting.

Other agencies use solar energy to:

- power overhead security lighting next to a sign
- illuminate transit timetables attached to a sign
- power a bus stop illumination system that uses a flashing beacon on the signpost to notify bus operators of a stop request

The system is activated by bus patrons after dark by the use of touch switches. These stops can be located in less-developed areas with minimal lighting or fast moving traffic, mainly in suburban and rural areas. Options to activate this system with sensors instead of touch switches provide a better alternative for people with visual impairments.

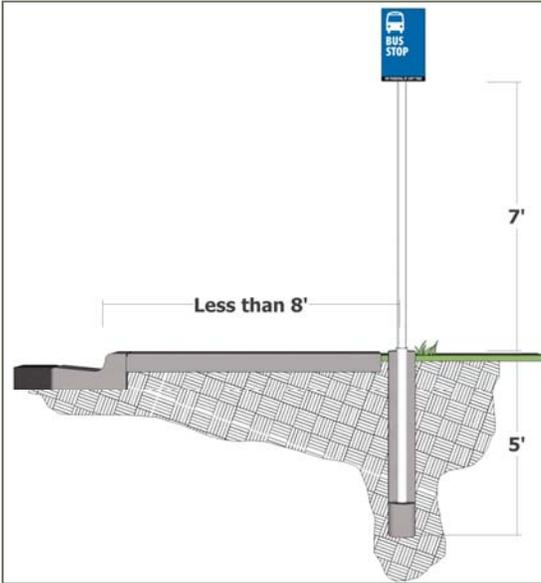


Figure 3.2.8 | Dimensions for a bus stop sign placed on the far side of a sidewalk adjacent to a travel lane.

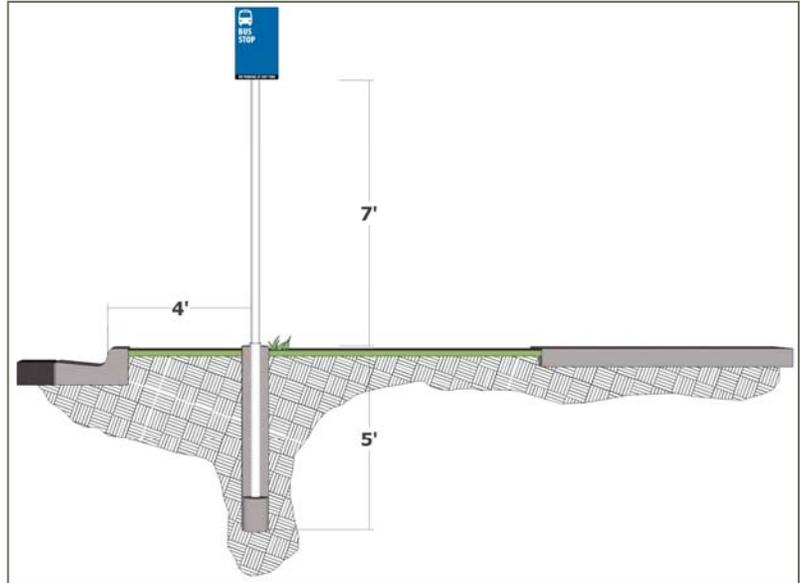


Figure 3.2.9 | Dimensions for a bus stop sign placed in a planting strip adjacent to a travel lane.

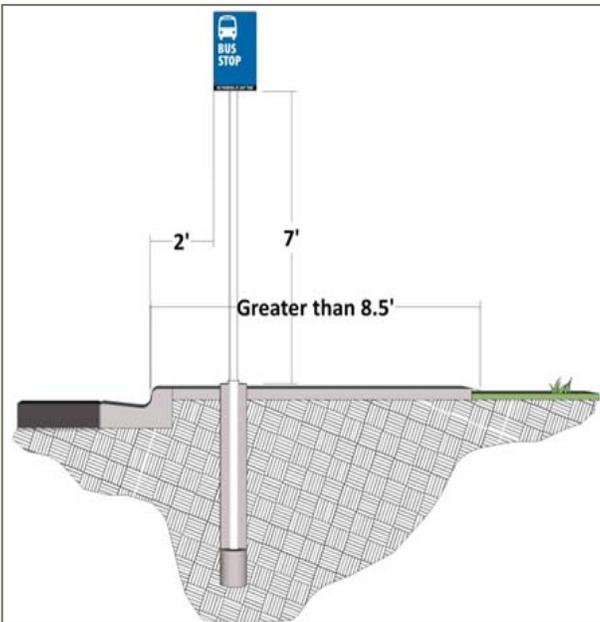


Figure 3.2.10 | Dimensions for a bus stop sign placed on the near side of a sidewalk adjacent to a travel lane.

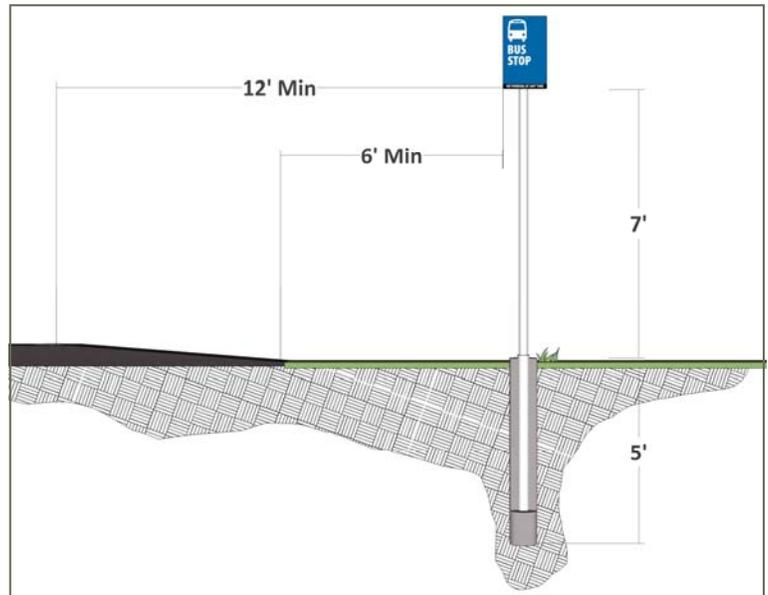


Figure 3.2.11 | Dimensions for a bus stop sign placed adjacent to a travel lane of a road without curb and gutter.



Figure 3.2.12 | Example of using existing poles/posts as support for bus stop signs.



Figure 3.2.13 | Solar-powered bus stop sign with bus signaling and lighting capabilities, Pinellas County, Florida.

When lighting at the stop is not provided by the transit agency at night, local stops without a shelter should be located within 30 feet, but not closer than 15 feet, to overhead light source. For additional information on bus stop lighting, see Lighting in Section 3.3, Shelter Design.

Figure 3.2.15 shows details of the touch switches from a stop sign on a pole with solar-powered lamps that can be illuminated at night. Agencies should also maintain landscaping adjoining the bus stop area to ensure that it does not block the light source.



Figure 3.2.14 | Bus stop shelter using solar-powered LED lighting, Seattle, Washington.



Figure 3.2.15 | Details of a solar-powered bus stop signpost that provides bus flagging capability and security lighting, Pinellas County, Florida.

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IMAGE CREDITS FOR IMAGES BY OTHERS

- 3.2.14 Photo courtesy of King County Department of Transportation, Metro Transit Division. Seattle, WA. Used with permission.

3.3 Bus Stop Shelters

OVERVIEW

Shelters provide a comfortable waiting area for passengers and protect them from exposure to the sun, rain, and heavy wind. The shelters, together with the provision of other amenities under or near the shelter, enhance the image of the transit service and help provide a more comfortable and convenient overall transit experience for patrons. With natural environmental factors in Florida such as solar radiation, heavy precipitation, winds, and high relative humidity, waiting for the bus, especially in the summer, can become extremely uncomfortable for passengers. As a result, allowing for shading, shelter, and ventilation are important factors that should be considered when bus stop shelters are implemented in Florida.

The decision to place a bus shelter should be based on a number of factors, including ridership, location, and route connectivity. Bus shelters should be provided at stops that are major generators of peak-hour transit ridership or are major transfer points between routes. Stops that attract large concentrations of patrons that are young or who are older adults or persons with

temporary or permanent disabilities should be sheltered. See Rule 14-20.003, FAC, for requirements on the placement of bus shelters. Also see Chapter 4 for more information on the placement of bus stops.

Figure 3.3.1 shows an artistic rendering of a sheltered bus stop.

ACCESSIBILITY

Per FAC 14-20.003, a shelter may be erected only at bus stops designated by a public transit agency or the local school board and identified as having service a minimum number of 10 times in a 5-day period, excluding weekends and holidays.

Table 3.3.1 shows examples of suggested best practices¹ for installing shelters.

Location	Minimum Boardings
Rural	10 or more per day
Suburban	25 or more per day
Urban	50 to 100 per day



Figure 3.3.1 | Typical curbside bus shelter at a bus bay in a suburban area.

The table suggests a higher number of minimum boardings before building a shelter and is provided by *TCRP Report 19, Guidelines for the Location and Design of Bus Stops*.

The seating and protection provided by shelters benefit bus patrons with mobility impairments. Additionally, a shelter clearly marks a bus stop, supplies an area to post route and timetable information, and provides refuge for waiting passengers, separated from the public way.

Bus shelters shall be connected to a B&A area by an accessible route in compliance with the Florida Accessibility Code for Building Construction, Section 402, and ADA Standards, Section 810.

LOCATION

Shelter placement should be designed with consideration for environmental sensitivity to heat, cold, rain, and wind. Table 3.3.2 shows preferred locations for various types of shelters for a larger transit agency.²



Location Tip

Shelter locations must meet setback and minimum clear recovery zone requirements as established in *FDOT Design Standards*, Index 700.

Per FAC 14-20.003, shelters are currently prohibited in medians and on limited access roads. Shelters erected outside of the urban limits shall be spaced so that no more than two shelters are erected per mile of a two-lane highway and no more than four shelters are erected per mile on highways with four or more lanes.³ Shelter locations must meet setback and minimum clear recovery zone requirements as established in *FDOT Design Standards*, Index 700.

When bus shelters are provided by the private sector, whether located on the public right-of-way or private property, they must meet all applicable local building codes, permit requirements, land development codes, and the guidelines listed in this handbook.

**Table 3.3.2
Preferred Locations by Shelter Type**

Shelter Type	Threshold (Minimum Daily Boardings)	Preferred Location
Basic and most common shelter (8.5' x 4.5' x 8')	50	Business and retail districts, residential neighborhoods, industrial and manufacturing areas, etc.
Narrow version of basic and most common shelter (8.5' x 2.5' x 8')	50	Pursued when a basic and most common shelter is warranted but right-of-way is limited.
Longer version of basic and most common shelter (12' x 4.5' x 8')	100	At stops with strong usage.
Longer version of narrow shelter (12' x 2.5' x 8')	100	At stops with strong usage and limited setback.
Large shelter (16' x 4.5' x 8')	150	At stops with significant ridership and likely only at activity centers.
High-capacity shelter (size varies)	>200	Special shelters for extremely high usage areas, e.g., transit centers, light rail stations, and high transfer points.
Awning	Not applicable	Protection provided by businesses



Design Tips

If a bus shelter is provided, per ADAAG requirements, it must:

- Be on the public access route.
- Not block the public access route.
- Have 48" min. clearance; 60" recommended.
- Have 30" x 48" min. clear floor area within the shelter.
- Have 48" min. approach to clear floor area.

When placing a bus shelter, the open side of the shelter should be placed toward the street and should be grade-separated from the travel lane.

Shelters should be located upstream of the bus zone so they do not interfere with passenger boarding and alighting and to maximize the visibility for approaching buses, passing traffic, and waiting passengers. They should not be obstructive to pedestrian circulation and should be easily detectable to persons with visual impairments. The location of bus shelters should minimize walking distances for waiting passengers. Shelters should be located at least 5 feet from the front door of the bus along the direction of travel to provide adequate circulating space for persons in wheelchairs while not obstructing the 5-foot-by-8-foot B&A area.⁴

Proper horizontal clearance (distance away from the edge of the roadway) to shelters must be provided. On flush shoulder roadways, the distance will vary according to the design speed of the road (see *FDOT Design Standards*, Index 700). Shelters shall not be placed on sidewalks where they could obstruct the movement of pedestrians. When a shelter is located on the street side of a sidewalk, a minimum 4-foot pedestrian pathway, per State requirements, shall be maintained on three sides of the shelter. In areas with high pedestrian volumes, a 6-foot sidewalk on one side of the shelter is preferred. To meet ADA Standards, the sidewalk adjacent or connected to the shelter must be designed with a width of at least 5 feet or, at every 200 feet, a space at least 5 feet by 5 feet must be provided so that two wheelchair users can pass traveling in opposite directions.

Shelters should also allow for unobstructed views into and out of shelter structures. The design of the shelter should not create blind spots or hiding places that might increase crime risks.

Shelters should not be placed on the B&A area required by ADA. Shelters shall not be located within 15 feet of a fire hydrant or a disabled parking space.³

Prior to the installation of a shelter, the impacted utility companies must be notified to determine the location of utilities and prevent conflicts.³

Shelters must also be securely attached to their foundations and must provide for a clear opening between the structure and the ground or foundation to facilitate cleaning, preclude the accumulation of debris, and increase security.

Shelters should be oriented to provide patrons with as much protection as possible from environmental factors such as sun, cold, rain, and wind. Shelters should be designed to maximize shading and encourage cooling air movement. Particularly in Florida, sun shade protection is also very important and should exist on all sun-exposed sides of the shelter. Shelters oriented to the southeast or southwest may become uncomfortable for passengers if adequate shade is not provided.⁴ Figure 3.3.2 shows a typical bus shelter in Florida.



Figure 3.3.2 | Typical bus shelter, Tallahassee, Florida.

DESIGN

Shelters shall have provisions to accommodate older adults and people with disabilities to meet ADA Standards. A shelter that is accessible to people in wheelchairs must have a minimum clear floor area that is 30 inches wide and 48 inches deep and entirely within the perimeter of the shelter.⁵ Shelter access entry and exit points shall provide a minimum clear width of 4 feet to meet State requirements (ADA requirements are 3 feet). The ADA-mandated B&A area can be extended into clear space within the shelter. However, no obstructions to the 5-foot-by-8-foot area shall be allowed. If a bench is provided within a bus shelter, the 30-inch-by-48-inch clear floor area should be located adjacent to the bench to allow shoulder-to-shoulder seating with a companion for wheelchair users.

There shall be no vertical change in elevation greater than ¼-inch untreated or ½-inch treated to a slope of 1:2 along the walking surfaces between the sidewalk or bus B&A area and the shelter.⁶ Changes in level greater than ½-inch must be ramped in compliance with 405 or 406 of the ADA Standards.⁵

Shelters should incorporate seating whenever possible, both to make the service more attractive in general and to serve patrons with mobility impairments (such as older adults, women who are pregnant, persons with temporary injuries, etc.).

Shelters should include route maps and schedules. To the greatest extent possible, these should be easily readable by people in wheelchairs and people who have visual impairments.⁵ Shelters can also be designed to incorporate benches and/or leaning rails and may also include transit service literature, telephones, newspaper vending, and trash receptacles. When available right-of-way is limited, it is better to provide a smaller shelter than not to provide a shelter at all.

All pedestrian infrastructure and amenities should be without any sharp edges or protruding elements.⁷

Shelter Dimensions

Dimensions for shelters of various sizes are shown in Figures 3.3.3 through 3.3.10. The size and design of shelters varies with the number of boardings at a bus stop and space availability. Per FAC 14-20.003, the maximum height of a shelter cannot exceed 10 feet³ for shelters located on the



Figure 3.3.3 | Cross-section of a small bus shelter with a leaning rail and no seating, with typical vertical dimensions.

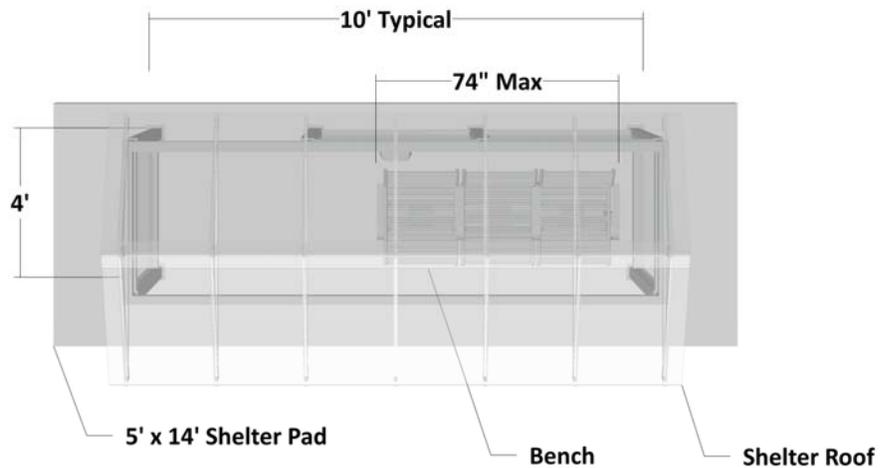


Figure 3.3.4 | Typical dimensions of a small bus shelter with seating.

State Highway System. However, if necessary, a variance to the Rule can be considered. The recommended minimum dimensions for a bus shelter are 10 feet by 4 feet by 7 feet high (interior clearances). To allow clear passage of the bus and its side mirror, shelters should be a minimum distance of 5 feet between the face of the curb and the roof or panels of the shelter. Greater distances are preferred to separate waiting passengers from nearby vehicular traffic and must meet the State setback requirements.⁷ Shelters should include seating space for three adults and one space for a wheelchair (30 inches by 48 inches minimum).

If an agency employs a variety of shelters, the architecture of the shelter should be indicative of nearby land uses; it should provide the rider with a means of orientation within the community. In areas where the unique character of the urban

environment is particularly important (e.g., historic districts, traditional downtowns, along the waterfront, etc.), agencies should consider modifying the design and look of individual shelters to give the shelters local flair that the community will appreciate. Figure 3.3.11 shows a public art bus shelter uniquely designed in St. Petersburg, Florida. With local participation comes a feeling of ownership, which may help reduce vandalism.

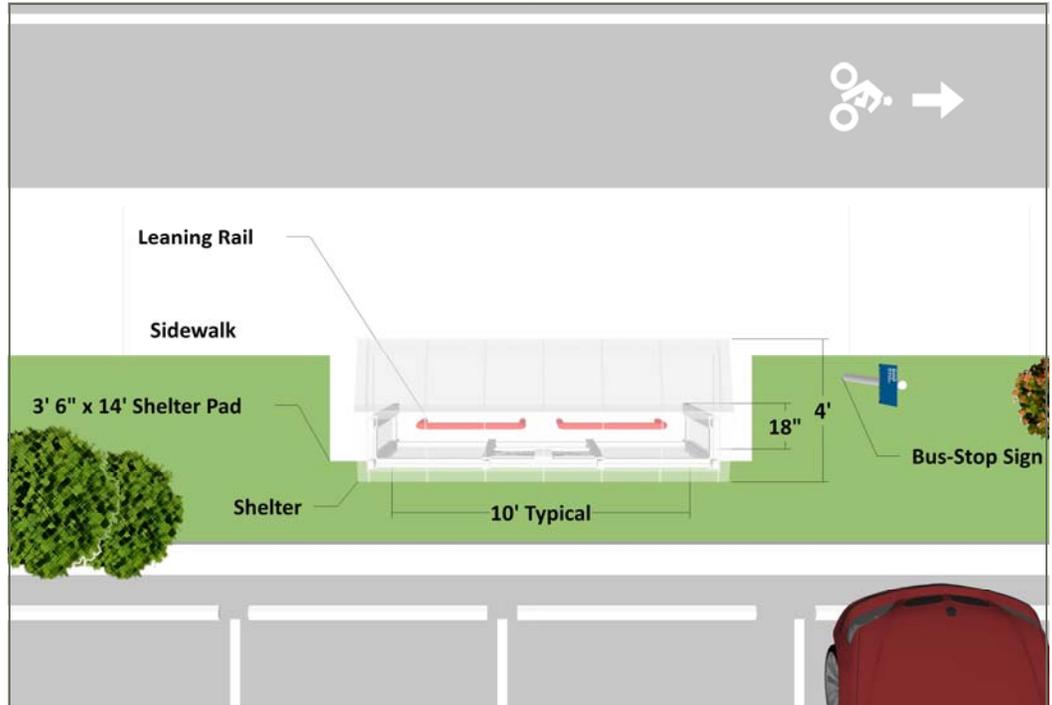


Figure 3.3.5 | Typical dimensions of a bus shelter on a limited right-of-way width.

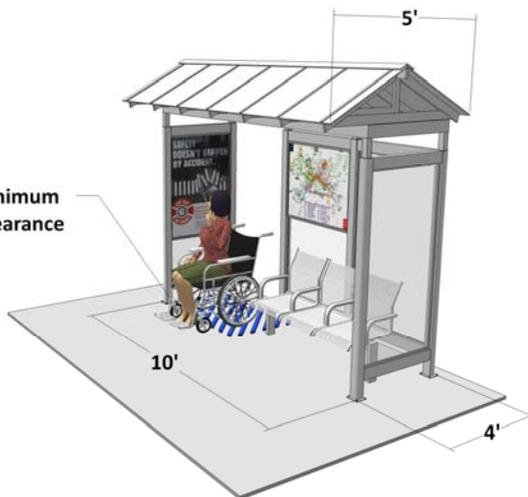


Figure 3.3.6 | Typical dimensions of a bus shelter with seating.

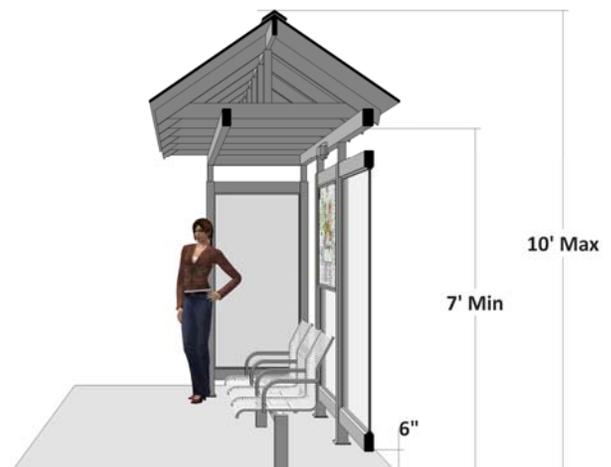


Figure 3.3.7 | Cross-section of a small shelter with seating.

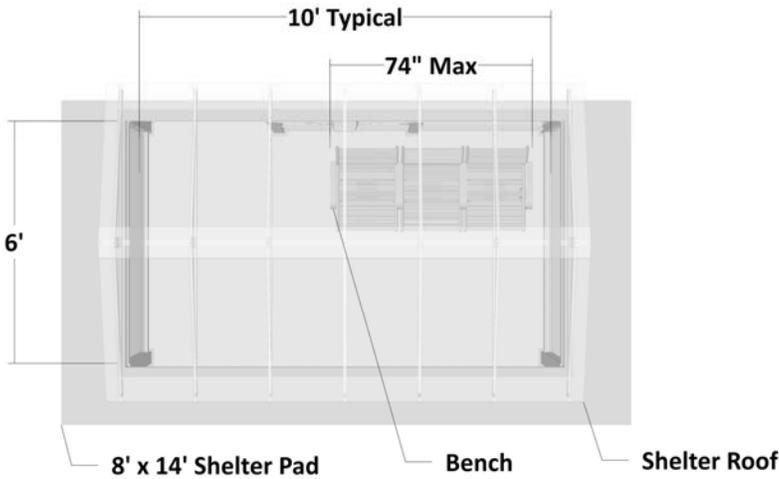


Figure 3.3.8 | Typical dimensions of a mid-sized bus shelter.

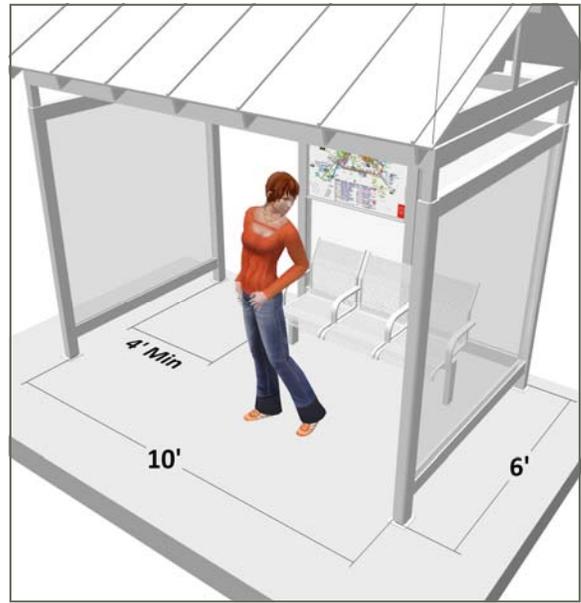


Figure 3.3.9 | Typical mid-sized bus shelter.

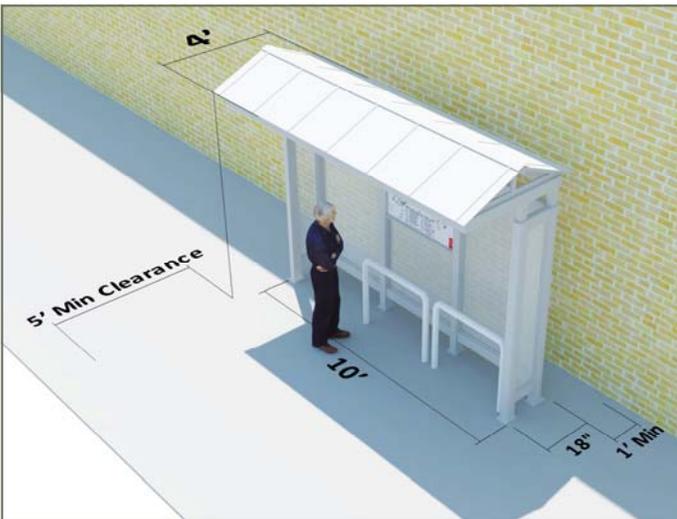


Figure 3.3.10 | Small bus shelter next to a wall.



Figure 3.3.11 | Bus shelter with natural lighting during the day and a unique, public art design, Pinellas County, Florida.

Frangibility

Shelters within the clear zone shall incorporate mechanisms to be frangible or breakaway when impacted. Breakaway mechanisms include slip-bases and bases incorporating a component with low impact strength. Bus shelter hardware shall be crashworthy (breakaway when struck leaving a stub of no more than 4 inches above the ground, yielding, or shielded with a longitudinal barrier or crash cushion) if the shelter is not within the clear zone. Breakaway supports placed near intersections should be of an omni-directional

design, meaning that the support is symmetrical and will break safely when struck from any direction. The criteria for breakaway supports focus on the velocity change of the impacting vehicle and the height of the stub of the support remaining after impact.

Maintenance

Shelters should be designed to require low levels of maintenance. It should be easy to clean the

shelters and the concrete shelter pad beneath and around the shelters. To achieve this, shelters should be made out of materials that are durable and vandal-resistant. Agencies should also identify opportunities for incorporating local, recycled, or renewable materials into bus shelter designs and should consider re-using existing bus shelters when possible.

It is important to maintain the cleanliness of the bus stop. A well-maintained stop conveys a message to the community that the bus stop is functional and an important public space.⁵ Public works crews should remove obstacles that affect visibility and maintain the cleanliness of the bus stop. Shelters also should provide a clear opening between the shelter and the ground to allow for cleaning and increased security, and a clear minimum area of 2 feet should be provided behind the shelter for maintenance. Shelters should not be placed in front of the store windows of adjacent properties. When a shelter is located in front of a building, a minimum 12-inch space should remain between the building and the shelter to allow for cleaning.

Lighting

The purpose of shelter lighting is to enhance the safety of patrons at bus shelters and to illuminate passenger information and advertising where applicable. Adequate lighting enables the bus operator to see waiting passengers and to safely approach and depart from a bus stop. Figure 3.3.12 shows an example of bus shelter lighting.

Lighting is the most critical factor in the Crime Prevention Through Environmental Design (CPTED) program, which seeks to prevent certain crimes within a specific boundary by manipulating variables within the physical environment. Bus passenger facilities along routes that offer night-time or after-dark services should have optimum levels of lighting incorporated into the design of the facility. Adequate lighting greatly influences safety and passenger perception of safety, especially at off-street facilities.⁵ Local transit stops without a shelter should be located within 30 feet of an overhead light source. When connecting power to a shelter, all shelter utility connections shall comply with Rule 14-46.001, FAC, and must be approved



Figure 3.3.12 | Solar-powered shelter light.

by the appropriate city or county building department.

Lighting Design – Lights are not permitted for the sole purpose of illuminating advertising, per Rule 14-20.003, FAC.³ All lights within a shelter must be placed or shielded so they do not interfere with motorists on roadways. Lighting should be directed toward illuminating passengers so drivers can see them. Flashing lights on shelters are prohibited.

Light fixtures should be visually non-obtrusive so they do not attract the attention of vandals. Light patterns should concentrate light at the shelter or the stop while minimizing overthrow of glare onto the street. Off-site lighting and night-sky light pollution should be avoided through proper lighting direction and lamp shielding. For road lighting installations, light near and above the horizon should be minimized to reduce glare and visual intrusion. Specifically-designed lighting equipment may be used to minimize the upward spread of light near to or above the horizon. Illumination should be achieved to prevent harsh shadows, as shadows could pose a security hazard.⁴ These shadows may cause a fishbowl effect, whereby the transit user can easily be seen by others but cannot see outside.⁵

If a bus shelter is provided, the level of lighting at the shelter pavement should be between 22 and 54 lumens per square meter.⁷ The lower end of this

range may be as effective for enhancing safety as the higher end, and care should be taken to avoid over-lighting or spot-lighting the shelter. Doing so may make it difficult for patrons to observe their surroundings.

If pedestrian paths adjacent to transit stops are illuminated, the height of the light fixture should be appropriately scaled. A minimum 7-foot vertical clearance from the paved surface should be maintained under all conditions for lighting fixtures outside of the shelter.⁷

Shelter fixtures should be vandal-resistant and durable. Lamp compartment and electrical access areas should be secured with recessed hex-head screws or equal means of securing the fixture. If possible, electrical services should be low voltage to reduce the risk of electrical shock. Cutoff luminaries, low-reflectance surfaces, and low-angle spotlights can be employed to reduce light pollution.

Advertising

For some agencies, advertising is an important revenue source when providing shelters. If so, care should be taken with advertising placement. According to Rule 14-20.003, FAC, there shall be no more than one advertisement per side, including the roof, and said advertisement shall be no greater than 6 feet by 5 feet in size.³ The owner of an abutting property shall be notified by Certified Mail of the proposed shelter location if there will be advertising. Companies engaged in the business of outdoor advertising shall obtain and maintain a current license pursuant to Section 479.04, F.S., and Rule 14-10.003, FAC. Figures 3.3.13 and 3.3.14 show examples of bus shelter advertising.

Environmental Hazards

Sun & Rain – Shelter canopies should take into account sun and rain protection. Shelters should be designed to maximize shading and to encourage cooling air movement. Sun shade protection should exist on all sun-exposed sides of the shelter. Shelters oriented to the southeast and southwest may be uncomfortable for passengers if adequate shade is not provided. Impervious side



Figure 3.3.13 | Bus shelter with an advertisement.



Figure 3.3.14 | Dimensions of bus shelter advertising.

panel materials are poorly suited to Florida’s climate. Pervious side panels allow for ventilation. Figures 3.3.15 and 3.3.16 show typical Florida-related environmental hazards in relation to bus stops.

Wind – Shelters must be built in compliance with the Florida Building Code wind-loading criteria. Compliance with Wind-Borne Debris Region requirements is important to ensure that shelters or amenities do not become the source of flying debris during high wind events.



Figure 3.3.15 | Typical angle of falling rain in Florida.



Figure 3.3.16 | Approximate angle of the sun during late afternoon peak commuting hours in midsummer in Florida for southwest-facing bus shelter.

In wind-borne debris regions (areas with wind speeds of 120 mph and above), all exterior coverings must be made of shatter-resistant materials. (Some Florida counties may have stricter design and construction standards than those in the Florida Building Code. Transit agencies should check local regulations before starting plans and designs.)

In areas that experience hurricanes, bus shelters are prone to damage and may become sources of flying debris if they are not adequately anchored, sized, and fabricated to resist high wind speeds. The Florida Building Code has minimum requirements to ensure that bus shelters in hurricane-prone areas can withstand high winds and the impacts of wind-borne debris.⁹ In addition, transit stops, if identified in an emergency evacuation plan, must be provided with signage indicating the same.⁷ Figure 3.3.17 is a map of ultimate design wind speeds for Florida regions.

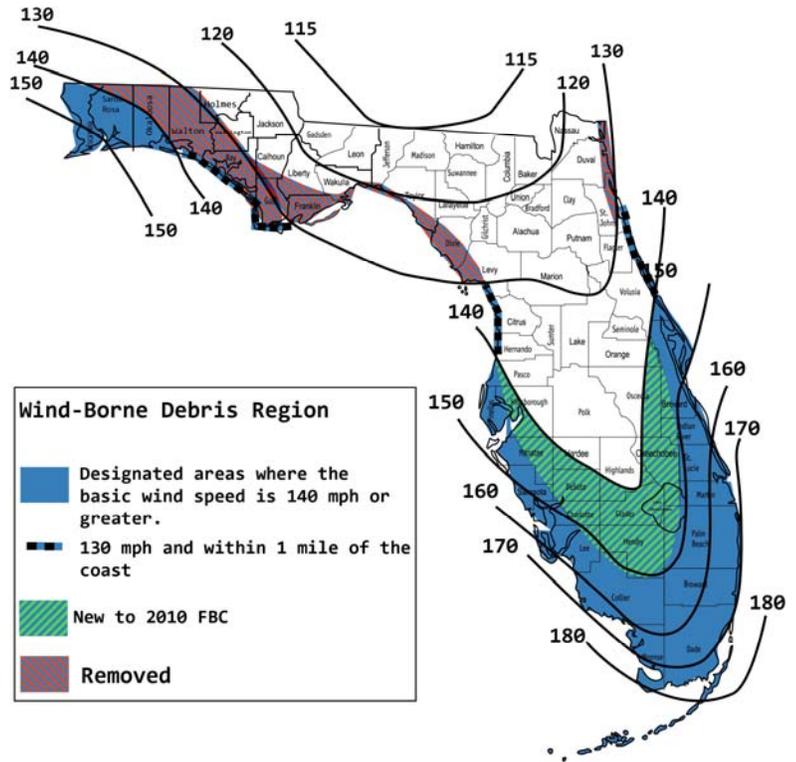


Figure 3.3.17 | Ultimate design wind speeds for wind-load and wind-borne debris regions as established by the Florida Building Code.

SECURITY

Shelters located in areas with good lighting and visibility from surrounding land uses enhances the safety of the stop.⁵ Bus stops should be coordinated with existing street lighting to improve visibility. Cameras can be installed inside and outside the shelter to monitor activities. Locations near stores and businesses also enhance natural

surveillance of the site. Refer to the National Crime Prevention Council at www.ncpc.org for more techniques and examples on safety and security at bus shelters.

Transit agencies should address any line-of-sight issues and visual barriers to drivers seeing passengers waiting inside shelters at bus stops



Security/Safety Tip

Personal security and safety is promoted by maximizing visibility, which can be enhanced by:⁸

- Providing lighting.
- Lowering vegetation heights.
- Removing hiding places.

(advertising panels, information panels, signage, trash can location, vegetation, lighting, etc.).

For example, shelter sides and internal dividers shall be constructed in a manner to provide visibility of waiting passengers to passing traffic and pedestrians. All transparent materials must be shatterproof. No shelter shall be located in such manner or be constructed of such materials so as to adversely affect sight distances at any intersection or obstruct the view of traffic signs or other traffic control devices. If used, glass panels should be marked with a distinctive pattern or by using contrasting colors to indicate their presence.⁵ It is better to have no advertising panels on a shelter at all to avoid limited visibility.

**GREEN BUILDING/
ENERGY EFFICIENCY**

Renewable energy technology, including wind and solar power, can be adapted by transit agencies to provide shelters with electricity for illumination and cooling. Solar lighting is suggested in areas where there is currently no utility service or as a temporary measure until utilities can be established for the shelter or stop. Portable solar lighting may be used when transit service is detoured during construction projects. Figures 3.3.18 and 3.3.19 show examples of “green” bus shelters.

Shelters using solar or electric power can be designed to maintain a continuous low level of illumination inside at night. Once a passenger enters the shelter, lighting can be increased using infra-red technology, giving the passenger increased security and comfort. LED lighting in combination with solar power can also increase

energy efficiency. Due to its low voltage requirement, the installation and long-term cost per shelter may be lower than using traditional electric bulbs and accessories. Solar power considerations include use at stops that do not have a large amount of tree coverage. Limited sunlight providing energy for solar could reduce the efficiency or usefulness of any solar power system, particularly at shelters that see a high intensity of use but may not receive the appropriate amount of sun to power the facility. Any solar-powered additions to a shelter should be carefully considered prior to installation to ensure that the engineering specifications and requirements for use are met.



Figure 3.3.18 |
Bus shelter with solar panels.



Figure 3.3.19 |
Solar-powered bus shelter.

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- 3.3.2 Photo courtesy of StarMetro Transit. Tallahassee, FL. Used with Permission.
- 3.3.23 Photo courtesy of Bike Chattanooga. Chattanooga, TN. Used with Permission.

3.4 Bus Stop Benches

OVERVIEW

Transit users who experience difficulty walking and standing benefit from benches while waiting for the bus. Benches provide comfort for waiting passengers, help identify a bus stop, and are a much lower cost option when compared to installing a shelter. In addition, benches provide opportunities to generate advertising revenue, which can be used to cover the cost to maintain them.

Benches are recommended when a shelter with seating is not provided and if bus headways are longer than 15 minutes.

FDOT allows placement and maintenance of benches on the right-of-way of a state highway pursuant to written approval by the appropriate city or county government within whose jurisdiction the bench is to be located.¹ Bus bench guidelines are applicable to both public- and private-sector benches located at a transit stop location; the local government is responsible for bus bench location and permitting approvals, compliance with ADA, and bus bench maintenance.

Transit agencies use various criteria for the placement of benches at stops along bus routes. Table 3.4.1 presents example bench placement criteria for a large transit agency. The table shows an example of how different types of benches are used depending on a number of placement criteria determined by the agency.



Accessibility Tip

If a bench is provided, make sure to locate it:

- On an accessible route.
- Not blocking an accessible route.
- Must also provide a minimum 30" x 48" concrete pad adjacent to the bench seat.

According to 14-20.0032 FAC, benches shall be placed only at agency-authorized transit stops. However, only a minimum number of benches necessary to accommodate comfort and convenience of the general public shall be erected or maintained. Benches may be sheltered or unsheltered.

ACCESSIBILITY

Bench placement must be in an accessible location (i.e., not on the far side of a drainage ditch from the actual bus stop) and appropriately connected to the path of travel on an accessible path to the bus B&A area. Connections between an accessible path and/or bus stop B&A area must be provided. Coordination with the FDOT District Public Transportation/Modal Development Offices and the local public transit provider(s) is necessary to determine how and where the connectivity can be provided.³ At stops with high ridership, benches may be provided in addition to shelters to accommodate patrons.

To assist passengers using mobility aids, clear floor or ground space 30 inches by 48 inches minimum with slopes not steeper than 1:48 (2.08%) shall be provided and shall be positioned

Table 3.4.1
Example Bench Placement Criteria²

Type of Seat	Length	Criteria for Placement	Placement Notes
Shelter Bench	4'	N/A	Placed inside shelters
Premium Bench	6'2"	Minimum of 25 daily boardings; appropriate surroundings	Often placed in business and retail districts where shelters are not appropriate
Ad Bench	6'	Will be considered at any stop lacking amenities if in a safe location	Placed for ad exposure

at the end of the bench seat and parallel to the short axis of the bench. To assist in transferring to the bench, providing grab bars on a wall adjacent to the bench, but not on the seat back, should be considered. If provided, grab bars cannot obstruct transfer to the bench.⁴ At least 50 percent of benches, but no less than one, at each location should provide such clear space adjacent to the bench. The clear space should be located either at the end of the bench or should not overlap the area within 1.5 feet from the front edge of the bench.⁵ Figure 3.4.1 shows an example of a typical sheltered bus bench.



Figure 3.4.1 | Sheltered bus bench, Hillsborough County, Florida.

LOCATION

Any bench placed on any part of a sidewalk shall leave clearance for pedestrian traffic between the bench and the nearest edge of the road. Sidewalk width shall never be less than 5 feet in clear width unless approved by the District Engineer governing the work being performed. Regardless, in no cases shall the clear width be less than 3 feet in accordance with ADA. Placement of benches should be planned so that no part of a bench, even when placed at an angle, is closer than 1 foot from the edge of a sidewalk or 4 feet from the edge of a shared-use path. Bench location must meet the setback and minimum clear recovery zone requirements as established in *FDOT Design Standards, Index 700*. To alleviate discomfort and exposure to traffic, bus benches should be set back at least 10 feet from the travel lane in curbed sections and outside the clear zone in non-curbed sections.³ In rural areas, the distance between the edge of the road and the bench should vary according to the design speed of the road; the higher the roadway speed, the farther the bench should be placed from the lane.

Benches should be placed on non-slip, properly-drained concrete pads or on grass, gravel, or rubber sidewalks, if possible. According to 14-20.0032 FAC, benches shall not be placed in the median of any divided highway or on limited access facilities.¹

Placement and design of bus benches is governed by FAC Rule 14-20.0032–Placement of Transit Bus Benches, 336.408 F.S., and the *PPM*.

According to FAC, if FDOT finds any bench in violation of any portion of this rule, except those determined to be a safety hazard, FDOT shall provide written notice of the violation to the owner of the bench, or the appropriate city or county government, who shall correct the violation or remove the bench within 30 days after receipt of the notice. If FDOT finds any bench to be a safety hazard, it will provide notice to the owner of the bench, or the appropriate city or county government, who shall take immediate steps to make the bench safe or remove the bench. If the condition or location of a bench is not corrected in accordance with the notice, FDOT will cause the bench to be moved or removed and seek the cost of removal.

Unsheltered benches may be provided in locations where the regular number of riders does not warrant a shelter or in high-use areas that are unsuitable for shelters because of high levels of pedestrian movement in a small area.

Benches must not obstruct the full 5-foot-by-8-foot B&A area or passenger access to loading and unloading areas. As a best practice, benches should be placed no closer than 5 feet and no farther than 12 feet from the forward end of any bus stop. Benches should also be placed so that streetlights or other objects do not obscure the visibility of waiting passengers or oncoming buses.⁷ Bench placement should accommodate passenger legs and feet without placing them too



Figure 3.4.2 | Bench at a bus stop, Miami-Dade County, Florida.

close to traffic. Figure 3.4.2 is an appropriately-located bus bench example.

DESIGN

According to ADA guidelines, benches must be able to support 250 pounds of force applied at any point on the seat, fastener, mounting device, or supporting structure. The bench shall provide for back support or shall be affixed to a wall. All benches should be slip-resistant and designed to shed water.⁶

In interior locations, grab handles should be provided for those with difficulty standing up. Arm rests, sometimes provided with bus stop benches, are not required by ADA. However, they can be used as a tool to help keep people from laying down on the bench. When provided, similar to grab bars on a wall adjacent to a bench, arm rests also should not obstruct the ability of a passenger with disabilities to transfer from a mobility aid to a bench. Figures 3.4.3 to 3.4.6 show dimensions and placement examples for benches.

The design of benches is determined by desired sitting patterns and number of participants. Two-person benches (50 inches long) can be placed at bus stops with medium ridership levels. These are usually placed inside shelters but can also be freestanding. Freestanding, three-person benches can be placed at bus stops with high ridership levels and/or high visibility.⁷

Quick Facts

Design Tip

Bench dimensions shall be as follows:^{4,8}

- Minimum 20" to maximum 24" in seat depth.
- Maximum 28" in depth and 44" in height.
- Minimum 42", maximum 74" wide.
- Bench seat 17–19" (17" preferred) above the ground or floor.
- Back support that extends from a point 2" maximum from above the seat surface to a point 18" above the seat surface.

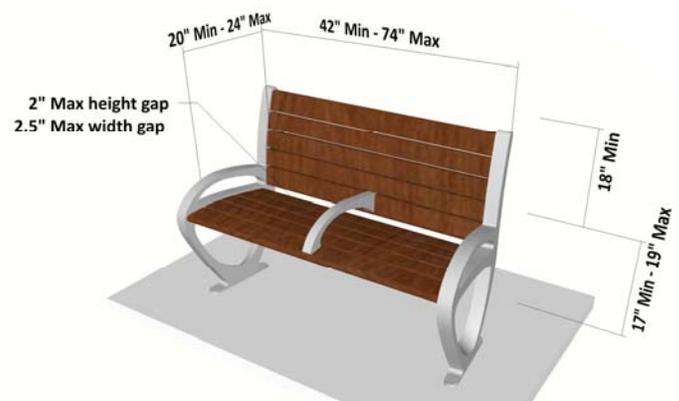


Figure 3.4.3 | Dimensions for a typical bus bench at a sheltered stop.

Advertising on Benches

Private sector convenience benches may be placed at bus stop locations with approval from the state or local governments. Commercial advertising shall be displayed upon a bench only on either the front or rear surface of the backrest area. Advertising displayed on a bench shall not be greater than 6 feet in length nor be greater than 2 feet in height, and no advertising displayed upon a bench shall be of a reflectorized material.¹

GREEN BUILDING/ ENERGY EFFICIENCY

Possible Materials for Use

Bench materials should be weather resistant, discourage vandalism and vagrancy, and require minimal maintenance. Concrete bases (end pieces)

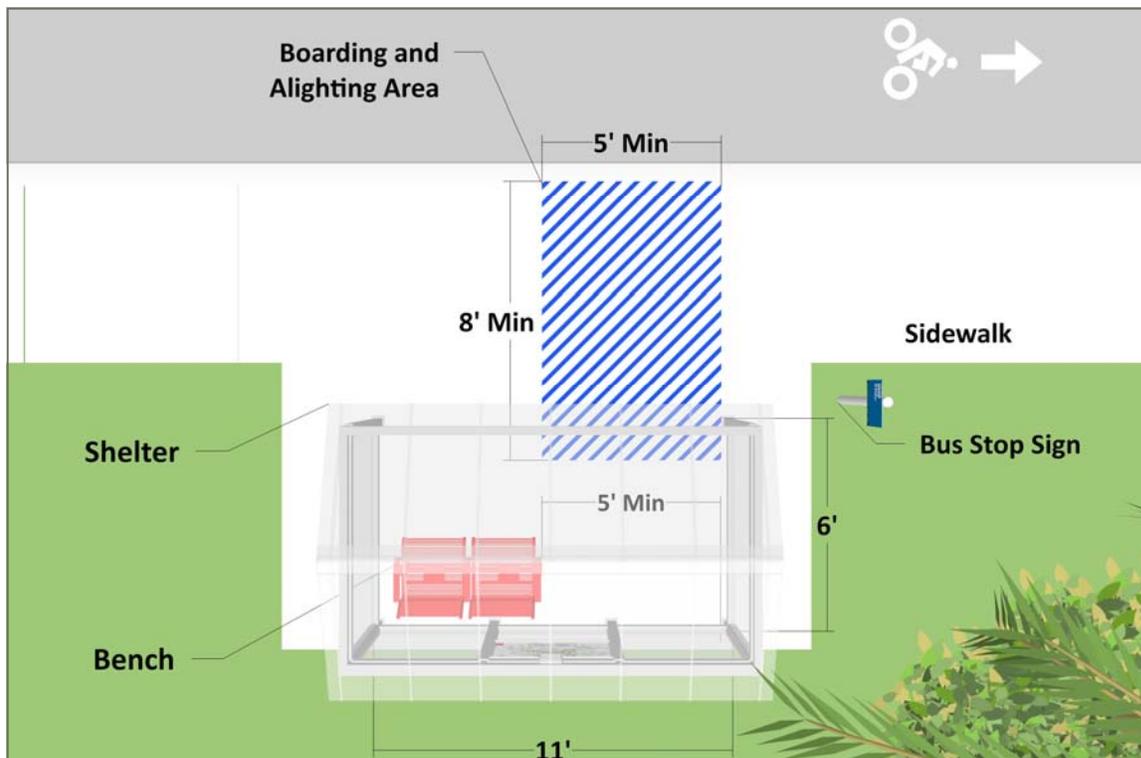


Figure 3.4.4 | Location of bus benches within a bus shelter with an opening on one side.

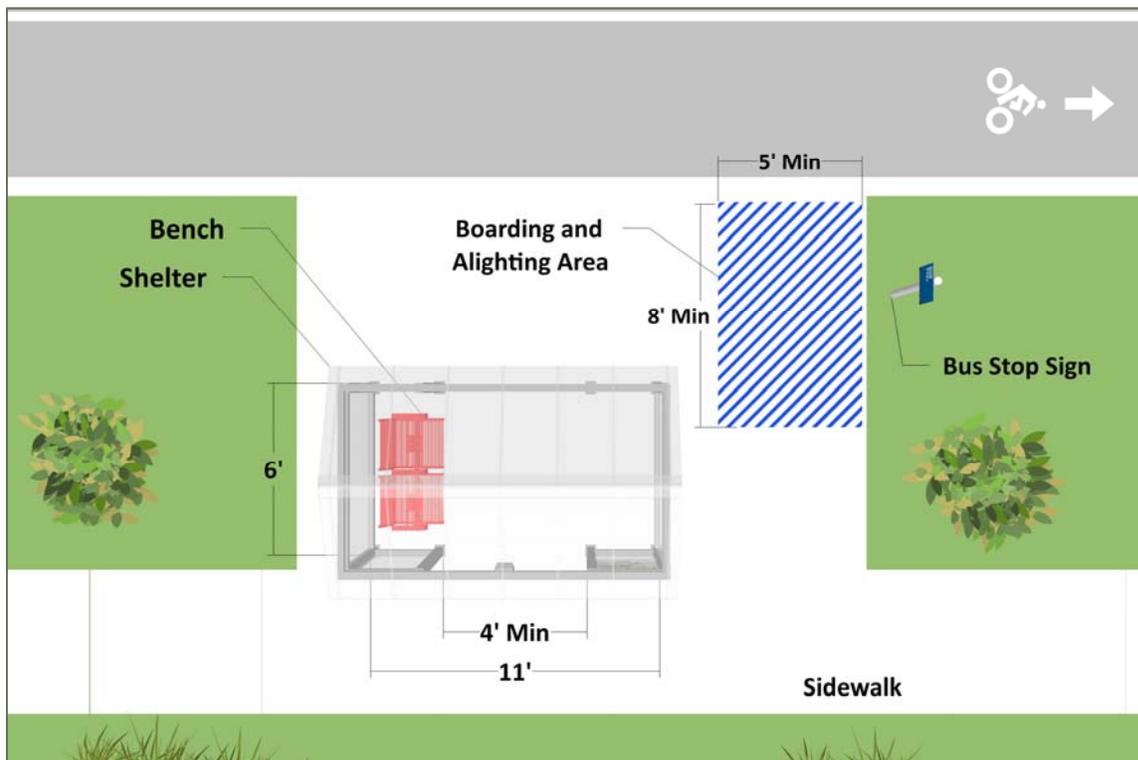


Figure 3.4.5 | Location of bus benches within a bus shelter with the openings located centrally on two sides.

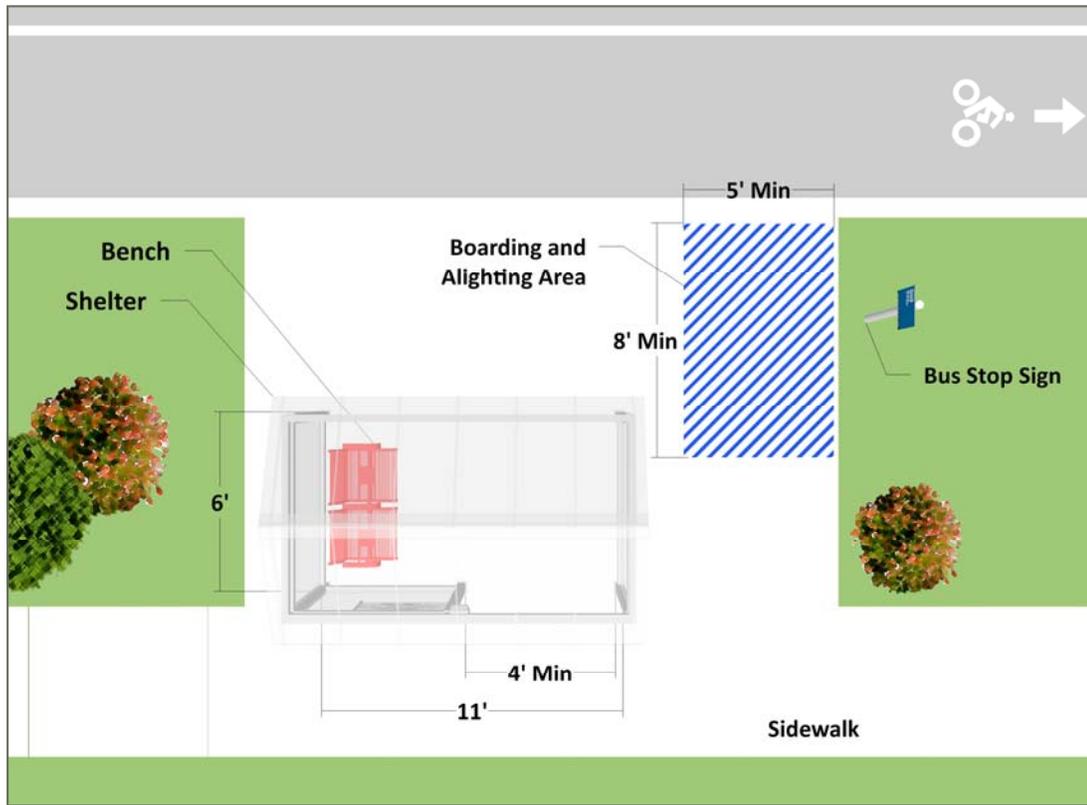


Figure 3.4.6 | Location of bus benches within a bus shelter with different side panel alignments with openings on both sides.

are recommended for stand-alone non-secured benches, as weight discourages moving or stealing the benches. Agencies should consider bus benches composed of recycled materials, including high density polyethylene, one of the most popular types of recycled plastic, and rapidly-renewable materials such as wood. See Figures 3.4.7 and 3.4.8 for examples. Avoid uncoated, dark metal seating surfaces, as they become hot in the summer and cold in the winter.

SAFETY/SECURITY

Benches should allow transit patrons a clear view of the bus and bus operators a clear view of waiting patrons. Benches should not be placed near an area where the safety of transit patrons could be compromised. Bus benches should be located properly to avoid conflicts with pedestrians and bicyclists.

Benches should discourage opportunities for sleeping or reclining. Bus benches should be durable and graffiti-resistant. Upkeep of benches helps maintain a bus stop, and poorly-kept bus benches discourage use by patrons.⁸



Figure 3.4.7 | Recycled bus bench, Hillsborough County, Florida.



Figure 3.4.8 | Recycled bus bench, Pinellas County, Florida.

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3.5 Other Components

This section includes guidance on other components typically associated with bus stop shelters. For complete and the most up-to-date requirements on the components included herein, refer to the list of resources provided at the end of this handbook.

BICYCLE RACKS

Bike racks should be placed at most bus stops along routes with bicycle accessibility; however, special consideration should be given to place them at key stops for routes on which the bus-mounted bicycle racks are at capacity and cannot accommodate more bicycle passengers without causing passengers to wait for the next bus. At park-and-ride lots, it also may be appropriate to add a bike-and-ride section.

Location

Provisions for bicycle storage should be considered at transit stations and bus stops to encourage intermodal travel. Bicycle storage areas should be placed in spaces that are physically and visually accessible. Placement along heavily-trafficked streets and walkways protects bicycles from theft and vandalism. Bicycle parking areas should be provided on the upstream side of the B&A area.

Bicycle racks and lockers should not be placed in the corner of a parking garage or in other areas with low visibility. Where possible, bicycle racks should be kept underneath a covered area to protect the bicycles from exposure to the weather. Bicycle racks should be placed at areas without any unnecessary potential for water damage, such as adjacent to landscape watering systems or in areas where rain water accumulates. Bicycle racks must not be placed on the B&A area. Bicycle racks must not be placed so that, when bicycles are stored in the racks, the bicycles will overlap or block the B&A area. They shall not be placed where they obstruct pedestrian traffic either on the sidewalk or to and from the bus stop B&A area.

The upper elements of a bicycle rack shall not protrude, creating an obstacle for a traveler with visual impairment, in accordance with ADA Standards, Section 307. Bicycle rack locations must meet the setback and minimum clear recovery zone requirements established in *FDOT Design Standards*, Index 700.

Where shared-use paths (facilities not immediately adjacent to travel lane) are provided, bus stops should be coordinated so they are located in proximity of shared-use path access points to the roadway. Where shared-use paths are provided, bus stops should be located so they do not hinder sight distance or create congestion at path-roadway connections. Figure 3.5.1 shows a sheltered bicycle rack.

Design

One of the simplest, most effective bicycle racks for short-term bicycle parking is the “inverted U” bicycle rack. It follows the Association of Pedestrian and Bicycle Professionals guidelines that state that bicycle racks should support bicycles by their frames at two points (as opposed

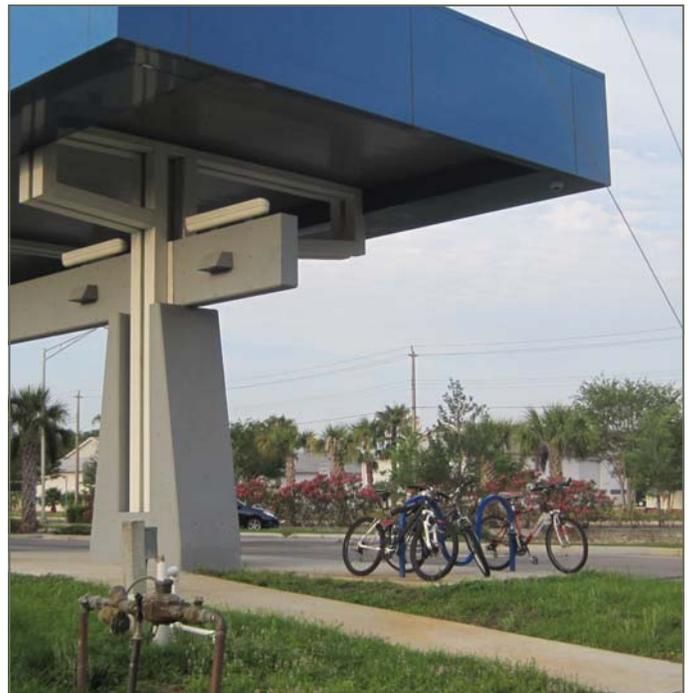


Figure 3.5.1 | Bicycle rack built beneath shelter of a transfer center, Bradenton, Florida.

to supporting them by the wheel as is common in comb and toast racks) (see Figures 3.5.2 and 3.5.3). The height of bicycle racks should not exceed 4 feet from the paved surface. Bicycle racks should provide 48-inch aisles, measured from tip to tip of bicycle tires across the space between racks or between the tip of the tire and an adjacent obstacle. One person should be able to walk one bicycle through the aisle. A total of 72 inches of depth (6 feet) should be allowed for each row of parked bicycles. Transit agencies may consider installing multiple bicycle racks. Depending on the size of the transit stop and projected bicycle usage, multiple bicycle racks can be installed to create a “bicycle parking lot.”¹

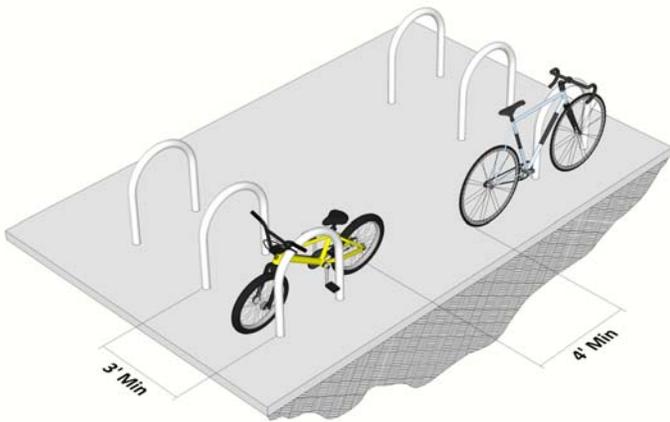


Figure 3.5.2 | Bicycle rack dimensions—spacing for inverted “U” bicycle racks.

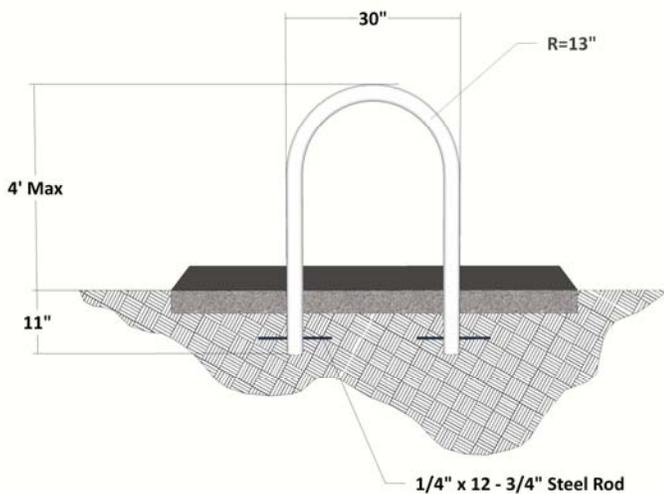


Figure 3.5.3 | Critical dimensions for installing an inverted “U” bicycle rack.

Bike Sharing

Some transit agencies have implemented bike sharing programs using special types of bicycle racks/docking stations where users may rent bicycles temporarily for short trips for a minimal fee and then return them when the trip is over. Pricing is designed to encourage shorter trips, for example, to the bus station or the grocery store, where the bicycle can be returned to a different kiosk. Another bicycle is then picked up and ridden home. When linked with the existing public transit providers, bike sharing can provide the critical first-mile/last-mile solution to connect riders to buses. Bike sharing is now used in Miami Beach and Broward County in Florida. Figure 3.5.4 shows an example of bike sharing.

Rather than using docking stations, some bike sharing programs use typical bicycle racks with a bicycle-fitted locking device. The system, called “Social Bicycle” in New York City, connects a bicycle with a lock box on any typical bicycle rack.

SHOPPING CART STORAGE

Location

Shopping cart storage should be provided at bus stops adjacent to retail centers, located at least 4 feet back from the face of curb and clear of sidewalks. To maintain accessibility, bus stop



Figure 3.5.4 | Bike sharing, Chattanooga, Tennessee.

B&A areas may not be used for shopping cart storage. Because shopping carts are generated by the shopping center, agreements should be made between the land owner and the transit agency to remove the carts regularly.² Shopping cart locations must meet the setback and minimum clear recovery zone requirements established in *FDOT Design Standards*, Index 700.

Design

The frames for shopping cart corrals should be constructed from steel pipe. Surface-mounted flanges should be constructed from flat steel bars. Standard hot-dipped galvanized steel pipes should be used to resist corrosion and rust.³ Figures 3.5.5 and 3.5.6 provide the dimensions of and placement for a typical shopping cart corral.

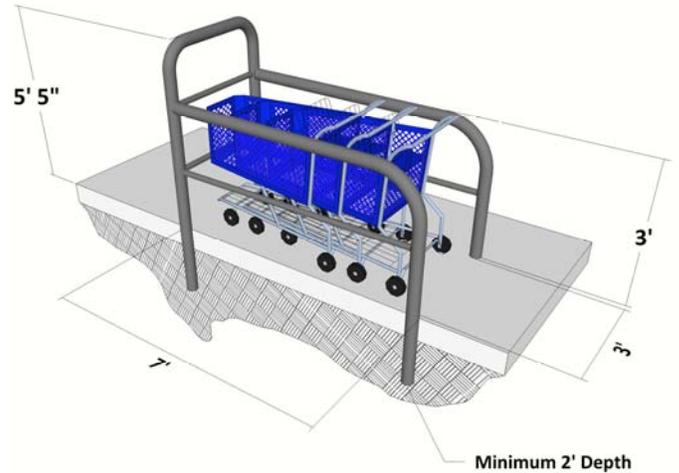


Figure 3.5.5 | Typical vertical and horizontal dimensions of a shopping cart corral.

BUS STOP LEANING RAILS

A number of passengers prefer leaning to sitting while waiting at bus stops. Leaning rails also provide a place to shelve objects passengers may carry. Agencies that have placed leaning rails at their bus shelters claim that they are inexpensive to install and are heavily used by passengers.

Location

Leaning rails can be located within shelters mounted on walls, freestanding, or built into the landscape. Leaning rails must not intrude on the accessible path clear space and must not be a protruding object. Figure 3.5.7 shows placement of a leaning rail outside a sheltered bus stop.

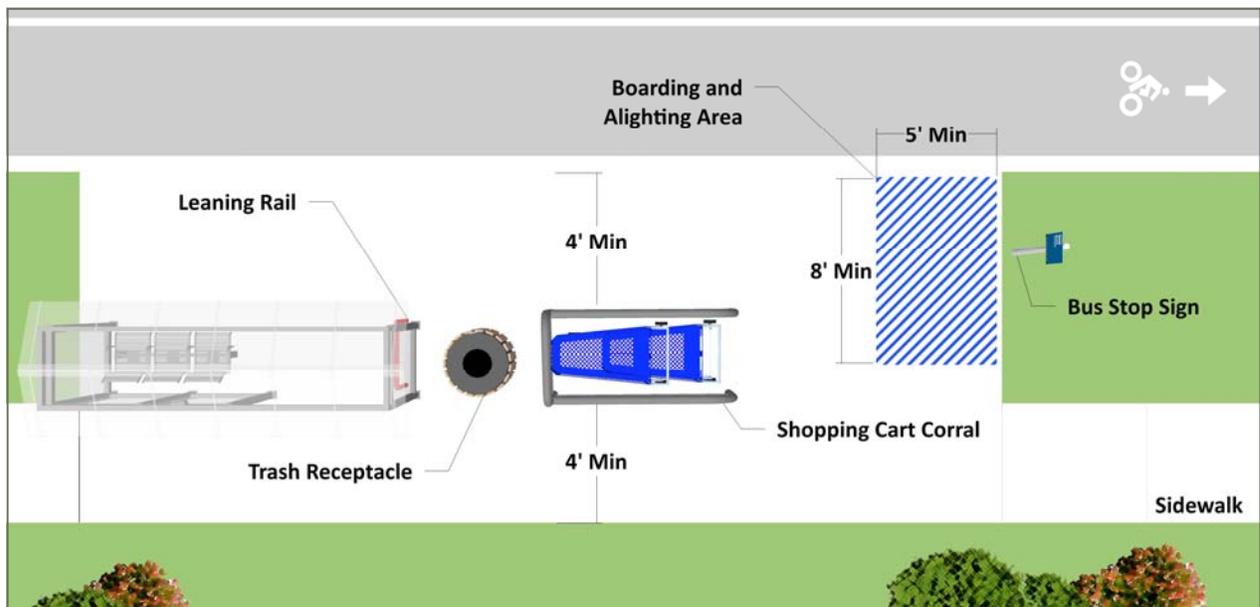


Figure 3.5.6 | Suggested location and dimensions of a shopping cart corral at a sheltered bus stop.

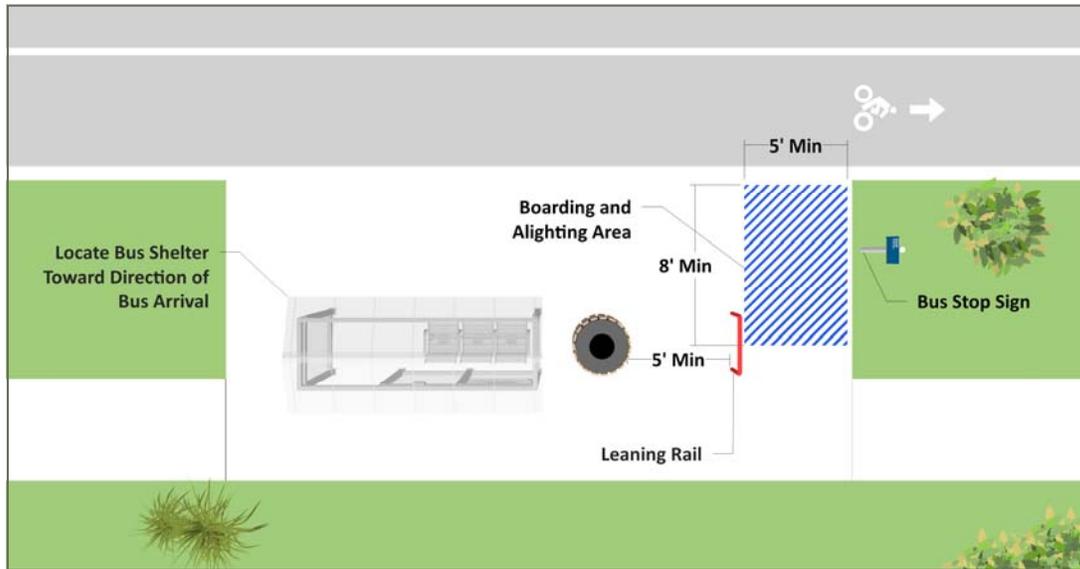


Figure 3.5.7 | Placement of a leaning rail outside a sheltered bus stop.

Design

ADA Standards specify that handrail and grab bars must be mounted at 34–38 inches above the surface of the shelter/ground. While a leaning rail may not be classified as a handrail/grab bar, a leaning rail that could serve the same purpose as a handrail should be mounted according to ADA Standards. Freestanding leaning rails should be between 27 and 42 inches in height. Leaning rails attached to bus shelters should have a round (as opposed to square or rectangular) section with a diameter of 1.5–2.5 inches.³ Figure 3.5.8 shows dimensions of a bus stop leaning rail.



Figure 3.5.8 | Dimensions of a bus stop leaning rail.

The leaning rail foundation base should be a reinforced concrete slab at least 4 inches thick extending 4 inches beyond any vertical rail “foot print.”⁴ Leaning rails can be sheltered or unsheltered. When unsheltered, landscaping is recommended to shield customers from the weather. Leaning rails should be constructed of anodized aluminum to enhance their durability.

BUS STOP INFORMATION & WAYFINDING DEVICES

Service information provided at bus stops is important to transit users and can be used effectively to increase ridership by retaining existing riders and attracting potential new riders to the transit system. System maps and fare information at bus stops provide passengers with service information concerning that stop and the transit agency, in general. They also provide an opportunity to educate existing and potential passengers about bus transit services. Real-time information displays at key bus stops give patrons up-to-the-minute information on bus arrival times and delays.

Ridership and the characteristics of the rider mix have been the primary considerations in selecting locations to provide bus stop information and wayfinding devices, as the displays will benefit the

greatest number of users. Bus stops with interchange activity, such as park-and-ride lots and transfer points, are considered priority locations. Information displays should not block the clear zone or B&A area, and all signs should be accessible to individuals who use mobility aids. Signs must be installed in a manner that eliminates any protruding objects hazards.

Wayfinding is an essential element in transit connectivity. Good wayfinding helps with travel planning and execution. It is especially important to consider connectivity between transit systems, either multimodal or multi-agency. By making a multi-operator trip nearly as easy as a single-operator trip, good connectivity can attract new transit riders, retain existing riders, and increase people's mobility.⁵

Technological innovations have also assisted with bus stop information and wayfinding. Certain smart phone applications can now be used to find transit stop and/or bus service information provided by larger transit systems. Figure 3.5.9 shows an application for real-time bus tracking on a smart phone. Google Maps may also provide bus route and stop information that can easily be obtained by most smart phones.

More and more, agencies have begun to effectively use satellite technology to track buses, providing customers with real-time arrival information at all stops, by phone, and through wireless devices.

Accessibility

The overall design of maps and schedules should also consider the needs of sight- and hearing-impaired passengers. Information should be provided in redundant formats whenever possible. For the visually-impaired, a pushbutton-activated system, such as NextBus, can provide voice annunciation of bus information. Where public address systems convey audible information to the public, the same or equivalent information shall be provided in visual format.⁶ Figures 3.5.10 through 3.5.12 show examples of bus stop information and wayfinding devices.

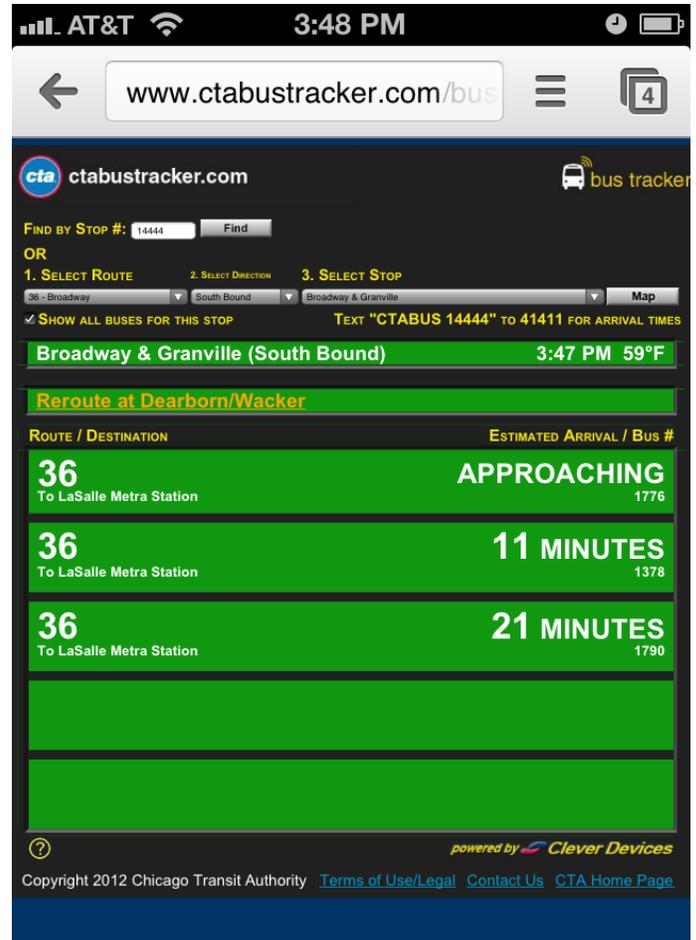


Figure 3.5.9 | Real-time bus tracking on a smart phone.

Design

Information displays should be designed and placed at shelters or stops in a manner that does not reduce security by lowering the visibility of waiting patrons. Fixed information displays should have a format that is easy to change, so that schedule and route updates can be readily posted. System maps should highlight bus stop locations. Schedules and route maps should be updated whenever changes are made.

Posted information on route schedules and destinations served should be available at bus stops. Route maps should be easily understandable to transit passengers. The use of text should be minimized and pictograms and other symbols should be used where possible. Text should be large and easy-to-read and must comply



Figure 3.5.10 | Real-time bus information on electronic display at a bus stop, Pinellas County, Florida.



Figure 3.5.11 | Audible stop.



Figure 3.5.12 | Route information and county map at a bus stop, Pinellas County, Florida.

with all ADA requirements for text and pictogram size, placement, and contrast.⁷

The use of multiple languages should be considered in areas with large visitor and other non-English speaking populations. Maps and schedules should adopt uniform graphic standards, sizes, and color codes. Color schemes should be highly contrasting.⁷ Figure 3.5.13 shows acceptable color combinations for shelter signage based on contrast.

Signs are more legible for pedestrians with low vision when characters contrast as much as possible with their background. Additional factors affecting the ease with which the text can be distinguished from its background include shadows cast by lighting sources, surface glare, and the uniformity of the text and its background colors and textures.⁸

	Beige	White	Dark Grey	Black	Brown	Pink	Purple	Green	Orange	Blue	Yellow	Red
Red	X	X									X	
Yellow			X	X	X		X	X		X		
Blue	X	X										
Orange				X								
Green	X	X										
Purple	X	X										
Pink												
Brown	X	X										
Black	X	X										
Dark Grey		X										
White												
Beige												

Figure 3.5.13 | Acceptable (70% or greater contrast) color combinations for shelter signage based on contrast.

Green Building/Energy Efficiency

When possible, solar power should be considered to light information displays. On-demand illumination should be considered for bus stop information and wayfinding devices.

BUS STOP TRASH RECEPTACLES

Trash receptacles should be treated as a normal amenity of most bus passenger facilities. Maintenance of trash receptacles and trash pickup are important considerations when receptacles are provided. As such, the availability of regular maintenance and frequent trash pickups should be considered prior to adding trash receptacles.

Location

Trash receptacle locations must meet the setback and minimum clear recovery zone requirements established in *FDOT Design Standards, Index 700*. Trash receptacles must be placed so that they do not interfere with the accessibility of the site or with passage along any adjacent sidewalks and so that the containers are accessible. To maintain accessibility, trash receptacles shall not be placed on bus stop B&A areas.

Trash receptacles should be located at least 4 feet back from the face of the curb and should be anchored to the pavement or B&A area to prevent unauthorized movement. Trash receptacles should not impede pedestrian circulation in and around the transit stop. Additionally, transit agencies should choose receptacles that can be used by those who have difficulty manipulating objects with their hands, such as those with arthritis or other disabilities. Figures 3.5.14 through 3.5.16 show examples of trash receptacles and placement at bus stops.

The receptacles should be placed so that they do not obstruct a driver's vision while turning. If possible, trash receptacles should not be placed in direct sunlight. Direct sunlight exposure may result in odors.³

Design

Trash receptacle designs should coordinate with benches and other furniture at the bus stop or transfer center with regard to material and finish color. Trash receptacles should be made out of steel with a powder-coat paint finish. They may also be attached to the side of the shelter as a pre-fabricated feature. If vandalism is a concern,

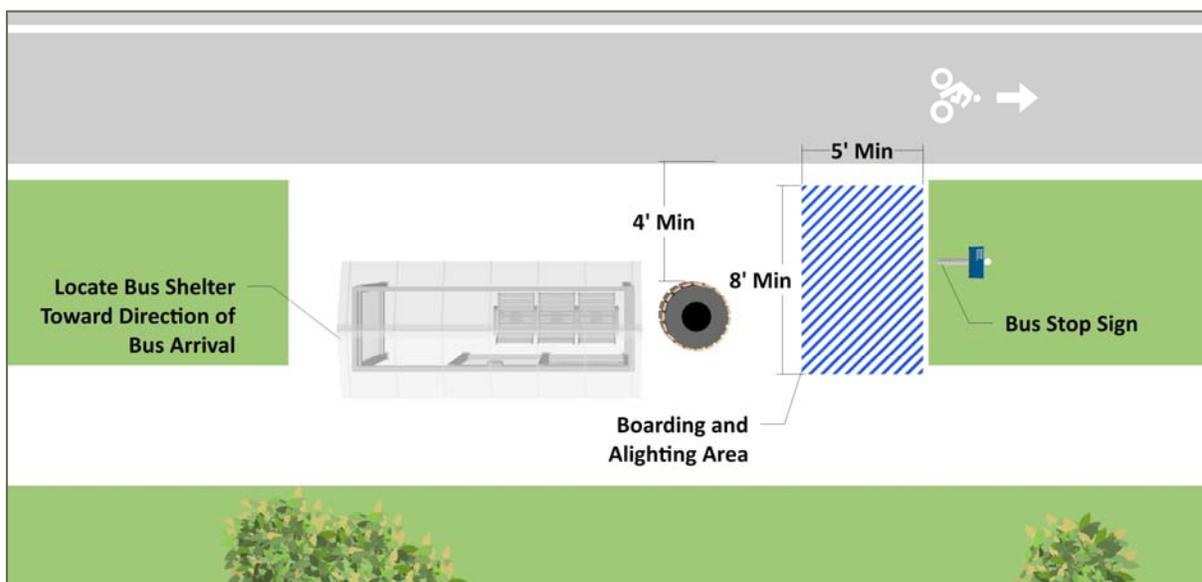


Figure 3.5.14 | Example of a trash receptacle at a sheltered bus stop.

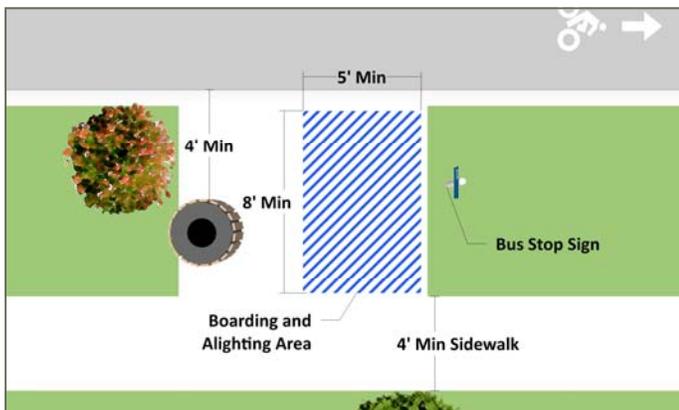


Figure 3.5.15 | Example of a trash receptacle location at an unsheltered bus stop.



Figure 3.5.16 | Typical bus stop trash receptacle.

agencies should consider trash receptacles with lockable lids or other anti-vandalism features.

Green Building/ Energy Efficiency

Transit agencies employ various green and energy-saving strategies for managing trash collection and removal at bus stops. Some use trash receptacles made out of recycled plastic materials and others have installed compacting trash receptacles to reduce the quantity of litter at bus stop sites and thereby reduce the trip frequency for trash pickup. Such receptacles are capable of reducing trash volume by up to five times by compacting the trash after each use. The compactor works via a solar panel at the top of the unit that charges an enclosed battery, thus requiring no external electrical service. The unit is about the size of a mailbox and is made partially of recycled materials. Figure 3.5.17 shows an example of a solar-powered trash receptacle at a bus stop.

The selection of sites for the installation of compacting trash receptacles can be based on a number of criteria, including proximity to an attractor that generates a lot of trash like fast food establishments, quantity of trash accumulated, distance from the maintenance facility or final disposal location, and visibility.⁵



Figure 3.5.17 | Typical solar-powered trash compactors at a bus stop.

Quick Facts

Energy Efficiency Tip

Installing solar-powered compacting trash receptacles at bus stops can significantly reduce the number of trips for trash removal from those sites. For one agency, the installation of only 3 solar trash compactors reduced the number of miles driven to collect trash each week by approximately 150 miles, thus reducing labor costs, fuel costs, vehicle depreciation, and carbon footprint and helping with a cleaner environment, not only with CO₂ emissions but with litter.⁵

Recycling Receptacles

At high-ridership bus stops, transit agencies should consider using recycling receptacles in addition to trash receptacles. Figure 3.5.18 is an example of a recycling receptacle. As people have become more concerned about the environment and seek to follow recycling practices when disposing of recyclable trash, recycling receptacles—at least at heavily-used bus stops—are in demand.

Like any other amenity at a stop, recycling receptacles must meet clear zone requirements as put forth in *FDOT Design Standards, Index 700*. In addition, they may not intrude upon the required clear path for ADA accessibility requirements. A maintenance agreement with the local agency that performs recycling may also be necessary to ensure timely pick-up of recyclable materials.

BOLLARDS

Bollards separate pedestrian and vehicular areas to protect people, buildings, and site elements. They are sometimes illuminated to provide path lighting and are especially important in areas where errant buses or other vehicles may threaten waiting passengers or pedestrians.

Location

Bollards are not allowed along the state-owned right-of-way. Bollards must be placed so they do not interfere with the accessibility of pedestrian routes that connect to and from bus stops. Bollards should be installed at bus parking spaces where errant buses or other vehicles may “jump” the curb and strike pedestrians. When used to separate pedestrians and vehicles, bollards should be spaced sufficiently close to clearly define the desired separation of space and to prevent intrusion of automobiles, but not so close that passage of wheelchairs is impeded. Figure 3.5.19 shows an example of placement of bollards.



Figure 3.5.18 | Recycling receptacle inside a transit station.

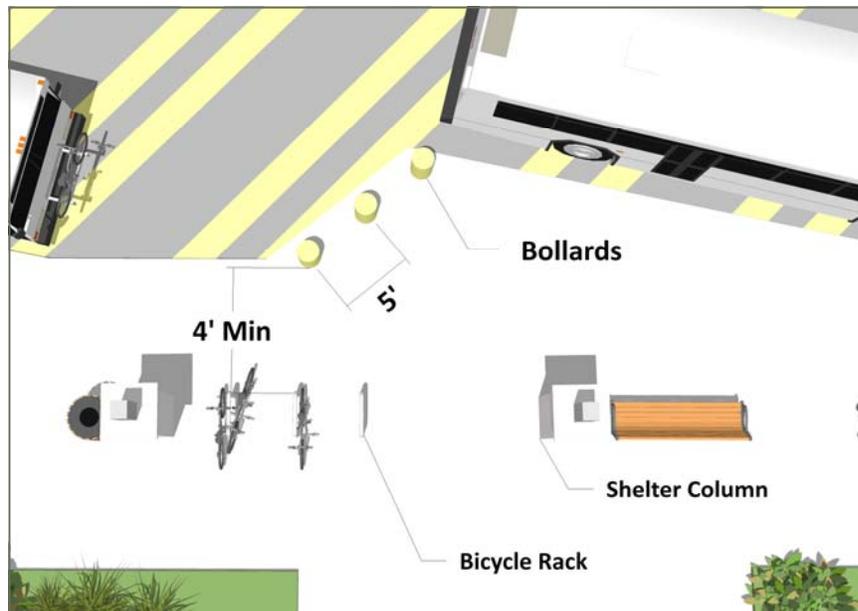


Figure 3.5.19 | Placement of bollards in a half saw-tooth bus bay.

Design

The design of bollards should respond to the character of the site and may be pre-manufactured or custom-designed in a style that complements the bus stop architecture and other site furniture. Figure 3.5.20 shows a detailed cross-section of a typical bollard. Bollards should be tall enough to discourage vehicle access (standard height of 2–4 feet) but spaced far enough apart to allow bicycle, wheelchair, and pedestrian access (minimum clear width of 48 inches). Where security bollards are installed at transit stops, they must not obstruct the clear space at B&A areas or reduce the required clear width at connecting pedestrian access routes.⁶ When placing bollards in pedestrian areas, consideration should be given to marking them with contrasting color bands (e.g., white or red on black bollards) or retro-reflective squares or panels.

A single bollard should be designed to stop a 36,000-pound vehicle traveling at 4 mph. At bus parking areas, 3 bollards of concrete-filled, 8-inch diameter, heavy-wall steel pipe should be located ahead of the bus. The pipes should be set vertically in a 6-foot, auger-drilled hole, and retained by reinforced concrete.³ They should be spaced at 5 feet on center across heavily-trafficked locations to protect pedestrian-only zones.

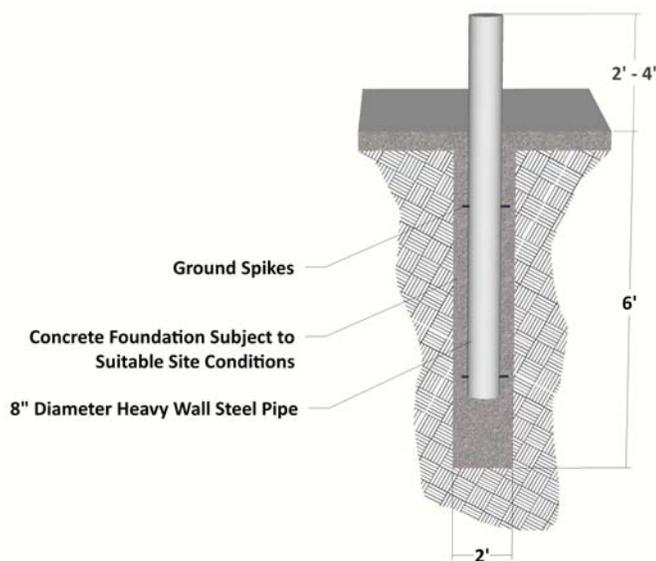


Figure 3.5.20 | Detailed section of a typical bollard.

Bollards should be solid for durability and stability. They can either be permanently installed by embedding or may be made removable through the introduction of an in-ground sleeve or receiver to provide temporary service and emergency access. Some bollards can be equipped to accommodate chains (e.g., eyebolts). If chain barriers are used in conjunction with bollards, care should be taken to ensure that the chain is easily visible and not a hazard.

Green Building/Energy Efficiency

Recycled plastic bollards have been used instead of typical metal bollards. Some agencies have used plastic bollards to help reduce greenhouse gas emissions as well as to reduce costs. For example, TriMet’s MAX light-rail line in Portland, Oregon, uses recycled plastic bollards in the paved trackway instead of reinforced metal stanchions, saving the agency \$100,000 in purchasing costs over steel and an additional \$150,000 in installation costs.

PUBLIC TELEPHONES

While increasingly rare due to the wide use of wireless phones, public telephones at bus stops can still offer many potential benefits. Figure 3.5.21



Figure 3.5.21 | Public telephone at a bus stop, Hillsborough County, Florida.

shows a public telephone at a bus stop. Users may make personal and emergency phone calls while waiting for the bus.

Location

When installing public telephones at bus stops, at least one telephone must be installed at a location accessible to persons using wheelchairs. Public telephones must be located so that the receiver, coin slot, and control are no more than 48 inches above the floor. Public telephones shall provide a clear floor or ground space at least 30 inches by 48 inches at the approach side of the telephone, not impeded by bases, enclosures, and fixed seats, and allow either a forward or parallel approach by a person using a wheelchair. The phone and the bus stop waiting area should be separated by a short distance when possible. The telephone base or enclosure cannot obstruct the 5-foot-by-8-foot B&A area.

Public telephones must also be located according to ADA Standards for protruding objects and operable parts. The ADA Standards for protruding objects states that objects with leading edges more than 27 inches and not more than 80 inches above the finished floor or ground may protrude 4 inches maximum horizontally into a circulation path. The ADA Standards for operable parts states that operable parts of a telephone shall comply with clear floor space, height, and operation.

Design

The length of the telephone handset cord shall be a minimum of 29 inches. Phones shall be hearing-aid compatible and volume-control equipped. The highest operable part of the telephone and telephone books should be located within the reach of wheelchair users (48 inches maximum).⁷

EMERGENCY CALL BOX

Emergency call boxes establish a safe communication element, especially at stops with fewer patrons and those located in suburban and rural areas. Figures 3.5.22 shows a typical emergency call box, and Figure 3.5.23 shows a

solar-powered call box. Emergency call boxes require less maintenance than traditional telephones and do not encourage loitering by non-bus patrons.

Location

A call box must be located in such a place that it does not obstruct access to the bus stop B&A area and connecting pathways.⁷ A call box must also be located according to ADA Standards for protruding objects and operable parts. The ADA Standards for protruding objects states that objects with leading edges more than 27 inches and not more than 80 inches above the finished floor or ground may protrude 4 inches maximum horizontally into a circulation path. The ADA Standards for operable parts states that operable parts of a telephone shall comply with clear floor space, height, and



Figure 3.5.22 | Emergency call box.



Figure 3.5.23 | Solar-powered call box.

operation requirements.⁶ The clear space requirement is 48 inches by 30 inches minimum. This clear space requirement is so that individuals who use mobility aids may maneuver to use the call box or other elements.

The use of Blue Light Emergency Phones, which are typically used to increase security in parking lots on university and community college campuses, may be extended to external campus bus stops, as well.⁹ Call boxes may also be solar-powered.

Design

Call boxes should be instantly visually identifiable in the event of an emergency and must be suitable for users with hearing impairments and those using a wheelchair.⁴

VENDING MACHINES

Vending machines are provided at bus stops for passengers to conveniently access refreshments and/or reading materials while they wait for the bus. Newsprint companies usually seek high profile locations for their machines and transit agencies have limited regulatory authority concerning the placement of vending machines.

Location

Vending machines should be anchored to the ground to reduce vandalism and placed at least 4 feet back from the face of the curb. ADA Standards must be followed for accessible site circulation. Vending machine locations must meet the setback and minimum clear recovery zone requirements established in FDOT Design Standards, Index 700. They cannot be placed on the bus stop B&A area. If vending machines are provided, at least one of each type needs to comply with the standards set

forth in the ADA Standards.⁶ Figure 3.5.24 is an example of a vending machine at a bus stop.

Design

Vending machines, newspaper boxes, and other street furniture cannot reduce the clear space required by ADA Standards. A 30-inch-by-48-inch minimum clear space must be provided. According to ADA Standards, when affixed to an existing structure, a vending machine may not protrude more than 4 inches into the accessible path when mounted at 27 to 80 inches above the finished floor or ground surface.⁶ ADA guidelines also state that any operable parts shall comply with clear floor space, height, and operation requirements. The specifics of these operable parts requirements can be found in the *2012 Florida Accessibility Code for Building Construction*.



Figure 3.5.24 | Newspaper vending machine at a bus stop, Hillsborough County, Florida.

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IMAGE CREDITS FOR IMAGES BY OTHERS

- 3.5.7 National Easter Seal Society, Project ACTION, 2005. *Toolkit for the Assessment of Bus Stop Accessibility and Safety*. Washington, DC.
- 3.5.11 Photo courtesy of King County Department of Transportation, Metro Transit Division. Seattle, WA. Used with permission.

3.6 Landscaping

OVERVIEW

Trees can provide transit patrons with a low-cost shelter from wind and rain and, together with other landscaping elements, can make a bus stop more inviting, both visually and physically. In addition, landscaping contributes to the safety, security, and comfort of passengers, reducing heat islands (thermal gradient differences between developed and undeveloped areas) and minimizing the facility's impact on the microclimate.

Coordinating stop locations with existing shade trees helps to provide protection from the wind and other elements. Uncomfortable and unwelcoming bus stop environments, such as heat or sun, can discourage the use of stops or benches and may force patrons to find other locations to wait for their bus.¹ However, maintenance is a primary consideration when deciding whether to provide landscaping at bus stops.

LOCATION

Landscaping should be installed properly to prevent the obstruction of views and safety hazards for passengers waiting at bus stops. Landscaping should be located so that it buffers waiting passengers from traffic and provides some degree of protection from the weather. However, it should not be located in such a way to increase walking distances to transit stops.² Figure 3.6.1 shows an example of appropriate landscaping at a bus stop. Low vegetation should not block air movement beneath the shelter.

To the extent practical, plant selection and placement should.³

- Preserve visibility of signage.
- Minimize roadside maintenance requirements.
- Reduce stormwater run-off volume and velocity.
- Promote water conservation.
- Minimize impacts to natural areas.
- Minimize soil erosion.

Quick Facts

Location and Design Tips

When selecting plants for installation at bus stops, consider these key factors:³

- Visibility
- Maintenance requirements
- Stormwater run-off
- Water conservation
- Impacts to natural areas
- Soil erosion
- Existing and proposed utilities



Figure 3.6.1 | Landscaping at a bus stop, Palm Beach County, Florida.

- Avoid conflicts with existing and proposed above-ground utilities.

DESIGN

To ease maintenance and ensure longevity, native plants and wildflowers should be used. Landscape plans should be designed to complement and enhance the natural and man-made environment.³ To the extent practical, landscape plans should include the following elements:

- Conservation of natural roadside growth (vegetation) and scenery
- Relocation of existing vegetation
- Selective clearing and thinning of existing vegetation
- Natural regeneration and succession of native plants
- Plants purchased from Florida-based nurseries
- Florida native plants with known provenance (original source of plant stock) to be as close to planting site as possible
- Recycled and recyclable materials

In coastal areas, plants should also be salt-tolerant. Exotic plants should be avoided. Trees shall be pruned to allow minimum 9 feet 10 inches of vertical clearance from sidewalks or B&A areas.⁴ To maintain a defensible space and preserve visibility, the height of groundcover plants should not exceed 2 feet and the height of shrubs should not exceed 3 feet at maturity. Vegetation should not block accessways and views of bus operators, drivers, or pedestrians.⁶

All landscaping along FDOT rights-of-way must comply with standards in the latest editions of the PPM, Florida Highway Landscape Guide, and FDOT Design Standards, Index 546 and Index 700. Transit agencies should coordinate landscape installation with the state or local agency assigned the responsibility of maintaining the landscaping. For site distance information on tree height and roadway design speed, refer to *FDOT Design Standards*, Index 546. Figure 3.6.2 shows the appropriate location and vertical dimensions for landscaping at bus stops.

Efforts should be made to shade all constructed surfaces. Shade trees should be high-branching so they do not interfere with breezes or sightlines. Low vegetation should not block air movement beneath the shelter. When river-rock and other masonry materials are used, the material should be grouted to prevent removal by hand. River-rock should be grouted/mortared so that only one-third of the rock is exposed above ground. Landscapes should be designed to permit sufficiently wide, clear, accessible, and safe pedestrian walkways and transit waiting areas. Regular maintenance

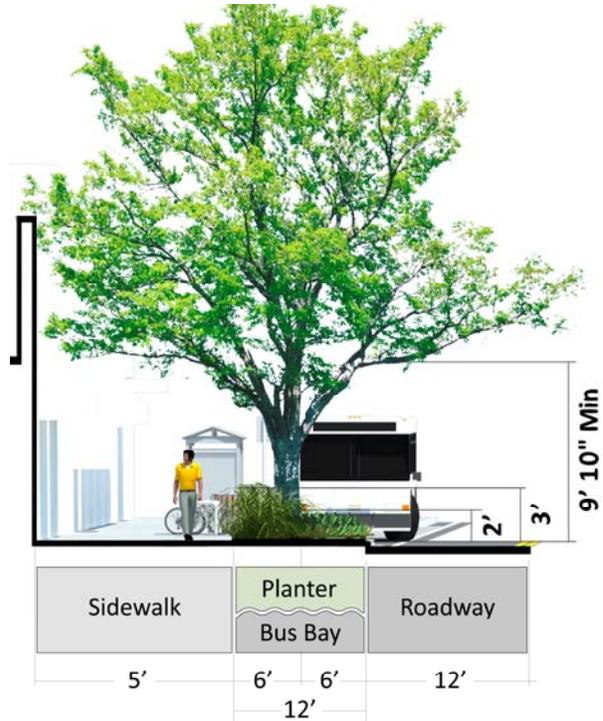


Figure 3.6.2 | Appropriate locations and vertical dimensions for landscaping at bus stops.

should ensure that all sidewalks and pedestrian crossing areas are free of obstruction or debris. Care should be exercised to ensure that requirements for site distances and clearance to obstructions are observed, especially at intersections.³

Whenever possible, agencies should minimize the use of potable water in landscape irrigation through the use of high-efficiency irrigation systems, low-water use native plants, or the reuse of stormwater or gray water for irrigation.

Trees

The use of trees is encouraged to provide shade to passengers exposed to sunshine, particularly pedestrians and bicyclists. Additionally, trees offer environmental benefits such as providing stormwater retention and reducing pollution. Trees are typically planted alongside bikeways and pedestrian pathways. Shaded bus stops, particularly in the hot Florida climate, make waiting for the bus more comfortable. At bench-only bus stops, thoughtful landscaping may be the only thing that protects passengers from the Florida

elements.⁶ Trees should be high-branching, deciduous shade trees. Certain evergreens such as cedar and some firs should be avoided, as they may provide a visual barrier.¹ Native trees that require minimal maintenance are preferred.⁵

GREEN BUILDING/ ENERGY EFFICIENCY

Recycled materials such as plastic or rubber may be used for sidewalks installed near trees to allow water to seep in between panel seams, avoiding the problem of tree roots pushing them up and the associated maintenance problems associated with concrete. For a list of approved materials, FDOT should be contacted for state and federal highways, and local agencies should be contacted for city and county roadways.⁵ Salvaged and recycled-content materials can also be used in landscaping. These materials may add value by creating attractive landscapes while reducing greenhouse gas emissions. Some of the salvaged and recycled-content materials currently used in landscaping include:⁷

- Salvaged bricks for patios, walkways, and edging
- Mulch and compost from local plant debris, food scraps, and wood chips
- Recycled plastic and composite lumber for decking, railings, and raised beds

Groundcovers

The use of groundcovers in lieu of trees in sidewalk planting areas reduces stormwater run-off, irrigation water needs, and requirements for future petrochemical fertilizer and pesticides.⁸ In addition, groundcovers reduce the frequency of mowing typically performed with gasoline-

burning equipment. When mature, these plantings provide full ground coverage and total interception of rainfall to limit the impacts of erosion.

Drought-Tolerant Plants

Several transit agencies, including TriMet in Portland, Oregon, have adopted an “irrigate-to-establish-only” philosophy.⁸ Under this philosophy, plantings that need irrigation only for the first few seasons are used to reduce the long-term need for irrigation water. Other strategies such as using native and drought-tolerant plantings can also be employed to eliminate or reduce the use of irrigation water.⁷ When irrigation is required, the use of recycled water is strongly encouraged.

Green Roof Bus Shelter

Figure 3.6.3 shows another green initiative used by some transit agencies to introduce green concepts at bus shelters and provide attractive waiting areas for transit riders. Green roofs offer many benefits—they help to ease the summer heat and reduce the amount of rainwater that makes its way to the sewer.⁹ Green roof bus shelters use native, low-maintenance plants on top of the bus shelters.

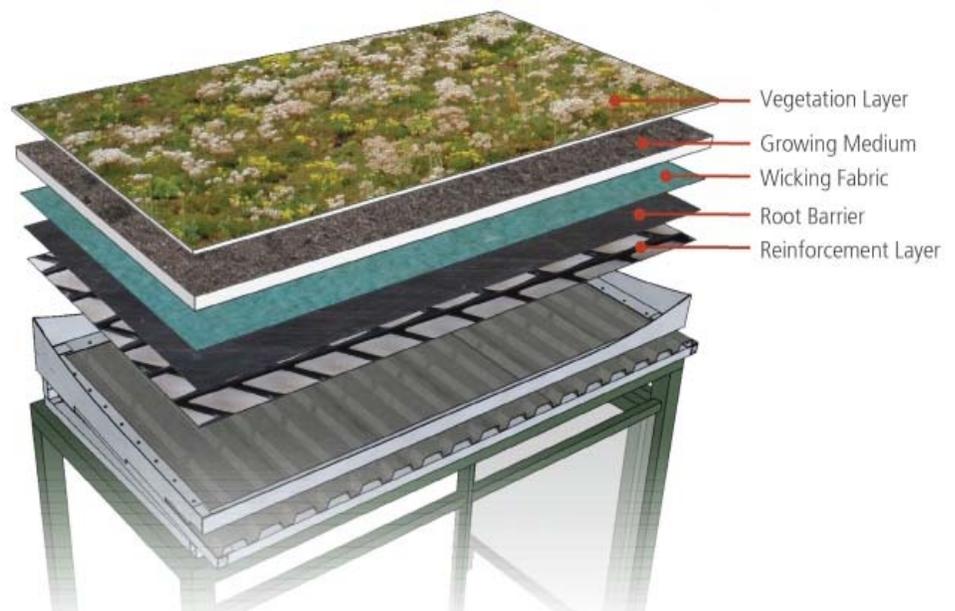


Figure 3.6.3 | Layers of green roof system used by the Philadelphia Water Department's green roof bus shelter demonstration project.

REFERENCES: SECTION 3.6

1. National Easter Seal Society, Project ACTION, 2005. *Toolkit for the Assessment of Bus Stop Accessibility and Safety*. Washington, DC.
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8. FDOT, 2010. *Guidelines for Enhancing Intermodal Connections at Florida Transit Stations*.
<http://www.dot.state.fl.us/transit/Pages/EnhancingIntermodalConnections.pdf>, accessed February 8, 2012.
9. The Philadelphia Water Department. <http://www.phillywatersheds.org/green-roof-bus-shelter>, accessed May 14, 2013.

3.7 “Green” Building Facilities

Transit agencies are increasingly focusing on building facilities that are energy efficient for a number of reasons, including the desire to adopt “green” practices, cut energy costs, reduce adverse environmental impacts, and leverage an array of new federal and state renewable energy grants.

Specific energy-saving strategies being pursued by transit agencies include certification of facilities under the LEED® standard, the primary green building rating system used in the design of new and renovated buildings that has been adopted for buildings constructed for use by many transit agencies and federal, state, and local governments.

Many agencies already have LEED-certified buildings or policies requiring LEED certification of new buildings:¹

- WMATA (Washington Metropolitan Area Transit Agency) in Washington, DC, has a policy goal of LEED Silver Certification for all new buildings and major renovations.¹
- LACMTA (Los Angeles County Metropolitan Transportation Authority) plans to adapt the operation and maintenance of its existing buildings according to LEED principles.
- Sacramento Regional Transit District in California has consolidated its headquarters into a LEED-certified building.
- King County Metro in Washington is pursuing LEED Silver Certification or better for any new construction.
- LeeTran in Lee County, Florida, plans to use LEED construction guidelines for a new facility.

Transit agencies and state and local governments also use a simpler self-rating system that addresses energy efficiency, Energy Star® for Buildings and Manufacturing Plants. The Energy

Star® system rates energy consumption of appliances developed by the U.S. Department of Energy (DOE) and U.S. Environmental Protection Agency (EPA).

FTA has recognized these and other green building rating systems that are applicable to transit facilities in the U.S. in its Green Building Action Plan. The U.S. Green Building Council (USGBC) and Green Building Initiative both offer rating systems that assess building performance in the ability to:²

- optimize site potential
- minimize non-renewable energy consumption
- protect and conserve water
- use environmentally-preferable products
- enhance indoor environmental quality
- optimize operational and maintenance practices

For more information, refer to the July 2009 Report to Congress, *Transit Green Building Action Plan*, prepared by FTA.

GREEN/ENERGY EFFICIENCY OPTIONS FOR TRANSIT FACILITIES

The remainder of this chapter reviews potential energy saving/green options typical for medium-to large-scale transit facilities. While facilities of any size can use any of these energy saving options, investments that generate meaningful energy reductions usually are made with medium- to large-scale facilities. However, incorporating green design even on smaller components will help local governments become more sustainable.

Reducing Resource Consumption

Transit agencies looking to reduce resource consumption and save energy can turn to recycled materials such as recycled concrete, steel, and other building materials. These reused materials prevent waste from entering the landfill and also reduce immediate resource use in the construction phase of a project. Recycled sidewalks can offer a

long-term cost benefit. Recycled concrete, traditionally treated as waste, can be crushed and sorted to be reused as a source of aggregate or can be used as crushed rock. Benches made from recycled materials can also save resources. They require less maintenance and also are cooler to sit on so they are more useful year round.

Any waste that comes from the construction site that cannot be reused on site can potentially be recycled.¹ Figures 3.7.1 and 3.7.2 show examples of how transit agencies are reducing resource consumption at their transit facilities.

Using Solar Energy

Another green practice that transit agencies are increasingly adopting is the installation of solar panels to help reduce the energy consumption of major transit facilities and buildings. While the capacity needed to significantly reduce energy costs for an agency is larger than what an on-line bus stop can support, many agencies are moving toward solar-powered shelters to supply night-time lighting or route information. Such small steps, once aggregated, can contribute to the agency bottom line in a number of ways, including safer stops, reduced vandalism, system attractiveness, and community perception, all of which will help increase system usage. (See Section 3.2 for information on solar energy use at bus stops.) Operations and maintenance facilities are good candidates for the use of solar energy, especially larger facilities as they frequently have unused roof space for the installation of photovoltaic solar panels. For examples of transit facilities using solar energy, see Figures 3.7.3 and 3.7.4.

Energy savings from the use of solar technology can be significant. A transit station in New York City increased its energy efficiency by up to 30 percent by using a 100-kW photovoltaic roof and 200-kW fuel cell systems.³ The power-generating capability of the roof's solar technology provided up to 65 percent of the station's electricity during the summer months, for an average savings of 15 percent over the course of one year, reducing its consumption of electricity from the city's grid.³ This example indicates that in areas with almost year-



Figure 3.7.1 | Recycled rubber sidewalk.



Figure 3.7.2 | Solar-powered bus shelter, which reduces the energy required to light it at night, Polk County, Florida.



Figure 3.7.3 | Parking lot covered by solar panels, La Sierra train station, California.



Figure 3.7.4 | Transit facility using solar panels, Akron, Ohio.

round sunshine such as Florida, transit agencies may, with similar investment, yield even greater energy savings.

Some agencies are using solar panels to supplement power at major park-and-ride or parking garage facilities, connecting the power to an electrical outlet for passengers to use as a charging station for electric cars. As electric and hybrid cars become more common, these types of plug-in facilities will become more necessary.

Reducing Storm Water/ Polluted Water Run-Off

Agencies also use various strategies to reduce run-off of storm water and/or polluted water. To reduce storm water run-off and the need for on-site drainage material, permeable or semi-permeable materials are used, including pervious paver blocks. Pervious concrete offers a unique and innovative means to manage storm water: it is made with little or no sand, producing a strong and durable pavement with voids that allow rainwater to pass through where soils permit. Impervious pavements, particularly at park-and-ride facilities, collect pollutants such as oil, anti-freeze, and other automobile fluids that can be washed into natural water bodies when it rains. Figure 3.7.5 provides an example of pervious pavement at a park-and-ride lot. Pervious pavements capture the first flush of rainfall and allow it to percolate into the ground,



Figure 3.7.5 | Pervious pavement at a park-and-ride lot, Seattle, Washington.

whereby soil chemistry and biology can treat the polluted water naturally. Studies conducted on the long-term pollutant removal in porous pavements suggest high pollutant removal rates.

Other advantages of pervious pavements include reduced retention areas, increased aquifer recharge, reduced peak water flows, and minimized flooding. The use of pavers at park-and-ride lots and sidewalks serve the same purpose. If pavers are used, consideration should be given to pedestrian pathways, as they might present additional difficulty for wheelchairs and transit riders using canes or walkers.³ Pervious pavers should be used in the less frequently used areas of the lots. The use of rain gardens and vegetated swales on the periphery of the lot can also reduce run-off. Figure 3.7.6 shows an example of a vegetated swale (also known as a bioswale) created with native vegetation.



Figure 3.7.6 | Drainage ditch enhanced with native plants to act as a bioswale for rainwater.

REFERENCES: SECTION 3.7

1. Transportation Research Board (TRB), 2010. *TCRP Synthesis 84, Current Practices in Greenhouse Gas Emissions Savings from Transit*. Washington, DC.
2. Federal Transit Administration, 2009. Report to Congress: *Transit Green Building Action Plan*. http://www.fta.dot.gov/documents/Transit_Green_Building_Action_Plan.pdf, accessed March 9, 2012.
3. FDOT, 2010. *Guidelines for Enhancing Intermodal Connections at Florida Transit Stations*. <http://www.dot.state.fl.us/transit/Pages/EnhancingIntermodalConnections.pdf>, accessed February 8, 2012.

IMAGE CREDITS FOR IMAGES BY OTHERS

- 3.7.1 FDOT, 2010, *Guidelines for Enhancing Intermodal Connections at Florida Transit Stations*, Tallahassee, FL.
- 3.7.4 Image courtesy of METRO RTA, Akron, OH. Used with permission.
- 3.7.5 Photo courtesy of King County Department of Transportation, Metro Transit Division, Seattle, WA. Used with permission.
- 3.7.6 Photo courtesy of EcoSarasota. Retrieved on October 15, 2012, from <http://ecosrq.com/bioswale.html>. Used with permission.

Quick Reference Guide

STANDARDS & MINIMUM REQUIREMENTS

Bus Stop B&A Areas

The dimensions of bus stop B&A areas may be adjusted as necessary to accommodate site conditions. However, the minimum size of bus stop B&A areas shall be 8' (perpendicular to roadway) by 5' (parallel to roadway).*

Bus stop B&A areas shall have a firm, stable surface.¹ ADA Standards further stipulate that floor and ground surfaces must also be slip resistant.

Bus stop B&A areas shall be connected to streets, sidewalks, or pedestrian paths by an accessible route.¹

Parallel to the roadway, the slope of the bus stop B&A area shall be the same as the roadway, to the maximum extent practicable. Perpendicular to the roadway, the slope of the bus stop B&A area shall not be steeper than 1:48 (2.08%).¹

Bus stop B&A areas must be designed to maintain a minimum clear width of 4' and vertical clearance of 7' minimum along the pedestrian access route.

If a B&A area includes a concrete pad or other structure, it must be located within the specified clear zone for the roadway environment being used, according to *FDOT Design Standards*, Index 700.

A sidewalk and/or ramp provided to access the B&A area shall be a minimum of 60" in width, and the ramp shall not exceed a slope of 1:12.²

A detectable warning is required on the surface of any curb ramp or where a sidewalk associated with access to a B&A area connects to the roadway at grade.²

Except for the area adjacent to the 5" Type E curb, the areas surrounding the B&A area shall be flush with the adjacent shoulder and side slopes and designed to be traversable by errant vehicles.²

On state roadways, the B&A area (and ramp and level landing, if needed) are to be constructed with 6" thick concrete.²

The B&A area on flush shoulder roadways shall use a Type E (5" curb height) and be connected to the sidewalk along the roadway, or to the roadway when no sidewalk is present.

When establishing a new or altered route with new bus stop locations, the public transit provider must, if not constructing them with current bus stop plan, take into account the future construction of B&A areas.

For a bus stop designated by only a sign on a post and no other amenities (shelter, bench, trash can, etc.) and where complementary ADA paratransit service is provided, the B&A area is still required, but it may not have to be a concrete pad.

*The U.S. DOT adoption of ADA Standards provides one exception for this requirement at 810.2.2 Dimensions: Bus boarding and alighting areas shall provide a clear length of 96" measured perpendicular to the curb or vehicle roadway edge, and a clear width of 60" measured parallel to the vehicle roadway. Public entities shall ensure that the construction of bus boarding and alighting areas comply with 810.2.2, to the extent the construction specifications are within their control.

¹ Florida Building Code Online, 2012, *Florida Accessibility Code for Building Construction*, [http://www.floridabuilding.org/fbc/committees/accessibility/aac/Changes to Law/Florida Accessibility Code 2012 ICC FINAL.pdf](http://www.floridabuilding.org/fbc/committees/accessibility/aac/Changes%20to%20Law/Florida%20Accessibility%20Code%202012%20ICC%20FINAL.pdf), accessed February 22, 2012.

² Florida Department of Transportation, 2012, *Plans Preparation Manual, Volume 1*, <http://www.dot.state.fl.us/rddesign/PPMManual/PPM.shtm>, accessed February 23, 2012.

Bus Stop Signs

Bus stop signs must be posted at all bus stops and bus passenger facilities and must include the route or routes available to passengers from that bus stop.

Signs shall provide a minimum 7' vertical clearance from the paved surface (sidewalk or roadway pavement). If the vertical clearance is less than 7' and is placed along an accessible route, a barrier to warn people with visual impairment should be provided. Signs that have a vertical clearance of less than 7', but a leading edge greater than 27", must not protrude into the circulation path more than 12" from the post.

Bus Stop Signs (cont'd)

Sign and signpost placement must conform to ADA as well as Florida-specific requirements for height, width, visibility, and other design and location criteria.

Sign panels must be located to provide a minimum sidewalk clearance of 4'. Per the *PPM*, 5' is the requirement, but if the area is constrained, 4' can be an acceptable variance.

The sign panel must be securely mounted at an angle perpendicular to the street.

Sign characters shall be selected from fonts where the width of the uppercase letter "O" is 55% minimum and 110% maximum of height of uppercase letter "I."
 Characters shall be uppercase or lowercase or a combination of both.
 Characters shall be conventional in form. Characters shall not be italic, oblique, script, highly decorative, or of other unusual forms.¹
 Characters and their background shall have a non-glare finish and shall contrast with their background with either light characters on a dark background or dark characters on a light background.
 To the maximum extent practicable, bus route identification signs shall comply as follows: Minimum character height shall comply with Table 3.2.1 (see Chapter 3, Section 3.2). Viewing distance shall be measured as the horizontal distance between the character and an obstruction preventing further approach toward the sign.¹

Bus schedules, timetables, and maps that are posted at the bus stop or bus bay shall not be required to comply with the above requirements.¹

For curb and gutter sections, *FDOT Design Standards*, Index 17302, requires a minimum 2' distance from the face of the curb to the nearest edge of the sign.

Refer to *FDOT Design Standards* for guidance on bus stop sign on state roads. *FDOT Design Standards*, Index 700, requires a minimum clearance of 4' from the face of the curb to frangible signposts.

FDOT Design Standards, Index 17302, stipulates that on flush shoulder roadways or non-curbed roads, the lateral offset from the nearest edge of the sign itself must be at least 12' from any travel lanes and at least 6' from the edge of any paved shoulder. The minimum distance will vary according to the design speed of the road.

Bus stop signs must comply with all the applicable requirements set forth in the *MUTCD*. The most stringent standard must be followed.

Post-mounted signs shall be crashworthy (breakaway when struck leaving a stub of no more than 4" above the ground, yielding, or shielded with a longitudinal barrier or crash cushion) if within the clear zone.

Signposts placed near intersections must be of an omni-directional design, meaning that the support is symmetrical and will break safely when struck from any direction.

Signposts in the clear zone (a roadside that is traversable and unobstructed by fixed objects to allow vehicles that leave the roadway to recover safely) must be designed with breakaway mechanisms or else protected by a barrier or crash cushion. All sign supports, except overhead cantilever, truss type or bridge, or barrier wall-mounted, shall be breakaway as defined in the *AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals* and the *AASHTO Roadside Design Guide*. Sign supports shall be of an acceptable and crashworthy design as described in the *FDOT Design Standards*.

The bus stop sign must neither block jurisdictional signs nor be blocked by other signs, trees, or buildings.

Signs shall not be installed where signing interferes with the functions or visibility of existing traffic control devices. This does not negate the ADA Standards requirement for bus stop signs at all bus stops.

Bus Stop Signs (cont'd)

Transit bus stop signs shall be attached to supports meeting the location, height, and lateral placement requirements established in *FDOT Design Standards*, Index 17302.

¹ Florida Building Code Online, 2012, *Florida Accessibility Code for Building Construction*, http://www.floridabuilding.org/fbc/committees/accessibility/aac/Changes_to_Law/Florida_Accessibility_Code_2012_ICC_FINAL.pdf, accessed February 22, 2012.

² Florida Department of Transportation, 2012, *Plans Preparation Manual, Volume 1*, <http://www.dot.state.fl.us/rddesign/PPMManual/PPM.shtm>, accessed February 23, 2012.

Bus Stop Shelters

Bus shelters shall be connected by an accessible route to a bus stop B&A area.

When a shelter is located on the street side of a sidewalk (between sidewalk and edge or roadway), a minimum 4' pedestrian pathway, per State requirements, shall be maintained on three sides of the shelter.

The B&A area can be extended into the clear space within the shelter (no obstructions to the 5'-by-8' area allowed).

The shelter shall provide a minimum clear floor or ground space of 30" by 48" and entirely within the shelter.¹ The minimum clear floor or ground space and accessible route shall comply with *2012 Florida Accessibility Code*, Sections 305 and 402, respectively.²

Shelter access entry and exit points shall provide a minimum clear width of 4', per State requirements.

There shall be no change in elevation greater than 1/4" untreated or 1/2" treated to a slope of 1:2 along the walking surfaces between the sidewalk or bus stop B&A area and the shelter. Changes in level greater than 1/2 inch must be ramped in compliance with 405 or 406 of the ADA Standards.

Shelters within the clear zone shall incorporate breakaway mechanisms in order to be frangible or breakaway. Breakaway mechanisms include slip-bases and bases incorporating a component with low impact strength.

Proper horizontal clearance (distance away from the edge of the roadway) to shelters must be provided. Shelters shall not be placed on sidewalks where they could obstruct the movement of pedestrians.

Per FAC 14-20.003, the maximum height of a shelter cannot exceed 10 feet.

To meet ADA Standards, the sidewalk adjacent or connected to the shelter must be designed with a width of at least 5' or, at every 200', a space at least 5' by 5' must be provided so that two wheelchair users can pass traveling in opposite directions.

Shelter and bus stop amenities must comply with Florida Wind-Borne Debris Region Requirements to ensure they do not become the source of flying debris during high wind events. Shelters must be built in compliance with the Florida Building Code wind-loading criteria. See the Florida Building Code for detailed requirements.

Bus shelters provided by the private sector, whether located on the public right-of-way or private property, must meet all applicable local building codes, permit requirements, land development codes, and these guidelines.

Shelters are prohibited in medians and on limited access roads. Shelters shall not be located within 15' of any fire hydrant or accessible parking space.³

A shelter may be erected only at bus stops designated by a public transit agency or the local school board and identified as having service a minimum number of 10 times in a 5-day period, excluding weekends and holidays.³

Shelters erected outside of the urban limits shall be spaced so that no more than two shelters are erected per mile of a two-lane highway and no more than four shelters are erected per mile on highways with four or more lanes.³

The Florida Building Code has minimum requirements to ensure that bus shelters in hurricane-prone areas can withstand high winds and the impacts of wind-borne debris. In addition, transit stops, if identified in an emergency evacuation plan, must be provided with signage indicating the same.

Bus Stop Shelters (cont'd)

The shelter location must meet the setback and minimum clear zone requirements as established in the *FDOT Design Standards*, Index 700.³

Shelters located adjacent to a sidewalk within the right-of-way of any road on the state highway or county road system shall be located to leave at least 48" of clearance for pedestrians and persons in wheelchairs.

Prior to the installation of a shelter, the impacted utility companies must be notified to determine location of utilities and prevent conflicts.³

The owner of abutting property shall be notified by certified mail of the proposed shelter location if there will be advertising.³

Companies engaged in the business of outdoor advertising shall obtain and maintain a current license pursuant to Section 479.04, F.S., and Rule 14-10.003, FAC.

Sides and internal dividers in shelters shall be constructed in a manner to provide visibility of waiting passengers to passing traffic and pedestrians. All transparent materials must be shatterproof. No shelter shall be located in such manner or constructed of such materials as to adversely affect sight distances at any intersection or obstruct the view of traffic signs or other traffic control devices.³

There shall be no more than one advertisement per side, including the roof, and said advertisement shall be no greater than 6' by 5' in size.³

Shelters must be securely attached to their foundations and must provide for a clear opening between the structure and the ground or foundation to facilitate cleaning, preclude the accumulation of debris, and increase security.

Flashing lights on shelters are prohibited. All lights must be placed or shielded so they do not interfere with motorists on the roadway.

Lights are not permitted for the sole purpose of illuminating advertising.

When connecting power to a shelter, all shelter utility connections shall comply with Rule 14-46.001, FAC, and must be approved by the appropriate city or county building department.

For complete and most up-to-date requirements on shelters, refer to the Index of Resources provided in this handbook.

¹ U.S. DOJ, *2010 ADA Standards for Accessible Design*, <http://www.ada.gov/regs2010/2010ADAStandards/2010ADAStandards.pdf>, accessed October 8, 2011.

² Florida Building Code Online, 2012, *Florida Accessibility Code for Building Construction*, http://www.floridabuilding.org/fbc/committees/accessibility/aac/Changes_to_Law/Florida_Accessibility_Code_2012_ICC_FINAL.pdf, accessed February 22, 2012.

³ Florida Administrative Code Online, 2008, <https://www.flrules.org/gateway/ruleNo.asp?id=14-20.003>, accessed February 22, 2012.

⁴ FDOT, 2007, *Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways (Florida Greenbook)*.

Bicycle Racks at Shelters

Bicycle racks shall not be placed on or obstruct access to ADA-mandated B&A areas.

Bicycle racks shall not be placed such that they obstruct pedestrian traffic either on the sidewalk or to and from the bus stop B&A area.

The upper elements of a bicycle rack shall not protrude, creating an obstacle for a traveler with visual impairment, in accordance with ADA Standards Section 307. Bicycle rack locations must meet the setback and minimum clear recovery zone requirements established in *FDOT Design Standards*, Index 700.

Bicycle rack locations must meet the setback and minimum clear recovery zone requirements established in *FDOT Design Standards*, Index 700.

Shopping Carts at Shelters

To maintain accessibility, bus stop B&A areas must not be used for shopping cart storage.

Shopping cart locations must meet the setback and minimum clear recovery zone requirements established in *FDOT Design Standards*, Index 700.

Bus Stop Benches

According to Rule 14-20.0032, FAC, benches shall be placed only at agency-established transit stops. However, only a minimum number of benches necessary to accommodate comfort and convenience of the general public shall be erected or maintained.

Clear floor or ground space of minimum 30" by 48" with slopes not steeper than 1:48 (2.08%) shall be provided and shall be positioned at the end of the bench seat and parallel to the short axis of the bench.¹ See ADA Standards for Transportation Facilities for additional requirements on clear floor or ground space.

The bench shall provide for back support or shall be affixed to a wall.¹

Bench dimensions shall be as follows:¹

- Maximum 74" in length, 28" in depth, and 44" in height.
- Seats shall be 42" long minimum, shall not exceed 74" in length, and 20" (minimum) to 24" (maximum) deep.
- The top of the bench seat surface shall be 17" minimum and 19" maximum above the finish floor or ground.
- Back support shall be 42" long minimum and shall extend from a point 2" maximum above the seat surface to a point 18" minimum above the seat surface. Back support shall be 2.5" maximum from the rear edge of the seat measured horizontally.

Allowable stresses on benches shall not be exceeded for materials used when a vertical or horizontal force of 250 pounds is applied at any point on the seat, fastener, mounting device, or supporting structure.¹

Any bench placed on any part of a sidewalk shall leave clearance for pedestrian traffic between the bench and the nearest edge of the road. Sidewalk width shall never be less than 4' in clear width unless approved by the District Engineer governing the work being performed. Regardless, in no cases shall the clear width be less than 36".

Bench placement must be in an accessible location (i.e., not on the far side of a drainage ditch from the actual bus stop), and appropriately connected to the path of travel on an accessible path to the bus B&A area.

Bench location must meet the setback and minimum clear recovery zone requirements established in *FDOT Design Standards*, Index 700.

Benches shall not be placed in the median of any divided highway or on limited access facilities.

Commercial advertising, if allowed by the governing jurisdiction, shall be displayed upon a bench only on either the front or rear surface of the backrest area.

Advertising displayed on a bench shall not be greater than 6' in length nor greater than 2' in height, and no advertising displayed on a bench shall be of a reflectorized material.

Benches must not obstruct the full 5'-by-8' B&A area or passenger access to loading and unloading areas.

If any bench is found to be in violation of FAC Rule 14-20.0032, except those determined to be a safety hazard, FDOT shall provide written notice of the violation to the owner of the bench, or the appropriate city or county government, who shall correct the violation or remove the bench within 30 days after receipt of the notice. If FDOT finds any bench to be a safety hazard, it will provide notice to the owner of the bench, or the appropriate city or county government, who shall take immediate steps to make the bench safe or remove the bench.

Where installed in wet locations, the surface of the seat shall be slip resistant and shall not accumulate water.¹

Refer to FAC Rule 14-20.0032–Placement of Benches, *FDOT Design Standards*, *PPM*, and *ADA Standards for Transportation Facilities* for more information on placement and design of bus benches on State rights-of-way.

¹ U.S. DOT, *ADA Standards for Transportation Facilities*, November 26, 2006, <http://www.access-board.gov/ada-aba/ada-standards-dot.cfm>, accessed February 22, 2012.

² FDOT, 2007, *Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways (Florida Greenbook)*.

Bus Stop Leaning Rails

Leaning rails must not intrude on the accessible path or B&A area clear space and must not be a protruding object. Refer to *2012 Florida Accessibility Code for Building Construction* for details on clear space and protruding object requirements.

ADA Standards specify that handrail and grab bars must be mounted at 34–38” above the surface.

Bus Stop Information and Wayfinding Devices

Text should be large and easy-to-read and must comply with all ADA requirements for text and pictogram size, placement, and contrast.

Signs must be installed to eliminate any protruding objects hazards.

Where public address systems convey audible information to the public, the same or equivalent information shall be provided in visual format.¹

¹ Florida Building Code Online, 2012, *Florida Accessibility Code for Building Construction*, [http://www.floridabuilding.org/fbc/committees/accessibility/aac/Changes to Law/Florida Accessibility Code 2012 ICC FINAL.pdf](http://www.floridabuilding.org/fbc/committees/accessibility/aac/Changes%20to%20Law/Florida%20Accessibility%20Code%202012%20ICC%20FINAL.pdf), accessed February 22, 2012.

Bus Stop Trash Receptacles

Trash receptacles must be placed appropriately to ensure the accessibility of the site and provide clear and unobstructed passage along any connecting sidewalk and the B&A area.

Trash receptacles shall not be placed in B&A areas, in compliance with the ADA Standards.

Trash receptacle locations must meet the setback and minimum clear zone requirements established in *FDOT Design Standards*, Index 700.

Bollards

Bollards must not interfere with the accessibility of pedestrian routes connecting to and from bus stop B&A areas. Bollards may not obstruct a required accessible route.¹

Where security bollards are installed at transit stops, they must not obstruct the clear space at B&A areas or reduce the required clear width of pedestrian access routes.¹

Bollard location must meet the setback and minimum clear recovery zone requirements established in *FDOT Design Standards*, Index 700.

¹ Florida Building Code Online, 2012, *Florida Accessibility Code for Building Construction*, [http://www.floridabuilding.org/fbc/committees/accessibility/aac/Changes to Law/Florida Accessibility Code 2012 ICC FINAL.pdf](http://www.floridabuilding.org/fbc/committees/accessibility/aac/Changes%20to%20Law/Florida%20Accessibility%20Code%202012%20ICC%20FINAL.pdf), accessed February 22, 2012.

Public Telephones

Where public telephones are provided, at least one telephone must be accessible to persons using wheelchairs. This involves mounting height, clear approach area, knee and toe space, and telephone accessibility features, as specified in ADA Standards Section 704.

Public telephones must be located so that the receiver, coin slot, and control are no more than 4' above the floor.

Public telephones shall be fixed on a clear floor or ground space at least 30" by 48"; not impeded by bases, enclosures, or fixed seats; and allow either a forward or parallel approach by a person using a wheelchair.

Phones shall be hearing-aid compatible and volume-control equipped.

Objects with leading edges more than 27" and not more than 80" above the finished floor or ground shall protrude 4" maximum horizontally into the circulation path.

Operable parts of a telephone shall comply with clear floor space, height, and operation, as required in ADA Standards, Section 309.

Emergency Call Box

The ADA Standards for operable parts state that operable parts of a telephone shall comply with clear floor space, height, and operation requirements. The clear space requirement is 30" by 48" minimum.

A call box must be located in such a place that it does not obstruct access to the bus stop B&A area and connecting pathways.

A call box must be located according to ADA Standards for protruding objects and operable parts. Objects with leading edges more than 27" and not more than 80" above finished floor or ground may protrude 4" maximum horizontally into the circulation path.

Vending Machines

Vending machines, newspaper boxes, and other street furniture cannot reduce clear spaces required by ADA Standards. A 30"-by-48" minimum clear space must be provided.¹ The bus stop B&A area and connecting pathways cannot be obstructed by such amenities placed at bus stops.

Vending machine locations must meet the setback and minimum clear zone requirements established in *FDOT Design Standards*, Index 700.

ADA guidelines also state that any operable parts shall comply with clear floor space, height, and operation requirements.

According to ADA Standards, when affixed to an existing structure, a vending machine may not protrude more than 4" into the accessible path when mounted at 27" to 80" above the finished floor or ground surface.

¹ Florida Building Code Online, 2012, *Florida Accessibility Code for Building Construction*, [http://www.floridabuilding.org/fbc/committees/accessibility/aac/Changes to Law/Florida Accessibility Code 2012 ICC FINAL.pdf](http://www.floridabuilding.org/fbc/committees/accessibility/aac/Changes%20to%20Law/Florida%20Accessibility%20Code%202012%20ICC%20FINAL.pdf), accessed February 22, 2012.

Landscaping

All landscaping along FDOT rights-of-way must comply with standards in the latest editions of the *PPM, Florida Highway Landscape Guide*, and *FDOT Design Standards*, Index 546 and Index 700. Consult the FDOT Environmental Management Office website for the most current information on this topic, <http://www.dot.state.fl.us/emo/>.

Trees shall be pruned to allow a minimum 9' 10" of vertical clearance from sidewalks or B&A areas.¹

To maintain a defensible space and preserve visibility, the height of groundcover plants should not exceed 2' and the height of shrubs should not exceed 3' at maturity.

Transit agencies shall coordinate landscape installation with the state or local agency assigned the responsibility of maintaining the landscaping.

¹ FDOT, 1995, *Florida Highway Landscape Guide*.

CHAPTER 4



Street-Side Facilities

Street-Side Facilities

4.1 Transit Vehicle Characteristics

OVERVIEW

To understand the roadway features necessary to accommodate transit vehicles and transit passengers, it is important to first understand transit vehicle characteristics and how these vehicles interact with the roadway environment. Transit agencies typically use buses that range in length from 30 to 40 feet, with some vehicle lengths shorter for mini-buses suitable for paratransit or longer for articulated buses. It is considered best practice to plan for a typical 40-foot bus as a minimum requirement for key roadway features such as lane and shoulder widths, pavement design, vehicle stop areas, acceleration and deceleration distances, turning radii, and clearances.¹ An agency not currently using 40-foot buses should consider planning ahead for operational and design features to accommodate such buses to avoid costly changes.

VEHICLE DESCRIPTION

Vehicle Types and Dimensions

Vehicle types and dimensions are an important part of roadway design when it comes to buses. Narrow lanes and limited turning radii can make bus interaction with traffic not only challenging, but dangerous. It is important to consider the lengths and widths of buses that an agency uses when designing roads. If an agency is planning on upgrading its buses, turning radius and bus width are important to consider when planning for activities on existing streets, particularly older, narrower roadways.

Standard Bus

There are numerous types of buses produced by various manufacturers operating throughout Florida. However, the most popular bus at this time is the Gillig low-floor bus, which, for the purposes of this handbook, will be used as the prototypical bus for general dimensions and specifications. Table 4.1.1 lists general specifications for a typical bus.²

BRT Bus

BRT buses can be the same length or longer than those designed for traditional fixed-route service. Table 4.1.2 provides various lengths and design characteristics of BRT buses. Figures 4.1.1 through 4.1.7 illustrate the typical dimensions of the buses used in public transit.

Length	40'	35'	29'
Width*	102"	102"	102"
Height	114.5"	114.5"	114.5"
Passenger capacity	40	32	28
Front door opening width	35"	35"	35"
Rear door opening width (56" available)	30"	30"	30"
Wheelchair lift platform width	31"	31"	31"
Front aisle width	36"	36"	36"
Wheel base	284"	235"	163"
Turning radius (bumper corner)	41'	36'	29'
Approach/departure angle (standard tires)	9/9	9/9	9/9
Step heights, front/rear (kneeled, standard tires)	12"/13.2"	12"/13.2"	12"/13.2"
Optional step height, front/rear (kneeled, low-profile tires)	9.4"/10.6"	9.4"/10.6"	9.4"/10.6"
Fuel tank capacity (gallons)	120	120	75

*The standard mirror-to-mirror width for buses is approximately 120" to 126".³

Table 4.1.2 Typical BRT Vehicle Dimensions and Capacities ¹¹				
Length (feet)	Width (inches)	# Door Channels	# Seats (incl. seats in wheelchair tie-down areas)	Maximum Capacity* (seated plus standing)
40	96–102	2–5	35–44	50–60
45	96–102	2–5	35–52	60–70
60	98–102	4–7	31–65	80–90
80	98–102	7–9	40–70	110–130

*Capacity includes seated riders plus standees computed at a density of 3 standing persons per 10.76 square feet.

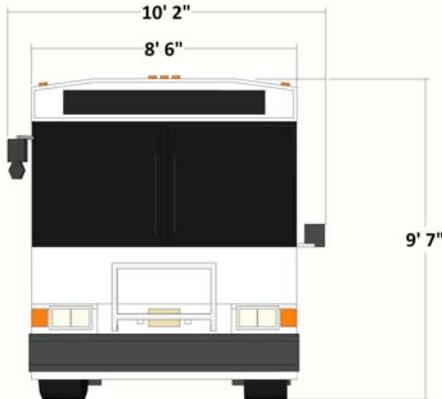
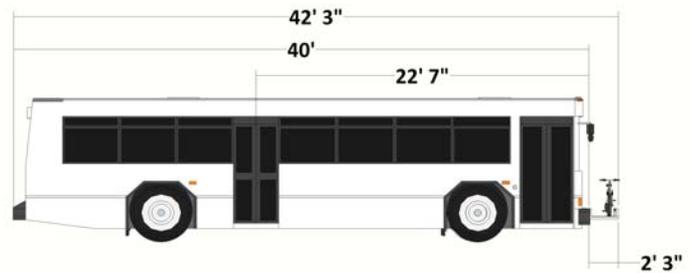


Figure 4.1.1 | Front view of a standard 40-foot bus.



Seating Capacity: 40
Standing Capacity: 64

Figure 4.1.2 | Side view of a standard 40-foot bus.

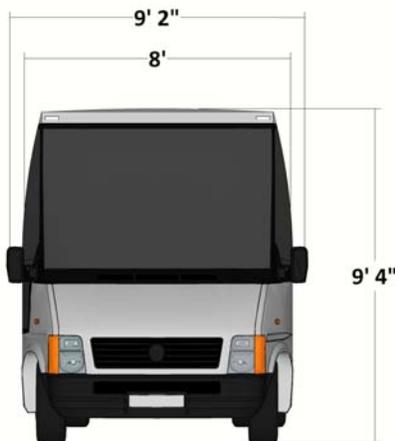


Figure 4.1.3 | Front view of a mini-bus or paratransit vehicle.



Seating Capacity: Paratransit = 9 to 11 No Standing Allowed
Fixed Route = 15

Figure 4.1.4 | Side view of a mini-bus or paratransit vehicle.

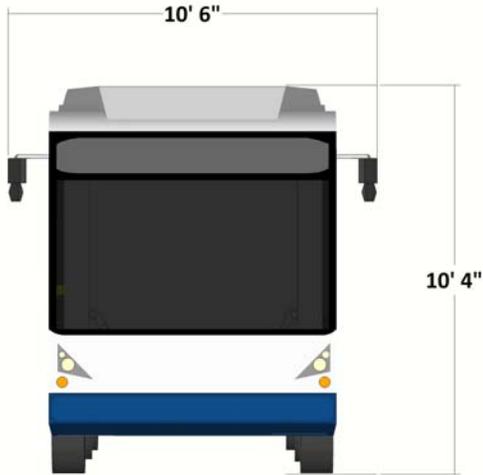


Figure 4.1.5 | Front view of an articulated bus.

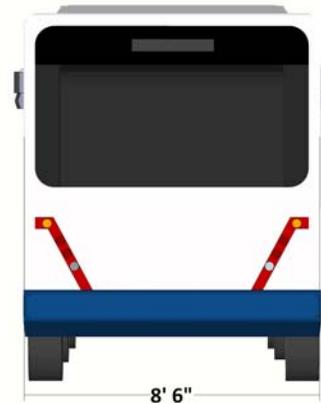


Figure 4.1.6 | Rear view of an articulated bus (width without mirrors).

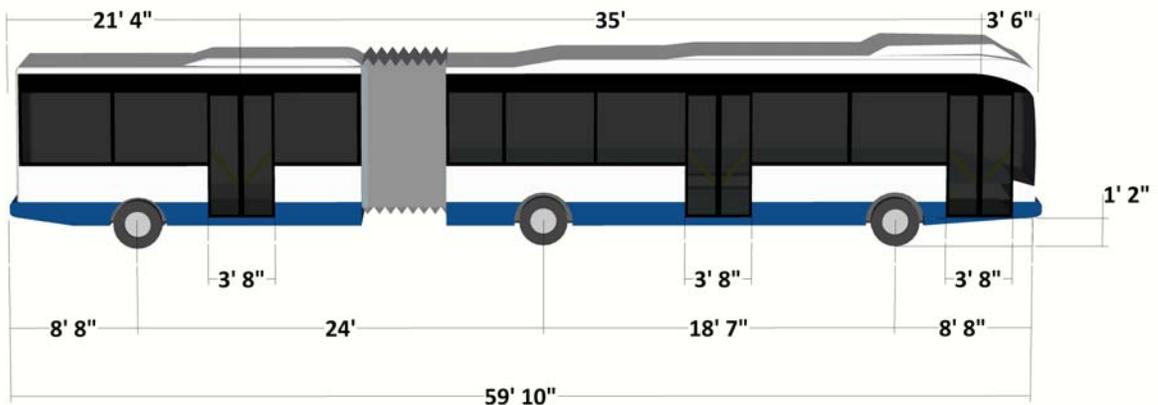


Figure 4.1.7 | Side view of an articulated bus.

Bus Turning Radius

Figure 4.1.8 shows the key components of bus turning movements at intersections. Table 4.1.3 shows the desirable intersection geometry measurements for traffic lanes used by buses.

Bicycle racks on the front of buses can affect minimum turning radii, which should be considered in roadway design construction standards. Accounting for this added dimension is particularly critical on driveways, in bus transit centers, and in neighborhoods with limited turning maneuverability.

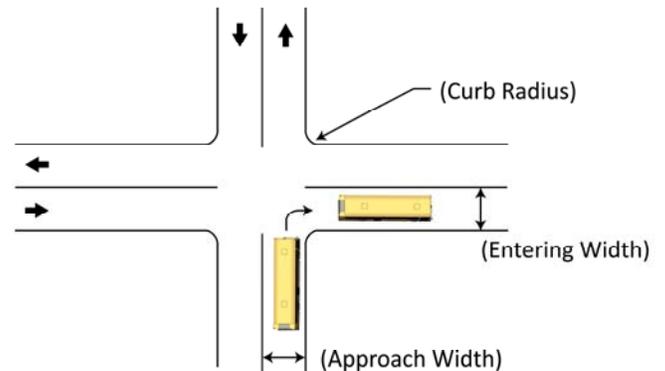


Figure 4.1.8 | Key components of bus turning movements at intersections (see Table 4.1.3 for desirable dimensions).

Table 4.1.3
Desirable Intersection Geometry Minimum Measurements for Transit Use

Approach Width (feet)	Entering Width (feet)	Curb Radius (feet)
12 (single lane)	12	50
	16	45
	20	40
	24	35
16 (single lane with 4' shoulder)	12	45
	16	40
	20	30
	24	25
20 (single lane with parking)	12	40
	16	35
	20	30
	24	25

Figure 4.1.9 shows the typical bus turning template for a vehicle with a front-mounted bicycle rack.³ Figure 4.1.10 shows an example of a bus with a bicycle rack.

DESIGN ISSUES

As ADA requires passengers using mobility aids be allowed on buses, most buses are manufactured to meet ADA Standards for vehicles. They can deploy ramps of the proper slope to allow mobility aid users to enter and disembark the bus; however, these ramps require the appropriate curb height to function properly. It is important that agencies take into consideration curb height at their bus stop locations when purchasing new buses.

The Quick Reference Guide at the end of this chapter contains more detailed accessibility information pertaining to internal bus characteristics. This information is in accordance with ADA Part 38, Subpart B—Buses, Vans and Systems, Sections 38.21 through 38.39; however, it is not exhaustive. (As most transit agencies will be purchasing bus vehicles pre-fabricated and with properly designed components, this information has been included only as reference.)

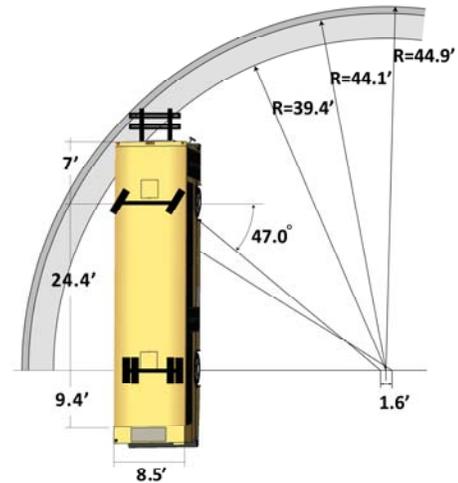


Figure 4.1.9 | Typical bus turning dimensions for a bus with a front-mounted bicycle rack in use.



Figure 4.1.10 | Bus with a bicycle rack, Pinellas County, Florida.

Roadway

Roadway dimensions must take into account the minimum space in which buses can turn in order to ensure safe roadway turning movements by buses. The minimum radius required for a 40-foot coach (the standard bus) is illustrated in Figure 4.1.11. An articulated bus is an extra-long bus (54–60 feet) with two connected passenger compartments. The rear body section is connected to the main body by a joint mechanism that allows the vehicle to swivel when in operation for sharp turns and curves and still maintain a continuous interior. It is typically used for express bus, high volume routes, and BRT services. The 60-foot articulated bus turning movement is illustrated in Figure 4.1.12.

Other bus-related design considerations include the following:

- The desirable minimum width for traffic lanes used by buses is 12 feet.
- Roadway grades should be based on bus performance characteristics for grade ascents or descents under fully-loaded conditions.
- Turning radii requirements for a standard 40-foot transit bus are:
 - minimum interior radius = 24½ feet^{3,4}
 - minimum outer radius = 42 feet^{3,4}
- A bus with a front-mounted bicycle rack typically requires at least 1.5 additional feet added to the turning radii. This may vary by bus and rack manufacturer.⁴
- Additional turning radii requirements will be needed under the following conditions:
 - buses turning at speeds greater than 10 mph
 - buses making reverse turns
 - turns in areas with sight distance limitations
 - turns involving changes in pavement grade
 - turns in areas that restrict the movement of the bus overhang
- Low or absent curbs make boarding and alighting more difficult for passengers. Higher curbs may interfere with wheelchair lifts.

- To make articulated buses nimble enough to safely navigate streets at their increased length, they are fitted with an extra axle (set of wheels) and a joint usually located slightly behind the midpoint of the bus behind the second axle.
- While not always practical, there are situations where concrete pads should be incorporated into the pavement design of a project. The frequent stopping of transit vehicles in a particular location where the pavement is wearing is an example where concrete pads may be warranted.⁵

Bus Safety Markings

Buses face challenges when merging with the flow of traffic, particularly at intersections where there are shared-use bicycle lanes as well as regular vehicular traffic. The yield hierarchy at these locations is not necessarily well known, often creating conflicts between the buses and general traffic. To attract the attention of motorists, on-vehicle devices such as “Yield to Bus” signage should be used. In the event that such a sign on the back of the bus is not effective, roadside signage should be available at bus bay locations to inform the motorists that they must yield to the bus during merging maneuvers.

In places where automobile-bus crashes have occurred, agencies should consider installing informational signage reminding motorists of State law that grants right-of-way to buses entering traffic and should request increased traffic enforcement by police. F.S. 316.0815 specifies that the driver of a vehicle must yield the right-of-way to a publicly-owned transit bus traveling in the same direction that has signaled and is re-entering the traffic flow from a specifically-designated pullout bay.

Figure 4.1.13 provides an example of “Yield to Bus” signage installed on the back of a bus.

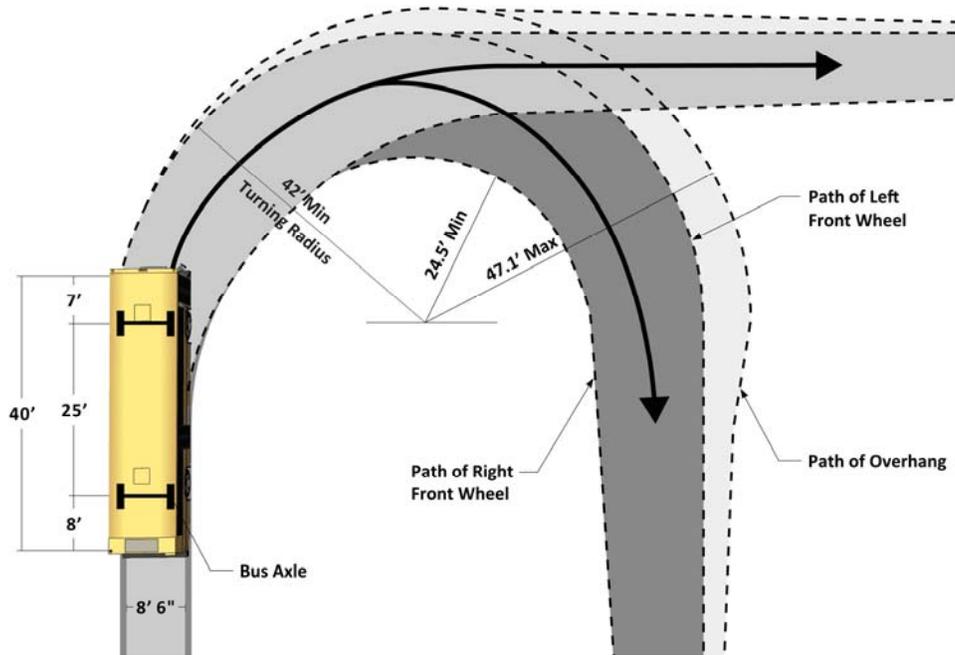


Figure 4.1.11 | Bus turning movement geometry for a 40-foot bus.

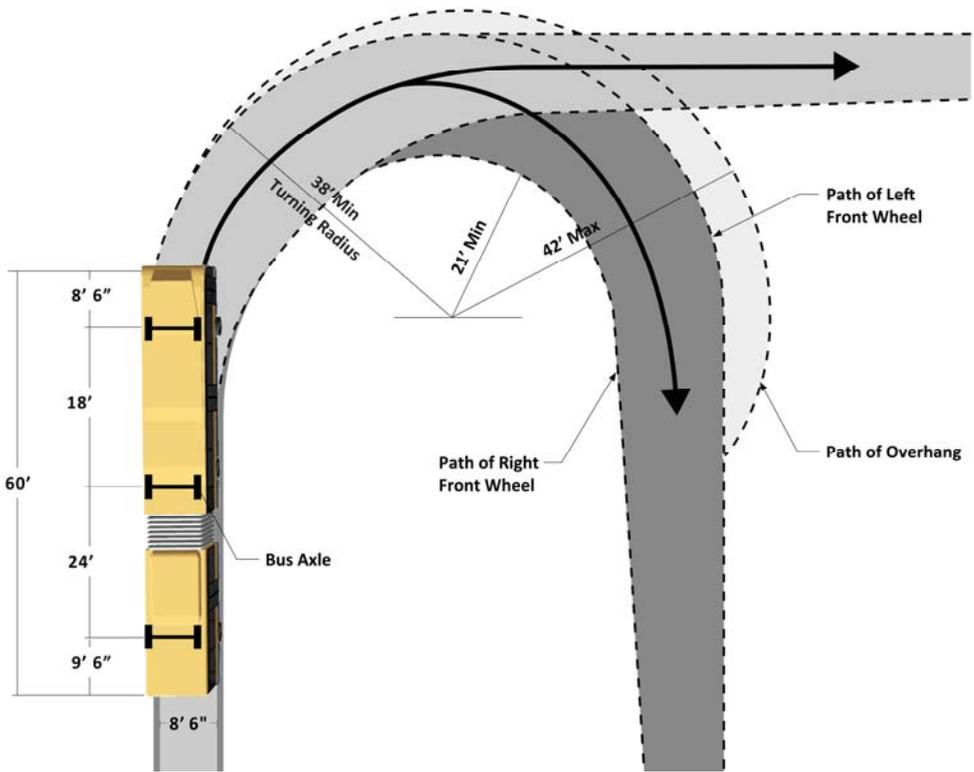


Figure 4.1.12 | Bus turning movement geometry for a 60-foot bus.



Figure 4.1.13 | Yield-to-bus signage on the back of a bus.

Consideration should be given to installing and resurfacing pavements with higher bus volumes or in areas with special soil conditions. At bus stops accommodating very high bus volumes, reinforced concrete pads for the travel lane should be provided. These reinforced pads help lengthen the life of the pavement at those busy locations.

When possible, agencies should give thoughtful consideration toward shifting their buses to more fuel-efficient bus types. Currently, nearly 80 percent of transit agencies in the U.S. use conventional diesel fuel.

BUS SAFETY FEATURES

Good design of transit vehicles can increase the safety of passengers and reduce the risk of collisions with pedestrians. Examples of transit vehicle technologies that can improve safety include:⁶

- Collision avoidance technology on buses – provides operators with an advance warning or alarm when pedestrians or other objects are within close proximity of the bus.
- Strobe lights on top of buses – intended to get the attention of pedestrians when buses approach bus stops and shelters.

- Door safety interlocks – automatic controls to prevent buses from moving once doors are open.
- Right rear wheel safety guards – can reduce the risk and severity of rear wheel pedestrian accidents.
- Front brake lights – indicate to pedestrians crossing the street in front of a bus when the bus is stopped and when it has started to move.

REFERENCES: SECTION 4.1

1. FDOT, Districts 1 and 7, 2007. *Transit Facility Handbook*.
http://www.dot.state.fl.us/transit/Pages/FDOT_D1_D7_Transit_Facility_Handbook.pdf.
2. Gillig.com. Gillig Low Floor. (Online) <http://www.gillig.com/LowFloor.htm>, accessed March 12, 2012.
3. AASHTO, 2009. *Guide for the Geometric Design of Transit Facilities on Highways and Streets*. Ballot Draft.
4. TRB, 2007. *TCRP Report 117, Design, Operation, and Safety of At-Grade Crossings of Exclusive Busways*. Washington, DC.
5. FDOT, 2007. *Manual of Uniform Minimum Standards for Design, Construction, and Maintenance for Streets and Highways (Florida Greenbook)*.
6. U.S. DOT, FHWA, 2008. *Pedestrian Safety Guide for Transit Agencies*. Washington, DC.

4.2 Bus Stop Placement

OVERVIEW

Designating an effective location for a bus stop is necessary for any transit agency striving to better serve its existing riders and attract potential new ridership. As most bus transit operates in mixed traffic on streets, bus stop locations are usually defined in relation to an intersection. The locations can be categorized as far-side, near-side, and mid-block stops. Within these three general locations, bus stops may be located on a curbside, a soft shoulder, or a bus bay/pullout to allow buses to pick up and discharge passengers in an area outside of the travel lane.

ACCESSIBILITY

Bus stops must be located to effectively serve a wide range of passengers with various accessibility concerns. Regardless of the location in relation to a roadway feature such as an intersection, driveway, bridge, etc., all key elements related to accessibility at a stop must be addressed. Table 4.2.1 is an accessibility/placement checklist that presents the key elements of bus stop accessibility.

LOCATION

Some of the primary considerations in locating bus stops are access to major trip generators, adequate right-of-way, and safe B&A areas, as well as access to the stops for transit patrons. The operator of a transit bus system may designate a bus stop within the boundaries of the right-of-way of a state road. The location of a transit bus stop site on a state road right-of-way is dictated by the needs of the riding public and the route availability of the public transit system.¹ The transit agency is required by ADA to choose a site for a bus stop that affords the greatest accessibility practicable. In general, avoid bridges, driveways, and areas with very little usable right-of-way width when locating a bus stop. Stops should be located so that passengers are not forced to wait for a bus in the middle of a driveway, nor should a stopped bus block a driveway. Stops should be located so that patrons board or alight directly from the curb rather



Minimum Requirements for Bus Stop Placement

- Must be on an accessible route.
- May be on a sidewalk or paved shoulder.
- Must have an accessible approach to the stop.
- Must meet running slope/cross slope criteria.
- Is firm, stable, and slip-resistant to the maximum extent possible.

than from a driveway, with the B&A area required by the ADA Standards located completely outside any adjacent driveways. Relocating a bus stop to a different, nearby location should be considered if a corner location proves to be unacceptable.

The site selection and establishment of a transit bus stop shall provide the maximum safety to users of the public transit system and vehicular and pedestrian traffic. If a transit bus stop is located (within the right-of-way of a state road) at a site deemed to be unsafe by FDOT, modification or removal shall be required by FDOT and shall be at the expense of the transit bus system.¹

Curbside stops should be provided where:

- the design speed is less than or equal to 45 miles per hour
- there is adequate space in the right-of-way for improvement of shelters and benches
- access can be provided for passengers with disabilities
- major trip generators are nearby
- connections exist to pedestrian facilities
- nearby major intersections are signalized
- street lighting exists for nighttime routes
- adequate curb length is present to accommodate the bus stop zone

Rural stops should be placed at the least sloped points that comply with ADA guidelines for B&A areas, as locations for rural stops mostly include

soft shoulders that are generally sloped. The majority of kneeling buses create a 1:6 slope on ramps, and excessive slope may make wheelchair ramps too steep for safe use.

Placement of bus stops in exclusive right-turn lanes is not recommended. However, if a local decision is made to allow them, the bus stop should also be located at least 100 feet in advance of the intersection to avoid creating a conflict with vehicles merging to the inside lane or turning right at the intersection. Similarly, when the right-turn lane is a through-lane that is being dropped at a signalized intersection, a bus stop should also be located at least 100 feet in advance of the intersection.

Drainage needs to be a consideration when locating bus stops, as curb inlets on roads are typically placed near intersections (where a near-side or far-side stop may be located) and usually are located right next to the crosswalk. Refer to the *Florida Greenbook* and *PPM* for more guidance on drainage issues.

If a bus stop is provided near a railroad crossing, it should be placed a minimum of 25 feet in advance of the railroad crossing pavement markings. If a bus bay/pullout is provided near a railroad crossing, it should be located a minimum of 50 feet from the stop bar. If a bus stop must be located on the far side of a crossing, it should be located at least 450 feet beyond the crossing.³

**Table 4.2.1
Bus Stops Accessibility/Placement Checklist²**

Presence, Design, and Placement	<ul style="list-style-type: none"> • Are bus stops sited properly? • Are safe pedestrian crossings nearby for transit passenger use? • Is sight distance to the bus stop adequate? • Are shelters appropriately designed and placed for pedestrian safety and convenience?
Quality, Conditions, and Obstructions	<ul style="list-style-type: none"> • Is the seating area at a safe and comfortable distance from vehicle and bicycle lanes? • Do seats (or persons sitting on them) obstruct the sidewalk or reduce its usable width? • Is a sufficient area provided to accommodate waiting passengers, boarding/alighting passengers, and through/bypassing pedestrian traffic at peak times? • Is the B&A area a firm, stable, slip-resistant surface and free of problems such as uneven surfaces, standing water, or steep slopes? • Is the sidewalk free of temporary/permanent obstructions that constrict its width or block access to the bus stop?
Continuity and Connectivity	<ul style="list-style-type: none"> • Is the nearest crossing opportunity free of potential hazards for pedestrians? • Are transit stops part of a continuous network of pedestrian facilities? • Are transit stops maintained during periods of inclement weather?
Lighting	<ul style="list-style-type: none"> • Are access ways to transit facilities well lit to accommodate early morning, late afternoon, and evening travel?
Visibility	<ul style="list-style-type: none"> • Are open sight lines maintained between approaching buses and passenger waiting and loading areas?
Traffic Characteristics	<ul style="list-style-type: none"> • Do pedestrians entering and leaving buses conflict with cars, bicycles, or other pedestrians?
Signs and Pavement Markings	<ul style="list-style-type: none"> • Are appropriate signs and pavement markings provided for transit stops?

Figure 4.2.1 shows the bus stop placement process, from selecting a potential location to establishing a location for a bus bay or curb-side bus stop on-street (on the side of traffic lane) or off-street (removed from traffic).

When placing a bus stop at an unsignalized intersection, a minimum distance of 12 feet from the intersection point of curve/tangent or edge of crosswalk, whichever is farther back from the intersection, should be maintained. If the intersection is signalized, the minimum distance should be 5 feet from the intersection point of curve/tangent or edge of crosswalk, whichever is farther back from the intersection. Site conditions or other regulations may require more distance (see Figure 4.2.2).

Far-Side Bus Stop

Located downstream of an intersection, far-side bus stops are generally preferred to near-side stops because they result in fewer traffic delays, provide better vehicle and pedestrian sight distances, and cause fewer conflicts among buses, cars, pedestrians, and bicyclists. Far-side stops are recommended particularly when the street is wide enough to permit other vehicles to pass uncontrolled around the stopped bus.³

Near-Side Bus Stop

Located at the near side (upstream) of an intersection, near-side stops should be located at least 100 feet in advance of the intersection to avoid conflicts with vehicles. Near-side stops are preferred on two-lane roadways without a bus bay, where vehicles are restricted from going around the bus to prevent the stacking of vehicles in the intersection. Near-side stops should be used where far-side stops cannot be provided. Near-side bus stops are also appropriate when street crossings and other pedestrian movements are safer on the near side than the far side. Near-side stops are also appropriate when the cross-street is one-way from right to left or when the bus route requires the bus to turn right at an intersection.⁴

When locating a near-side bus stop, it should be in advance of the leading taper for the right-turn lane

to provide sufficient distance for drivers to see and access the turn lane.³ Avoid near-side stops at intersections with dedicated right-turn lanes where right-on-red turning is permitted.

Mid-Block Bus Stop

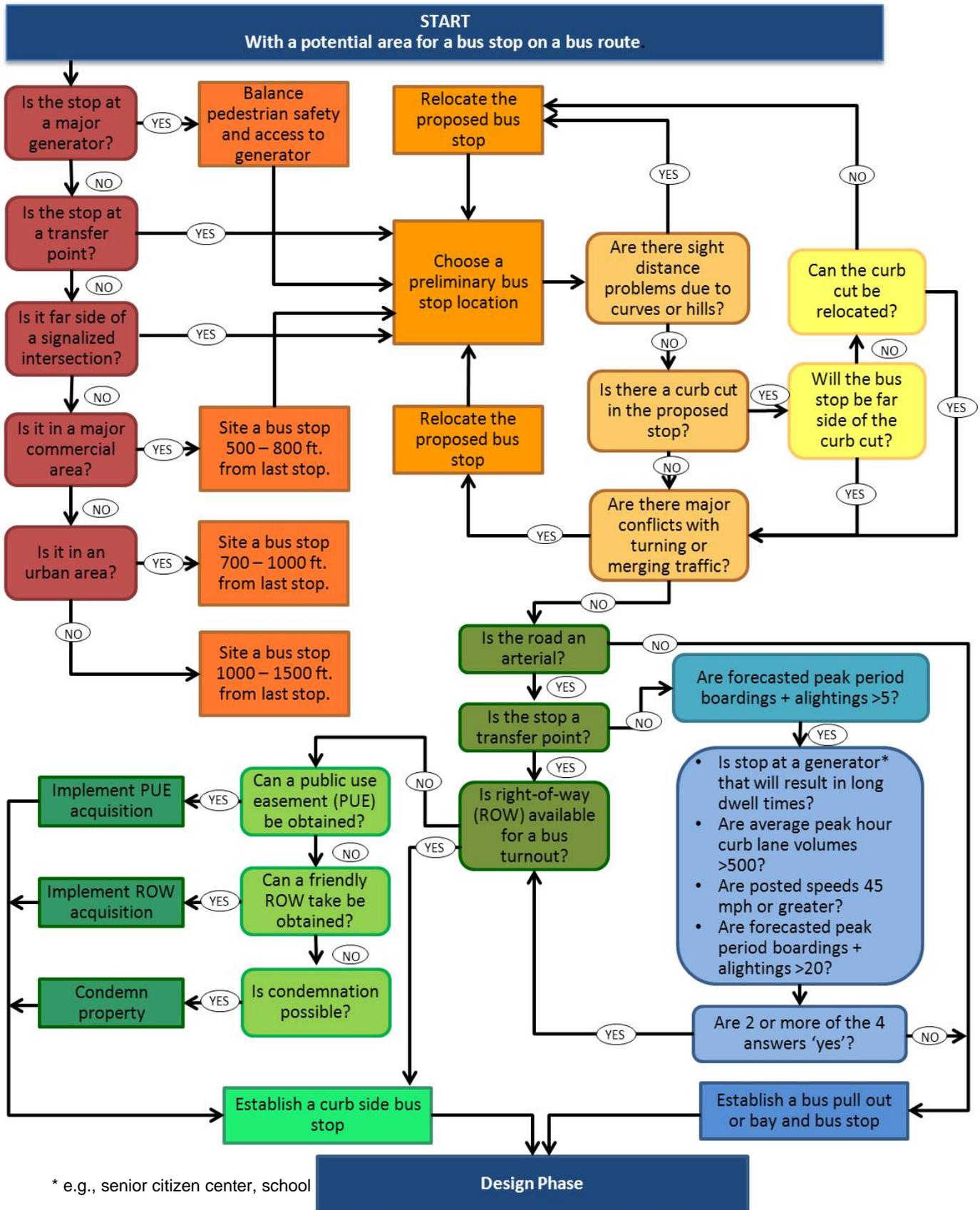
Mid-block stops are located halfway between intersections and generally should be avoided. They are appropriate only when traffic or street/sidewalk conditions at the intersection are not conducive for a near-side or far-side stop.³ They also are suitable at locations where a major passenger traffic generator is located in the middle of the block or when the interval between adjacent stops exceeds stop spacing standards for the area.⁴ Mid-block stops are also suitable when the design is compatible with a corridor or district plan. Mid-block crosswalks should be discouraged immediately downstream from an intersection, within 1/8-mile or 600 feet, because the distance to the intersection is near enough to walk and drivers will not expect a mid-block pedestrian crossing.³

Because of safety concerns, mid-block stops are not recommended near schools. In addition, mid-block crossings should be well-lit and well-marked. Some analyses have shown that 50 percent of all urban pedestrian crashes involve dashes into the street at mid-block locations or intersections. Frequently, the cited cause of these incidents is on-street parked cars that obstruct visibility for the pedestrian and motorist. On-street parking should be prohibited in advance of all mid-block crosswalks and intersections.³ Figure 4.2.2 shows the placement of bus stops with reference to an intersection.

Table 4.2.2 describes intersection bus stop location criteria along a state road facility where on-street parking does not exist.

Bus Stop Placement at Bus Bays/Bulbs

Bus bay and bus bulb applications are widely considered when locating bus stops. See Chapter 4, Section 3, for bus stop placement at bus bays and bus bulbs.



Source: *Accessing Transit, Design Handbook for Florida Bus Passenger Facilities*, Version 2, 2008.

Figure 4.2.1 | Bus stop placement flow chart.



Bus Stop Location—Advantages and Disadvantages

Far-Side Stop

Advantages

- Minimizes conflicts between right-turning vehicles and buses.
- Provides additional right-turn capacity by making curb lane available for traffic.
- Minimizes sight distance problems on approaches to intersection.
- Encourages pedestrians to cross behind the bus.
- Creates shorter deceleration distances for buses since the bus can use the intersection to decelerate.
- Results in bus operators being able to take advantage of the gaps in traffic flow that are created at signalized intersections.

Disadvantages

- May result in intersections being blocked during peak periods by stopping buses.
- May obscure sight distance for crossing vehicle.
- May increase sight distance problems for crossing pedestrians.
- Can cause a bus to stop far-side after stopping for a red light, interfering with both bus operations and all other traffic.
- May increase number of rear-end accidents since drivers do not expect buses to stop again after stopping at a red light.
- Could result in traffic queued into an intersection when a bus is stopped in travel lane.

Near-Side Stop

- Minimizes interferences when traffic is heavy on far side of intersection.
- Allows passengers to access buses closest to crosswalk.
- Results in width of intersection being available for driver to pull away from curb.
- Eliminates potential of double stopping.
- Allows passengers to board and alight while bus is stopped at red light.
- Provides driver with opportunity to look for oncoming traffic, including other buses with potential passengers.

- Increases conflicts with right-turning vehicles.
- May result in stopped buses obscuring curbside traffic control devices and crossing pedestrians.
- May cause sight distance to be obscured for cross vehicles stopped to right of bus.
- May block through lane during peak period with queuing buses.
- Increases sight distance problems for crossing pedestrians.

Mid-Block Stop

- Minimizes sight distance problems for vehicles and pedestrians.
- May result in passenger waiting areas experiencing less pedestrian congestion.
- Requires additional distance for no-parking restrictions.
- Encourages patrons to cross street at midblock (jaywalking).
- Increases walking distance for patrons crossing at intersections.

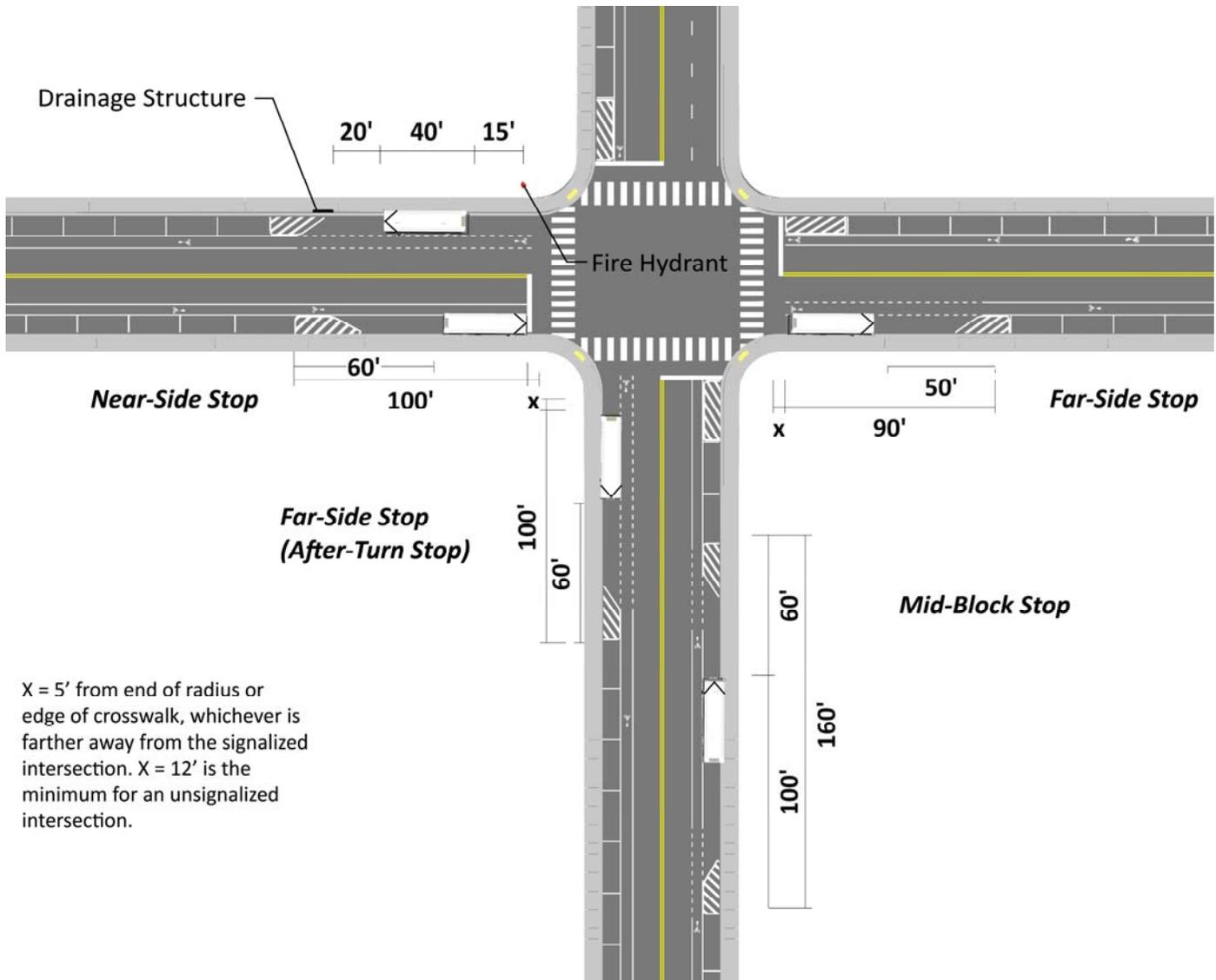


Figure 4.2.2 | Bus stop locations in relation to an intersection.

Bus Stop Placement – Special Cases

Near a Bridge

Upstream – The bus stop should be far enough upstream from the bridge so that passengers do not have to straddle the guard rail or anchorage, or be in jeopardy of falling down drop-offs or off any side-fill slopes. The stop should be located upstream enough to have a flat surface large enough to accommodate an ADA-compliant B&A area. Where a greater incline approach to the bridge exists, the stop should be located at an adequate distance to allow the bus to go from a

stop and get up to the required speed to cross over the bridge.

Downstream – The bus stop should be located enough distance downstream from the bridge to allow the bus to make a safe stop. There must also be consideration given to allow for adequate site distance to accommodate the traffic behind the bus to see a stopped bus as well as safely maneuver around a stopped bus.

Agencies should refer to appropriate *FDOT Design Standards* and coordinate with the Design Office when placing bus stops near bridges.

**Table 4.2.2
Intersection Bus Stop Location Criteria**

Bus Stop Variables	Near-Side Major Intersection	Far-Side Major Intersection	Near-Side Minor Intersection	Far-Side Minor Intersection
No turn lanes in direction of transit	Not recommended unless 2-lane roadway*	<ul style="list-style-type: none"> Not recommended unless 2-lane roadway 10' before entry taper for turn bay 100' if drop lane 	Not recommended unless 2-lane roadway	Not recommended unless 2-lane roadway*
Right-turn lane on near side in direction of transit	40' for a standard bus (60' for articulated bus)	40' for a standard bus (60' for articulated bus)	110' **	45' for a standard bus (65' for articulated bus)***
Right-turn lane on near side and auxiliary lane on far side in direction of transit**	12' min.	<ul style="list-style-type: none"> As close to entry taper as possible 	N/A	N/A
Auxiliary lane on far side in direction of transit***	40' for a standard bus (60' for an articulated bus)	40' for a standard bus (60' for articulated bus)	N/A	N/A

*If necessary, 12-foot minimum dimension is required.

**This combination of bus bays is referred to as a queue jump bus bay.

***This arrangement is referred to as an open bus bay.

Adjacent to a Canal

Where right-of-way is constrained, a bus stop could be designed to encroach into the canal right-of-way or be built partially or wholly over the canal. Adequate canal flows must be maintained in areas where the bus stop encroaches into the canal section. A continuous handrail or pedestrian/bicycle rail on a barrier wall should be provided around stops immediately adjacent to canals. It is desirable that all bus stops in urban areas be located at least 20 feet from canals and 6 feet from a drop-off location.

Near Guardrails

When a guardrail runs parallel to a roadway that has or will have transit service, the bus stop should be located outside the guardrail and an opening provided in the guardrail to permit pedestrian access. A B&A area must be provided at the guardrail opening to permit access to the bus.

The purpose of the guardrail may be to protect motorists from a steep slope adjacent to the roadway. In these locations, the designer must review the conditions adjacent to the proposed bus stop and protect pedestrians from any identified hazards with a handrail or fence. Pedestrian access behind the guardrail should be limited to the area of the bus stop. Pedestrian guard rails should be implemented immediately adjacent to canal or drop-off locations if a bus stop location has a dangerous drop-off or is located near drainage or a canal.⁵ Figure 4.2.3 shows an example of a bus stop near a guardrail and adjacent to a canal. For specific guidance on drop-off hazards for pedestrians, see the most recent *PPM*, Section 8.8. Refer to the *FDOT Design Standards* for details on guardrails and barriers.

Near a Driveway

Whenever possible, bus stops should be located beyond driveways to minimize conflicts between

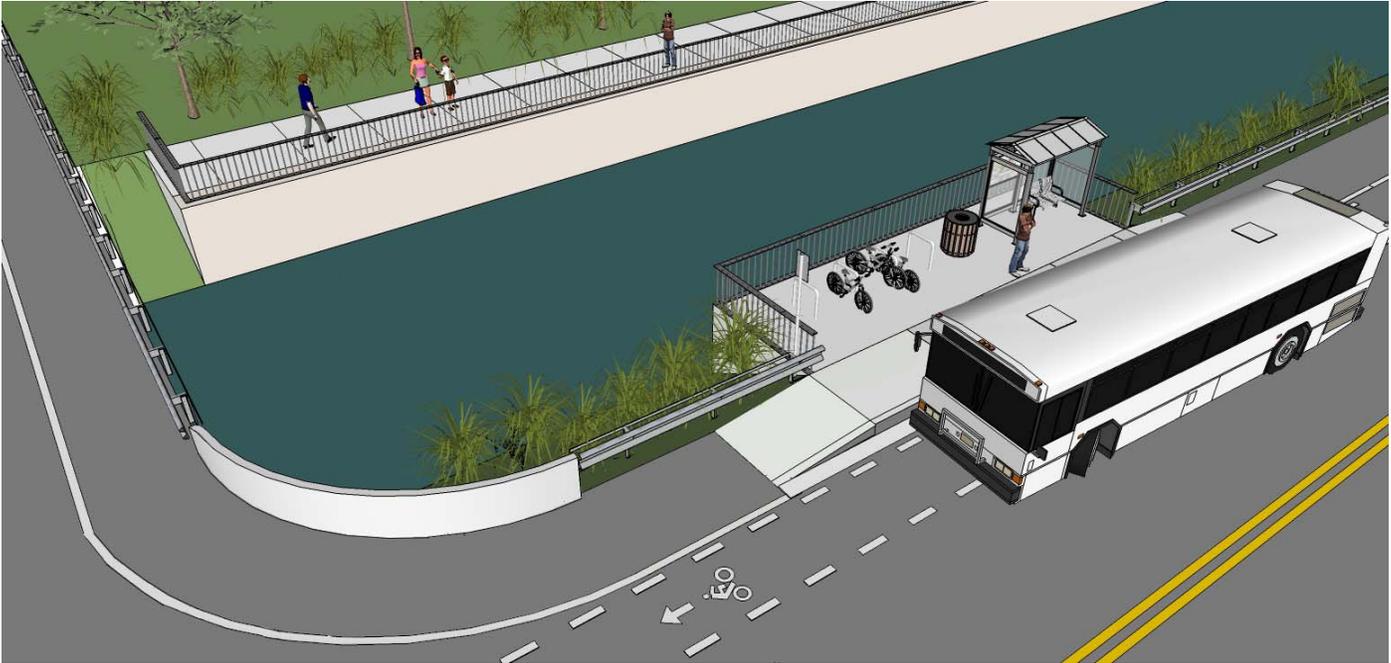


Figure 4.2.3 | Bus stop located near a guardrail adjacent to a canal.

buses and other vehicles leaving or entering driveways. Figure 4.2.4 provides examples of acceptable bus stop placements near driveways. Ideally, transit stops should be located a minimum of 200 feet from any existing driveway. It is recommended that a bus stop be located downstream of traffic movement from a driveway. If blocking a driveway cannot be prevented, at least one entrance and exit to a property should remain open at all times while a bus is loading or unloading passengers. Bus stop infrastructure and

amenities should not block the view of traffic entering or exiting the driveway. Bus stops where a vehicle blocks an access way should not be layover points or transfer locations. The transit agency should consult roadway authorities and property owners when there is a possibility of a transit vehicle blocking the only access route to a property.⁴ See the *FDOT Driveway Information Guide* in the Index of Resources at the end of this handbook for more information on driveways.

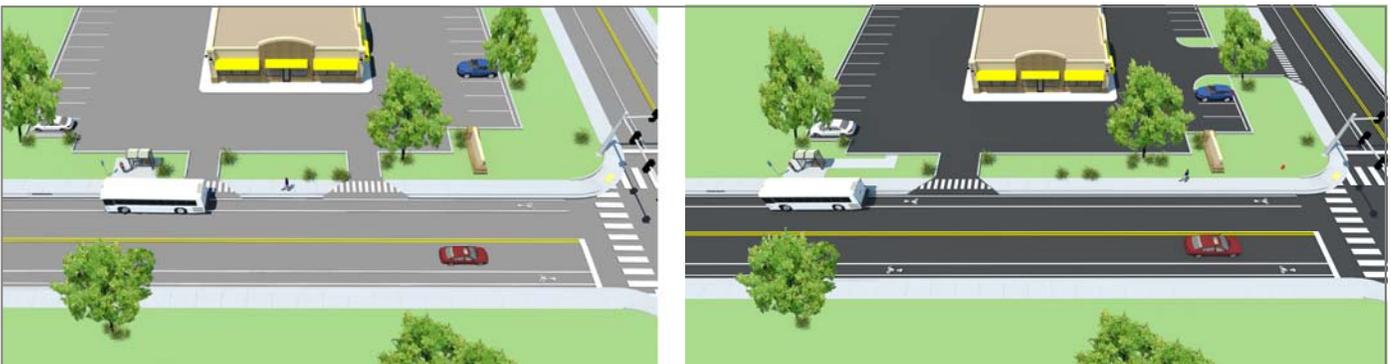


Figure 4.2.4 | Examples of acceptable bus stop placements near driveways.

At a Roundabout

Roundabouts should be treated similar to conventional intersections. The goal when locating a bus stop in relation to a roundabout should be to avoid the queuing of vehicles back into the circulatory roadway. Since the bus stop should, where possible, be located on the far side of the roundabout after the exit, the stop should either use a bus bay or be far enough downstream from the splitter island to avoid a long queue from interfering with circulation within the roundabout.^{6,7}

Areas of Limited Visibility

Bus stops should not be located over the crest of a hill, immediately after a road curve to the right, or at other locations that limit the visibility of the stopped bus to oncoming traffic. If the bus stops in the travel lane at such locations, it is in danger of being struck from the rear. Even if the bus pulls off the road at such stops, pulling back into the travel lane presents accident potential.⁴ If a bus stop must be placed at such a location, approaching cars should be warned of the need to be prepared to stop. Proper signage for this advance warning can be found in the *MUTCD*.

Near Schools

In locating transit facilities near primary schools, stops should be placed in an area where they can be visually monitored by school personnel and/or crossing guards to increase security. Mid-block stops near schools are not recommended.

Rural Bus Stops

Bus stops in rural areas require special consideration. Because of roadway design speed, right-of-way constraints, and site distances, as well as accessibility concerns, rural bus stops should be carefully designed. Like all stops, they also must meet all applicable ADA Standards. Refer to *FDOT Design Standards*, Index 546, for site distances for rural stops at intersections on the State Highway System. The *Florida Greenbook* should be referenced for any roadways not on the State Highway System. Refer to *FDOT Design Standards*, Index 700, for clear zone requirements.

In addition, rural shelters must meet hurricane wind load design strength requirements found in the F.B.C. Any associated amenities also must either be placed outside of the clear zone or meet frangibility requirements.

Near Railroad Crossings

The following requirements and limitations should be considered when locating bus stops near railway crossings. Refer to *FDOT Design Standards*, Index 17346 and Index 17882, *PPM*, and *MUTCD* for additional requirements and guidelines on placing bus stops near a railway crossing.

- If a bus stop is provided near a railroad crossing, it should be located on the near side of the crossing in advance of the railroad crossing stop bar.
- If a bus stop is provided near a railroad crossing, it should be placed a minimum of 25 feet in advance of the railroad crossing pavement markings. If a bus bay/pullout is provided near a railroad crossing, it should be located a minimum of 50 feet from the railroad crossing stop bar. If a bus stop must be located on the far side, it should be located at least 450 feet beyond the crossing (see Figure 4.2.5).
- Bus stops should be located so that a stopped bus does not obstruct any railroad warning signs.
- It is recommended to place bus stops on the near side of a railroad crossing to avoid creating a queue that would conflict with the crossing.
- When located near-side, adequate stopping distance for the bus for a complete and safe stop should be planned accordingly and provided. Table 4.2.3 provides stopping sight distances for a near-side bus stop. In addition, these stopping sight distances apply to all instances where stopping sight distance is important.
- Near-side bus stops are recommended for bus routes that run perpendicular to railroad tracks.

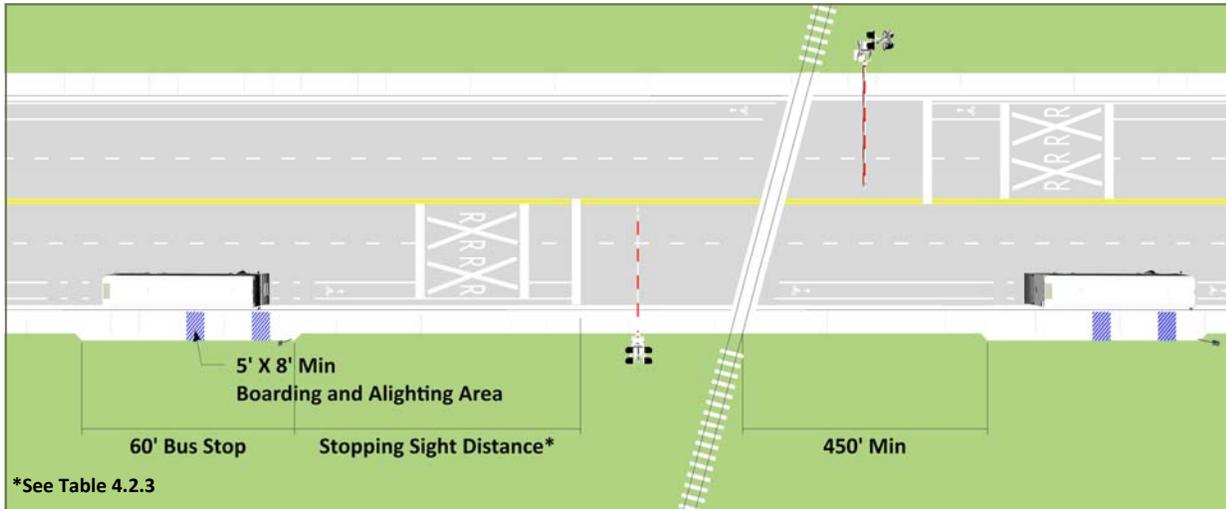


Figure 4.2.5 | Near-side and far-side bus stops near a railway crossing.

- In situations where bus routes are parallel to railroad tracks, bus stops should be placed outside of the clear zone of the railway, which is a minimum of 8 feet, or they need to be protected by crash walls.

Stop Spacing Criteria

Industry practices on spacing vary, as different agencies opt for different bus stop spacing standards. Often, bus stops are added on an as-requested basis along existing bus routes. The addition of bus stops should be evaluated carefully prior to implementation to ensure that operational efficiencies in bus services are not degraded and they do not negatively impact service reliability. Additionally, a periodic reexamination of stop spacing is recommended.

Table 4.2.4 provides examples of typical industry practices and selected agency stop spacing standards suggested from individual agency guidelines, AASHTO guidelines, and TCRP Report 19 on guidelines for the location and development of bus stops. These numbers represent typical fixed-route bus service and should not be applied to BRT or light rail modes.

Design Speed (mph)	Stopping Sight Distance (feet)*	
	Draft 2009 AASHTO Transit Guide ¹²	FDOT 2012 PPM ⁵
30	200	200
40	325	305
50	475	425
60	650	570
70	925	730

OTHER DESIGN CONSIDERATIONS IN LOCATING BUS STOPS

- When placing a stop, FAC Section 14-20.003 requires that a minimum 15-foot distance be maintained between a bus stop and a fire hydrant or an on-street parking space for persons with disabilities.
- The actual B&A area for a stop must not be located in a driveway where slopes exceed ADA Standards.
- It is desirable that a shelter be placed at a 15-foot distance from a pole (any non-frangible pole existing in the clear zone); under all circumstances, a minimum distance of 8 feet should be maintained.

Table 4.2.4
Industry Examples of Bus Stop Spacing

Agency	Conditions	Stop Spacing (in feet)
Portland, OR ⁸	Dense areas (22 units/acre)	780
	Medium- to low-density areas (4–22 units/acre)	1,000
	Low- to rural-density areas (below 4 units/acre or 10 persons/acre)	No more frequent than every 1,000
San Francisco, CA ⁹	Grades at 10%	900–1,400
	Grades > 10%	500
Hillsborough County, FL ¹⁰	CBD	400–800
	Urban	500–1,000
	Suburban	600–1,200
	Rural	800 (as needed based on development and activities)
Palm Beach County, FL ¹¹	Urbanized areas	528
	Residential areas	528–1,056
	Rural	At intersections or recognizable landmarks
TCRP Report 19 ¹²	High-density residential areas, CBDs, and major employment centers	300–1,000
	High-density residential and employment areas	500–1,000
	Suburban residential areas (4–22 units/acre)	600–2,500
	Rural areas	650–2,640
AASHTO Geometric Design Guide for Transit Facilities on Highways and Streets ¹³	CBD	<400
	Urban areas	<660
	Suburban areas	660–1,320

- Locating a bus stop on the near side of an intersection creates conflicts with turning traffic when a right-turn lane is present. If a far-side bus stop cannot be provided, a near-side bus stop should be located in advance of the leading taper for the right-turn lane to provide sufficient distance for drivers to see and access the turn lane.

The following conditions also should be considered when placing a bus stop:

- A bus stop should not be placed in free-flow right-turn lanes.³
- The higher the design speed of the roadway, the greater the distance between the bus stop and the radial point in the road before or after

Quick Facts

Location Tip

In 2009, a transit agency in the western U.S. found that nearly 70 percent of the stops on its routes did not adhere to its own policy on stop spacing. Nearly 20 percent of its route delay was related to dwell time, due in large part to bus stop density. On one of the most traveled routes, officials suggested a reduction of 9 inbound and 11 outbound stops, as doing so could save the agency nearly \$200,000 in operator costs alone, with an additional saving of 7 minutes on the route running time.⁹

the intersection will be, to meet sight distance and other standards.

- To determine how far the bus stop will accumulate a queue through an intersection, a formal queue study should be conducted for that location if a recent study cannot be found. At locations where a specific queue study does not exist or is not feasible, a minimum queue storage value of 100 feet should be used in urban or suburban areas and a minimum storage value of 50 feet in rural areas.

Street Lighting at Stop Location

Proper lighting at bus stops is an important security feature. Lighting along streets is typically designed for vehicular movement and may not always meet the illumination requirements of a transit stop. It should be ensured that lighting is suitable for both vehicular movement and the stop area. When possible, solar lighting should be used to reduce operating costs and to increase functionality during blackout periods. Figure 4.2.6 shows how light can affect a roadway segment.

- Where possible, local transit stops should be located within 30 feet of an overhead light source. A minimum distance of 15 feet is recommended between a shelter and light pole.
- Lighting fixtures should be oriented so that bus stop infrastructure (such as the shelter or other amenities) does not cast shadows on the waiting area and in a manner that allows the bus operator to see waiting patrons.
- Lighting scaled to the human body helps create pedestrian-friendly environments. Agencies should consider lighting at bus stops that attracts significant ridership in the evenings or early mornings.

- Lighting fixtures of any height should minimize glare that could adversely impact drivers and should provide even and uniform illumination over the whole area.
- Glare on signs should also be minimized to enhance their legibility.
- Places such as mid-block crossings associated with bus stops, where significant vehicle-pedestrian interactions may occur, should be illuminated to enhance the safety of bus patrons.
- Uniform illumination, rather than lighting patterns that produce bright and dark areas, is also helpful in preventing crime at bus stops.
- In rural areas, efforts should be made to maximize the safety and security of bus stops with proper lighting. The conditions for lighting transit facilities in rural areas should be reviewed on a location-specific basis. Where utility service is not readily available, solar-powered illumination should be considered.

Transit agencies should initiate private-public cooperation with neighborhood businesses, malls, hospitals, and recreational or sport facilities to provide lighting at the scale of the human body at bus stops.⁴ More information on agency coordination can be found in Chapter 7.

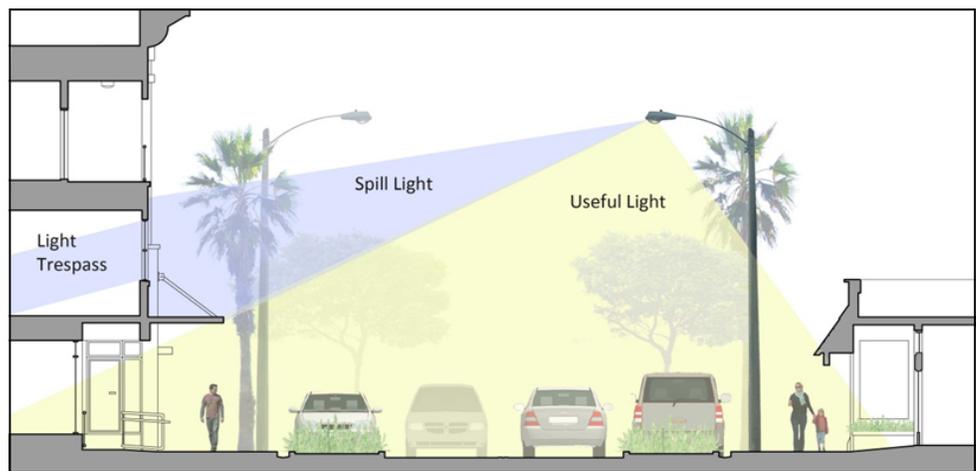


Figure 4.2.6 | Light pollution is wasteful of energy resources and causes dangerous glare that can spread into the right-of-way.

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4.3 Bus Bays, Bus Bulbs, and Nubs

BUS BAYS

Bus bays, also known as bus pullouts, improve safety for passenger alighting and boarding and provide a protected area away from moving traffic for stopped buses with long dwell times or for layovers. Bus bays can be closed or open-ended, and positioned near-side, far-side, or mid-block in relation to an intersection. They also may incorporate queue bypass lanes.

A greater distance placed between waiting passengers and the travel lane increases safety at a stop. Bus bays are encouraged on roadways with high operating speeds, such as roads that are part of the urban principal arterial system. For a particular bus stop, a high frequency of crashes involving buses is a good indicator for the need for a bus bay. Bus bays may also be appropriate in downtown or shopping areas where many passengers may board and alight at the same time.

Bus bays should be considered when right-of-way width is adequate to construct the bay without adversely affecting sidewalk pedestrian movement and also when improvements such as widening are planned for a roadway, presenting an opportunity to include a pullout in the construction process. Figures 4.3.1 and 4.3.2 show examples of bus bays. In addition, bus bays should also be considered when:

- The curb lane (traffic lane next to curb) is (or will be) used by moving traffic.
- Traffic in the curb lane is between 250–500 vehicles during the peak hour.
- Traffic speed is greater than 40 mph.
- Potential exists for vehicle/bus conflicts that warrant separation of transit and passenger vehicles.
- There is a history of repeated traffic and/or pedestrian accidents at the stop location



Figure 4.3.1 | Bus bay, Baltimore, Maryland.



Figure 4.3.2 | Bus bay, Tallahassee, Florida.

(particularly rear-end collisions with stopped buses).

- Sight distances (hills, curves) prevent traffic from stopping safely behind a stopped bus.
- A right-turn lane is used by buses as a queue jump lane.
- Appropriate bus signal priority treatment exists at the intersection (near-side stop).
- Bus volumes are between 10–15 each way in the peak hour on the roadway.
- Passenger volumes exceed 20–40 boardings per hour each way.
- Average peak-period dwell time exceeds 10 to 30 seconds per bus or the bus stop location is a layover at the end of the bus trip.
- Bus parking in the curb lane is prohibited or can be prohibited.
- The bus has extended layover times to accommodate transferring passengers.
- Roadway profile low points can be avoided.
- A 2-percent cross-slope can be achieved on the roadway.

Bus bays may be appropriate at mid-block stops associated with destinations that are major transit trip generators. Bus bays at far-side stops should be placed at signalized intersections so that the signal provides gaps in traffic that permit bus re-entry into the travel lane. Near-side bus bays should be avoided because of conflicts with right-turning vehicles and delays in service resulting

from the difficulty associated with bus re-entry into the travel lane.

Bus bay designs typically incorporate five elements: an entrance taper, a deceleration lane, the stopping area, an acceleration lane, and an exit taper. Bus stop B&A areas at bus bays shall comply with surface, dimension, connection, and slope requirements for an ADA-compliant B&A area. Bus bays must meet all requirements in the *PPM, Florida Greenbook, and FDOT Design Standards*. Figure 4.3.3 shows the elements and key measurements of a bus bay. Also, the engineering design layouts at the end of this section show far-side and mid-block bus bay configurations as recommended by the *PPM*.

The design of bus bays should aim to reduce automobile-bus conflicts, provide greater separation between traffic and pedestrians waiting for a bus, and allow a bus to quickly regain its travel speed upon its re-entry into traffic.

The total length of a bus bay should allow room for an entrance taper, a stopping area, and an exit taper, at a minimum. However, in some cases, it may be appropriate to consider providing acceleration and deceleration lanes, depending on the volume and speed of the through-traffic.¹ Speed impacts the deceleration and acceleration lane lengths, which will impact the right-of-way cost.

Table 4.3.1 provides sample lengths for acceleration lanes, deceleration lanes, and entrance and exit tapers. The lengths are based on

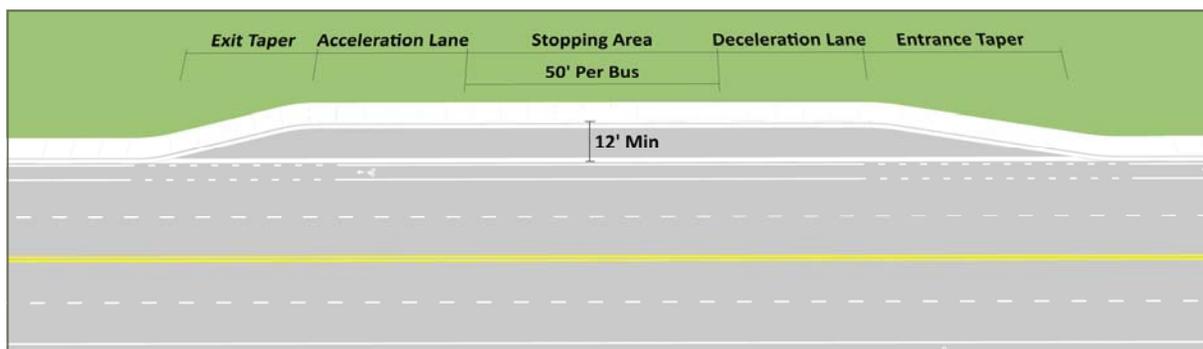


Figure 4.3.3 | Typical bus bay elements. (See Table 4.3.1 for element dimensions.)

**Table 4.3.1
Bus Bay Element Lengths and Speeds²**

Through Speed (mph)	Enter Speed (mph)	Element Length					
		Entrance Taper (feet)	Decel. Lane (feet)	Stopping Area (feet)	Accel. Lane (feet)	Exit Taper (feet)	Total (feet)
<30	<20	5:1 min	None	50	None	3:1 max	130 min
35	25	170	165	50	250	170	805
40	30	190	265	50	400	190	1,095
45	35	210	360	50	700	210	1,530
50	40	230	470	50	975	230	1,955
55	45	250	595	50	1,400	250	2,545
60	50	270	735	50	1,900	270	3,225

the through-speed of the adjacent travel lane and the speed of the bus entering the bus bay.

In curb-and-gutter locations, the bus bay pavement should slope into the roadway at a 2-percent cross-slope that directs run-off to a drainage structure located outside of the bus bay area. In the absence of curb and gutter, the bus bay pavement or B&A areas should be sloped away from the roadway (2% cross-slope minimum or matching the adjoining roadway pavement slope) to direct run-off to roadway drainage ditches. Standard asphalt pavements are normally adequate to handle bus traffic, including bus bays. For concrete pavements, it is important to provide adequate sub-grade drainage, thickness, and joint details.

A mid-block crosswalk can be used in locations where there is a major transit-oriented activity center or the distance to the next intersection is greater than 300 feet. Bus bays should not be located on low profile points to avoid placing passengers in areas of potential ponding. Drainage structures should not be located within the bus bay stopping area/passenger loading areas.

Signing/pavement markings near bus bays shall differentiate bus bays from travel lanes. Generally, a broken 6-inch white stripe, 2-foot dash, 4-foot skip should be used in areas where buses will be entering/leaving the bus bay (acceleration/ deceleration lanes). A solid 6-inch white stripe should be used between dashed areas to delineate the travel lane for through vehicles.

Drainage inlets should not be placed in a bus bay, except at the exterior edge when drainage restrictions are severe. The *PPM* should be used for guidance on alternative pavement treatments (patterns or textures), standards, and limitations on materials used for bus bays. Architectural pavers are not acceptable for use on the State Highway System in the travel way, but can be used elsewhere, as specified in Volume I, Subsection 2.1.6 of the *PPM*.

Alternatives to bus bays should be considered when traffic volumes exceed 1,000 vehicles per hour per lane and in high-density commercial areas with on-street parking. Also, the right-of-way width should be adequate to construct the bay without adversely affecting sidewalks and, thus, pedestrian movement. Bus bulbs are potential alternatives to bus bays.

Lighting designs for bus bay pavement areas should meet the same criteria for minimum illumination levels, uniformity ratios, and maximum-to-minimum ratios that are being applied to adjoining roadways based on FDOT Lighting Design Criteria.

CLOSED BUS BAY

A closed bus bay consists of a physical entrance taper, a stopping area, and a physical exit taper. Closed bus bays are usually located at far-side bus stops at signalized intersections. The signal creates breaks in the flow of traffic to permit bus

operators to re-enter the travel lane. They are also provided at mid-block bus stops near major transit destinations with high passenger activity and longer-than-average dwell time.

As previously indicated, these are recommended for far-side bus stops at signalized intersections or at mid-block bus stops near major transit destinations. Near-side bus bays are generally not recommended because of conflicts with vehicles approaching the intersection in a curb lane to make a right-turn. Figure 4.3.4 provides an example of a closed bus bay. Figure 4.3.5 shows an experimental “Smart” bus bay in Gainesville, Florida.

OPEN BUS BAY

An open bus bay does not have a physical entrance taper and is thus open to the upstream intersection. This type of bus bay is recommended for far-side applications at signalized intersections, as the signal creates breaks in the flow of traffic to permit bus operators to re-enter the travel lane. Open bus bays are not recommended on facilities of six or more lanes. In near-side applications, an open bus bay at an intersection may result in use by right-turning traffic, but can be effectively used as part of a queue jump bus bay.

The typical size of an open bus bay for a 40-foot bus with a design speed of 40 miles per hour consists of a 50-foot stop area for one bus and a 400-foot acceleration lane. (See Table 4.3.1 for element dimensions and design speed for bus bays.) Figure 4.3.6 presents an example of an open bus bay.



Figure 4.3.4 | Closed bus bay.



Figure 4.3.5 | Experimental “Smart” closed bus bay, Gainesville, Florida.



Figure 4.3.6 | Open bus bay.

QUEUE JUMP BUS BAY

This application requires an open bus bay on the far side of a signalized intersection where the bus stop is located and an extended lane on the near side of the intersection to bypass the traffic queue stopped at the signal. This type of bay is most effective with signal prioritization that allows buses to bypass traffic congestion by moving ahead of other vehicles through the intersection. It provides a double benefit by removing stopped buses from the traffic stream and guiding them through congested intersections.³ It is most suitable for far-side open bus bays on high-frequency bus service routes on streets with traffic volumes of 250 vehicles per peak-period hour or level of service “D” or worse.³ For more information on signal timing and prioritization, see Chapter 4, Section 4. Figure 4.3.7 presents an example of a queue jump bus bay at an intersection with transit signal priority.

The length of an extended lane in a queue jump bus bay should be sufficient to exceed the traffic queue, but not less than 240 feet.² The extended bus lane can be designed as a “right-turn-only except buses” lane. Signalization, if combined with transit signal priority, should be provided as per the *MUTCD* guidelines.

OFF-STREET HALF-SAWTOOTH BUS BAY

Half-sawtooth bus bays should be used at off-line transfer centers where the length of the site is limited, but where the depth of the site is adequate to accommodate bus movement in and out of the bays. This configuration allows buses to leave the bus bay without having to wait for buses ahead of them to exit. Compared to parallel bus bays, half-sawtooth bus bays require greater station width but allow for shorter stations. Half-sawtooth bus bays are sometimes used where space is limited to provide the optimum number of bus loading positions. These are typically located in bus waiting or parking facilities and are not located in the roadway right-of-way.



Figure 4.3.7 | Queue jump bus bay at an intersection with transit signal priority.



Figure 4.3.8 | Example of off-street half-sawtooth bus bay.

The loading-lane width of 21 feet and 11 inches, as shown in Figure 4.3.8, is the minimum berth width required for 40-foot buses with bus-mounted bicycle racks. These lengths would have to be extended for articulated buses by 20 feet.

Re-entering and merging into traffic flow is considered the major safety concern with using bus bays. F.S. 316.0815 specifies that the driver of a vehicle shall yield the right-of-way to a publicly-owned transit bus traveling in the same direction that has signaled and is re-entering the traffic flow from a specifically-designated pullout bay.

BUS BULBS/NUBS

Bus bulbs/nubs extend the curb into the parking lane, providing additional space for pedestrians to walk and transit patrons to wait for the bus. The extended areas also provide space for bus stop amenities. A bus bulb (or bus nub or curb extension) can be located on the near side, far side, or both sides of an intersection and involves the extension of a sidewalk across a shoulder or parking lane to the edge of the first through traffic lane.

Since buses stop in the moving traffic lane to pick up and discharge passengers, bus bulbs tend to reduce delays associated with buses reentering

traffic. Figure 4.3.9 shows an example of a bus bulb, and Figure 4.3.10 shows the typical layout and dimensions of a bus bulb.

Bus bulbs and curb extensions are recommended for streets that are perceived to be pedestrian-



Figure 4.3.9 | Bus loading at a bus bulb on Broadway, Manhattan, New York.

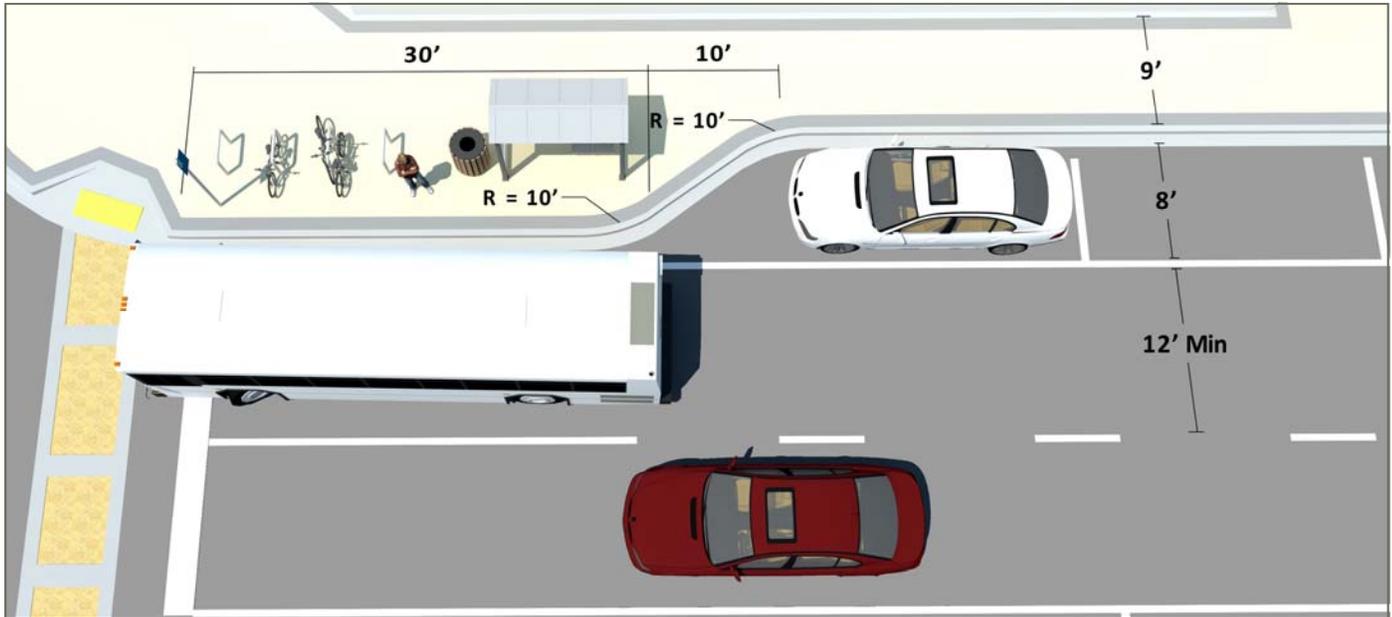


Figure 4.3.10 | Dimensions of a near-side bus bulb.

friendly, have relatively low traffic volumes and speeds below 40 mph, and allow curb parking. They may be appropriate in urban settings with high-density, mixed-use developments and crowded sidewalks, where the number of people moving along the street as pedestrians or as transit patrons is high and may exceed the number of people in personal vehicles.²

Bulbs should be located in the following areas:

- Where parking is critical (and bus bays may take up too much space).
- Where buses experience delays in re-entering the traffic lane.
- Where traffic calming is desired.
- On streets that are perceived to be pedestrian-friendly.
- On the near side of signalized intersections.
- On streets with design speeds up to 40 mph.
- In low traffic volume areas or on streets with diagonal or parallel parking.
- Where mid-block stops may be appropriate to serve a transit demand generator.

Bus bulbs are not appropriate at locations where:

- Streets have design speeds greater than 40 mph or high-volume facilities.
- Bus route requires the bus to make a right-turn, unless the bulb precedes a right-turn lane.
- Transit corridors serve a large wheelchair-dependent population.
- Areas have low transit ridership or pedestrian activity.
- Streets have high traffic volumes.
- Streets do not have 24-hour on-street parking.
- Streets have high bicycle traffic.
- Streets have only two lanes (where traffic cannot pass a stopped bus).
- Sites have drainage problems (making boarding difficult for patrons).
- Bus stops allow buses to layover.

The bulb should be a minimum of 6-feet wide, leave a 2-foot offset between the bulb and the edge of the travel lane, and be long enough to allow for the simultaneous boarding of several buses as required.

The near-side bus bulb design limits opportunities for bus traffic signal priorities. Cars behind a stopped bus, however, are queued mid-block. The far-side bus bulb design permits bus traffic signal priority, and cars turning right can use the curb lane.

Drainage patterns may need to be reworked to prevent water from ponding in the stop vicinity. Right-turn restrictions may be required because of the tighter curb radius associated with the treatment.

At intersections, nubs should be designed to allow for bus turning movements and can form bus bulbs that allow buses to make curbside stops without weaving in and out of the travel lane. They also have a traffic calming effect.

Bus Bulb/Nub Impact on Bicycle Movement

Provisions for cyclists should be considered since bicycle lanes may have to be routed around the

curb extension, creating potential vehicle and bicycle conflicts. See Section 4.5, Pedestrian and Bicycle Access to Bus Stops, for more information on bicycle lane considerations and issues at bus bulbs/nubs.

Bus Bulb/Nub Impact on Pedestrian Movement

Bus bulbs/nubs, primarily at intersections, shorten pedestrian crossing distances and increase the visibility of pedestrians at roadway crossings (see Figure 4.3.11). They also narrow the curb-to-curb width of a roadway, potentially reducing motor vehicle speeds and improving pedestrian safety. Curb extensions at bus stop locations can help preserve on-street parking because fewer parking spaces need to be removed for buses to pull to the curb. Bus bulbs may improve transit operations by enabling a bus to pull to the curb more easily and board and discharge passengers more quickly. They also help to increase the clear-width on sidewalks by locating the shelter out of the pedestrian travel way.⁴

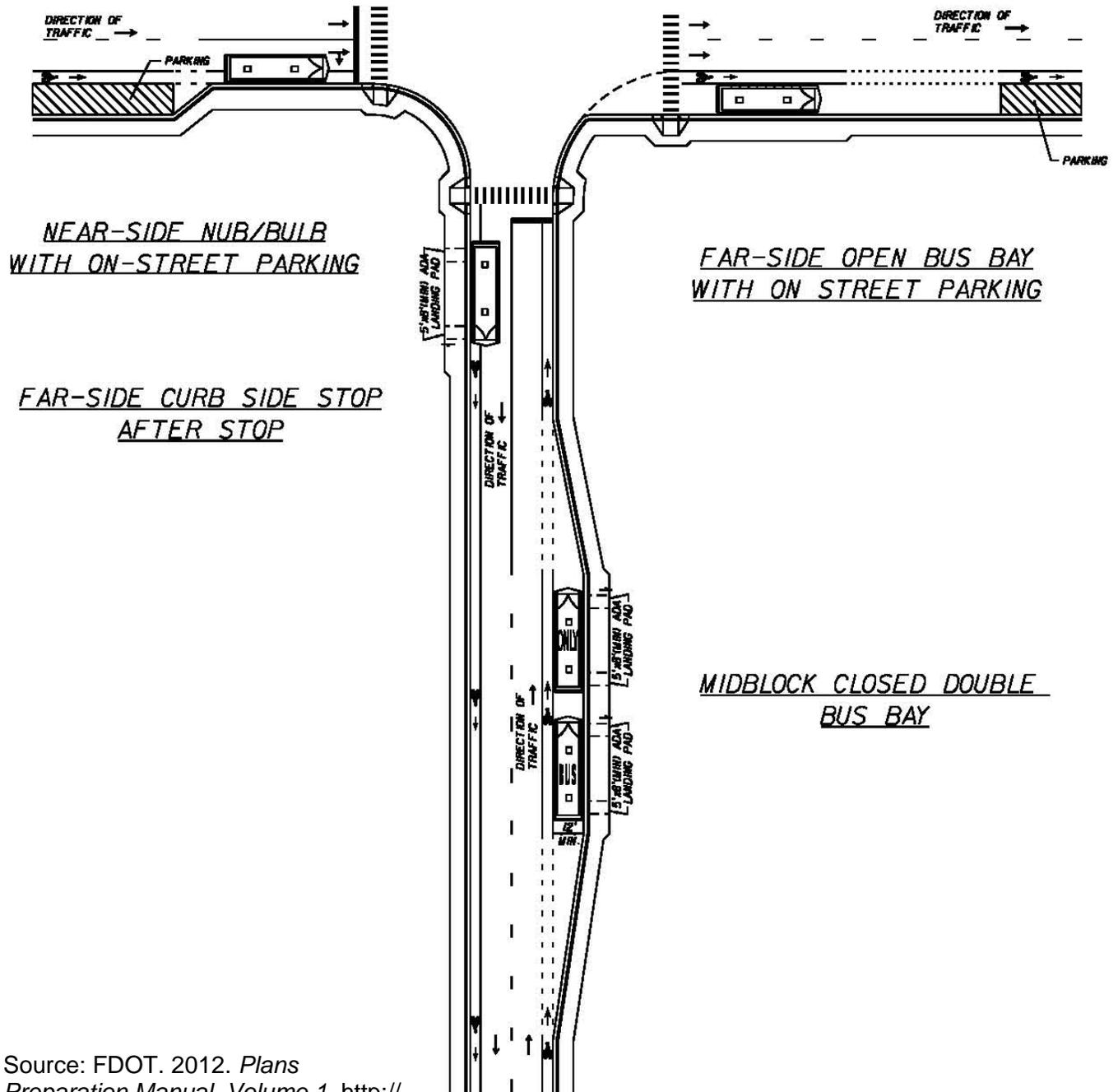


Figure 4.2.11 | Intersection with intersection nubs.

ADDITIONAL RESOURCES

Engineering Design Templates

Figure 4.3.12 shows bus stop and bus bay categories. For more information, refer to FDOT's *PPM, Volume 1*.



Source: FDOT. 2012. *Plans Preparation Manual, Volume 1*. <http://www.dot.state.fl.us/rddesign/>

Figure 4.3.12 | Design of bus bays, nubs, and stops.

REFERENCES: SECTION 4.3

1. FDOT, 2012. *Plans Preparation Manual, Volume 1*.
<http://www.dot.state.fl.us/rddesign/PPMManual/PPM.shtm>, accessed February 23, 2012.
2. AASHTO, 2009. *Geometric Design Guide for Transit Facilities on Highways and Streets*. Ballot Draft.
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4.4 Traffic Signals and Transit Priority

OVERVIEW

When operating in mixed traffic, granting preferential treatment to buses at signalized intersections can contribute significantly to fast and reliable transit services on arterial streets. This section looks at the two most common methods of bus preferential treatments used in the U.S. and elsewhere—transit signal priority and queue jump. A third method, bus bulbs/curb extensions, is discussed in the Bus Bays and Bulbs section of Chapter 4 (Section 3).

TRANSIT SIGNAL PRIORITY

Transit Signal Priority (TSP) is the most popular preferential treatment on urban streets as it improves transit operations and service quality, which, in turn, can help influence increased transit usage. TSP temporarily adjusts traffic signal timing at intersections to give priority to transit operating in mixed traffic or in an exclusive bus lane.

The basic principle of TSP is that a bus is automatically detected on the approach to a signalized intersection, and the signal timing and phasing are adjusted to provide the bus with clear passage through the intersection. This may save the bus up to one minute or more of signal delay wait time at a red light.



TSP vs. Signal Pre-Emption

TSP differs from signal pre-emption in that it temporarily modifies signal timing to accommodate transit, while pre-emption (e.g., for an emergency vehicle or a train crossing) completely interrupts the signal cycle. After the interruption, the cycle returns to the normal signal timing plan. In almost all applications, transit priority does not involve pre-emption.

A TSP system typically is used on corridors with high ridership, moderate frequencies of buses, and significant corridor congestion. Bus routes with the most delay should be considered as the highest priority routes for TSP system implementation. Studies have found that TSP is most effective at signalized intersections operating under level of service “F” conditions (severe congestion, as defined in *FDOT Level-of-Service Handbook*), with a volume-to-capacity of ratio between 0.80 and 1.00. A basic guideline is to apply TSP when there is an estimated reduction in bus delay with negligible change in general traffic delay.¹ Table 4.4.1 lists the benefits of using TSP for transit based on location and other factors.

TSP applications are desirable in the following conditions:

- Person-minutes saved by bus and vehicle passengers along the bus route exceed the person-minutes lost by side-street vehicle drivers and passengers.

Table 4.4.1
Factors to Consider When Implementing TSP

Greater Benefits Achieved	Lesser Benefits Achieved
Far-side stops	Near-side stops
Buses behind or on schedule	Buses ahead of schedule
Variety of bus routes with moderate to lengthy headways	High-frequency service where “on schedule” is irrelevant to passenger
Congested corridors	Oversaturated corridors
High transit ridership corridors where overall person travel time savings can be achieved	Low level of transit ridership unless done specifically to promote significant ridership increase

- Side-street green time can be reduced and still provide adequate clearance times for pedestrians crossing the artery.
- Increased queues on side-streets are manageable.

When TSP is applied to an intersection, the following guidelines should be considered:

- The traffic signal cycle may extend or advance the green time, but the additional green time should be available only to buses running late.
- Priorities should not be given in two successive cycles.
- Approaching bus flow volumes in any direction should not exceed 20–30 buses per hour.

The most basic and widely-used TSP strategies include passive and active priority. Passive strategies provide some level of transit priority through the use of pre-timed modifications to the signal system that occur whether or not a bus is present. Applications could range from just one signal to an entire signal system in a corridor. Active strategies adjust the signal timing after a transit vehicle is detected approaching an intersection.



Design Tip

The road authority responsible for overall intersection operations should attempt to accommodate TSP measures while maintaining signal progression and minimizing traffic delays for other vehicles and pedestrian impacts.

Refer to *MUTCD* for design or application of any traffic control device contained in this section. Construction procedures related to TSP applications along state roads must comply with FDOT requirements. Under all conditions, all facilities must comply with applicable FDOT and local regulations.

Some of the key design considerations for implementing TSP are shown in Table 4.4.2. Passive and active strategies in TSP are described in the following sections.

Passive Transit Signal Priority

In passive TSP, traffic control devices are adjusted to suit the bus schedule along the route, generally using a combination of fixed-time and schedule-

**Table 4.4.2
Design Considerations for Implementing TSP**

Transit agency and signal operator should define the functional parameters for TSP. This agreement should consider:

- Roadway geometry and traffic volumes.
- Traffic improvements at cross-streets to increase capacity.
- Traffic signal hardware and software (capability of existing equipment; specifications for future equipment).
- Traffic signal operation.
- Overall person delay.
- Pedestrian needs.
- Coordination with other signals/signal progression.
- Emergency pre-emption systems, if present.
- Traffic agency signal operation policy and practices.

Transit agency should consider TSP needs in the context of:

- Bus service and operations (express/local bus mix, left- and right-turn requirements, etc.).
- Bus stop location.
- Compatibility with existing transit hardware and software (ability to communicate between the bus and the signal controller).
- Transit agency operating policies, practices, and standards (e.g., on-time performance criteria).
- Coordination with other transit priority measures such as bus lanes.

based control strategies. Passive priority is usually implemented only on roads with significant transit usage, often close to the bus origin point where schedules are most likely to be adhered to.

Passive priority costs less, but offers limited potential to improve bus operations. Passive improvements may also include such things as adjusting signal timing plans, reducing cycle length, or coordinating signals on a corridor. Simply timing the intersection to minimize person delay, as opposed to vehicle delay (person delay refers to the total time required to move individuals, as opposed to their vehicles), is considered a passive strategy.² Passive signal priority can benefit transit service, requires no equipment, and operates regardless of the presence or absence of a transit vehicle.³

Active Transit Signal Priority

An active priority system detects buses on approach to an intersection and then changes the traffic signals. For example, a green extension strategy can extend the green light at an intersection as a bus approaches so that there is no wait at the intersection, while a red truncation strategy can shorten a red light to help make the bus wait a shorter period of time. An active priority system is usually installed at specific points along the corridor associated with signalized intersections.

Figure 4.4.3 shows examples of red truncation and green extension TSP, and Figure 4.4.4 shows components used for active TSP systems.

Active signal priority can take several forms:³

- *Early green phase (red truncation)* – When a bus is detected approaching on a red phase, the cross-street’s green phase(s) is truncated (Figure 4.4.3 A).
- *Extend green phase (green extension)* – When a bus is approaching on a green phase, the phase extends until the bus passes through (Figure 4.4.3 B).
- *Special signal phasing* – This strategy may include a number of strategies using traffic signals at intersections, including inserting

special bus phases. A description of these special phases follows.

Special Signal Phasing

This strategy includes introducing a transit-only signal or adding a signal phase into an intersection. This typically involves provision of one or more of the following features at intersections:

- *Special left-turn* – Provision of a special left-turn signal at a desired location to allow transit vehicles to make left turns onto a cross-street.
- *Special right “bus-only or turn”* – When a bus is on the far-right lane at the intersection, a “bus-only or turn” phase allows the bus to move while other vehicles are stopped (Figure 4.4.6).
- *Re-order phases to favor bus route* – Shift, for example, a lagging left-turn phase to a leading left to accommodate a waiting or approaching bus.

Bus Vehicle Detection

When implementing TSP, transit agencies also should consider various vehicle detection systems and select the appropriate strategy that is applicable. Transit vehicles may be detected in four ways, as indicated in Table 4.4.3.³

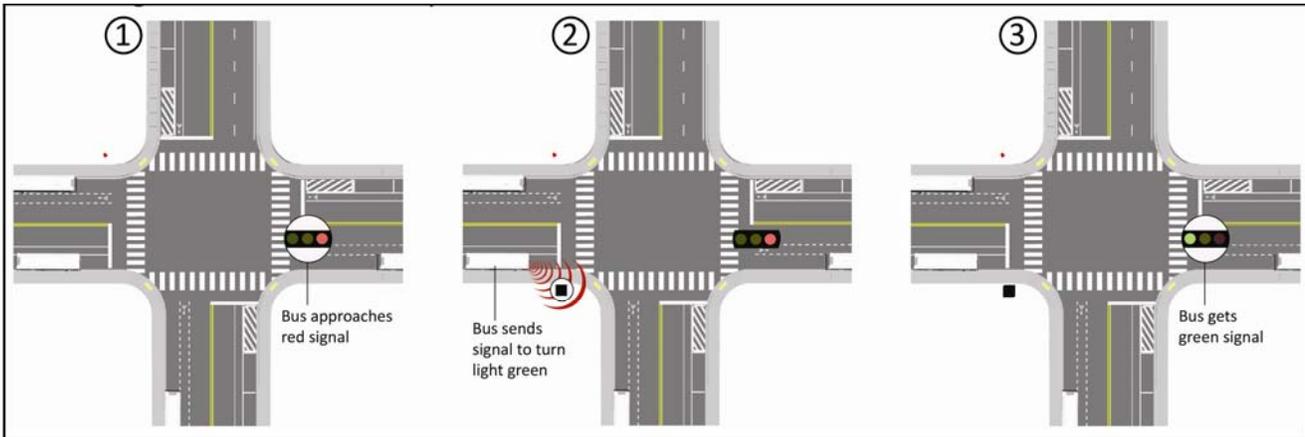
Placement of Bus Stops

Stops can be modified along a corridor to assist in the implementation of TSP. Stops may be relocated or consolidated to enhance a priority treatment. This is particularly useful when a new BRT or express bus service is implemented along a corridor. By having such a service make fewer stops, travel time savings and improved on-time performance for the service as a whole can be achieved.¹ For more information on the placement of bus stops at intersections, see the Bus Stop Placement section in Chapter 4 (Section 2).

QUEUE JUMP

A queue jump is a strategy that allows for transit vehicles to bypass general traffic at an intersection through a relatively short lane. The transit vehicle enters into a right- or left-turn lane (the right lane

A: Red Signal Truncation Example



B: Green Signal Extension Example

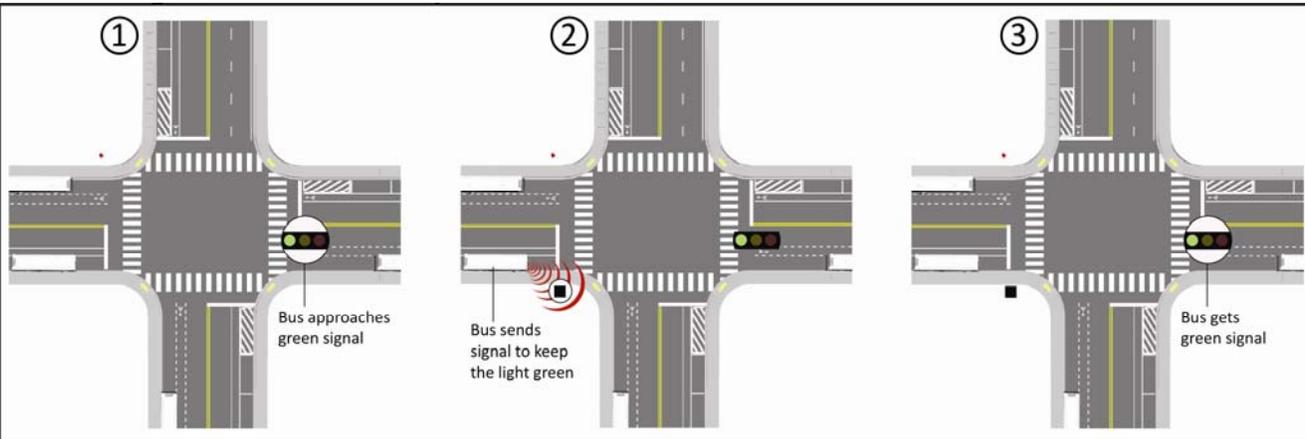


Figure 4.4.3 | Examples of an active TSP system showing early (A) and extended (B) green phase.

Table 4.4.3
TSP Vehicle Detection Systems

Driver-Activated	Point Detectors	Area Detectors	Zone Detectors
Experience has shown that driver-activated systems are ineffective in practice because drivers tend to leave on the “priority request” call rather than use it only when necessary, which results in inefficient signal operations and an overall increase in delay.	In this application, costs are minimized but information on bus speed and location is limited and the signal priority system must “guess,” either based on recent/previous bus travel patterns or on a pre-set basis.	An “area” detection system (e.g., using GPS to continuously track buses through the roadway network) provides better information to the TSP system.	A “zone” system is a smaller version of an area system, limited to the immediate approaches of the intersection. When the system detects a bus in the zone, the system alerts the controller that priority is needed.



Figure 4.4.4 | Components used for active TSP system, Seattle, Washington.



Figure 4.4.5 | Active TSP in use, Seattle, Washington.

being most common) or a new exclusive transit lane developed on the intersection approach. The lane must be sufficiently long enough to allow transit vehicles to effectively access the lane without blockage if there is an adjoining through-traffic queue.¹ Location and design of various methods used for queue jumps are described below.



Figure 4.4.6 | Special right “bus-only or turn” lane, Baltimore, Maryland.

Queue jumps should be considered at arterial street intersections when the following factors are present:³

- Bus routes have an average headway of 15 minutes or less.
- Traffic volumes exceed 250 vehicles per hour in the curb lane during the peak hour.
- The intersection operates at a level of service “D” or worse.
- Land acquisitions are feasible and costs are affordable to construct the required infrastructure improvements.

Instead of a turn lane, an exclusive bus lane (bus bypass) located between the through lane and the right-turn lane should be considered when right-turn volumes exceed 400 vehicles per hour in the curb lane during the peak hour, and/or when the right-turn movement operates on a phase with non-conflicting cross-street movements.³

Queue Jump with Turn Lane/Transit Signal Priority

With this queue jump treatment, a separate, short signal phase is provided to allow the transit vehicle an early green indication to move into the through lane or bus loading area on the far side of the intersection, ahead of through traffic. Typically, green time from the parallel general traffic movement is reduced to accommodate the special bus signal phase, but usually in the range of only 3–4 seconds. If there is an optional transit stop at an intersection, it typically would be located near-side.¹ Figure 4.4.7 is an example of using queue jump with TSP at an intersection.

With a near-side stop located at the curb lane with a “Right Turn – Except Bus” sign, passenger boarding and alighting could occur during a red signal indication. In this situation, a signal priority call would be sent to the controller to activate the special signal phase immediately after the closure of vehicle doors.¹ Based on the draft *Geometric Design Guide for Transit Facilities on Highways and Streets* provided by AASHTO, the length of the extended lane should be sufficient to exceed the traffic queue but not less than 240 feet.

Queue Jump with Turn Lane/Bus Bay

If signal priority is not provided, a transit vehicle could still use a right-turn lane or right-side separate lane to bypass a general traffic queue, but then proceed under the normal through-signal phase into a far-side bus bay.¹ Figure 4.4.8 shows a right-turn lane that is also used as a bus lane to bypass traffic. However, bus stop placement at turn lanes should be carried out only after careful consideration of all related aspects to ensure the safety of transit riders, buses, and motorists.

For more information on queue jump bus bays, see Bus Bays, Bus Bulbs, and Nubs previously discussed in this chapter.

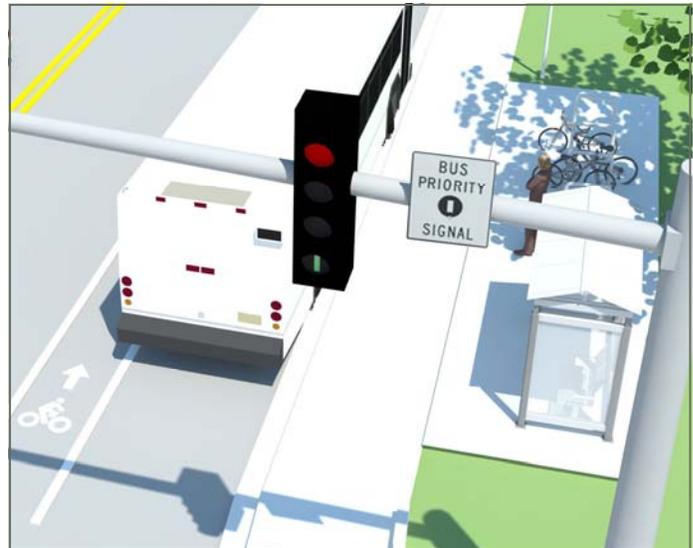


Figure 4.4.7 | Queue jump with TSP at an intersection.



Figure 4.4.8 | Bus lane coinciding with a right-turn-only lane, Jacksonville, Florida.

REFERENCES: SECTION 4.4

1. TRB, 2010. *TCRP Synthesis Report 83, Bus and Rail Transit Preferential Treatments in Mixed Traffic*. Washington, DC.
2. U.S. DOT, 2005. *Transit Signal Priority: A Planning and Implementation Handbook*.
3. AASHTO, 2009. *Geometric Design Guide for Transit Facilities on Highways and Streets*. Ballot Draft.

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4.5 Pedestrian and Bicycle Access to Bus Stops

Bus stop location can impact the convenience and safety of pedestrians accessing transit. Bus stops should be provided in locations with the safest and most convenient pedestrian access possible. The site of a bus stop should be selected considering a number of factors, including:¹

- Sight lines between approaching buses and passenger waiting areas – Bus operators and passengers waiting at bus stops should be able to see each other easily to ensure that operators have sufficient time to stop for waiting passengers. Similarly, passengers waiting for a bus should have a clear view of approaching buses so they do not step into the roadway in front of an approaching bus.
- Proximity to destinations in the surrounding area – Bus stops should be located to reduce walking distance to key destinations. Where possible, stops serving major pedestrian generators should be located on the same side of an intersection as the destination.
- Ease of transfers to other bus routes – Stops where pedestrians frequently transfer between different bus routes should be located on the same side of intersections.
- Locations of traffic signals and other crossing facilities – Bus stops should be located close to adequate crossing facilities to encourage pedestrians to use safer crossing facilities and reduce jaywalking.
- Locations of sidewalks and other pathways that provide access to the stop – Bus stops should be located to take advantage of existing sidewalk and pathway infrastructure.
- Location of access driveways – Bus stops next to driveways require passengers to wait in a driveway for the bus, elevating the potential for pedestrian/vehicle conflicts.

Close coordination with the state and local agencies that operate and maintain roadway facilities is imperative. Physical modifications to the

roadways, including signing, pavement marking, and signalization, should be implemented with consent of the jurisdictional engineering agency.

Consideration also should be given to installing protected left-turn-only phasing near bus stops, as pedestrians may be struck by left-turning vehicles while crossing with the walk signal.

Coordination of Bus Stops with Pedestrian Crossings

All transit stops are potential pedestrian crossings. The following design and safety prompts should be used to initiate discussions with local agencies:²

- Has the project been developed in cooperation and coordination with the state or local engineering and operational agencies? Have they reviewed the bus stop plans and provided comments?
- Are there paved connections between the bus B&A area and the passenger waiting area?
- Is there sidewalk continuity between the transit stop and adjacent pedestrian facilities?
- Would someone with mobility challenges (wheelchair, walker, etc.) be able to go from the sidewalk or bench to the transit vehicle without difficulty?
- Is the seating area at a safe and comfortable distance from vehicle and bicycle lanes?
- Are marked pedestrian crossings convenient to the transit stop?
- Is there a sufficient area provided to accommodate waiting passengers, boarding/alighting passengers, and through/bypassing pedestrian traffic at peak times?
- Do seats or benches (or people sitting on them) obstruct the sidewalk or reduce its usable width?
- Will the location of the transit stop create operational issues for other road users (sight distance obstruction, stopping sight distance, etc.)?
- Are transit B&A areas offset appropriately with respect to the travel way?

FHWA's *Pedestrian Safety Guide for Transit Agencies* identifies the following safety and/or benefits on bus stop siting:

- Far-side stops have the safety benefit of encouraging pedestrians to cross the roadway at the intersection behind the bus. This increases the visibility of pedestrians to drivers traveling through or turning at the intersection.
- Pedestrians crossing an intersection in front of a near-side stop are not as visible to drivers approaching the intersection from behind the bus and also may be hit by the bus itself.
- Mid-block stops may encourage pedestrians to cross roadways at locations where there is no traffic control.

Pedestrian impacts of stop placement also should be carefully considered. Pedestrian traffic generated by the presence of bus passengers traveling to and from bus stops frequently crosses mid-block, regardless of the presence of a crosswalk (Figure 4.5.1). These high-volume crossing locations deserve additional consideration and coordination among transit and highway agencies. A well-planned transportation network can use intersection elements (e.g., crossing distance and signal timing) to reduce the potential conflicts while accommodating all modes.

Pedestrian Crosswalks

Marked pedestrian crosswalks guide pedestrians to walk at the safest location and alert vehicle operators to the potential of a pedestrian's presence. As roadway volumes, speeds, and the number of travel lanes increase, marked crosswalks are best used in conjunction with other treatments (including signals, signs, beacons, curb extensions, raised medians, refuge islands, and enhanced overhead lighting).

Crosswalks are essential to bus passengers who may have origins or destinations on either side of the roadway. It is preferable that all streets that are directly served by transit should also be designed or retrofitted to serve crossing pedestrians. Streets within walking distance from a transit stop should be designed to accommodate pedestrians, as well, with an emphasis on pedestrian safety.

Crosswalks should be provided at intersections where bus passengers are required to cross streets to transfer between routes. Pedestrian crosswalks must be lighted. It is important that a driver sees a pedestrian at night; proper illumination makes a pedestrian visible. Pedestrian crashes occur disproportionately at night, with about four times more risk in relation to exposure.

Curb Ramps – ADA-compliant curb ramps (at all curbs along accessible routes) shall be provided at all crosswalks, marked and unmarked. Curb ramps should not interfere with free access to the bus stop. Bus stop locations (B&A areas) should not be interrupted by curb ramps. When designing intersections and crosswalks, curb ramps must be included wherever a curb is encountered along the circulation path. Curb ramps must be fully within striped crosswalks.



Figure 4.5.1 | Pedestrians illegally crossing the street at a bus stop.

Detectable Warnings – Detectable warning is required at sidewalks at intersecting roads, streets, and railroads. A detectable warning consists of a series of parallel truncated domes that warn visually-impaired pedestrians about the end of the ramp and the beginning of the roadway. *FDOT Design Standards*, Index 304, includes specific design specifications for detectable warnings. Detectable warning surfaces at platform boarding edges shall be 24 inches wide and shall extend the full length of the public use areas of the platform.⁴ Figure 4.5.2 shows the appropriate placement of detectable warning at a bus stop.

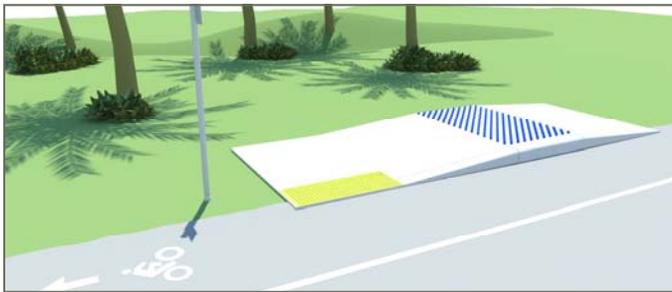


Figure 4.5.2 | Appropriately-placed detectable warning at a bus stop.

Pedestrian Islands

Pedestrian islands (also known as refuge islands) are extensions of the median into the crosswalk area to improve safety for pedestrians and vehicles (Figure 4.5.3). Where appropriate, transit agencies should work with state and local roadway agencies to locate pedestrian islands near high pedestrian generators such as schools, park entrances, transit stops, and parking lots.

Per FHWA, refuge islands should be at least 4 feet wide (preferably 8 feet) and of adequate length to allow the anticipated number of pedestrians to stand and wait for gaps in traffic.

Mid-Block Crosswalks

Mid-block pedestrian crossings are located mostly at trip generator locations or areas where bus stops may have a high volume of transfers needing to cross the street. Mid-block crosswalks can be used to supplement the pedestrian crossing needs in an area between intersections.

At mid-block stop locations, if a significant number of pedestrians cross the roadway, signalized crossings should be considered. In such cases, crosswalks should be located such that oncoming traffic is visible to pedestrians. This can provide pedestrians with a more direct route to their destination. An example of a mid-block crosswalk is shown in Figure 4.5.4.



Figure 4.5.3 | Pedestrian refuge island dimensions.

Intersection Nubs

Intersection nubs are extensions of the sidewalk, usually into the parking lane, that reduce pedestrian



Figure 4.5.4 | Mid-block pedestrian crossing near a bus bay.

The design of such curb extensions must take into consideration the needs of transit vehicles, drainage, and bicyclists. For more information on other types of curb extensions, refer to the Bus Bays, Bus Bulbs, and Nubs section in this chapter, Section 4.3.

Bicycle Lanes in Relation to Bus Stops and Exclusive Bus Lanes

A bicycle lane is a portion of a roadway (either with curb and gutter

crossing distances and make pedestrians more visible to drivers. They should be designed to allow for bus turning movements and can form bus bulbs that allow buses to make curbside stops without weaving in and out of the travel lane. They also have a traffic calming effect. Figure 4.5.5 shows an example layout of nubs at an intersection.

Nubs should be avoided at intersections where the bus route requires the bus to make a right-turn. They should also be avoided in low-speed central business districts to avoid congestion of traffic.

or a flush shoulder) that has been designated by striping and special pavement markings for preferential use by bicyclists.⁵ This handbook addresses selected aspects of bicycle lanes as they relate to transit stops and exclusive bus lane operations. For complete guidelines, requirements, policies, and design criteria on bicycle lanes and other types of bicycle facilities, including paved shoulders, wide curb lanes, shared-use paths, traffic control devices, and bicycle parking facilities, refer to the most recent versions of the *PPM*, *AASHTO Guide for the Development of Bicycle Facilities*, and *MUTCD*. For additional guidance

related to bicycle facilities, see the Index of Resources at the end of this handbook. Figures 4.5.6 and 4.5.7 illustrate a sample layout and dimensions associated with bicycle lanes.

Bicycle lanes are typically located on the right side of the street and frequently conflict with buses traveling in exclusive lanes, bus stops, and right-turning buses, as well as pedestrians boarding or alighting at a bus stop. Where shared-use paths (bicycle and pedestrian facilities not immediately adjacent to travel lane) are provided, bus stops should be coordinated so they are located in proximity to shared-use path access points to the roadway. (See also the *AASHTO Guide for the Development of Bicycle Facilities* for more information on the design of bicycle facilities.)



Figure 4.5.5 | Intersection with intersection nubs.

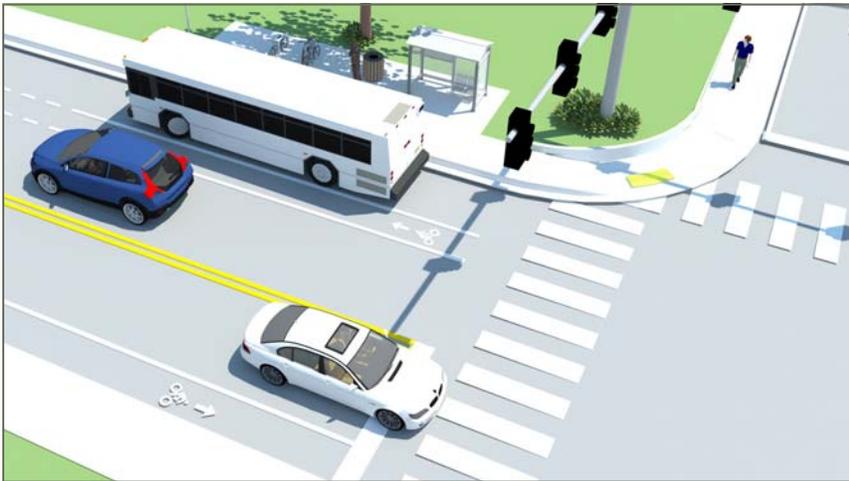


Figure 4.5.6 | Bicycle lane at a bus stop near an intersection.

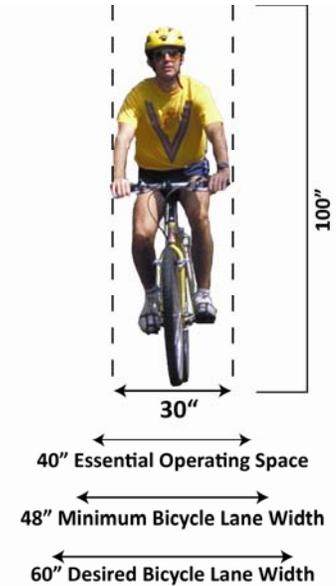


Figure 4.5.7 | Operating space of a bicyclist.

Bicycle lanes should be considered part of the larger transit network and should connect transit users to bus stops. They should also be considered a good way to connect park-and-ride lots to neighborhoods via arterial collector streets and may connect users more easily than even major roadways.

Green Color Bicycle Lanes

A green pavement color in a bicycle lane is permitted on the State Highway System in traffic conflict areas (or “keyholes,” areas where bicycle lanes exist between through lanes and right-turn lanes, bus bays, or parking lanes) when certain additional conditions are met. An example of a

green paved bicycle lane can be seen in Figure 4.5.8. Refer to the most recent *PPM* for more details on permitted conditions and requirements for green color bicycle lanes.

Shared-Use Paths

Instead of a bicycle lane, a passenger may also choose to ride on a shared-use path to a bus stop and then board the bus. Shared-use paths are paved facilities physically separated from motorized vehicular traffic by an open space or barrier and either within the highway right-of-way



Figure 4.5.8 | Dimensions and design of a green-colored bicycle lane at a bus bay.

or an independent right-of-way. Shared-use paths are used by bicyclists, pedestrians, skaters, runners, and others. Where shared-use paths are provided, bus stops must be connected so that they are located in a manner providing accessible shared-use path access points to the roadway. Refer to *PPM* Chapter 8.6 for information on the design of shared-use paths. Refer to the *AASHTO Guide for the Development of Bicycle Facilities* for information on the design of bicycle facilities.

Shared Bus/Bicycle Lanes

A growing number of communities are using shared bus and bicycle lanes to give preferential treatment to both bicycles and public transit. Often, the lanes are also able to be used by taxis and right-turning vehicles. Because buses and bicycles will pass each other in these lanes, lane width is an important issue. Sometimes, 16-foot lanes are used to allow a clear 3 feet of separation between the bicyclist and a passing bus; however, if either bus or bicycle traffic is light and space is limited, the width of a shared lane might be 14 feet or less.

Bus–Bicycle Conflicts

In designing bicycle lanes, conflicts with other modes of transportation should be minimized. Dashed line pavement markings are used where buses are allowed to move in and out of their lane. A major bus–bicycle conflict arises when buses load at the curb, thus slowing traffic and causing bicyclists in outside bicycle lanes to swerve into the main traffic lane to avoid the pedestrian and the bus.⁶ Figure 4.5.9 presents an example of a bus stop location with a potential for bicycle and bus conflict.

There are multiple solutions to help prevent as much conflict as possible. These include:⁶

- *Colored lane treatments.* These draw attention to bicyclists and helps make drivers and pedestrians aware that conflict may occur in the colored area.
- *Discontinued bicycle lanes at transit stops.* When a bicycle lane is discontinued, bicyclists are, in some cases, expected to stop and, in other cases, to merge left into general traffic. This

allows cyclists to avoid competing for space with boarding and alighting pedestrians.

- *Physical rerouting of bicycle lanes around bus stops.* This has limited applicability in areas with limited right-of-way and also not suitable for areas without heavy bicycle traffic, as it tends to be more capital intensive.
- *Unique pavement markings.* Such markings also help to reduce conflicts. With the addition of signage to address specific issues, such as shared right-turn lanes and bicycle paths through bus stops, signs and pavement markings can help clarify roadway confusion. This would also include signage on right-of-way hierarchy such as “Yield to Bus” or “Yield to Bike.”

When a bus stop is located in a bus bay, dashed line pavement markings consistent with the MUTCD must be used to notify bicyclists and transit operators of a potential conflict.



Figure 4.5.9 | Stopped bus blocking a bicycle lane, potentially causing bicyclists to swerve into the main traffic lanes.

REFERENCES: SECTION 4.5

1. 2008. *Florida Administrative Code*. <https://www.flrules.org/gateway/ruleNo.asp?id=14-20.003>, accessed February 22, 2012.
2. FDOT, District 7, 2011. *Design Safety Prompt Lists*.
3. U.S. DOT, FHWA, 2008. *Pedestrian Safety Guide for Transit Agencies*. Washington, DC.
4. *Florida Accessibility Code for Building Construction*. 2012. [http://www.floridabuilding.org/fbc/committees/accessibility/aac/Changes to Law/Florida Accessibility Code 2012 ICC FINAL.pdf](http://www.floridabuilding.org/fbc/committees/accessibility/aac/Changes%20to%20Law/Florida%20Accessibility%20Code%202012%20ICC%20FINAL.pdf), accessed February 22, 2012.
5. FDOT, 2012. *Plans Preparation Manual, Volume 1*. <http://www.dot.state.fl.us/rddesign/PPMManual/PPM.shtm>, accessed February 23, 2012.
6. South Eastern Pennsylvania Transportation Authority, City of Philadelphia, 2009. *Bicycle-Bus Conflict Area Study*. Philadelphia, PA.

4.6 Transit and Bus Stop Provisions during Construction

Coordination among agencies is important to ensure that adequate provisions are made for safe pedestrian and bicycle access to transit during periods of roadway construction or maintenance.¹ Careful consideration should be given to transit operations and necessary arrangements should be made to minimize inconvenience to transit patrons. Figures 4.6.1 and 4.6.2 provide examples of construction near bus stops.



Figure 4.6.1 | Construction near a bus stop, Hillsborough County, Florida.

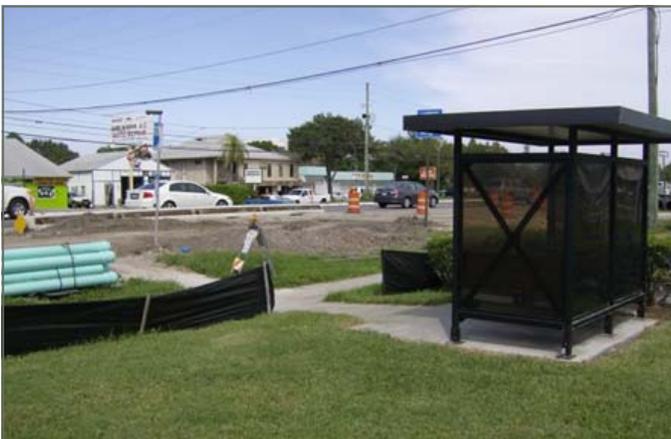


Figure 4.6.2 | Construction near a bus stop, Pinellas County, Florida.

Quick Facts

Accessibility

- Access to temporary bus stops must be considered where temporary pedestrian routes are channelized.²
- Barriers and channelizing devices that are detectable by people with visual disabilities must be provided.²
- If an accessible path exists prior to the alteration or construction project, that path or an alternative path for all users must be provided in an accessible manner.²
- Under no circumstances can accessible conditions be reduced to a level less than what existed prior to a construction project.

The following should be considered for bus stops in or near construction areas:

- Where existing pedestrian routes are blocked or detoured, information must be provided about alternative routes that are usable by pedestrians with disabilities, particularly those who have visual disabilities.² ADA prescribes that the level of accessibility existing prior to an alteration must not be reduced during the alteration.
- Access to temporary bus stops must be considered where temporary pedestrian routes are channelized. Barriers and channelizing devices that are detectable by people with visual disabilities must be provided.²
- Where applicable, the Temporary Traffic Control (TTC) plan and the Maintenance of Traffic (MOT) plan should provide for features such as accessible temporary bus stops, pullouts, and satisfactory waiting areas for transit patrons, including persons with disabilities, if applicable.²
- When detours are required, the geometry of the detour route should be compared against the operational requirements of transit vehicles.
- Traffic control devices should not be placed in locations where they will block transit stops or passenger access to stops.

- At transit stops, provisions should be made to ensure that passengers can safely board and depart from transit vehicles.
- If a transit stop or route needs to be relocated, appropriate signage and advance notification to passengers must be provided.
- While designing detours, ADA requirements must be considered.
- If a road improvement project affects transit services, transit agencies should be involved in the planning of traffic control during construction.
- Signage should be used to direct pedestrians to safe street crossings in advance of an encounter with a work zone. Signs should be placed at intersections so pedestrians, particularly in high-traffic-volume urban and urbanized areas, are not confronted with mid-block crossings.
- Ensure that the transit agency bus stop coordinator or other staff person is aware of construction activities planned at or around bus stops and other transit facilities, and works with roadway agencies and their contractors to ensure that adequate pedestrian access routes are provided during construction periods.¹

Because printed signs and surface delineation are not usable by pedestrians with visual disabilities, blocked routes, alternate crossings, and sign and signal information should be communicated to pedestrians with visual disabilities by providing audible information devices, accessible pedestrian signals, and cane-detectable barriers and channelizing devices that are detectable to pedestrians traveling with the aid of a long cane or who have low vision.² Provisions for effective continuity of transit service should be incorporated into the TTC planning process because, often, public transit buses cannot efficiently be detoured in the same manner as other vehicles (particularly for short-term maintenance projects). Figure 4.6.3 provides an example of a proper accessible detour.

According to *FDOT Design Standards*, Index 660, any temporary sidewalk must be a minimum of 4 feet wide with a maximum of 2-percent cross-slope



Figure 4.6.3 | Appropriate accessible detour of pedestrian traffic in a construction area.

and a maximum of 5-percent running-slope between ramps.³

- Temporary walkways less than 5 feet in width must provide for a 5-foot-by-5-foot passing space at intervals not to exceed 200 feet.³
- Temporary ramps must meet the requirements for curb ramps specified in *FDOT Design Standards*, Index 304.³
- Temporary walkway surfaces and ramps must be stable, firm, and slip-resistant and kept free of any obstructions and hazards such as holes, debris, mud, construction equipment, and stored materials.³

Figure 4.6.4 shows an example of how pedestrians should not be detoured in a construction zone.

Bicycle Considerations

Additional considerations in planning for bicyclists in work zones on highways and streets include the following.⁴

- Bicyclists should not be led into direct conflicts with mainline traffic, work site vehicles, or equipment moving through or around traffic control zones.
- Bicyclists should be provided with a travel route that replicates the most desirable

characteristics of a wide, paved shoulder or bicycle lane through or around the work zone.

- If the work zone interrupts the continuity of an existing shared-use path or bicycle route system, signs directing bicyclists through or around the work zone and back to the path or route should be provided.
- Bicyclist should not be directed onto the same path used by pedestrians.

According to *FDOT Design Standards*, Index 660, measures are required to provide a temporary path anytime a vehicle, equipment, or workers or their activities encroach on a sidewalk for a period of more than 60 minutes.³ If a barrier is constructed, it must be a detectable barrier to encourage compliance and communicate with pedestrians that a sidewalk is closed.

One transit agency uses pre-constructed interlocking barriers to provide a safe pedestrian channel (see Figure 4.6.5). These devices are interlocking so the route is continuous and are specially designed to be inward facing with no protruding footings into the path.⁵

A barrier or barricade detectable by a person with a visual disability is sufficient to indicate that the sidewalk is closed. If the barrier is continuous with detectable channelizing devices for an alternate route, accessible signage might not be necessary. However, an audible information device is needed when the detectable barricade or barrier for an alternate channelized route is not continuous.²

Quick Facts

Design Quick Fact

If a temporary sidewalk needs to be constructed, it must:³

- Be 4 feet wide minimum.
- Have a maximum cross-slope of 2 percent.
- Have a maximum running-slope of 5 percent.
- If less than 5 feet wide, it shall provide a 5-foot-by-5-foot passing space at intervals not to exceed 200 feet.



Figure 4.6.4 | Inappropriately-placed construction materials, creating a barrier in the accessible pathway.



Figure 4.6.5 | Interlocking barriers that provide a safe pedestrian channel.

REFERENCE: SECTION 4.6

1. U.S. DOT, FHWA, 2008. *Pedestrian Safety Guide for Transit Agencies*. Washington, DC.
2. U.S. DOT, 2009. *Manual on Uniform Traffic Control Devices*.
<http://mutcd.fhwa.dot.gov/pdfs/2009/mutcd2009edition.pdf>, accessed November 7, 2011.
3. FDOT, 2012. *FDOT Design Standards*. Index 660. <http://www.dot.state.fl.us/rddesign/DS/12/IDx/00660.pdf>, accessed March 9, 2012.
4. FDOT, 2012. *Plans Preparation Manual, Volume 1*.
<http://www.dot.state.fl.us/rddesign/PPMManual/PPM.shtm>, accessed February 23, 2012.
5. *Journal of the Oregon Department of Transportation Traffic Control Plans Unit*, January 2011. *In the Zone*. http://www.oregon.gov/ODOT/HWY/TRAFFIC-ROADWAY/docs/pdf/InTheZone_2011-Issue1.pdf?ga=t, accessed March 12, 2012.

IMAGE CREDITS FOR IMAGES BY OTHERS

- 4.6.5 Photo retrieved from <http://www.plasticsafety.com/safety-rail-ada-compliant-pedestrian-barricades> on October 10, 2012. Used with permission.

4.7 Roadway

OVERVIEW

FDOT is responsible for providing guidance and a regulatory framework regarding location and standards for transit bus stops along state roads. Although the permitting, design, construction, and maintenance of these facilities has been delegated to the local jurisdiction, this handbook should serve as guidance in providing safe and efficient access to transit users. These guidelines for transit facility-related issues are applicable to both state and non-state roads. Additional guidance regarding roadway design is provided by the Office of Design. *FDOT Design Standards* apply only to roads on the State Highway System, unless noted elsewhere (such as in the FAC); however, the *Florida Greenbook* applies to city and county roadways.

Roadway design features necessary to enhance accessibility and transit operations, such as special use lanes, bus bays, crosswalks, pavement markings or signals, should be approved by the state or local roadway agency with cooperation and coordination of the transit agencies.

Figure 4.7.1 is an example of a bus stop adjacent to a general use lane.

STATE ROADS

Although FDOT is responsible for the construction and maintenance of state roads, transit facilities along them are typically built and maintained by transit agencies, local governments, private developers, and/or non-governmental agencies.

Construction procedures to build transit facilities along state roads must comply with FDOT requirements. Under all conditions, all facilities must comply with applicable FDOT and local regulations.



Figure 4.7.1 | Bus stop adjacent to general use lane, Sarasota, Florida.

NON-STATE ROADS

Typically, county governments are responsible for traffic operations and other issues related to county roads. Local roads are mostly under the jurisdiction of local governments and constitute a high proportion of roadway mileage in Florida. The majority of transit routes are located on non-state roads since they generally have lower speeds and volumes.

PAVEMENT MARKINGS

Pavement markings are necessary to help ensure roadway safety by helping to provide orderly and predictable movement of all traffic. Pavement markings help guide transit vehicle flow and provide information to the transit vehicle driver. With premium transit such as BRT, pavement markings are required regulatory devices to restrict use of the road or lane only to the vehicles designated to run on them.

Pavement markings occur anywhere travel lanes are affected, such as at a bus stop, at the start of a bus-only lane, or when a bicycle path enters or exits the travel path. Traffic markers inform pedestrians, bus operators, and other individuals that use the transportation system of changes or roadway conditions. Different types of bus travel lanes have their own pavement markings, as do bicycle lanes and bus stops. Pavement markings are also necessary during roadway construction.

Major marking types include pavement and curb markings, object markers, delineators, colored pavements, barricades, channelizing devices, and islands. The following should be considered:

- Pavement markings shall be in compliance with maintaining agency regulations and standards in the *MUTCD*. Color selections for curb markings should be conducted according to the general principals of markings (see the most current version of the *MUTCD*, Section 3B.23¹).
- Physical obstructions in and around bus stops, if identified as a hazard to vehicular or pedestrian safety, must either be removed or

adequately marked by painting or by use of other highly-visible material.

- Striping treatments should be used at applicable locations, primarily where traffic conflicts exists. Striping treatments provide additional visibility beyond that provided by regular street signage and help modify driver behavior. Green-color bicycle lanes are one example of such striping treatments. See “Green Color Bicycle Lanes” earlier in this chapter for additional information. For additional guidance, see the *PPM*. Figure 4.7.2 shows the pavement markings at a bus stop for bicycle lanes near a signalized intersection.

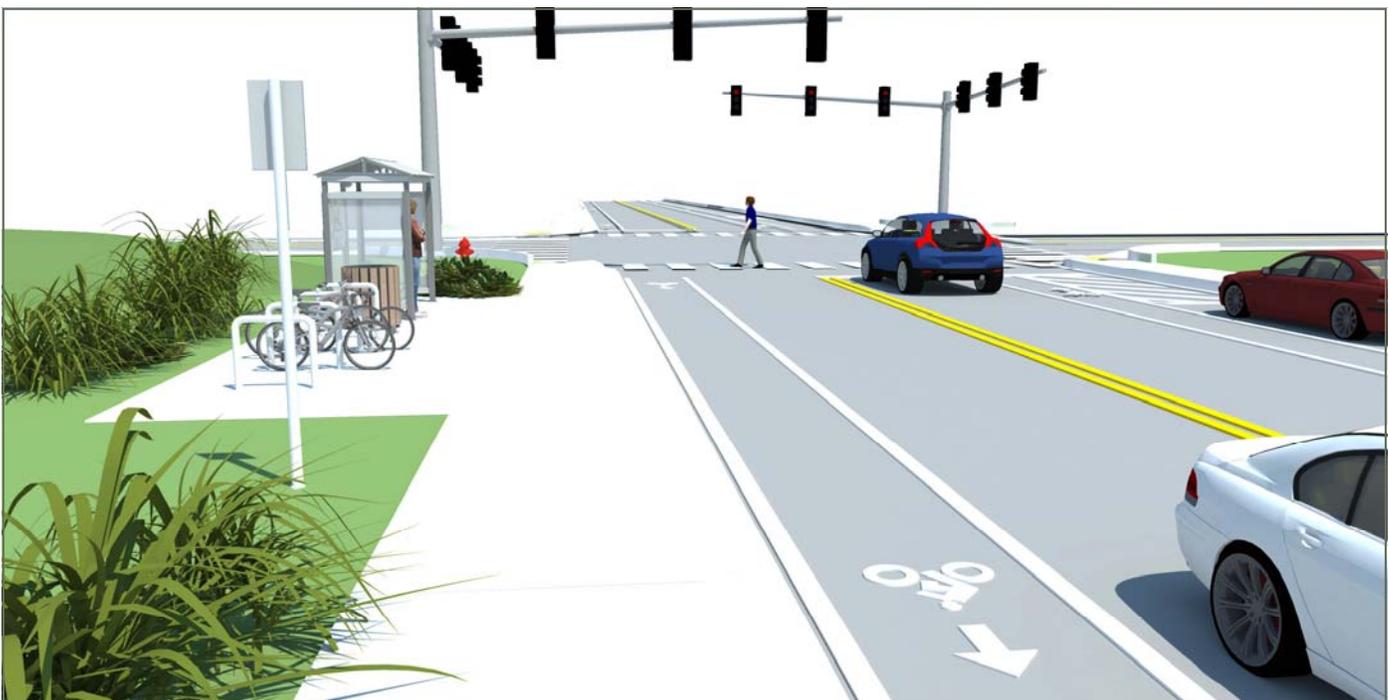


Figure 4.7.2 | Bicycle lane pavement markings at a bus stop near an intersection.

REFERENCES: SECTION 4.7

1. U. S. DOT, 2009. *Manual on Uniform Traffic Control Devices*. <http://mutcd.fhwa.dot.gov/pdfs/2009/mutcd2009edition.pdf>, accessed November 07, 2011.

Quick Reference Guide

STANDARDS AND MINIMUM REQUIREMENTS

Transit Vehicle Characteristics

The PPM requires 10'–12'-wide lanes for commercial and transit vehicles, and also states that an agency should provide lanes as wide as practical.¹

The ADA requires that passengers using mobility aids be allowed on buses, per 49 CFR Sec. 37.165, “(b) All common wheelchairs and their users shall be transported in the entity’s vehicles or other conveyances. (d) The entity may not deny transportation to a wheelchair or its users on the ground that the device cannot be secured or restrained satisfactorily by the vehicle’s securement system.”

In accordance with ADA Part 38, Subpart B-Buses, Vans and Systems, Sections 38.21 through 38.39, the following accessibility features must be provided on buses used for public transportation (this list is not exhaustive and Subpart B should be consulted prior to vehicle specification development):

- Must provide a level change mechanism or boarding device (e.g., lift or ramp) complying with Part 38 requirements to permit a wheelchair or other mobility aid user to reach the designated securement locations and devices.
- At least two securement locations and devices shall be provided on vehicles in excess of 22' in length and at least one securement location and device shall be provided on vehicles 22' in length or less.
- The securement system shall be placed as near to the accessible entrance of the vehicle as practicable and shall have a clear floor area of 30" by 48" minimum. Such space shall adjoin, and may overlap, an access path. Securement areas may have fold-down seats to accommodate other passengers when a wheelchair or mobility aid is not occupying the area, provided the seats, when folded up, do not obstruct the clear floor area required.
- The securement system shall secure common wheelchairs and mobility aids and shall be either automatic or easily attached by a person familiar with the system and mobility aid having average dexterity.
- All vehicle aisles, steps, floor areas where people walk, and floors in securement locations shall have slip-resistant surfaces.
- All step edges, thresholds, and the boarding edge of ramps or lift platforms shall have a band of color(s) running the full width of the step or edge that contrasts from the step tread and riser, or lift or ramp surface, either light-on-dark or dark-on-light.
- For vehicles in excess of 22' in length, the overhead clearance between the top of the door opening and the raised lift platform, or highest point of a ramp, shall be a minimum of 68 inches. For vehicles of 22' in length or less, the overhead clearance shall be a minimum of 56".
- Each vehicle shall contain sign(s) that indicate that seats in the front of the vehicle are priority seats for persons with disabilities, and that other passengers should make such seats available to those who wish to use them. At least one set of forward-facing seats must be so designated.
- Each wheelchair or mobility aid securement location shall have a sign designating it as such.
- Interior handrails and stanchions shall permit sufficient turning and maneuvering space for wheelchairs and other mobility aids to reach a securement location from the lift or ramp.
- Handrails and stanchions shall be provided in the entrance to the vehicle in a configuration that allows persons with disabilities to grasp such assists from outside the vehicle while starting to board, and to continue using such assists throughout the boarding and fare collection process.
- Any stepwell or doorway immediately adjacent to the driver shall have, when the door is open, at least 2 foot-candles of illumination measured on the step tread or lift/ramp platform. Other stepwells and doorways, including doorways in which lifts or ramps are installed, shall have, at all times, at least 2 foot-candles of illumination measured on the step tread or lift/ramp when deployed at the vehicle floor level.
- The vehicle doorways, including doorways in which lifts or ramps are installed, shall have outside light(s) that, when the door is open, provide at least 1 foot-candle of illumination on the street surface for a distance 3' perpendicular to the bottom step tread or lift outer edge. Such light(s) shall be shielded to protect the eyes of entering and exiting passengers.

Transit Vehicle Characteristics (cont'd)

- Where provided, the farebox shall be located as far forward as practicable and shall not obstruct traffic in the vestibule, especially wheelchairs or mobility aids.
- Vehicles in excess of 22' in length used in multiple-stop, fixed-route service, shall be equipped with a public address system permitting the driver or recorded or digitized human speech messages to announce stops and provide other passenger information within the vehicle.
- Where destination or route information is displayed on the exterior of a vehicle, each vehicle shall have illuminated signs on the front and boarding side of the vehicle.

¹ FDOT, 2012. *Plans Preparation Manual, Volume 1*. <http://www.dot.state.fl.us/rddesign/PPMManual/PPM.shtm>, accessed February 23, 2012.

Bus Stop Placement

The operator of a transit bus system may designate a “bus stop” within the boundaries of the right-of-way of a state road. The location of a transit bus stop site on a state road right-of-way is dictated by the needs of the riding public and the route availability of the public transit system.¹ The transit agency is required by the ADA to choose a site for a bus stop that affords the greatest accessibility practicable.

The site selection and establishment of a transit bus stop shall provide the maximum safety to the users of the public transit system and vehicular and pedestrian traffic. If a transit bus stop is located at a site deemed to be unsafe by FDOT, modification or removal shall be required by FDOT and shall be at the expense of the transit bus system.¹

A minimum 15' distance shall be maintained between a bus stop and a fire-hydrant or on-street parking space for persons with disabilities.

The operator of a transit bus system shall indicate or mark the bus stop in accordance with the *MUTCD*, incorporated by reference under Rule 14-15.010, FAC.

The actual passenger B&A area for a stop must not be located in a driveway where slopes exceed ADA Standards.

ADA-compliant curb ramps (at all curbs along accessible routes) shall be provided at all crosswalks, marked and unmarked. Curb ramps must be fully within striped crosswalks.

Where shared-use paths (facilities not immediately adjacent to the travel lane) are provided, bus stops must be connected so that they are located in a manner providing accessible shared-use path access points to the roadway. Refer to the *AASHTO Guide for the Development of Bicycle Facilities* for information on the design of bicycle facilities. Refer to *PPM* Chapter 8.6 for information on the design of shared-use paths.

When a bus stop is located in a bus bay, dashed line pavement markings consistent with *MUTCD* must be used to notify bicyclists and transit operators of a potential conflict.

The District Pedestrian/Bicycle Coordinator shall be consulted during planning and design to establish appropriate bicycle facility elements on a project-by-project basis.

Refer to the most current version of the *MUTCD* when designing bicycle lanes.

Green color in a bicycle lane is permitted on the State Highway System in traffic conflict areas when certain additional conditions are met. Refer to *PPM* Chapter 8.4.2 for more details.

Adequate canal flows must be maintained in areas where the bus stop encroaches into the canal section.

Rural shelters must meet hurricane wind load design strength requirements found in the Florida Building Code. Any associated amenities also must either be placed outside of the clear zone or meet frangibility requirements.

When designing intersections and crosswalks, curb ramps must be included wherever a curb is encountered along the circulation path. Pedestrian crosswalks must be lighted.

Bus Stop Placement (cont'd)

Detectable warning is required on sidewalks at intersecting roads, streets, and railroads.

Detectable warning surfaces at platform boarding edges shall be 24 inches wide and shall extend the full length of the public use areas of the platform.

¹ Florida Administrative Code, 2008. <https://www.flrules.org/gateway/ruleNo.asp?id=14-20.003>, accessed February 22, 2012.

Bus Bays, Bulbs, and Nubs

Where new bus stop B&A areas are constructed at bus bays and bus nubs, they shall have a firm, stable surface, minimum clear length of 96 inches (measured from the curb or vehicle roadway edge), minimum clear width of 60 inches (measured parallel to the vehicle roadway) to the maximum extent allowed by legal or site constraints, and shall be connected to streets, sidewalks, or pedestrian paths by an accessible route.¹

Signing/pavement markings near bus bays shall differentiate bus bays from travel lanes.

Bus stop B&A areas at bus bays shall comply with surface, dimension, connection, and slope requirements for an ADA-compliant B&A area.

Bus bays must meet all requirements in the *PPM*, *Florida Greenbook*, and *FDOT Design Standards*.

F.S. 316.0815 specifies that the driver of a vehicle shall yield the right-of-way to a publicly-owned transit bus traveling in the same direction that has signaled and is re-entering the traffic flow from a specifically-designated pullout bay.

See Chapter 3 for requirements for bus stop components (B&A area, shelter, etc.) located in bus bays, bus bulbs, and nubs.

¹ FDOT, 2007. *Manual of Uniform Minimum Standards for Design, Construction, and Maintenance for Streets and Highways (Florida Greenbook)*.

Traffic Signals and Transit Priority

Refer to the *MUTCD* for design or application of any traffic control device contained in this section. The *MUTCD* is incorporated by reference in 23 CFR, Part 655, Subpart F, and shall be recognized as the national standard for all traffic control devices installed on any street, highway, bicycleway, or private road open to public travel.

Construction procedures related to the applications in this section along state roads must comply with FDOT requirements. Under all conditions, all facilities must comply with applicable FDOT and local regulations.

Refer to the applicable sections in this handbook for accessibility, design, and location requirements for any transit facilities/features associated with the transit preferential treatment applications discussed in this section.

For additional and the most up-to-date regulatory requirements and guidelines on transit preferential treatment applications, refer to the Index of Resources provided at the end of this handbook.

Transit and Bus Stop Provisions During Construction

Where existing pedestrian routes are blocked or detoured, information should be provided about alternative routes that are usable by pedestrians with disabilities, particularly those who have visual disabilities.¹ The ADA prescribes that the level of accessibility existing prior to an alteration must not be reduced during the alteration. This means that alternative accessible routes and features must be provided during renovation projects. Proper use of signage and other pedestrian guidance methods are necessary to ensure that an accessible circulation path is maintained.

Access to temporary bus stops must be considered where temporary pedestrian routes are channelized. Barriers and channelizing devices that are detectable by people with visual disabilities should be provided.¹

When designing detours around transit stops, applicable ADA requirements must be considered.

If a transit stop or route needs to be relocated, appropriate signage and advance notification to passengers must be provided to maintain accessibility of the facility.

Refer to *MUTCD* and *FDOT Design Standards*, Index 660, for additional requirements on transit and bus stop provisions during construction.

According to *FDOT Design Standards*, Index 660, any temporary sidewalk must be a minimum of 4 feet wide with a maximum of 2 percent cross-slope and a maximum of 5 percent running-slope between ramps.

Temporary walkways less than 5' in width shall provide for a 5'-by-5' passing space at intervals not to exceed 200'.

Temporary ramps shall meet the requirements for curb ramps specified in *FDOT Design Standards*, Index 304.

Temporary walkway surfaces and ramps shall be stable, firm, and slip-resistant and kept free of any obstructions and hazards such as holes, debris, mud, construction equipment, and stored materials.

According to *FDOT Design Standards*, Index 660, measures are required to provide a temporary path anytime a vehicle, equipment, or workers or their activities encroach on a sidewalk for a period of more than 60 minutes. If a barrier is constructed, it must be a detectable barrier to encourage compliance and communicate with pedestrians that a sidewalk is closed.

¹ U.S. DOT, 2009. *Manual on Uniform Traffic Control Devices*. <http://mutcd.fhwa.dot.gov/pdfs/2009/mutcd2009edition.pdf>, accessed November 7, 2011.

Roadway

Construction procedures to build transit facilities along state roads must comply with FDOT requirements. Under all conditions, all facilities must comply with applicable FDOT and local regulations.

For complete and the most up-to-date regulatory requirements and guidelines on general and exclusive/special use lanes refer to the Index of Resources provided at the end of this handbook.

Pavement markings shall be in compliance with maintaining agency regulations and standards in the *MUTCD*.

Physical obstructions in and around bus stops, if identified as a hazard to vehicular or pedestrian safety, must be removed or adequately marked by painting or by use of other highly-visible material.

CHAPTER 5



Exclusive/Special Use Lanes

Exclusive/Special Use Lanes

5.1 Locating Bus Stops on Exclusive/Special Use Lanes

Bus service can be operated within various types of roadway configurations, ranging from streets with mixed traffic to exclusive bus-only lanes. A greater degree of separation from non-transit traffic reduces travel times, increases service reliability, and makes a transit trip less stressful. Total to partial separation between transit and non-transit vehicles can be achieved using the following methods.

Special use lane applications, depending on the type and context, require transit agencies to focus on additional accessibility considerations when placing bus stops along such facilities. Figures 5.1.1 through 5.1.4 are examples of bus stops along exclusive/special use lanes.

Most of the basic accessibility guidelines that are applicable when placing bus stops along any lane, whether general or special use, are presented in Chapters 3, 4, and 6 of this handbook. While this chapter is included to provide a supplementary overview of the key aspects related to locating bus stops along exclusive lanes, this handbook does not address detailed guidelines that are specific to placing bus stops for various types of special use lane applications. FDOT is in the process of addressing this need due to the heightened popularity and use of special use lanes for transit nationally as well as in Florida. An FDOT-led effort is under way to prepare a study to develop typical sections of the various exclusive lanes for inclusion in the *PPM* and *Florida Greenbook*, which is expected to provide more detailed guidance applicable to bus stop placement along special use lanes.



Figure 5.1.1 | Bus stop on an exclusive lane, New York City, New York.

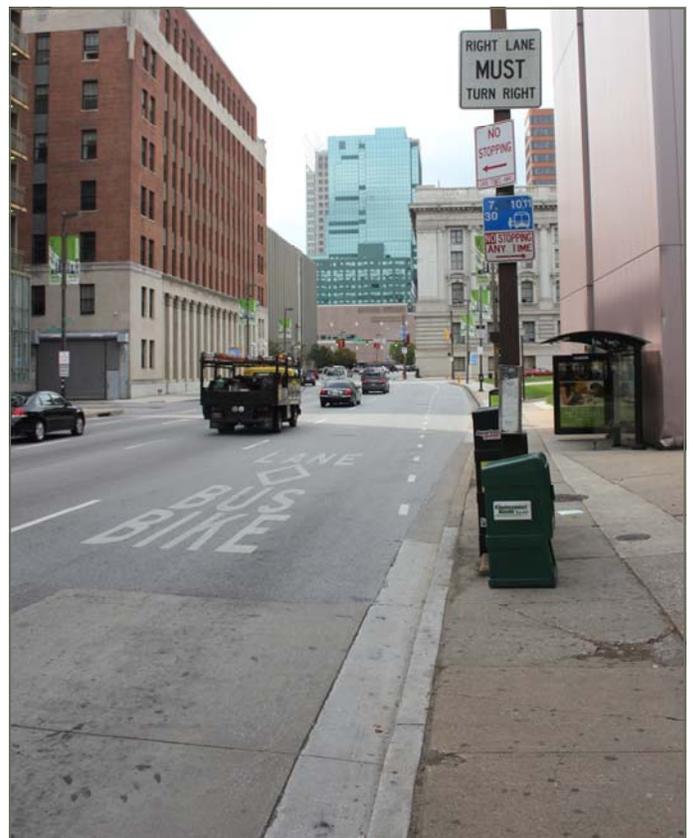


Figure 5.1.2 | Bus stop on an exclusive lane, Baltimore, Maryland.

KEY ASPECTS/CONSIDERATIONS ON LOCATING BUS STOPS ALONG SPECIAL USE LANES

Several key considerations for transit agencies placing bus stops along special use lanes are summarized below. These include various aspects related to on-street and off-street stop locations. The application of accessibility requirements changes based on various roadway, intersection/interchange, and grade level applications at the location where a bus stop is being considered for placement.

- **Use Bus Bulbs** – The addition of bus bulbs along streets where the bus-only lane is adjacent to a parking lane provides an easily-identified stop location without reducing parking.
- **Locate Stop on Far Side of Intersections** – Bus stops along grade- or curb-separated transit ways should be located on the far side of an intersection to best use any signal priority or queue jump treatment in place. If the transit way is a median transit way, bus stops may be located in the median itself. However, bus shelters on the median are prohibited in Florida at this time.
- **Use Off-Street Locations** – Off-street locations minimize potential conflicts between motor vehicles and transit riders and can be more easily connected to park-and-ride lots and the surrounding communities. For example, a BRT station can be located some distance away from its dedicated bus lane, such as on the side of the highway, where buses leave the main alignment to access the station, then re-enter the main alignment to continue the trip.
- **Plan Stop/Station Access on Case-by-Case Basis** – BRT stations placed in the center median will have different pedestrian access patterns than stations located like traditional bus stops along the right side of traffic lanes. In particular, with a center median, passengers have to cross traffic to reach the boarding area.



Figure 5.1.3 | Bus stop on an exclusive busway, Miami, Florida.



Figure 5.1.4 | Bus stop on an exclusive lane, Orlando, Florida.



Figure 5.1.5 | At-grade transit way, Orlando, Florida.



Figure 5.1.6 | Curb-separated transit way, Orlando, Florida.



Figure 5.1.7 | Busway, Brisbane, Australia.



Figure 5.1.8 | Grade-separated busway, Seattle, Washington.

- **Locate Freeway Stops Accordingly** – When locating bus stops for transit services on special use lanes on freeways, they should be placed in areas with major park-and-ride facilities. The stop spacing generally should reflect population densities, with wider spacing in suburban areas where most passengers arrive and depart by personal vehicle.

AT-GRADE OR CURB-SEPARATED TRANSIT WAY

Transit ways are typically uninterrupted stretches of roadway that allow buses to move effectively and efficiently outside of general traffic. Figures 5.1.5 and 5.1.6 are examples of transit ways. They can be either grade- or curb-separated. Transit ways are frequently used when designing BRT services in exclusive lanes, or they can be used in high-ridership corridors that may include express bus services. Eventually, it may be a consideration to turn these exclusive busways into light rail services if there is sufficient ridership demand and funding is available.

Transit ways are most suited to high-density downtown corridors. These facilities typically have one lane in each direction with dedicated right-of-way for the running way and stations. They can be located along the curb-side of the general use lanes or along the inside or median of a roadway. Median transit ways typically have stations at signalized intersections, where pedestrians can access the station platforms using crosswalks and pedestrian signal phasing. (At this time, Florida regulations prohibit shelters in medians and on limited access facilities.) Generally, far-side stations are recommended to facilitate the provision of signal priority for transit vehicles.¹

Median transit ways are exclusive transit facilities developed in the median of an urban street.¹ Median arterial busways are generally physically separated from adjacent travel lanes. Since they are located in the center of the roadway, it is necessary to create a loading platform between the bus lane and the general-purpose lanes at stations. If the vehicle has left-side doors, a central platform shared by both directions of movement can be used.

GRADE-SEPARATED TRANSIT WAY

Grade-separated transit ways are separated completely from vehicle and pedestrian traffic. Sometimes they are referred to as “quickways” because they provide faster and more efficient service that is not usually possible with mixed-traffic bus service.

Typically located in areas that have very high transit usage, grade-separated roadways are used along high-demand local/express bus corridors or BRT routes. Figures 5.1.7 and 5.1.8 are examples of grade-separated transit ways.

Grade-separated transit ways traverse cross-streets with overpasses or underpasses, allowing vehicles to operate unimpeded at maximum safe speeds between stations.



Figure 5.1.9 | Contra-flow bus lane, New Jersey.



Figure 5.1.10 | Contra-flow bus lane, St. Petersburg, Florida.

Underpasses and overpasses can be used at intersections, with the bulk of the right-of-way at grade to reduce costs. Additional lanes may need to be added, particularly when the volume of buses is high, to allow for passing or added capacity, especially around stations.²

CONTRA-FLOW BUS LANE

Contra-flow transit lanes involve designating a lane for exclusive transit use in the direction opposite that of general traffic.¹ Figures 5.1.9 and 5.1.10 show examples of contra-flow bus lanes.

Contra-flow lanes are applied almost exclusively on one-way streets, with bus lanes typically being no more than one to two blocks in length, with longer segments for BRT or light rail.¹

This design is like a two-way street that operates in one direction only for general traffic. Contra-flow lanes on the left side of the road require fencing because they operate contrary to the expectation of pedestrians.² Bus lane lengths vary, but typically are no more than one to two blocks in length.

CONCURRENT-FLOW BUS LANE

A concurrent-flow bus lane is a lane designated for transit vehicles moving in the same direction as general traffic.

The most common form of a concurrent-flow transit lane is one located at the right side of the street, adjacent to the curb or shoulder.

Although this layout is common, simply installing a curb-side transit lane does not imply the creation of an exclusive transit way because curb transit lanes are subject to a variety of interference and conflicts, including right-turning vehicles, vehicles seeking to park or load at the curb, and vehicles entering or exiting at local driveways. In this context, maintaining the integrity of the transit lane through signs, markings, education, and ongoing enforcement is critical to ensuring the speed and reliability of bus service in these lanes.¹ Figures 5.1.11 and 5.1.12 show examples of concurrent-flow bus lanes.



Figure 5.1.11 | Concurrent-flow bus lane, Jacksonville, Florida.



Figure 5.1.12 | Concurrent-flow bus lane, Seattle, Washington.

BI-DIRECTIONAL BUS LANE

A bi-directional transit lane is a lane application that can be used when two vehicles need to bypass each other.

A bi-directional transit lane is an exclusive lane that allows a transit vehicle (typically, a bus or streetcar) to pass in one direction through a constrained section while an other transit vehicle waits or dwells at a station or bypass area until it

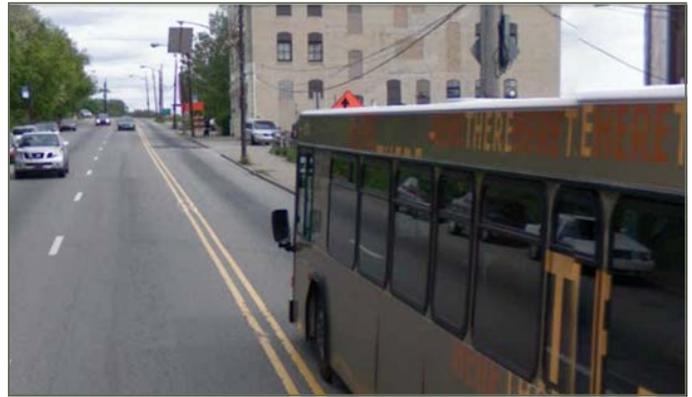


Figure 5.1.13 | Bi-directional bus lane, Pittsburgh, Pennsylvania.

can be given the green signal to pass though the section in the other direction.

This type of bus lane is used when there is only enough room to install a single transit lane of restricted length to traverse through no more than two to three signalized intersections, and with longer service headways.¹ Figure 5.1.13 shows an example of a bi-directional bus lane.

INTERMITTENT BUS LANE

An intermittent bus lane, also called a moving bus lane, is a restricted lane for short-term duration only. This concept consists of using a general-purpose lane that can be changed to a bus-only lane for the time needed for a bus to pass, after which the lane reverts back to a general-purpose lane until another approaching bus needs the lane for its movement.¹

These lanes typically use a series of signals and sensors to detect bus proximity during peak travel times. Additionally, the sensors track flow speed and queue length. Through a combination of lights installed in the pavement and an overhead sign to signal that the lane has changed from a regular lane to a bus lane, traffic moves forward, leaving an open space into which the bus can move.³

MANAGED LANES

Managed lanes are designed to control traffic flow or improve congestion along specific facilities. They typically are used on freeways and other



Figure 5.1.14 | Managed lanes, I-95, Miami, Florida.



Figure 5.1.15 | Managed lanes, Katy Freeway, Houston, Texas.

open lanes from managed lanes. Some managed lanes use plastic poles for separation from the rest of traffic and allow only limited access at certain points. Figures 5.1.14 and 5.1.15 show examples of managed lanes.

HIGH-OCCUPANCY VEHICLE (HOV) AND HIGH-OCCUPANCY TOLL (HOT) LANES

HOV/HOT lanes are a type of managed lane application specifically designed to alleviate congestion and improve travel flow and are the most commonly-used methods of preferential treatment for bus traffic. HOV lanes typically allow high-occupancy vehicles to travel through them. They are located along the median lanes of freeways or highways and may not be separated from general use lanes. HOT lanes allow single-occupancy vehicles to gain access by paying a toll. HOT lanes are, for the most part, HOVs overlaid with a pricing strategy.

Buses can operate successfully in HOV/HOT lanes if capacity permits. In areas where buses are permitted to use HOV/HOT lanes, buses of any type can use the lane, even without passengers, as it helps them maintain adherence to schedules.

limited access highways and allow access to only a limited number of buses, carpools, trucks, or toll-paying vehicles. This concept may also include value pricing—the charging of varying rates according to time of day, travel conditions, and/or vehicle type.

Managed lanes typically occur along major freeways or highways. In some cases, the far left traffic lane is converted into a managed lane with limited entry and exit points for authorized vehicles. Price-managed lanes may allow free access to registered carpools, vanpools, and local and regional transit services. Other users have the option of paying an electronic toll that may vary by congestion level and time of day.

The design of managed lanes is similar to that of regular highway lanes; however, signage and pavement markings are required to differentiate

Typical categories of HOV lanes with or without HOT pricing strategy overlays include the following:

- Exclusive freeway HOV lanes
- Concurrent-flow freeway HOV lanes
- Contra-flow freeway HOV lanes
- Busways or HOV lanes in separate rights-of-way
- Arterial street HOV facilities

The occupancy requirement for use of HOT/HOV lanes varies widely, depending on local policies. In theory, occupancy requirements can be raised to maintain a desired level of service and increase person-moving capacity. However, reduction in occupancy requirements is often done to reduce the negative public perception caused by the “empty lane” syndrome. The increased demand,

due to the reduced occupancy requirements, however, can negatively impact transit travel times. Figures 5.1.16 and 5.1.17 are examples of HOV/HOT lanes and signage.

Bus stops are not typically located along the freeways or managed arterials due to congestion, traffic flow, and pedestrian safety concerns. Most stops will be located at identified interchanges and will consist of an intermodal transfer facility or park-and-ride lot that is specifically designed to transfer passengers from the express lanes to other modes.



Figure 5.1.17 | HOV lanes, Minneapolis, Minnesota.



Figure 5.1.16 | Signage for managed toll lanes, Houston, Texas.

BUS BYPASS SHOULDER

Bus bypass shoulder (BBS) operations reduce passenger travel times and help improve travel time reliability.⁴ Buses bypassing traffic congestion in shoulder lanes can help make transit use more attractive, as travel time reliability and travel time competitiveness are key factors to attracting discretionary riders. Figures 5.1.18 and 5.1.19 show examples of bus-on-shoulder bypass operations.

BBS is applicable when widening a road to add a bus-only lane is not possible due to right-of-way constraints, environmental concerns, and/or financial constraints. Although the use of BBS on limited access facilities has been legislatively authorized, it still requires the approval of the FDOT District Secretary to implement the system.

Most shoulders are not constructed to the full structural requirements of general traffic lanes and typically are narrower than conventional traffic lanes. *The AASHTO Design Guide for Transit Facilities* suggests that shoulders on freeways



Figure 5.1.18 | Bus on shoulder, Miami, Florida.



Figure 5.1.19 | Bus on shoulder, Chicago, Illinois.

where buses travel on a part-time basis when warranted by congestion should be at least 11 feet wide; a 12-foot width is more desirable.⁵

Pavement design also needs to be taken into consideration if the shoulder will be supporting sustained loads of buses traveling at moderate speeds.⁵ Shoulder cross-slopes for drainage purposes are typically 2–6 percent. Some shoulders also have storm drain catch basins and electrical junction boxes located within their right-of-way. The cost and right-of-way implications on adjacent lane widths may, therefore, become a problem in converting the shoulder facility to accommodate heavy buses. Buses are not allowed to use the shoulder until general traffic speed falls below 35 mph. Only then may they use the shoulder, and their speed typically is limited to within 10–15 miles per hour above that of general traffic.⁴ Special bus-on-shoulder signage, which is similar to HOV lane signage, indicates to buses and general traffic where and when buses are allowed to use the shoulder.

Bus stops are not typically located along freeways or in BBS situations due to congestion, traffic flow, and pedestrian safety concerns. Most stops will be located at identified interchanges and will consist of an intermodal transfer facility or park-and-ride lot that is specifically designed to transfer passengers from the express lanes to other modes.

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Quick Reference Guide

STANDARDS AND MINIMUM REQUIREMENTS

Exclusive and Special Use Lanes
Construction procedures to build transit facilities along state roads must comply with FDOT requirements. Under all conditions, all facilities must comply with applicable FDOT and local regulations.
According to FAC 14-20.003(3), shelters are prohibited in medians and on limited access facilities.
For complete and the most up-to-date regulatory requirements and guidelines on exclusive/special use lanes, refer to the Index of Resources provided at the end of this handbook.

CHAPTER 6



BRT and Rail Station Design

BRT and Rail Station Design

6.1 BRT Station Design

BRT typically is identified as an enhanced bus system that operates on bus lanes or other running ways to combine the flexibility of buses with the efficiency of rail. However, BRT in mixed traffic combined with transit preferential treatments is also being used where dedicated bus lanes or running

ways are not feasible. BRT is intended to operate at faster speeds, providing greater service reliability and increased customer convenience than traditional bus service. A combination of advanced technologies, infrastructure, and operational investments allows BRT to provide significantly better service. Figure 6.1.1 provides overviews of some of the most common elements of BRT.

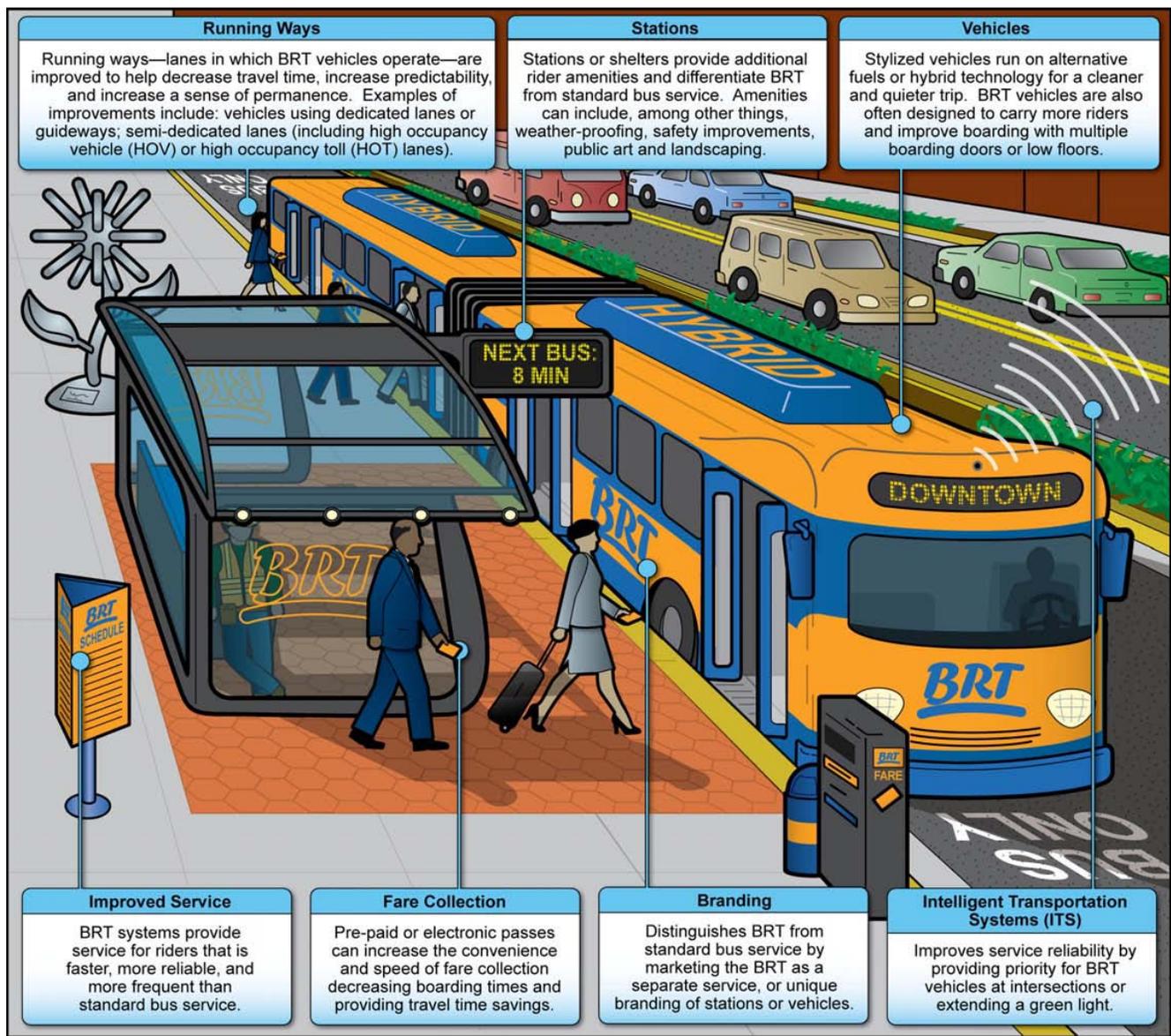


Figure 6.1.1 | Features of a BRT system.

Quick Facts **BRT Service**

Expanded service and improved frequency along BRT lines increase ridership for many transit agencies. One agency experienced a 70 percent increase on weekdays and a 150 percent increase on weekends due to improved coverage and the presence of its busway.¹



Figure 6.1.2 | BRT station, Eugene, Oregon.

BRT stations have the ability to function as development nodes in a BRT corridor, introducing new activity centers into a community or reinforcing existing activity centers in an urban area. They benefit developers by attracting typical transit markets (people who either do not have automobiles or are not able to drive, as well as discretionary riders) and by reducing the parking requirements for new development.² Enhanced BRT stations may attract economic investments more than basic bus stops, particularly for those systems operating in grade-separated running ways, due to BRT's unique appeal and its ability to enhance the perception of system permanence. Figures 6.1.2 and 6.1.3 provide examples of BRT stations.



Figure 6.1.3 | BRT station, Cleveland, Ohio.

While BRT systems use rubber-tire vehicles (i.e., buses), they combine characteristics more commonly associated with light rail transit. Transit agencies typically brand BRT systems as unique from local bus service and model BRT systems and facilities similar to light rail design features. This unique appearance and system operational performance generally provide passengers with an experience that is more like rapid transit than bus.³ BRT stations are designed to reflect this uniqueness of the mode, as described in the remainder of this section.

TYPES OF BRT STATIONS

A BRT station might include rail-like station amenities such as an exclusive right-of-way or protected transit way lane, platform signage, detectable warnings on platform edges, level boarding (or near-level boarding), off-vehicle fare payment, canopies, and other design elements common to a light-rail station. Because BRT is

designated as bus and not rail service, the minimum ADA Standards design elements for bus stops are applicable to all BRT services unless rail station amenities are included, which must also comply with ADA Standards requirements for rail.³

Similar to the traditional bus station hierarchy, BRT stations can be organized into the following hierarchy based on industry-wide practices: basic stops, enhanced stops, stations, transit centers, and terminus facilities.²

Basic Stop

A basic BRT stop, sometimes referred to as a simple BRT shelter, is located typically on the side of a road, is low capacity, and may include a small bus shelter but few, if any, additional passenger amenities (see Figure 6.1.4). While they are quick, easy, and inexpensive to install, they do little to distinguish BRT from traditional bus service and do not communicate permanence. These features limit a basic stop's ability to attract discretionary riders and its ability to encourage TOD. Basic stops generally are not recommended when designing stops for BRT service, but they may be used for temporary conditions or as a transitional strategy. If they are used, they should include branding elements, at a minimum.²

Enhanced Stop

An enhanced stop typically includes a few amenities, such as a small shelter, passenger information, seating, lighting, and branding elements. Typically, these stops are smaller in size and scale than stations. Enhanced stops are quick and easy to install and are inexpensive in comparison to full stations. However, these stops may only moderately distinguish BRT service from traditional bus service may offer few, if any, passenger amenities, and may provide only limited encouragement for TOD. Figure 6.1.5 is an example of an enhanced BRT stop.

Station

BRT stations typically include a wide array of components generally identified with BRT,

Quick Facts

BRT Stops

BRT enhanced stops are recommended when:²

- There is a limited budget or a strong need to save money.
- Quick deployment is a priority.
- Travel demand is expected to be low.
- Space limitations preclude installation of stations.
- The stops are planned for short-term use due to temporary conditions or as a transitional strategy.



Figure 6.1.4 | Basic BRT stop, Pittsburgh, Pennsylvania.



Figure 6.1.5 | Enhanced BRT stop, Seattle, Washington.

including an enhanced shelter, level boarding, advanced fare collection, a distinctive look and feel (branding), real-time passenger information, lighting and security, seating, and other features typically associated with rapid or rail transit stations.² Stations are recommended for most BRT applications.

BRT stations can serve as gateways for the community and can encourage TOD. These types of stations may be designed with the anticipation of conversion to rail stations in the future. BRT stations offer substantially more passenger amenities than enhanced stops and can accommodate a higher volume of passenger traffic.

Transit Center

BRT transit centers are a variation of stations and are located on or off a transit line to enable passengers to transfer to another transit line or service, generally without leaving the physical boundaries of the station.

End-of-Line or Terminus Facility

Some BRT transit center stations function as end-of-line facilities for some routes and may include certain design components needed for an end-of-line or terminus facility. As the endpoint, such station designs should allow areas for vehicles to



BRT Stations and Terminus Facilities

BRT stations are recommended when:²

- Sufficient space permits installation of stations.
- High demand is expected.
- Passenger experience is a high priority.
- It is desired to protect passengers from weather conditions.
- TOD is desired or proposed.

BRT terminus facilities are recommended when:²

- The BRT alignment ends or interfaces with a network of other transit services on local streets.
- Demand warrants placement of an endpoint station.
- Required by operational strategies.

turn around and wait, or to perform minor vehicle maintenance or facilities for bus operators to take a break/rest, and should provide opportunities for transfers to local buses and other modes or access to park-and-ride lots. Agencies should keep in mind that this station option may require more space to accommodate spare or replacement vehicles, and it may be less attractive for TOD-type developments. Terminus facilities will include features such as park-and-ride lots, kiss-and-ride lanes, bicycle parking, and local bus connections to ensure modal transfers. Figure 6.1.6 provides an example of a BRT terminus station.

LOCATION

Locations for BRT stations depend on the running way type proposed for the service, including on-street or exclusive-use lanes. Mixed-traffic BRT uses public right-of-way that is open to all modes of street traffic, whereas exclusive-use lane BRT travels on right-of-way that is restricted to use by specific types of traffic.

Unlike traditional bus stops that require relatively less investment and typically can be moved easily, locating a BRT station warrants additional planning for agencies.



Figure 6.1.6 | BRT terminus station, Eugene, Oregon.

Local zoning ordinances should be reviewed to ensure that existing regulations allow for stations and support facilities. Zoning within walking distance of a planned station also should be reviewed. If a station is proposed for an area zoned for industrial or automobile-oriented commercial uses, agencies should consider a change in zoning or moving the station to another location. Conversely, areas zoned for high-density residential or a mixture of residential, commercial, and office uses would be compatible with a new transit station. Agencies should also consider the availability of additional space to include park-and-ride lots.

Coordination among pertinent agencies is critical due to the issues involved and the magnitude of the effort and investment if an agency is considering a comprehensive BRT station. For more information on agency coordination, see Chapter 7 of this handbook.

Five location options may be considered for on-street BRT stations, with two related to the placement of the running way (curb or median) and three related to station position in relation to proximate intersections (near-side, far-side, mid-block).²



Figure 6.1.7 | Curbside station, Miami, Florida.

Curbside Station

A curbside station is located adjacent to the curb or parking lane of a street and is often integrated into a surrounding sidewalk. Curbside stations can be located far-side, near-side, or mid-block. Figure 6.1.7 provides an example of a curbside station.

Median Station

A median station is located in the median of a divided street or roadway and associated with a median running way or bus lanes. In many cases, the option for a median station may not exist. Currently, in Florida, the building of a shelter in the median of a state roadway is prohibited; however, if warranted, exemptions from state law can be obtained through administrative processes.

Some agencies have purchased buses with left-side door capabilities to allow median platform use on both sides of the platform for travel in a single direction. Figure 6.1.8 provides an example of a median BRT station.

Near-Side Station

A near-side station is located just before an intersection (“upstream” of the intersection) with another roadway. It is useful at intersections that have queue-jump capabilities with a through right-



Figure 6.1.8 | Median BRT station, Cleveland, Ohio.



Figure 6.1.9 | Near-side BRT station, Miami, Florida.



Figure 6.1.10 | Mid-block BRT station, Orlando, Florida.

turn lane for buses only. See Figure 6.1.9 for an example of a near-side station.

Mid-Block Station

A mid-block station is located between intersections and is typically unique to mid-block locations that have large trip generators located nearby. Mid-block stations may also be useful in situations where an agency wishes to implement transit signal priority (TSP) because they provide enough distance to the upcoming intersection to be able to trigger signal adjustments after the vehicles stop.¹ See Figure 6.1.10 for an example of a mid-block station.

Far-Side Station

A far-side station or stop is located just after an intersection (“downstream” of the intersection) with another roadway. A far-side stop may be useful working in tandem with a queue-jump lane or TSP. Locating the stop on the far side of the intersection reduces the conflict with right-turning traffic and places the transit vehicle beyond the traffic signal, thereby improving flow and possibly reducing the occurrence of having to merge.¹ Figure 6.1.11 is an example of a far-side station.

Table 6.1.1 summarizes advantages and disadvantages by type of on-street BRT stations.

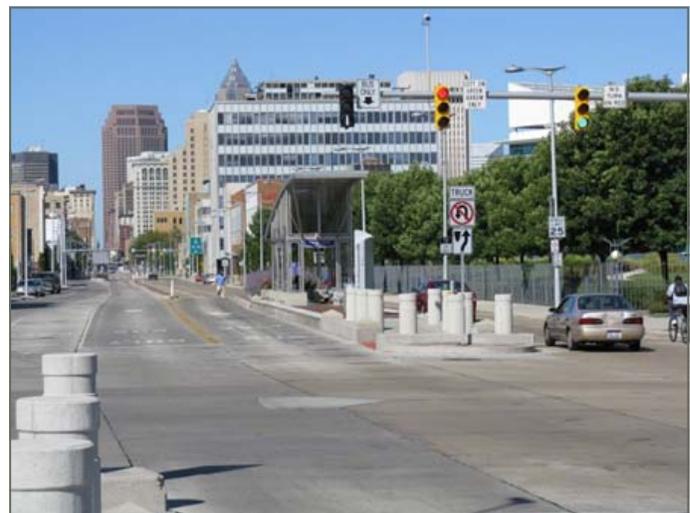


Figure 6.1.11 | Far-side BRT station, Cleveland, Ohio.

BRT STATION AND STOP DESIGN

There are a variety of different station types for BRT. From the most basic stop along a transitional route upgrading to BRT to a grade-separated busway with branded stations and pre-pay fare systems, each agency needs to customize its stops/stations to meet the needs of its system. The following is a basic introduction to the typical design characteristics for consideration for each type of station.

Table 6.1.1
Advantages and Disadvantages by BRT Station Location²

Advantages	Disadvantages
Curb-Side Station	
<ul style="list-style-type: none"> Space likely to be available; possible to avoid taking street space by using existing sidewalk area. Possible to use standard bus stop and share facility with traditional bus service. Eliminates need for some pedestrian street crossings. 	<ul style="list-style-type: none"> Buses must use curb lane to serve stop, potentially creating conflicts with right-turning vehicles, parked cars, bicycles, etc. (use of a curb extension will help mitigate this issue). Generally requires two platforms (one in each direction) and may conflict with other uses of sidewalk. In commercial areas, may be difficult to distinguish station stop signs from other signage. In cases where level boarding is desired, there may be grade issues because the typical platform height (14") is higher than the standard curb height (6").
Median	
<ul style="list-style-type: none"> Can serve both directions simultaneously and feels more "rail-like." Such stops maximize speed by minimizing car conflicts and make TSP easier because of unique signals and signal phasing. Can take advantage of unused medians and may enable curb-side parking. Makes it easier to create a distinct station to identify and enhance system visibility. Does not create a visual obstruction for businesses and avoids having passengers waiting in front of nearby storefronts, which can be a concern for local businesses. 	<ul style="list-style-type: none"> May require taking of more street space than curb-side options; may conflict with other uses of road, such as left turn lanes (far-side vs. near-side), and may require unique signal timing specifications. Requires all passengers to cross some street traffic at every stop and increases travel time for pedestrians if crosswalk is lengthened. Median space may be limited, and station may be more difficult to maintain.
Near-Side	
<ul style="list-style-type: none"> Can be used where limited property is available at a far-side location. For curb-side stations, a near-side location can be used where a BRT route makes a right turn or provides an opportunity for a queue-jump lane. Vehicle arrival is independent of traffic signal timing. Where there is no TSP, passenger loading/unloading may occur while signal is clearing. For both curb-side and median platform stations, reduces distance customers need to walk between intersection and front door of bus (an important feature if fares are collected on-board). 	<ul style="list-style-type: none"> Minimizes benefits or use of TSP; platforms may conflict with right-turn lanes, especially when bus stops at a green light (cars may try to pass the bus on left); departures may be delayed by traffic signal cycle (does not apply for median stations with side platforms). Bus operators could have difficulty seeing pedestrians crossing in front of bus. Passengers may be inclined to jaywalk, especially where they alight at rear of the bus. Near-side stop is set back from the intersection.
Mid-Block	
<ul style="list-style-type: none"> Both arrival and departure at platform are independent of traffic signal timing and, for curb-side stations, possibilities are better for exclusive use of lane at platform. Offers staging space to store buses between preceding intersection and platform and between platform and subsequent intersection (important when service is frequent, such as for headways equal to or less than traffic signal intervals). 	<ul style="list-style-type: none"> Mostly apply in unique situations, such as a large trip generator located mid-block. Need designated crosswalk to enable passengers to access station; without crosswalk, customers may need to walk to an adjacent intersection to cross street or may choose to jaywalk, especially when block is particularly long.
Far-Side	
<ul style="list-style-type: none"> Improves travel time if TSP is available. Makes it easier to implement bus bulbs. Passengers may be safer crossing at the intersection behind the bus. 	<ul style="list-style-type: none"> Potentially requires buses to stop twice at an intersection—once for a red signal and a second time to load and unload passengers at station. For a stop designed to serve multiple buses stopping at the same time, stop needs to be moved two or more vehicle lengths beyond intersection to accommodate multiple vehicles.

Basic Stop

A basic BRT stop is designed according to the bus stop design guidelines discussed throughout this handbook (refer to corresponding guidance in Chapters 3 and 4). Figure 6.1.12 shows a basic BRT stop design. Figure 6.1.13 shows a bus stop that acts as both a BRT stop and a local stop.

Enhanced Stop

Also referred to as an enhanced shelter, enhanced stops are often specially-designed for BRT to differentiate them from other bus stops in the system. They are designed to provide additional features such as more weather protection, additional lighting, BRT branding and marketing, and higher-quality amenities that users may associate with more premium, rail-like transit. This BRT station type often incorporates additional design treatments such as walls made of glass or other transparent material, high-quality material finishes, and passenger amenities such as benches, trash cans, or pay phones. Enhanced shelters are often installed for on-street BRT applications to integrate with the sidewalk infrastructure.⁴ Figure 6.1.14 shows an enhanced BRT stop design.

Station

Stations can be designed as station enclosures or station buildings.⁴ Stations must be designed to maintain all of the barrier-free access and ease of entry and transfers as the most basic stop. More complex stations require additional design attention to ensure that this happens.³

Enclosure

Station enclosures are designed specifically for a BRT system and are fabricated off-site, allowing for identical and modular designs for multiple locations (see Figure 6.1.15). A station enclosure may include level passenger boarding and alighting, a full range of passenger amenities including retail service, and a complete array of passenger information.⁴



Figure 6.1.12 | Basic BRT stop design, Seattle, Washington.

Building

Typically, a station building is a large enclosure designated for BRT. Designs for station buildings are specific to each station location and often include enclosures for passengers waiting in both directions of travel, pedestrian passageways, pre-pay fare systems, accessibility features such as ramps and elevators, grade-separated connections from one platform to another, and a full range of passenger amenities including retail service and a complete array of passenger information systems. Lower-cost stations include the cost of a canopy, a platform, a station enclosure, and pedestrian access; higher-cost stations are designed for higher



Figure 6.1.13 | Bus stop that serves both BRT and traditional transit, Seattle, Washington.

ridership and include longer platforms and canopies, larger station structure, passenger amenities, and roadway access.⁴

Specific BRT station accessibility parameters necessary for compliance with ADA Standards are being examined by the U.S. Access Board to determine whether BRT facilities should include rail accessibility features not currently required of bus facilities. To date, the industry standard for addressing this issue is to ensure that the amenities (signage, public address, boarding features, fare equipment, etc.) provided at BRT stations should follow the requirements of ADA Standards regardless of whether designated as rail or bus standards. Essentially, if an amenity is provided, it must meet the minimum ADA standard requirements.

PLATFORM DESIGN

Careful design of BRT platforms ensures smoother and safer boarding and alighting of BRT passengers and a comfortable wait for the bus. The design of BRT platforms varies depending on the type of investment desired and local preferences. Figure 6.1.16 shows a level boarding platform at a BRT stop.

Length

Platform length is easier to accommodate when a station/stop is located in the median. The length of a platform should exceed the length of the longest vehicle multiplied by the maximum number of vehicles expected to serve the station or stop simultaneously. Additionally, the length should also accommodate sufficient total bus stop length to allow vehicles to safely and efficiently merge into the traffic lane.² Platform length should meet the needs of the transit agency providing the station. Longer platforms help to reduce dwell times by providing space for multiple vehicles to load and unload passengers concurrently. However, they create a higher capital expense when implementing a new BRT route.



Figure 6.1.14 | Enhanced BRT stop design with real-time bus information, Seattle, Washington.



Figure 6.1.15 | Station enclosure, Cleveland, Ohio.



Figure 6.1.16 | Typical platform with required detectable warning at a BRT stop, Cleveland, Ohio.

Width

Width is generally determined by right-of-way constraints and is the distance across the station or stop perpendicular to the direction of travel. Width is generally a more challenging problem than length because width is often the most limiting factor and can cause conflicts with pedestrian and roadway space. To some extent, lack of width can be compensated for by increasing platform length, particularly where stations or stops are located in unused medians. However, with no right-of-way constraints, width generally is a function of the anticipated passenger load and the station/stop operational design. Side platforms should be about 10-to 12-feet wide and, at a minimum, should allow ease of passage for mobility-aid users to turn and pass each other. Center platforms should be as wide as 20 to 25 feet¹ because they are serving buses on both sides of the platform.

Width generally should be derived from the following considerations:²

- Width required for station amenities/ infrastructure.
- Width required for quantity of passengers waiting for a vehicle to arrive.
- Width required for passengers to enter/exit and circulate within the station/stop.

- Most important, width required to ensure access and safety for all passengers, including mobility aid users.

Height

Platform height refers to the vertical height of the station platform above the roadway or transit way. Typically, platform heights are associated with the type of boarding accommodated, from using the standard curb to use of a raised platform for level boarding.

In all cases, platform height needs to be coordinated with fare collection and vehicle design. Low-floor platforms are typically 6 inches above street level, leaving about 8 inches to the base of the vehicle. Raised curbs are typically 9 to 10 inches above the street level, leaving about 5 inches to the base of the vehicle. Level platforms are typically 14 inches high.¹

While the BRT platform characteristics discussed previously are typical, each jurisdiction should consider its unique requirements based on all applicable factors, including, but not limited to, right-of-way availability, bus ramp and other accessible boarding configurations, and vehicle and wheelchair turning radii. Table 6.1.2 provides an example of platform design characteristics used for planning BRT stations in Hillsborough County, Florida.

Types of Platforms

Platforms are an enhancement at a BRT station, not a requirement. An entire BRT system can choose to use a combination of concrete boarding areas using a typical bus stop boarding alignment. However, some agencies have moved to level boarding, which requires a platform. Level boarding adds to the rail-like qualities of BRT and can help speed up the boarding process.

Curb-Side Platform

A curb-side platform is generally used in mixed-traffic BRT or along the curb side of a dedicated busway. It can be a minimal station in the early development of a BRT system. A raised boarding

Table 6.1.2
BRT Station Design Characteristics

Design Element	Dimensions
Platform Height	6" (Standard Type D or Type F Curb & Gutter)
Clear pedestrian width within platform	6' typical; 4' minimum at obstacles
Sidewalk width behind station platform	5' minimum
Mini platform length:	
Prototype A	32'
Prototype B	37'
Prototype C	60'
Concrete bus pad	
Pad length	50'
Pad width	8' or full width of travel lane
Pad thickness	6" minimum, unreinforced; rigid pavement design required

Source: Hillsborough Area Regional Transit (HART) BRT Design Guidelines and Criteria.

platform and pre-boarding fare collection may be available at this type of platform. Side platforms should be about 10 to 12 feet wide.¹ They should be no less than the width required to provide for amenities and a clear pedestrian access route, as well as turning space required for individuals who rely on mobility aids.

Median Side Platform

Stations with this type of platform can be located far-side, side-by-side, near-side, or mid-block. The platform is located on each side of the median and allows right-side boardings. However, this platform type requires two station or stop units as well as more available space.

Median Center Platform

Located on the center island of the median running way, this platform allows shared passenger facilities serving both directions of service and, thus, reduced space needs and costs. BRT applications that use a median lane typically use a split center platform configuration. This configuration minimizes the right-of-way requirements for the station and reduces pedestrian congestion at the median.

A center platform width of at least 20 feet is desirable.⁶ However, to accommodate this configuration, it is necessary to have vehicles with left-side doors. It may also complicate left turns for automobiles across the running way. Figure 6.1.17 shows an example of a median BRT station with a center platform.

Station Amenities

Amenities at BRT stations can enhance the system branding and should be provided at BRT stops and stations for waiting passengers. As BRT mimics rail transit and is often associated with stylized bus shelters, even the most basic BRT stations should include better and more-recognizable amenities than those at a typical bus stop. This may include bus information displays, seating, trash receptacles, bicycle racks, and connections to pedestrian paths. Figure 6.1.18 shows a BRT station located adjacent to bus transfer, park-and-ride, kiss-and-ride, and bicycle/pedestrian facilities and amenities. In addition, Table 6.1.3 suggests different amenities for different types of BRT station types.



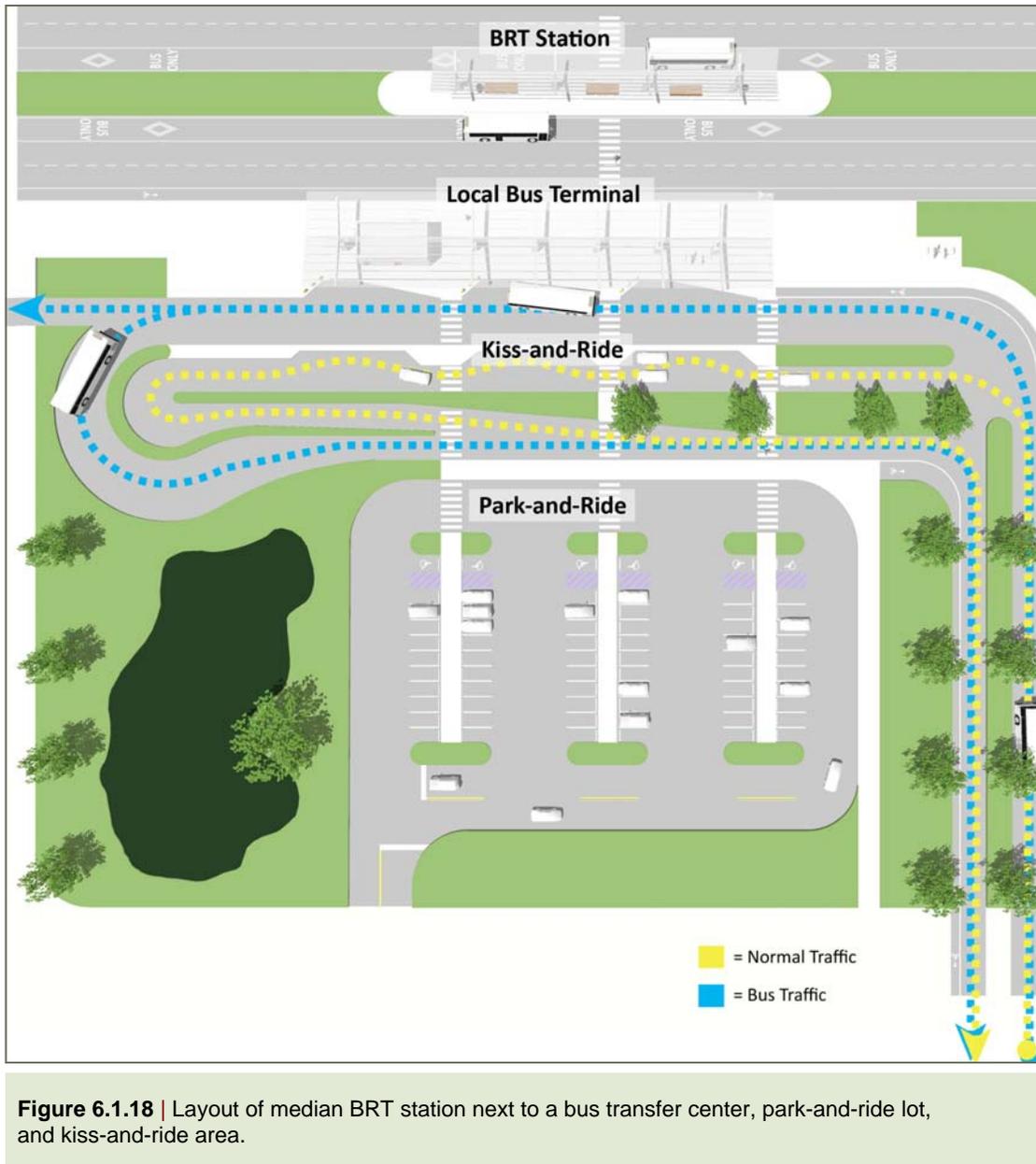
Figure 6.1.17 | Example of an enhanced BRT station with amenities.

Table 6.1.3
BRT Station Types and Features¹

Feature	Curb-Side Bus Stop		Median Arterial Busway		Busway		
	Typical	Major	Typical	Major	Typical	Major	Intermodal Center
Conventional shelter ^a	X						
Unique BRT shelter	X	X	X	X	X	X	X
Illumination	X	X	X	X	X	X	X
Phones/security phone		X	X	X	X	X	X
Temperature control			X	X ^b	X ^b	X	X
Passenger Amenities							
Seating		X	X	X	X	X	X
Trash containers		X	X	X	X	X	X
Restrooms							X
Public address/automated passenger information system		X	X	X	X	X	X
Passenger Services							
Off-board fare collection/ticket vending machines		X	X	X	X	X	X
Newsstands		X	X	X	X	X	X
Shops						X	X
Special services (dry cleaners, etc.)						X	X

^a Conventional shelter is a minimum treatment that generally should not be used for BRT service.

^b In some environments.



GREEN CONSTRUCTION

BRT stations provide ample opportunities to implement green practices covered previously. Because the mode of travel is “enhanced,” futuristic-looking, fuel-efficient buses are more appealing to transit users. Alternative-fuel buses, solar-powered shelters, LED lighting, and native landscaping are all features that can provide an opportunity to use green technology at BRT stations. These features are covered more in depth in Chapter 3 and Chapter 4.

Ways to reduce environmental impact and help “green” the BRT line include:⁴

- “Green” LEED-certified terminus stations (see Chapter 2 for more information on LEED-certified facilities).
- Green strip of grass on the busway, which enhances the visual appeal of the paved busway and absorbs oil discharge from buses and stormwater run-off.
- Extensive landscaping along medians and the busway with native plants.

SECURITY

In planning BRT stations or stops, consideration should be given to CPTED precepts, which include the following:²

- No entrapment areas.
- Available escape routes.
- Clear and unobstructed sight lines and using convex mirrors where necessary.
- Platforms and pedestrian pathways that are well-lit and highly visible.
- Remote video monitoring and a call box that connects directly with the system operator and/or the police, if station or stop is not attended.
- Signage, announcements, etc.
- Plants to prevent screening issues and ensure proper sightlines.
- Installation of tactile strips.
- Waste containers that avoid concealment of foreign objects and avoid materials that could become a projectile.
- Secured benches, bike racks, and other accessories to avoid theft and damage.

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6.2 Rail Station Design

OVERVIEW

The following section discusses guidelines and best practices of transit design for rail stations. While this section covers the basics, it is important to enlist additional outside resources for design guidance and construction standards for rail stations. This document is not intended to be comprehensive or exhaustive.

This section primarily incorporates design guidelines from the ADA Standards and various best practices from FDOT's *Enhancing Intermodal Connections at Florida Transit Stations*. The list of resources used in this chapter should be referenced for more specific instructions. Information on these documents is provided at the end of this chapter. Figure 6.2.1 provides an example of a rail station.

PLATFORMS

A rail platform is provided for passengers to wait for a rail vehicle and allows them to safely board and alight from rail vehicles. A number of different variations of rail platforms can be provided, depending on the station design and type of rail vehicles used. The types of platforms may include side, center, combined side/center, single, and split type, each named for its configuration and location relative to the train. Side and center platforms are the most commonly used. The choice of configuration type depends on the type of rail mode, right-of-way, geometry of tracks, and whether the station is accessed by grade or at a grade crossing.¹

The height and position of a platform must be coordinated with the floor of the vehicles it serves to minimize the vertical and horizontal gaps passengers will encounter while boarding or alighting the vehicle, in accordance with the ADA Accessibility Guidelines for Transportation Vehicles (36 CFR Part 1192). The preferred alignment is a high platform that provides a level transition from the platform to the vehicle floor. In some cases, the vehicle guidelines permit use of



Figure 6.2.1 | Rail station, South Florida.

a low platform in conjunction with a lift or ramp. Low-level platforms shall be 8 inches minimum above the top of the rail.² However, when vehicles are designed to be boarded from the street or a sidewalk along the street, ADA guidelines permit such boarding areas to be less than 8 inches high.

The horizontal gap between a car at rest and the platform shall be no greater than 3 inches, and the height of the car floor shall be within plus or minus 1.5 inches of the platform height to comply with the ADA regulations.¹ However, according to the *Florida Accessibility Code for Building Construction*, for rail systems subject to Department of Transportation regulation 49 CFR 37.21 (light rail, commuter rail, and intercity), where it is not operationally or structurally feasible to meet the horizontal gap or vertical difference requirements of Part 1192 or 49 CFR Part 38, mini-high platforms, car-borne or platform-mounted lifts, ramps or bridge plates, or similar manually-deployed devices that meet the requirements of 49 CFR Part 38 shall suffice.

Additional general requirements for platforms include the following:

- Platforms should have cross-slopes not exceeding 2 percent to provide proper water run-off.¹
- On some low-platform stations such as along LRT lines, “mini-high” platform stations and

ramp systems can be provided. These “mini-high” level platforms typically are 8 feet long and usually reached by ramps from the low-level sections of the platform or walkways. These raised platforms provide accessible vehicle boarding for passengers with disabilities or who use a wheelchair. Mini-highs (also known as “high blocks”) also provide easy boarding access for passengers with strollers or other similar devices. An example of a “mini-high” platform is provided in Figure 6.2.2.

The design components of a typical rail platform are identified and described below.

Boarding & Alighting

There are two types of platforms for boarding and alighting passengers in rail stations, including level and non-level boarding. In level boarding, no vertical movement is required, providing fast and easy full-length level boarding and alighting from the rail vehicle to the platform. In contrast, non-level boarding requires vertical movement, requiring wheelchair lifts for passengers with disabilities and step entry for ambulatory passengers.

Level Boarding

Level boarding is defined as involving a horizontal gap of no more than 3 inches and a vertical gap of no more than 5/8 inch.¹ Due to its advantages, such as an easy, efficient flow of patrons entering and exiting the vehicle, and time savings due to fast mobility-aid passenger boardings and alightings, this type of platform is recommended over a non-level boarding platform type. Figure 6.2.3 shows an example of a level boarding system.

Non-Level Boarding

In this type of boarding and alighting, passengers need to step up or down to enter or exit the vehicle using steps, as the platform level is lower than the vehicle floor level. This type of platform is generally used when longer dwell times are possible, such as with intercity rail systems and certain commuter rail systems. For stations with non-level boarding, a mini-high platform, a mechanical lift, or other form



Figure 6.2.2 | “Mini-high” rail platform, Baltimore, Maryland.

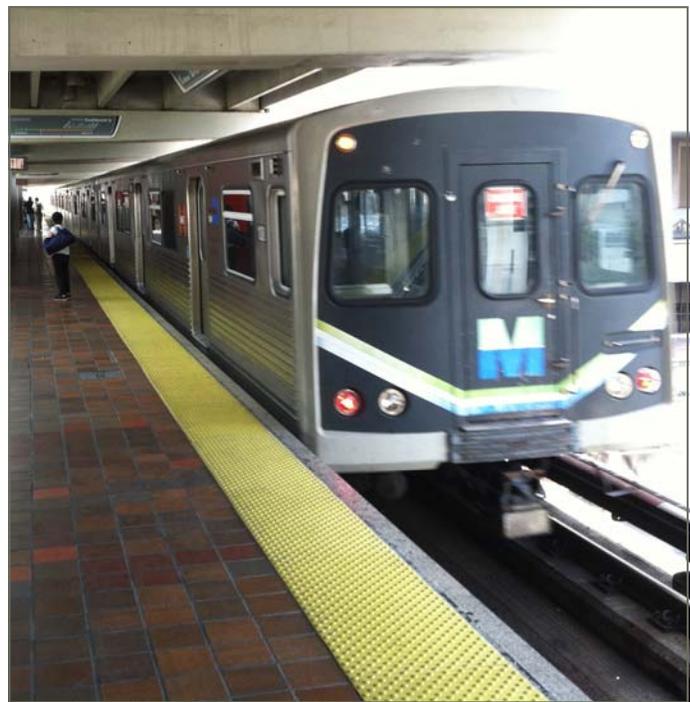


Figure 6.2.3 | Level boarding at a rail platform, Miami-Dade County, Florida.

of accessible boarding must be provided to facilitate access for passengers with disabilities.¹

Slope

Based on ADA guidance on slope requirements, newly-constructed rail platforms shall not exceed a

slope of 1:48 (2%) in all directions. However, where platforms serve vehicles operating on existing track or track laid in an existing roadway, the slope of the platform parallel to the track shall be permitted to be equal to the slope (grade) of the roadway or existing track.³

Platform Dimensions

Platform dimensions may vary depending primarily on the type of rail vehicles and the design configuration used. However, although different transit systems have varying dimensions, platforms must be designed, at a minimum, to allow passengers to walk, wait, board, and alight the rail vehicles in a safe and efficient manner. In addition, amenities such as benches, ticket booths, ticket vending machines, and wayfinding devices may also be installed, and the platform should accommodate passenger access to such amenities. Figure 6.2.4 provides example dimensions of a rail platform.

Length

The length of a station platform depends on the length of the trains that use the station plus at least 50 feet of tangent section at each end. Light rail systems typically consist of 50 to 80 feet per vehicle and up to 4-car trains. The overall length of a typical commuter train ranges from about 150 to 500 feet. For rapid rail, vehicle length ranges between 40 to 70 feet per car and can have up to 10-car trains. The platform length will vary based

on the type of vehicles expected to be used and the projected maximum number of vehicles per train.¹

Width

The ADA Standards require a clear width of at least 60 inches (5 feet) to allow a person in a wheelchair to make a turn around an obstruction. This distance may include the required 24-inch (2 feet) detectable warning surface along the platform boarding edge. A minimum of 7-foot clear width is recommended. Additional width is required to accommodate elements such as benches, signage, ticket machines, telephone booths, elevator shafts, and other pertinent amenities. Other structural members such as columns and walls should also be treated as obstructions; hence, their sizes should be deducted from the effective clear width. A minimum overall platform width for side platform configurations should be 12 feet, with 30 feet preferred. For center platforms, the minimum width should be 16 feet (30 feet preferred).¹

Waiting Area

A typical minimum design value for passenger waiting areas is 5 square feet per person, which allows passengers to wait without touching one another. As a rule of thumb, the platform minimum area, excluding the 24-inch strip adjacent to the platform edges, should be designed to accommodate the peak 15-minute loading demand

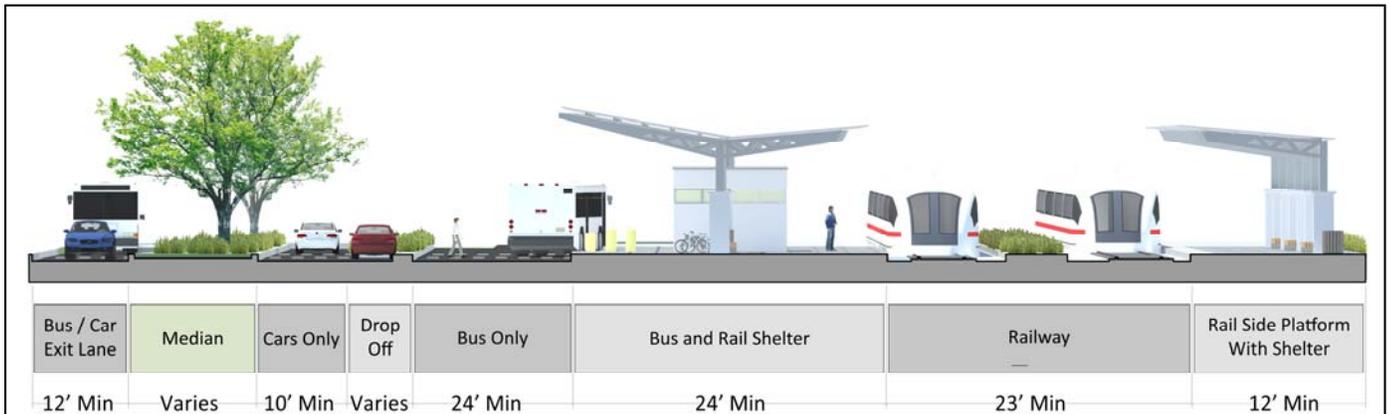


Figure 6.2.4 | Typical dimensions for a rail platform at a rail-bus station.

at 10 square feet per person or the peak 15-minute loading and alighting demand at 7 square feet per person.¹

Detectable Warnings

Detectable warnings provide a distinctive surface pattern of domes detectable by cane or underfoot to alert people with vision impairments of their approach to streets and hazardous drop-offs. Platform boarding edges not protected by platform screens or guards shall have 24 inches of detectable warning material along the full length of the public use area of the platform.³ The detectable warnings shall comply with ADA Standards Section 705. Figure 6.2.5 shows appropriately-placed detectable warnings at the edge of a rail platform.

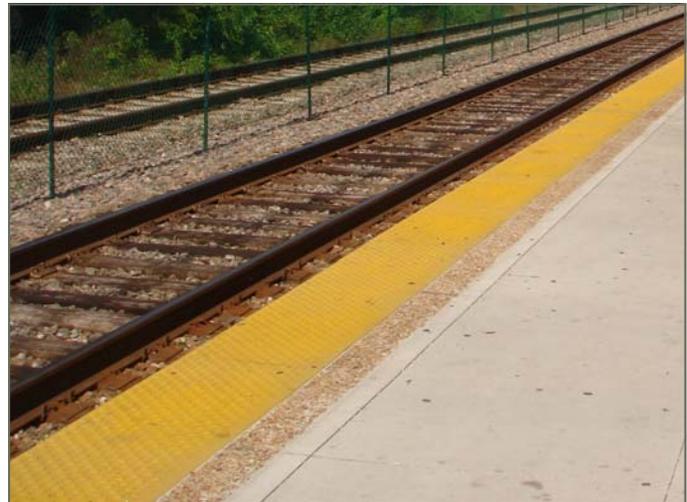


Figure 6.2.5 | Appropriately-placed detectable warnings at the edge of a rail platform.

Platform Safety

Adjacent platforms configured for opposing travel shall be separated by a low fence or other physical barrier. A barrier centered between the two tracks prevents passengers from crossing the tracks. The center barrier should be at least 3.5 feet higher than the top of the highest rail. The barrier should extend a distance of 200 feet beyond the end of the platform and is recommended to discourage patrons from crossing railway tracks at locations other than railway pedestrian crossings.¹



Figure 6.2.6 | Example of rail station signage, South Florida.

STATION SIGNAGE

Proper and adequate signage at rail stations contributes to an efficient flow of passenger circulation within the station. Passengers who are unfamiliar with the station would need to observe, read, learn, and comprehend these systems as they make their way through the transit station. Figure 6.2.6 shows typical rail station signage. ADA Standards have specific visual and tactile (raised characters and Braille) signage requirements for rail stations. Some of the key considerations for platforms and boarding areas signage include the following:⁴

- Those waiting on the platform can identify the facility they are in and facilities or stations that are served from that platform.

- Those arriving on a vehicle can look out the windows and see the name of the facility or station.
- Those arriving can find their way from the platform to their destination through the facility or station.

Station Entrances

Proper signage to identify a station or its entrance must be provided in accordance with ADA Standards for passengers to easily locate the station and its entrances. At least one sign at each station entrance shall comply with ADA tactile signage requirements (see ADA Standards Section 703.3 for requirements on tactile signage). Tactile signage shall also be placed in uniform locations to

the maximum extent practicable. Where signs identify a station that has no defined entrance, at least one sign shall be placed in a central location.³ However, such signs are not required to comply with these ADA guidelines where audible signs are remotely transmitted to hand-held receivers or when they are either user-actuated or proximity-actuated.

Providing visual graphics (pictograms) is considered the most effective method when passengers use directional signage. Typical graphic wayfinding information includes systems made up of text, pictograms, maps, photographs, models, and diagrams. Pictograms are used to reinforce the text message, providing concise and comprehensible directional, informational, and identification messages. International symbols are normally used.¹ These types of visual signs offer greater benefits to people who are visually impaired or persons with language barriers in understanding the message while offering easy-to-understand signage for others.

Bulletin/Message Boards

Message boards can be used to display basic transit system information including schedules, fares, route maps, and other pertinent travel information. The bulletin/message board should include information only necessary for trip information.¹

Routes and Destinations

Lists of connections, routes, and destinations served by the station typically are located on boarding areas, platforms, or mezzanines for passenger use. Other than route maps, these signs shall comply with the following ADA requirements:

- At least one tactile sign identifying the specific station and complying with ADA requirements for raised characters and Braille shall be provided on each platform or boarding area.
- Signs, to the maximum extent practicable, shall be placed in uniform locations within the system. Signs must meet ADA Standards for

Quick Facts

Station Design Tip—Audible Signs

Emerging technologies such as audible sign systems using infrared transmitters and receivers may provide greater accessibility in the transit environment than traditional Braille and raised-letter signs. The transmitters are placed on or next to print signs and transmit their information to a hand-held infrared receiver. By scanning an area, the person can hear the sign. This means that signs can be placed well out of reach of Braille readers, even on parapet walls and on walls beyond barriers. Additionally, such signs can be used to provide wayfinding information that cannot be efficiently conveyed on Braille signs.³

character stroke, width, spacing, line spacing, contrast, glare, and character height.

Public Address Announcements

People with visual impairments may need to get information using a medium other than monitors or boards. Public address announcements should be used concurrently with dynamic visual announcements.³ ADA requires that where public address systems convey audible information to the public, the same or equivalent information shall be provided in a visual format.

RAIL TRACK CROSSINGS

Often, stations are designed such that passenger circulation paths serving boarding platforms cross rail tracks. These crossings expose passengers to safety hazards and must comply with appropriate ADA guidelines. While ADA guidelines closely regulate open spaces in the accessible path, wheel flanges at rail crossings are an exception to the rule. Figure 6.2.7 is an example of a rail track crossing.

The 2010 ADA Standards allow for a maximum space of 2.5 inches for flangeway gaps on the inner rail only and requires that the walking surfaces between and on either side of the trackway be flush and level with the top of rail. For



Figure 6.2.7 | Pedestrian crossing of a railroad track.

railways that are exclusive to freight trains or include freight trains, the PROWAG allows up to 3 inches for the wheel flange gap. Pedestrian crossings of rail tracks should be perpendicular to the tracks, not skewed, to reduce the possibility/probability of a wheelchair wheel dropping into the flangeway gap and becoming stuck. This also applies to bicycles.

Rail track crossings can create a very dangerous situation for traffic as well as passengers. Special care should be taken to clearly sign and appropriately warn pedestrians of any rail crossing. Figure 6.2.8 provides guidance on the track crossing width allowance.

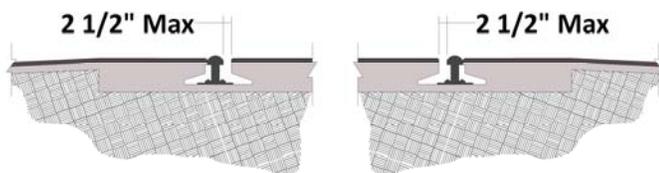


Figure 6.2.8 | Rail track crossing width allowance.

BUS–TRAIN INTERFACE

At intermodal transit stations, buses and trains interface to create a well-connected transit network. Typically, the bus network will pick up outlying passengers along radial rail routes into or

out of a central business district. Because of multiple modes of travel being offered, a bus terminal at a rail station must be well marked to communicate effectively which routes intersect. Effective signage for wayfinding and an adequate and well-connected network of accessible paths to take passengers from the bus B&A areas through the station to the rail platform are required. A well-coordinated bus and rail network is absolutely essential for an efficient bus–train interface at a multimodal facility. At a minimum, existing bus and rail facilities must be connected by at least one accessible path, and rail and bus aspects of the facility must meet ADA Standards for accessibility. Figure 6.2.9 is an example of bus-train interface at a station.

PARK-AND-RIDE LOTS AT STATIONS

Passengers generally reach rail stations by bus or from park-and-ride lots after parking their automobiles. As the placement of park-and-ride lots may vary from station to station due to various property or financial limitations and physical conditions unique to the station, accessibility for passengers from such lots to the rail station should be designed on a case-by-case basis. In every such case, however, the basic minimum ADA Standards must be followed in each and every aspect of providing park-and-ride facilities at stations to ensure proper compliance with existing regulations. Refer to *FDOT's Park-and-Ride Guide* at the Transit Office website (<http://www.dot.state.fl.us/transit/Pages/FinalParkandRideGuide20120601.pdf>) for more detailed information on various types and design conditions. Also refer to the park-and-ride section in Chapter 2 of this handbook. Figure 6.2.9 shows an example of a park-and-ride facility at a rail station.

SECURITY

In addition to providing the necessary amenities at the station, transit agencies also have an added responsibility to ensure safety with the circulation and boarding and alighting of the users of the stations, especially once a rail vehicle has arrived or safely departed.

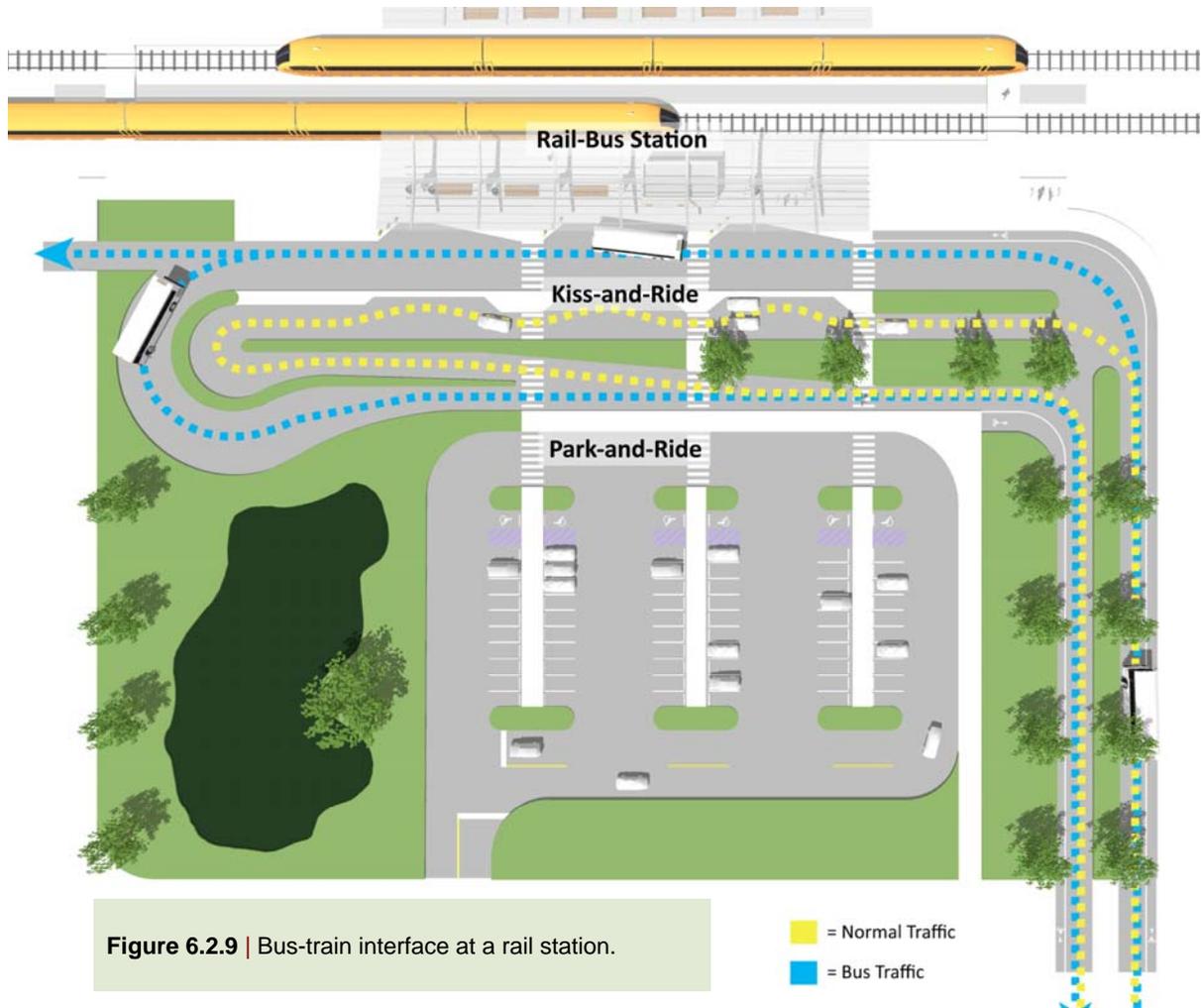


Figure 6.2.9 | Bus-train interface at a rail station.

Provision and maintenance of safety warnings such as detectable warning edges on platforms, warnings of the arrival of a second train once passengers are focused on an already-arrived train, proper and adequate signage, and adequate lighting are needed, at a minimum, to ensure safety at stations.

In some areas, pedestrians may need to cross railroad or light rail tracks to access a transit station or stop. The proper design of these crossings is critical, as pedestrian/train collisions typically result in severe or fatal injuries.⁵ While most current standards and requirements for railroad at-grade warning systems are tailored for motor vehicle traffic, FHWA's *Railroad-Highway Grade Crossing Handbook* provides additional guidance about pedestrian crossings.

Accommodation should also be made for bicyclists crossing rail tracks.

At-grade crossings with multiple tracks can present additional dangers to pedestrians who may assume that a warning has been deployed for a train that is currently stopped on one of the tracks when, in reality, a second train is also coming on another track. Separate warnings may be necessary for these locations to help alert pedestrians of the full extent of the danger of the at-grade rail crossing. Safety treatments that can be used at rail locations include the following:⁵

- **Traditional Gate/Flasher/Bell Assemblies** – These devices are useful for warning pedestrians of oncoming vehicles, but all of these devices should be considered “supplemental” and are typically deployed as part of an engineering decision or a diagnostic team review. While these traditional devices have been reliable and effective in the past, newer devices are entering the marketplace

such as digital voice announcements and strobe lights.

- **Active or Passive Warnings** – Active warnings, such as bells or whistles mounted near the crossing or on the train, are recommended at pedestrian at-grade crossings. Passive warnings, such as signs, can also be used.
- **Fencing** – Fences or other physical barriers can be used to discourage pedestrians from crossing rail tracks at undesignated locations.
- **Grade-Separated Crossings** – Railroad tracks with high-speed and high-frequency train service may require pedestrian tunnels or overpasses to ensure the safety of crossing pedestrians.
- **Surveillance, Education, Enforcement** – Enforcement can help reduce the number of pedestrians trespassing (e.g., walking along railroad tracks). When considering which pedestrian warning is to be deployed, a thorough review of the environment around the crossing is recommended. This includes evaluating the frequency of rail service and number of tracks that are present. It is also important that the assessment includes land uses and frequently-used pedestrian pathways in the vicinity of the railroad track. Railroads near schools, playgrounds, hospitals, retail centers, and other major pedestrian generators may have a much greater need for safety treatments than a railroad track in a rural setting.

GREEN BUILDING/ ENERGY EFFICIENCY

Providing illumination to the passenger platforms and waiting areas makes stations brighter, safer, and more comfortable for the riding public and employees. This, along with the exterior lighting of the station, requires that a relatively large amount of energy be used daily, making station operation and maintenance a potentially expensive task.

Similar to bus stops/stations, rail stations also have used an array of small steps to reduce traditional energy use and have begun to use various green

options. (See Chapters 3 and 4 for various green and energy-efficiency strategies that may also be applied at rail stations.) To have a much greater impact on their carbon footprint resulting from the heavy use of energy, operators of larger rail stations already have and/or are beginning to invest in much more significant green strategies. Examples of some of the strategies used are described below.

LED Signals

Some larger agencies have replaced their incandescent train signaling lights with highly-efficient LED signals. Using LED signals may provide up to 60 percent savings in energy compared to traditional incandescent lights. LED lights last longer, improve brightness significantly, and help decrease greenhouse gas emissions by lowering a station's need for energy use.

Solar Roof

Agencies are increasingly using solar power to improve long-term energy efficiency and costs. By using photovoltaic roofs and fuel cell systems, some agencies have been able to use the power-generating capability of the roof of a station and/or parking area to easily generate over 50 percent of the station's electricity during the summer months.¹ Summer climates with year-round sun, such as in Florida, have an ample energy resource to tap into to provide a sustainable source of energy for transit facilities. Figure 6.2.10 is an example of solar energy use at a rail station.



Figure 6.2.10 | Solar roof, Coney Island's Stillwell Subway Station, New York.

REFERENCES: SECTION 6.2

1. FDOT, 2010. *Guidelines for Enhancing Intermodal Connections at Florida Transit Stations*. <http://www.dot.state.fl.us/transit/Pages/EnhancingIntermodalConnections.pdf>, accessed February 22, 2012.
2. Florida Building Code, 2012. *Florida Accessibility Code For Building Construction*. http://www.floridabuilding.org/fbc/committees/accessibility/aac/Changes_to_Law/Florida_Accessibility_Code_2012_ICC_FINAL.pdf, accessed February 22, 2012.
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Quick Reference Guide

STANDARDS & MINIMUM REQUIREMENTS

BRT Station Design

Because BRT is designated as bus and not rail service, the minimum ADA Standards design elements for bus stops are applicable to all BRT services unless rail station amenities are included, which must also comply with ADA Standards requirements. See Chapters 3 and 4 of this handbook for curb-side and street-side design standards.

In Florida, the FAC disallows the building of a shelter in the median of a state roadway; therefore, this type of station is not acceptable for BRT applications until/unless new legislation is passed or if the project is granted a variance from the rule.

The following documents provide regulatory practices in roadway markings and should be referred to for further details on how to properly mark separated BRT running ways: *FDOT Manual of Uniform Minimum Standards for Design, Construction, and Maintenance for Streets and Highways (Florida Greenbook)*, *FDOT Design Standards*, *FHWA Manual of Uniform Traffic Control Devices*, *ADA Standards for Transportation Facilities*.

Rail Station Design

The height and position of a platform must be coordinated with the floor of the vehicles it serves to minimize the vertical and horizontal gaps passengers will encounter while boarding or alighting the vehicle, in accordance with the *ADA Accessibility Guidelines for Transportation Vehicles* (36 CFR Part 1192).

Low-level platforms shall be 8 inches minimum above the top of the rail.¹

The horizontal gap between a car at rest and the platform shall be no greater than 3", and the height of the car floor shall be within plus or minus 1.5" of the platform height to comply with the ADA regulations.² However, according to the Florida Accessibility Code for Building Construction, for rail systems subject to Department of Transportation regulation 49 CFR 37.21 (light rail, commuter rail, and intercity), where it is not operationally or structurally feasible to meet the horizontal gap or vertical difference requirements of Part 1192 or 49 CFR Part 38, mini-high platforms, car-borne or platform-mounted lifts, ramps or bridge plates, or similar manually-deployed devices that meet the requirements of 49 CFR Part 38 shall suffice.¹

For stations with non-level boarding, a mini-high platform, a mechanical lift, or other form of accessible boarding must be provided to facilitate access for passengers with disabilities.²

Based on ADA guidance on slope requirements, newly-constructed rail platforms shall not exceed a slope of 1:48 (2%) in all directions. However, where platforms serve vehicles operating on existing track or track laid in an existing roadway, the slope of the platform parallel to the track shall be permitted to be equal to the slope (grade) of the roadway or existing track.³

Platforms must be designed, at a minimum, to allow passengers to walk, wait, board, and alight the rail vehicles in a safe and efficient manner.

ADA Standards require a clear width of at least 60" (5') to allow a person in a wheelchair to make a turn around an obstruction. This distance may include the required 24" (2') detectable warning surface along the platform boarding edge.

Platform boarding edges not protected by platform screens or guards shall have 24" of detectable warning material along the full length of the public use area of the platform.³ The detectable warnings shall comply with ADA Standards Section 705.

Adjacent platforms configured for opposing travel shall be separated by a low fence or other physical barrier.

Rail Station Design (cont'd)

Proper signage to identify a station or its entrance must be provided in accordance with ADA Standards for passengers to easily locate the station and its entrances. At least one sign at each station entrance shall comply with ADA tactile signage requirements (see ADA Standards Section 703.3 for requirements on tactile signage). Tactile signage shall also be placed in uniform locations to the maximum extent practicable. Where signs identify a station that has no defined entrance, at least one sign shall be placed in a central location.³

Other than route maps, these signs shall comply with the following ADA requirements:

- At least one tactile sign identifying the specific station and complying with ADA requirements for raised characters and Braille shall be provided on each platform or boarding area.
- Signs, to the maximum extent practicable, shall be placed in uniform locations within the system. Signs must meet ADA Standards for character stroke, width, spacing, line spacing, contrast, glare, and character height.

ADA Standards require that where public address systems convey audible information to the public, the same or equivalent information shall be provided in a visual format.

Crossing of rail tracks at platforms must comply with appropriate ADA Standards.

At a minimum, existing bus and rail facilities must be connected by at least one accessible path, and rail and bus aspects of the facility must meet ADA Standards for accessibility.

Because of multiple modes of travel being offered, a bus terminal at a rail station must be well marked to communicate effectively which routes intersect.

For park-and-ride lot facilities connected to rail stations, ADA Standards must be followed. Refer to FDOT's *Park-and-Ride Guide* for additional information.

¹ Florida Building Code, 2012. *Florida Accessibility Code For Building Construction*. http://www.floridabuilding.org/fbc/committees/accessibility/aac/Changes_to_Law/Florida_Accessibility_Code_2012_ICC_FINAL.pdf, accessed February 22, 2012.

² FDOT, 2010. *Guidelines for Enhancing Intermodal Connections at Florida Transit Stations*. <http://www.dot.state.fl.us/transit/Pages/EnhancingIntermodalConnections.pdf>, accessed February 22, 2012.

³ US DOJ, 2010. *2010 ADA Standards for Accessible Design*. <http://www.ada.gov/regs2010/2010ADAStandards/2010ADAStandards.pdf>, accessed October 8, 2011

CHAPTER 7



Agency Coordination

Agency Coordination

The various entities involved and levels of required coordination for bus stop design and placement have continued to grow over the years in the transportation arena and now require a more concerted and emphasized focus than at any time in the past. A range of transportation agencies are involved in the design, location, construction, and maintenance of transit facilities, including state and local agencies, regional authorities, and private-sector entities. Departments and individuals within these agencies represent a wide range of disciplines, including permitting, transit planning, land use and development, roadway design, utilities, traffic operations, right-of-way, and maintenance. This handbook provides guidelines, recommendations, and best practice ideas for accessibility to help all entities and disciplines better understand the need for coordination and to foster results-oriented efforts for transit systems and their patrons.

NEED FOR COORDINATION

Transit operations occur on roads that are maintained and operated by various entities and often cross through multiple jurisdictions. Typical roadway owners/operators may be state or county agencies, cities, towns, or even private organizations (such as toll road operators, retail shopping centers, or homeowner associations).

Quick Facts

Agency Coordination Tips

- Start early and ensure open dialogue with state/city/community officials and developers.
- Align interests with each party's development goals and agree on the scope of the transit sustainability initiatives.

Working with roadway owners to determine route locations, stop locations, and passenger access facilities can yield solutions that are most appropriate and/or can accommodate all modes of travel.¹ Bus stop placement, moving a stop to a different location, or outright removal of a bus stop is a complex and relatively costly process and involves a variety of safety and technical considerations. Because of this, better coordination and cooperation among the external stakeholders of multiple agencies is required. The need for coordination is further highlighted when locating BRT or rail stations and their support facilities, as it may require displacement of existing residences and businesses. Table 7.1 provides a list of potential state and local agency partners for transit agencies.

APTA's *Transit Sustainability Guidelines* provides a framework for smart land use and livable

Table 7.1
Potential Partners for Transit Agencies²

Examples of State Agencies	Examples of Local Agencies
Department of Transportation	Department of Transportation
Parks and Recreation	Parks and Recreation
Historic Preservation Office	Historic Landmarks
Environmental Quality	Water
Housing and Community Services	Housing Authority
Economic Development	Local and Regional Planning
Land Conservation	Economic Development
Public Health	Environmental Services
	Arts and Culture

neighborhoods that guides transit systems to consider aspects of operations and maintenance activities when planning new or updated features of the system, including facility configuration, land use, and siting. These include the following:²

- Use public participation to build support for use and maintenance of transit.
- Use input from representatives of a broad cross-section of the community.
- Ensure early, open dialogue with state/city/community officials and developers to create collaborative goals.
- Align interests with each party’s development goals, and agree on the scope of the transit sustainability initiatives.

The federal government also requires that MPOs, when identifying regional transportation project funding priorities, account for coordination on major planning projects that relate to federal funding authorization provisions. Additionally, the federal government requires that agencies:

- Coordinate their transportation planning processes with local planning agencies (23 CFR 450.208).



Agency Coordination Tip

Transit agencies should review the adopted FDOT Work Program to identify new roadway projects, Project Development and Environment (PD&E) studies, and maintenance projects for early coordination.

- Develop and use a public involvement process that provides ample opportunity for meaningful participation by transportation stakeholders (23 CFR 450.210).

KEY PLAYERS

There are several key players typically involved in bus stop location and design. While their individual priorities may vary, the players have the same interest in the potential benefit of timely, safe, and convenient transit service. Although specific methods must vary to suit each particular situation, the challenge is to use their common interest to productively involve relevant players so that efficient transit service can result. Figure 7.1 shows the key players typically involved in transit agency coordination. Figures 7.2 and 7.3 show examples of situations that required inter-agency coordination.



Figure 7.1 | Key players in transit agency coordination.



Figure 7.2 | Example of an agency relocating a bus stop and shelter to outside the clear zone. This effort required coordination between FDOT and the transit agency.



Figure 7.3 | Bus stop shared by a university transit system and a county transit agency, Hillsborough County, Florida.

The key players in bus stop location and design are as follows:

Transit Agency – The transit agency is usually the primary provider of transit service.

City/County Governments – The authority with jurisdiction over the streets and sidewalks in the transit service area is usually a city or county agency, but state agencies are sometimes

involved. In Florida, the permitting and locating of transit facilities on state roads is delegated to the local city/county agency. State and federal agencies will become involved in more regional projects such as BRT and rail projects that impact Florida’s Strategic Intermodal System or other significant state facilities.

Developers – Developers provide new construction and growth in the transit service area. Development may be either residential or commercial. Though both are concerned with access, the specific nature of those concerns may vary between residential and commercial development.

Employers – Employees and customers are potential transit riders. Employers benefit when their employees and customers can travel to their premises easily and efficiently.

Neighborhood Groups – Neighborhood residents are potential consumers of transit service and potential supporters of transit, whether they use this service or not.

Key Destinations – These are the trip generators (central business districts, schools, shopping areas, public buildings, medical facilities, etc.) for those who work at these locations and for those who use the services provided at these locations.

WHEN TO COORDINATE

Transit agencies should engage stakeholders early in the planning, design, and location process for transit routes and stops. Establishing a comprehensive stakeholder engagement process for transit capital projects can identify the stakeholders and clarify the roles each has to play in the placement and design of the facilities. In addition, it may also provide a framework for public input to get integrated into the placement and design process.

It is important to coordinate activities between the transit agency and the agency responsible for the roadway. Through regular dialogue, the local Public Works Department or Department of Transportation may be able to incorporate specific

improvements into the early stages of roadway design projects that could benefit pedestrian safety for transit customers, including:¹

- Construction or enhancement of sidewalks near transit.
- Relocation and design of bus stops that promotes safer pedestrian access and egress.
- Roadway signings and markings in areas where pedestrians access transit.
- Incorporation of transit access improvements into land development or redevelopment projects.
- Location of bus bays and pullouts.

There are many different types of FDOT projects, and all have different processes and time schedules that drive decision-making:

- Major capacity projects may take 8–20 years to develop.
- Resurfacing is usually completed in just 2–5 years.
- Operational improvements that are minor can be decided upon and completed in a year; others can take up to 5 years.
- Other types of projects could be similar to any of these.

It is important that local agency staff are aware of these schedules and upcoming projects in FDOT or city/county capital improvement plans. Additionally, FDOT staff is aware that local agency staff often may not understand the State's processes. FDOT should coordinate regularly with transit and local agencies to include them in infrastructure projects that may affect their transit systems and operations. Often, transit agencies in Florida are members of an MPO's technical advisory committee or bicycle/pedestrian committee to ensure coordination with major projects. Also, many FDOT District Offices conduct quarterly or annual workshops with their transit agencies to discuss inter-agency issues and projects.

Quick Facts

Case Study #1: Agreements for Bus Stop Placement, Tacoma, Washington

The jurisdictions in the Tacoma, Washington, region have given Pierce Transit the opportunity to review most major new development and redevelopment projects within its service area. Each jurisdiction served by the transit agency has established guidelines whereby the developer may be required to provide transit enhancements when specific criteria are met. Additionally, the agency can recommend infrastructure changes such as sidewalks, through-streets, or other enhancements for improving pedestrian safety and access to transit when a site is developed. Pierce Transit has also developed a standard agreement that gives the agency the ability to locate bus stops on private roads. The transit agency signs this agreement with the owners of private property on which it would like to locate a stop, allowing the agency to locate the bus stop in the most accessible location for pedestrians.

UNDERSTANDING FDOT'S PROJECT DEVELOPMENT TIMELINE

Timely coordination with the local FDOT District Office is a key factor for a successful bus facility location and design on state roads. Knowing the timeline typically followed by FDOT may provide transit agencies and the local agencies working with them on bus facilities with a clear indication of when to coordinate with FDOT. Figure 7.4 shows FDOT's project development timeline for a major capacity improvement or realignment. These six phases of the FDOT roadway project development timeline are described as follows:³

1. **Planning** – This phase documents existing conditions and recommends mobility improvements and can take anywhere from 2 to 20 years and includes checking for consistency to ensure that the project is included in various state and local short- or long-range plans.

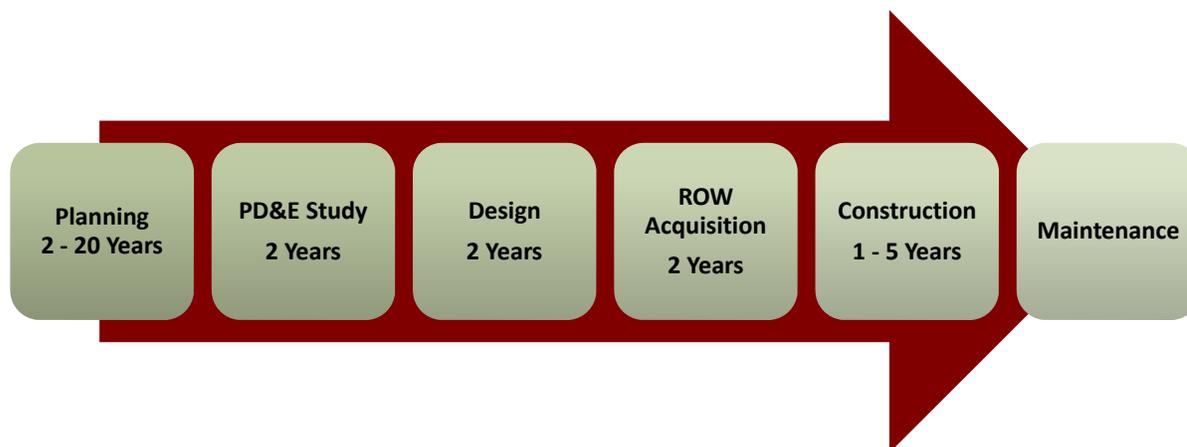


Figure 7.4 | FDOT project development timeline for major capacity improvement or realignment.

2. **Project Development & Environment (PD&E) Study** – This phase addresses environmental and community impacts associated with a project and includes the National Environmental Policy Act (NEPA) process. Also included here is the initial project scoping meeting. PD&E studies are scheduled for two years and result in a record of decision on whether to move forward with a project and various elements of the project, including transit facilities. There is an opportunity to review the plans while developing budget estimates for the various elements included in the plan. Once the plans are complete and a budget is set, changes must be completed by a supplemental agreement.
 3. **Design** – This phase provides detailed drawings and specifications regarding the design of the facility and takes approximately two years and includes detailed cost estimates to be used in budgeting for future phases. Included here is the development of the Maintenance of Traffic (MOT) plan and the plans for traffic operations.
 4. **Right-of-Way Acquisition** – This usually takes about two years to complete. Purchasing right-of-way may include right-of-way purchases for any previously-approved transit facility included in the plans.
 5. **Construction** – This can vary in length depending on how extensive the project is and how the MOT handles traffic. This phase of the project can last anywhere from one to five years, depending on the scale of the project. If transit facilities are to be built, close coordination with the construction manager is essential. Construction also may cause changes in route schedules and alignments and may even necessitate temporary stops. In such cases, mechanisms should be identified for proper public notification.
 6. **Maintenance** – This includes the ongoing monitoring of the system and the placement of retrofitted amenities. This phase is ongoing from the end of the construction phase. Transit agencies must coordinate with the managing agency because maintenance work may impact transit service along certain routes and specific stops and stations. Additionally, FDOT maintenance offices have the responsibility of removing unsafe or non-ADA-compliant objects in the state right-of-way. Notification and communication between these agencies regarding these issues is required.
- A project timeline varies according to the different types of projects. For those projects that are not major capacity, such as resurfacing and operational improvements, understanding the

timeline and who to contact can be critical to successful inclusion of bus stop and facility needs. Resurfacing projects are reviewed annually, but are usually identified about three fiscal years prior to the construction work. This means that the scoping and design phases of the projects can occur within a year or two from being identified and approved as a new project.

Identification of operational improvement projects can vary from one to five years, depending on the need and funding source. FDOT District staff should conduct roadway safety audits with the various affected entities prior to implementing operational improvements. Regular and consistent coordination with the appropriate staff members can help to ensure that potential bus stop and facility needs are considered and incorporated into these types of projects.

PROJECT MILESTONES FOR COORDINATION

A better understanding of when to coordinate allows transit agencies and their partners to prepare early and engage in timely and effective coordination efforts that can yield the desired outcomes. The key points where agency coordination is essential in bus stop design and placement include the following:

- **Facility Permitting** – Permits for shelter and bench placement along state rights-of-way are regulated by Rule 14-20, FAC. In this rule, local jurisdictions are charged with permitting shelters and benches on state roads; however, all installations must comply with design and accessibility standards. Understanding the local permitting process of each jurisdiction is important, and knowing when to coordinate with FDOT and other applicable entities is key to successfully placing benches and shelters. See information later in this section on the permitting process for placement of shelters and benches for additional details.
- **Bus Stop Design** – Decisions on design elements such as location, size, orientation, and other elements should be coordinated in a manner to ensure that all jurisdictions involved in the approval process will be supportive and receptive. To accomplish this, early and regular coordination should occur among the transit agencies and the local and state jurisdictions managing the rights-of-way in the transit service area. Providing an opportunity to review and endorse design guidelines and criteria for placement of facilities will help foster acceptance and approvals when requested. Many local jurisdictions have development codes that may become restrictive when seeking approvals. Resolving such issues before requesting an approval goes a long way towards gaining approval or support. Additionally, prior agreement on the parameters for selecting various locations to place amenities, selection or review checklists, and other resources for decision-making can help expedite approvals and reduce potential disagreements on when and what type of facilities to build. Sharing planned improvements and service expansion needs fosters understanding of long-term goals and enhances understanding of transit growth and needs. Many reference items, including this handbook, are available to transit systems to assist in establishing this coordination and decision-making process.
- **Bus Stop Placement** – While the transit agency may obtain the appropriate permits to place stops in the public right-of-way, notification needs to be sent to adjacent property owners and occupants to advise them of the impending change at least two weeks in advance of a bus stop being located permanently. When a stop is to be located adjacent to a planned development, coordinating the bus stop as well as sidewalk design and placement is needed between the developer and the transit agency to ensure direct access to a paved bus stop. Designing gates, providing openings through walls, and installing direct, accessible sidewalks in residential communities can be coordinated with developers to reduce walking times from the land use to the bus stop. Figure 7.5 shows an example of coordinating access points and sidewalk design with the location of a bus stop.

- Routine Maintenance** – All facilities require consideration of long-term maintenance needs; critical questions include what agency will maintain the facility, how will it be paid for, and what it will take to maintain it properly. With such decisions, early coordination can minimize potential conflicts and foster partnerships. Many local jurisdictions have become more supportive of local maintenance programs, especially when they meet their codes or community goals. Often, the local match for grant funding can include in-kind services such as maintenance activities. For facilities located on private property, owners often are willing to assist with enhancing a transit agency’s cleaning and maintenance function to match their regular property program practices.
- Bus Stop Advertising/Revenue Generation** – Frequently, agencies work with advertisers to generate revenue for bus stops. Such advertising can be applied on bus benches or even as a part of a bus shelter. However, before entering into an advertising agreement with a business, agencies must check with local and regional laws for advertising at transit stops and on bus benches. Some communities have begun limiting the amount of advertising allowed, with a few opting to ban the practice altogether. Additionally, per Rule 14-20, if bus shelters contain advertising, notification to adjacent property owners is required.
- Private Sector Purchasing Amenities/Adopting Stops** – Often, local agencies require developers to provide bus stops and amenities as part of their development orders. As these opportunities occur, transit agencies should have pre-developed plans or alternative facility goals that will allow private entities to help locate, select, build, and maintain facilities.

Quick Facts

Case Study #2: Agency Coordination, TriMet, Portland, Oregon

TriMet and the City of Portland have developed several Intergovernmental Agreements (IGAs) that have greatly improved TriMet’s ability to provide accessibility and comfort to neighborhood bus stops. For example, a carriage walk agreement between Project Planning and the Bureau of Maintenance has allowed the agencies to coordinate bus stop accessibility improvements such as ADA B&A areas and curb ramps with the City’s own efforts to upgrade the pedestrian infrastructure with curb ramps and accessible sidewalks. A bus shelter placement agreement has allowed TriMet and the City to simplify the placement and permitting process, putting amenities on the street more quickly. TriMet continues to pursue agreements such as these with its regional partners to make better and more efficient use of available funding and to provide timely, coordinated projects.⁴

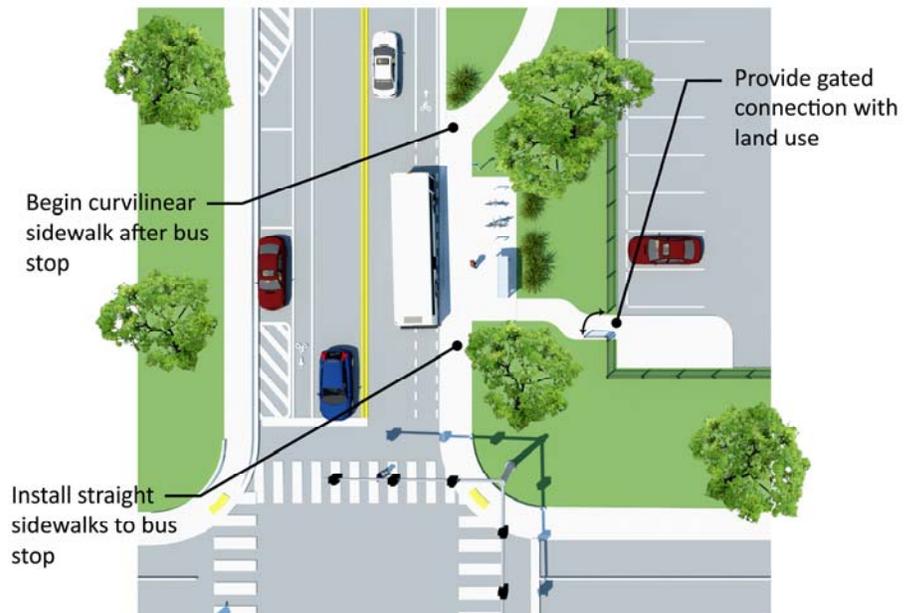


Figure 7.5 | Bus stop access points and sidewalk design—need for coordination.

Allowances to match development aesthetics, operational patterns, and other characteristics are valuable tools that can help support private-sector contributions in a manner that fosters their support. These orders and other negotiated private-sector contributions can enhance and expand the local transit agency's capabilities.

- **Stop Expansion** – Any expansion of stops along an existing route should be carefully planned and coordinated with the local jurisdictions to ensure approval and consistency. New stops require a certain degree of investment to ensure compliance with regulatory standards that should be a part of the decision-making factors. New stops being placed for new services and routes also require coordination and decision-making aspects, but also should be guided by stop placement guidelines previously agreed to with local jurisdictions.
- **Road Construction/Safety Concerns** – Roadway and/or development-related construction can sometimes impact adjacent bus stops and other transit facilities by either hampering access to some extent or making them completely inaccessible for use for some period of time. In such situations, it is critical to ensure that a transit agency's bus stop/pedestrian coordinator(s) or other staff person is aware of the planned construction activities at or around the bus stops and other transit facilities and works with roadway or development agencies and their contractors to ensure that adequate pedestrian access routes and convenient transit service access are provided during construction periods.
- **ADA Compliance** – Agencies should coordinate to inventory transit facilities periodically and ensure that these facilities are ADA compliant. This should include developing a plan to bring any non-compliant facilities into compliance, as facilities on state roads may be removed by FDOT if found to be non-compliant.

- **Bus Stop Move/Removal** – Before any stops or shelters are removed by a transit agency, the affected stops should be posted with an informational flier for a minimum of two weeks to alert customers of the planned changes and allow for rider comment. This does not apply if shelters or stops must be removed immediately due to safety concerns.

PERMIT PROCESS FOR PLACEMENT OF SHELTERS AND BENCHES

Transit systems develop criteria and standards for locating and placing bus stops along public rights-of-way. In Florida, FDOT, local municipalities, and counties maintain roadways and have responsibility to maintain usable and safe transportation facilities within their rights-of-way. However, for the placement of benches and shelters, Rule 14-20, FAC, places the permitting process for state rights-of-way with the local jurisdictions.

Regardless of the permitting entity, all design and accessibility standards still apply. When on state roadways, ensuring compliance with ADA, FDOT, and public right-of-way standards is the responsibility of both the permitting agency and the permit recipient. It should be noted that FDOT and other jurisdictions may take action to remove non-ADA-compliant components or mitigate unsafe conditions and maintenance impediments, such as when benches or shelters are in the clear zone or access for mowing grass shoulders is blocked.

As a best practice, agencies wanting to place or install benches and shelters should not only coordinate with the local jurisdiction issuing the permit, but also should contact FDOT Operation Centers where local maintenance staff are located as well as the District ADA coordinator for ADA-related issues. In new areas or where local jurisdictions are not experienced in the permitting process, the local transit agency can become a facilitator in helping to establish or

improve the permitting process and level of understanding of staff in such areas.

When roadway construction projects are being planned and shelters or benches exist, coordination with local transit agencies and permitting entities on existing permits is warranted to ensure that the current facilities are maintained or brought up to revised standards. Additionally, any special conditions that are in place for existing facilities need to be reviewed and considered in decisions. For example, a private entity or property owner may have funded or placed a bench or shelter and have a vested interest in ensuring that it is retained. The key factor in this process is proper coordination.

TOOLBOX OF ACTIONS FOR BETTER COORDINATION

Better coordination among agencies involved in any transit facility design project ensures the most desirable outcome for the parties involved while also fostering the attractiveness of transit as a viable alternative. Typically, agencies use various forms of strategies such as Intergovernmental Agreements (IGAs) and Memorandums of Understanding (MOUs) to build these relationships.

To aid agencies with their efforts on coordination, this section presents a toolbox of key actions to consider when developing and reviewing plans that include proposed transit facilities. Two “cardinal rules” in agency coordination are presented, followed by the three toolboxes of actions for transit agencies, FDOT, and local agency staff.

- **Cardinal Rule #1:** Find common ground and mutually understand the parameters in which agencies must operate. Local agencies should ask about FDOT restrictions and allowances, and FDOT needs to be aware of local goals and desires for the communities that it impacts.
- **Cardinal Rule #2:** Know the applicable regulatory requirements and always use the most stringent regulations. Ensure that you

have the right resources or know where to find the most current version.

Transit Agency Toolbox

General, non-project-specific actions that transit agencies can take to be prepared for and to foster partnerships with local, regional, and state transportation agencies as well as other key players include the following:

- **Develop a quick reference contact list** of key departments, agencies, and staff with responsibilities related to pedestrian safety. In particular, transit agencies should communicate regularly with local, regional, and state pedestrian and bicycle coordinators.
- **Develop required document templates and checklists** such as IGAs and MOUs on transit facilities and associated facility components (sidewalks, landscaping, etc.) and checklists for ADA or design standards as well facility best practices or options.
- **Schedule regular meetings** to discuss transit access and pedestrian safety issues.
- **Develop bus stop placement/maintenance agreements** for private sector partners.
- **Establish bus facilities task forces** with state, regional, and local jurisdictions and other applicable public/private organizations.
- **Serve on MPO advisory committees** such as the MPO Technical Advisory Committee.

Actions that transit agencies may need to take once a bus stop design and placement project is initiated include the following:

- **Engage early in project review and scoping processes** with local and state planning departments. Make every effort to be involved from the earliest stages of the planning process. Participate when asked and follow up when needed. Have inventories and data readily available to assist in quick turnaround needs.

- **Learn and know FDOT processes**, or at least become familiar enough to understand how and when to step up and what to watch for. Understand FDOT priorities and plans and which roads it has jurisdiction over and plans to improve. FDOT terminology can be different from the norm, and learning the differences and definitions can be important to communication.
- **Involve all required parties** by scheduling and conducting meetings with the appropriate stakeholders. The transit agency has the responsibility to consider the appropriate internal and external coordination necessary for each project.
- **Conduct productive meetings** by adhering to the meeting and project schedule and jointly developing checklists with internal and external staff to ensure that all parties are coordinating appropriately and contributing to the same results. Ensure that follow-up actions and assignments are understood and that someone will be tracking the action items for resolution.
- **Do your homework to learn about your roads and transit systems and planned improvements.** Learn the road system since, often, issues are caused by not knowing the roadway jurisdiction and/or not knowing its function. In addition, be aware of the transit agency's plans in order to facilitate and guide the coordination efforts. An understanding of the current versus planned road network also may assist the parties with seeing how things fit together in the big picture. Know the facility standards and best practices for the state and community/system and have resources available to explain that to them when asked.
- **Understand the needs** of the local agency planning the bus facility. Consider the impacts of decisions on local transit agency service and patrons, and understand that lane closures and detours can have adverse and long-term outcomes.
- **Know which counties or cities have transit.** If not already involved, keep FDOT Transit Office staff informed and involved so they can provide necessary assistance. Know that transit can be very adaptable or flexible, given the appropriate information and provided adequate notice.
- **Contact the right people and ask the right questions** when developing scopes, planning projects, considering impacts, etc. Since some transit agencies are separate authorities, while others are county or city departments, do not assume that you can reach all of the necessary players with one contact.
- **Know the resources**, such as what the available funding will allow, the existence of right-of-way, etc. Understand transit resources by asking questions and involving the appropriate people.
- **Understand FDOT's roles:** the agency is charged with developing and encouraging all modes, and much of the local transit service and facilities include State/FDOT investment. As a result, transit is an FDOT concern, not just the responsibility of local entities.
- **When invited, participate** or at least follow up. This is key to better coordination and helps transit agencies and other local jurisdictions to clarify key issues related primarily to facilities on state roadways.
- **Conduct roadway safety audits** of appropriate corridors to identify what elements of the road may present a safety concern: to what extent, to which road users, and under what circumstances. In addition, it can also help identify what opportunities exist to eliminate or mitigate identified safety concerns.

FDOT Staff Toolbox

FDOT also can ensure the coordination efforts among its offices, a transit agency, and any other participating local, regional, and/or state agencies through the following:

- **Collect needed information on affected roadways.** Know that rural versus urban has many meanings and that location is only one of them. For example, rural design means no curb and open drainage in typical sections to FDOT designers. Know the state inventories, including existing roadway and transit facilities. Collect data through field reviews if the needed information is not already available. Once the data are collected, identify gaps that need to be addressed (e.g., sidewalks, accessible pathway connections, etc.).
- **Ask many questions.** During field reviews and scoping, FDOT designers should ask questions about important topics such as the availability of bus routes, the location of bus stops, the agency in charge of the project, and planned improvements for the corridor, among others. In the design phase, ask questions such as who will review and comment and how FDOT will be provided with the information.
- **Conduct periodic and recurring workshops** with transit agencies.
- **Build consensus.** These tools should not be developed in a vacuum, so you should work with FDOT and other jurisdictions to reach consensus on the tools, and then use them. They can be your documentation, but they also will help you paint a clear picture.
- **Manage and maintain** your facilities on a regular basis to ensure compliance with all laws and regulations, specifically ADA, and maintain a safe, accessible path to transit stops and buses. Establish a process of public notification of bus stop problems and for issuing work orders to fix problem areas.

Initiating Coordination

When beginning the process to coordinate transit facilities at bus stops and within public rights-of-way, taking that first step to contact and involve others can seem cumbersome or even insurmountable. Just remember that most professional staff desires to do the right thing and wants to work cooperatively and be actively engaged.

Planning and/or participating in joint training opportunities to build relationships and develop common ground and references can help facilitate contact and relationships. Watching for and attending activities and workshops where common issues may be discussed and consensus could be initiated or developed is another strategy to engage other professional staff.

Local Agency Staff Toolbox

- **Know who to contact** by finding out the different roles and responsibilities of the participating agencies. Transit staff will look out for you, but you need to expend some level of effort to know who the project managers are, when the public information office gets involved, who manages the mail or contact lists, etc.
- **Illustrate your needs.** Pictures can paint a thousand words. If you can use or develop templates or guidelines and share them early with FDOT staff, it will not be a surprise later when you ask for a specific footprint to be reserved or location to be set aside. Think about what would make it easy to explain your needs and get agreement on the tools beforehand. Local agencies should make this as easy as possible by developing and adopting as many checklists as necessary to be able to identify and express needs adequately.

REFERENCES: CHAPTER 7

1. Federal Highway Administration, U.S. Department of Transportation, 2008. *Pedestrian Safety Guide for Transit Agencies*. Washington, DC.
2. American Public Transportation Association, 2011. *Transit Sustainability Guidelines, Framework for Approaching Sustainability and Overview of Best Practices*.
3. FDOT Districts 1 and 7, 2007. *Transit Facility Handbook*.
4. TriMet, 2010. *Bus Stop Guidelines*.

INDEX OF RESOURCES

The following is a list of the resources used to develop this handbook. Each listing includes a live Web link for users to access the resource. Resources for additional and updated standards and best practices are included as well.

A

Accessing Transit, Version II, FDOT

http://www.dot.state.fl.us/transit/Pages/2008_Transit_Handbook.pdf

Accessibility Design Guide for Bus Rapid Transit Systems, Easter Seals Project ACTION

<http://www.projectaction.org/ResourcesPublications/BrowseOurResourceLibrary.aspx>

ADA Accessibility Specifications for Transportation Vehicles, US DOJ

<http://www.gpo.gov/fdsys/pkg/CFR-2011-title49-vol1/pdf/CFR-2011-title49-vol1-part38.pdf>

ADA Standards for Accessible Design, US DOJ

http://www.ada.gov/2010ADASTandards_index.htm

ADA Standards for Transportation Facilities, US DOT

<http://www.access-board.gov/ada-aba/ada-standards-dot.cfm>

B

Bicycle-Bus Conflict Area Study, SEPTA

<http://onlinepubs.trb.org/onlinepubs/conferences/2010/NATMEC/Krykewycz.pdf>

Bicycle Facility Design Guidelines, City of Minneapolis

<http://www.minneapolismn.gov/bicycles/projects/plan>

Bus Rapid Transit Stations and Stops, APTA

http://www.aptastandards.com/Portals/0/Bus_Published/002_RP_BRT_Stations.pdf

C

Characteristics of Bus Rapid Transit for Decision-Making, FTA & DOT

<http://www.nbrti.org/CBRT.html>

D

Design Safety Prompt Lists, FDOT District 7

<http://www.d7ctst.org/FDOT%20D7%20Design%20Safety%20Prompt%20List.pdf>

Design Standards, FDOT

<http://www.dot.state.fl.us/rddesign/DS/12/STDs.shtm>

Driveway Information Guide, FDOT

<http://www.dot.state.fl.us/planning/systems/sm/accman/pdfs/driveway2008.pdf>

F

Florida Administrative Code (FAC), Chapters 14–20

<https://www.flrules.org/>

Florida Building Code

http://www2.iccsafe.org/states/florida_codes/

Florida Highway Landscape Guide, FDOT

http://www.dot.state.fl.us/emo/beauty/Highway_Main_files/Land_Arch_Main_files/Landscape_Guide.pdf

Florida Intersection Design Guide, FDOT

<http://www.dot.state.fl.us/rddesign/FIDG-Manual/FIDG.shtm>

Florida Safe School Design Guidelines: Strategies to Enhance Security and Reduce Vandalism, FDOT

http://www.fldoe.org/edfacil/safe_schools.asp

Florida Transit Oriented Development Clearinghouse, FDOT

<http://fltod.com>

G

Gillig Bus Dimensions, Gillig Corporation

<http://www.gillig.com/>

Guide for the Planning, Design, and Operation of Bicycle Facilities, AASHTO

<https://bookstore.transportation.org>

Guidelines for Enhancing Intermodal Connections at Florida Transit Stations, FDOT

<http://www.dot.state.fl.us/transit/Pages/EnhancingIntermodalConnections.pdf>

I

The Intermittent Bus Lane System: Demonstration in Lisbon, Bus Rapid Transit Workshop

http://www.brt.cl/workshop2008/pdf/miercoles/jmv_IBL_BRT_Wkshp_Santiago_Aug08_movie.pdf

J**Journal of the Oregon Department of Transportation Traffic Control Plans Unit, In the Zone, ODOT**

http://www.oregon.gov/ODOT/HWY/TRAFFIC-ROADWAY/docs/pdf/InTheZone_2011-Issue1.pdf?ga=t

L**Liveable Roadways Guidelines, Hillsborough County MPO**

http://www.hillsboroughmpo.org/pubmaps/pubmaps_folders/walk-bike-plans-studies/080106-Livable%20Roadways-final.pdf

M**Manual of Uniform Minimum Standards for Design, Construction, and Maintenance for Streets and Highways (Florida Greenbook), FDOT**

http://www.dot.state.fl.us/trafficoperations/Operations/PDFs/FDOT_Traffic_Engineering_Manual_revised_January_2012.pdf

Manual on Uniform Traffic Control Devices (MUTCD), FHWA

<http://mutcd.fhwa.dot.gov/>

O**Optimization Models for Prioritizing Bus Stop Facility Investments for Riders with Disabilities, US DOT, FTA**

<http://lctr.org/transpodeliverables/files/Bus%20Stop%20Optimization%20Final%20Report.pdf>

P**Pedestrian Safety Guide for Transit Agencies, FHWA**

http://safety.fhwa.dot.gov/ped_bike/ped_transit/ped_transguide/

Plans Preparation Manual (PPM), FDOT

<http://www.dot.state.fl.us/rddesign/PPMManual/PPM.shtm>

Plastic Safety Systems, Inc., Safety Rail

<http://www.plasticsafety.com/>

Project Development and Environment (PD&E) Manual, FDOT

<http://www.dot.state.fl.us/emo/pubs/pdeman/pdeman1.shtm>

Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG), US Access Board

<http://www.access-board.gov/prowag/nprm.htm>

R

Roundabouts: An Informational Guide, NCHRP

<http://www.trb.org/Main/Blurbs/164470.aspx>

S

State Park-and-Ride Manual, FDOT

<http://www.dot.state.fl.us/transit/Pages/FinalParkandRideGuide20120601.pdf>

Stop Waste, Alameda County Waste Management

<http://stopwaste.org/docs/salvaged.pdf>

Street Design Manual, New York City DOT

<http://www.nyc.gov/html/dot/html/about/streetdesignmanual.shtml>

Sun Pods, Sun-Bus Solar Power System

<http://www.sunpods.com/sunpods-sun-bus.html>

T

TCRP Report 12: Guidelines for Transit Facility Signing and Graphics, TRB

<http://www.tcrponline.org/>

TCRP Report 19: Guidelines for the Location and Design of Bus Stops, TRB

<http://www.tcrponline.org/>

TCRP Report 83: Bus and Rail Transit Preferential Treatments in Mixed Traffic, TRB

<http://www.tcrponline.org/>

TCRP Report 88: Strollers, Carts, and Other Large Items on Buses and Trains, TRB

<http://www.tcrponline.org/>

TCRP Report 117 : Design, Operation, and Safety of At-Grade Crossings of Exclusive Busways, TRB

<http://www.tcrponline.org/>

TCRP Synthesis 17: Customer Information at Bus Stops, TRB

<http://www.tcrponline.org/>

TCRP Synthesis 64: Bus Use of Shoulders, TRB

<http://www.tcrponline.org/>

TCRP Synthesis 80: Transit Security Update, TRB

<http://www.tcrponline.org/>

TCRP Synthesis 84: Current Practices in Greenhouse Gas Emissions Savings from Transit, TRB

<http://www.tcrponline.org/>

Toolkit for the Assessment of Bus Stop Accessibility and Safety, Easter Seals Project ACTION

<http://www.projectaction.org/ResourcesPublications/BrowseOurResourceLibrary.aspx>

Traffic Engineering Manual, FDOT

[http://www.dot.state.fl.us/trafficoperations/Operations/PDFs/
FDOT Traffic Engineering Manual revised January 2012.pdf](http://www.dot.state.fl.us/trafficoperations/Operations/PDFs/FDOT_Traffic_Engineering_Manual_revised_January_2012.pdf)

Transit Design Manual, PalmTran, Palm Beach County, FL

<http://www.pbcgov.com/palmtran/marketing/pdf/library/transit-design-manual.pdf>

Transit Facility Guidelines, FDOT District 4

<http://www.dot.state.fl.us/transit/Pages/UpdatedD4TransitFacilitiesGuidelines.pdf>

Transit Facility Handbook, FDOT Districts 1 & 7

http://www.dot.state.fl.us/transit/Pages/FDOT_D1_D7_Transit_Facility_Handbook.pdf

Transit Signal Priority: A Planning and Implementation Handbook, US FTA

<http://www.fta.dot.gov/documents/TSPHandbook10-20-05.pdf>

Transit Sustainability Guidelines – Framework for Approaching Sustainability and Overview of Best Practices, APTA

<http://www.apta.com/resources/hottopics/sustainability/Documents/Transit-Sustainability-Guidelines.pdf>

Bus Stop Guidelines, TriMet

<http://trimet.org/pdfs/publications/bus-stop-guidelines.pdf>

W

WorkZoneSafety.org, Pedestrian Safety and Accessibility in Work Zones, FHWA

[http://www.workzonesafety.org/files/documents/training/fhwa_wz_grant/
atssa_pedestrian_work_zones.pdf](http://www.workzonesafety.org/files/documents/training/fhwa_wz_grant/atssa_pedestrian_work_zones.pdf)

APPENDIX A

Glossary¹

A

AASHTO – American Association of State Highway and Transportation Officials.

ADA – Americans with Disabilities Act of 1990; see *Legislation, Americans with Disabilities Act of 1990*.

ADAAG – American with Disabilities Act Accessibility Guidelines.

APTA – American Public Transit Association.

AVL – Automatic vehicle location system.

Access, limited (controlled access) – in transportation, to have entry and exit limited to predetermined points, as with rail rapid transit or freeways.

Accessibility – 1) a measure of the ability or ease of all people to travel among various origins and destinations; 2) in transportation modeling and planning, the sum of the travel times from one zone to all other zones in a region, weighted by the relative attractiveness of the destination zones involved; 3) In traffic assignment, a measure of the relative access of an area or zone to population, employment opportunities, community services, and utilities.

Accessibility, persons with disabilities (full accessibility) – the extent to which facilities are free of barriers and usable by persons with disabilities, including wheelchair users.

Accessible transportation facilities – transportation facilities that are barrier-free, allowing their use by all travelers, including older adults, persons who are transportation disadvantaged, and persons with disabilities.

Accessway – a paved connection, preferably non-slip concrete or asphalt, that connects the bus stop waiting pad with the back face of the curb.

Advertising shelter – a bus shelter that is installed by an advertising agency for the purpose of obtaining a high visibility location for

advertisements; b agreement, the bus shelter conforms to the transit agency specifications but is maintained by the advertising company.

Alight – to get off or out of a transportation vehicle.

Alignment – in transportation, the horizontal and vertical layout of a roadway, railroad, transit route, or other facility as it would appear in plan and profile; the alignment is usually described on the plans by the use of technical data, such as grades, coordinates, bearings, and horizontal and vertical curves; see also *Roadbed*.

Alternate fuel – alternatives to conventional diesel fuel for urban transit buses, intended to reduce pollution; includes methanol, propane, CNG (compressed natural gas), LNG (liquefied natural gas), hydrogen (for fuel cells), and biomass derived fuels, all of which carry premium costs that trend in larger or more cost-conscious operators toward “clean diesel” solutions.

Amenities – items that provide or increase comfort or convenience.

American Association of State Highway and Transportation Officials (AASHTO) – national organization whose membership includes state and territorial highway and transportation departments and agencies and the U.S. Department of Transportation; its goal is to develop and improve methods of administration, design, construction, operation, and maintenance of a nationwide integrated transportation system; studies transportation problems, advises Congress on legislation, and develops standards and policies.

American Public Transit Association (APTA) – a non-profit international industry association made up of transit systems and other organizations and institutions connected to or concerned with the transit industry; performs a variety of services for the industry; objectives include promotion of transit interests, information exchange, research, and policy development.

Area, service – 1) the jurisdiction in which the transit property operates; 2) the geographic region in which a transit system provides service or that a transit system is required to serve.

Area, urbanized (UA) – as defined by the Bureau of the Census, a population concentration of at least 50,000 inhabitants, generally consisting of a central city and the surrounding, closely settled, contiguous territory (suburbs). The boundary is based primarily on a population density of 1,000 people/mi² but also includes some less densely-settled areas, as well as such areas as industrial parks and railroad yards, if they are within areas of dense urban development. The boundaries of UAs, the specific criteria used to determine UAs, or both may change in subsequent censuses. Also abbreviated as *UZA*.

Arterial – a moderate- or high-capacity roadway designed for the continuity of movement; usually broken into categories by their throughput ability, with principal arterials being of higher capacity than minor arterials.¹⁰

Articulated bus or articulated trolleybus – an extra-long, high-capacity bus or trolleybus that has the rear body section or sections flexibly but permanently connected to the forward section, which allows the vehicle to bend in curves and yet have no interior barrier to movement between the two parts. The *puller* type features a powered center axle, and the *pusher* type features a powered rear axle. Articulated buses with powered center and rear axles exist but are not common. Typically, an articulated bus is 16–18 m (54'–60') long with a passenger seating capacity of 60–80 and a total capacity of 100–140.

At-grade – operation at the ground level facility that may require signals or other traffic controls at junctions with other facilities, depending on volumes of traffic, visibility, and other factors such as speed that determine the extent of the probably conflict between the traffic flows.¹⁰

Automatic vehicle location system (AVL) – a system that determines the location of vehicles carrying special electronic equipment that communicates a signal back to a central control facility; used for detecting irregularity in service and are often combined with a computer-aided dispatch system.

B

Bicycle lane – see *Lane, bicycle*.

Bicycle locker – a lockable, enclosed container used for storing a bicycle; typically provided at major transit stops and stations and rented on a monthly basis.

Bicycle rack – 1) a fixed post or framework to which bicycles may be secured and locked, typically provided on a first-come, first-served basis; 2) a device mounted to a transit vehicle that allows bicycles to be transported outside the passenger compartment; typically provided on a first-come, first-served basis; many transit operators require that passengers obtain a permit to use them.

BOB – Bike on bus.

Boarding and alighting area (B&A area) – a firm, stable, and slip-resistant surface that is 5'x 8' in measurement with no greater than a 2% cross slope; should maintain vertical clearance and be connected to existing infrastructure via an accessible route.

Bollard – an upright fixed block (usually concrete) used to prevent the unauthorized or unintended entry of vehicles into an area.

BRT – Bus Rapid Transit, see also *Transit system, bus rapid*.

BSP – Bus signal priority.

Bus – a self-propelled, rubber-tired road vehicle designed to carry a substantial number of passengers (at least 16; various legal definitions may differ slightly as to minimum capacity), commonly operated on streets and highways. Has enough headroom to allow passengers to stand upright after entering. Propulsion may be by internal combustion engine, electric motors or hybrid; see also *Alternate fuels*. Smaller-capacity road transit vehicles, often without full headroom, are termed vans.

Bus, low floor – a bus without steps at entrances and exit. The low floor may extend throughout the bus or may use a ramp or steps to access the raised rear portion over a conventional axle and

drive train. Wheelchair access is provided by a retracting ramp.

Bus, standard urban (transit coach, urban transit bus) – a bus for use in frequent-stop service with front and (usually) center doors, normally with a rear-mounted engine and low-back seating. Typically 35–40' long.

Bus bay – 1) a branch from or widening of a road that permits buses to stop, without obstructing traffic, while laying over or while passengers board and alight; also known as a *blister*, *bus duckout*, *turnout*, *pullout*, *pull-off* or *lay-by*; as reentry of the bus into the traffic stream can be difficult, many agencies discourage their construction; 2) a specially-designed or designated location at a transit stop, station, terminal, or transfer center at which a bus stops to allow passengers to board and alight; also known as a *bus dock* or *bus berth*; 3) a lane for parking or storing buses in a garage facility, often for maintenance purposes.

Bus bay, sawtooth — a bus bay design in which the curb is indented in a sawtooth pattern, allowing buses to enter and exit bus bays independently of other buses; often used at transit centers.

Bus bulb (curb bulb) – an extension of the sidewalk into the roadway for passenger loading without the bus pulling into the curb; gives priority to buses and eases reentry into traffic; often landscaped and fitted with bus shelter and other passenger amenities. Also called *bus bulge*, *curb bulge*, and *curb extension*.

Bus stop spacing – the distance between consecutive stops.

Bus stop zone length – the length of a roadway marked or signed as available for use by a bus loading or unloading passengers.

Busway – a special roadway designed for exclusive use by buses. It may be constructed at, above, or below grade and may be located in separate rights-of-way or within highway corridors; variations include grade-separated, at-grade, and median busways. Sometimes called a *transitway*.

C

CBD – see *Central business district*.

CNG – Compressed natural gas.

CPTED – Crime Prevention Through Environmental Design is a concept to prevent crime by designing a physical environment that positively influences human behavior. The theory is based on four principles: natural access control, natural surveillance, territoriality, and maintenance.

Central business district (CBD) – defined by the Bureau of the Census as an area of high land valuation characterized by a high concentration of retail businesses, service businesses, offices, hotels, and theaters, as well as by a high traffic flow. A CBD follows census tract boundaries; that is, it consists of one or more whole census tracts. CBDs are identified only in central cities of MSAs and other cities with populations of 50,000 or more.

Clear zone – an unobstructed, traversable roadside area designed to enable a driver to stop safely or regain control of a vehicle that has accidentally left the roadway; an effective strategy for prevention and mitigation of roadway departure crashes.¹

Colored pavement – consists of differently colored road paving materials, such as colored asphalt or concrete, or paint or other marking materials applied to the surface of a road or island to simulate a colored pavement. FHWA has issued an Interim Approval for the use of green colored pavement in marked bicycle lanes and in extensions of bicycle lanes through intersections and other traffic conflict areas.²

Corridor – in planning, a broad geographical band that follows a general directional flow or connects major sources of trips. It may contain a number of streets and highways and transit lines and routes.

Curb-side factors – factors that are located off the roadway that affect patron comfort, convenience, and safety.

Curb-side stop — a bus stop in the travel lane immediately adjacent to the curb.

Curb-side platform – a raised boarding platform

at a curb-side location; typically in conjunction with level bus boarding or BRT.

D

DOT – department of transportation.

Deceleration, retardation, braking rate – decrease in velocity per unit time; in transit practice, often measured in m/s² (ft/s²) or, in the United States, mph/s.

Defensible space – a concept in architecture and urban design that precludes designs resulting in dark alleys, corners, or spaces where visibility and openness to other people is severely limited.

Department of Transportation (DOT) – a municipal, county, state, or federal agency responsible for transportation.

Destination – 1) the point at which a trip terminates; 2) in planning, the zone in which a trip ends.

Discharge – in transit operations, to let passengers exit the vehicle.

Detectable warning – as defined by ADAAG, a standardized surface feature built in or applied to walking surfaces or other elements to warn of hazards on a circulation path; should consist of a surface of truncated domes compliant with the 2010 Standards of Accessible Design.³

Downstream – in the direction of traffic.

E

EMS Access – Emergency Medical Services Access.

F

FAC – Florida Administrative Code.

FHWA – Federal Highway Administration.

FTA – Federal Transit Administration.

Federal Highway Administration (FHWA) – a component of the U.S. Department of Transportation, established to ensure development of an effective national road and highway transportation system; assists states in

constructing highways and roads and provides financial aid at the local level, including joint administration with the Federal Transit Administration of the 49 USC Section 5311 (formerly Section 18 of the Federal Transit Act) program.

Federal Transit Administration (FTA) – a component of the U.S. Department of Transportation, delegated by the Secretary of Transportation to administer the federal transit program under Chapter 53 of Title 49, United State Code and various other statutes. Formerly known as the Urban Mass Transportation Administration.

Freeway – a divided highway for through traffic that has full access control and grade separations at all intersections; in some countries, it is also known as a motorway.

G

Grade or gradient – a rise in elevation within a specified distance; for example, a 1% grade is a 1' (m) rise in elevation in 100' (m) of horizontal distance.

Grade separation – the separation of two or more transport axes at different heights to eliminate conflicts between traffic flows when they cross one another.

Greenhouse gas (GHG) – any gas that absorbs infrared radiation in the atmosphere; includes carbon dioxide, methane, nitrous oxide, ozone, chlorfluorocarbons, hydrochlorofluorocarbons, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride.⁴

H

HART – Hillsborough Area Regional Transit.

HOV – high-occupancy vehicle; see *Vehicle, high occupancy*.

HOV lane – high-occupancy-vehicle lane; see *Lane, high-occupancy-vehicle*.

HOT lane – High-occupancy toll lane.

Handicapped – see *Persons with disabilities*.

Headway – the time interval between the passing

of the front ends of successive transit units (vehicles or trains) moving along the same lane or track (or other guideway) in the same direction, usually expressed in minutes; see also *Service frequency*.

Hours of service – 1) the number of hours during the day between the start and end of service on a transit route; also known as *service span*; 2) for calculating transit level of service, the number of hours during a day when service is provided at least hourly on a transit route.

I

Intelligent Transportation Systems (ITS) — electronics, communications, or information processing used singly or in combination to improve the efficiency or safety of a surface transportation system.⁵

Interchange – 1. facility for passenger transfers or connection between routes or modes, see *hub*; 2) the system of interconnecting ramps between two or more intersecting travel ways (highways, transit guideways, etc.) that are grade-separated.

Intergovernmental agreement (IGA) – a legal pact authorized by state law between two or more units of government in which the parties contract for or agree on the performance of a specific activity through either mutual or delegated provision; tantamount to contracts; work best when responsibilities, financial obligations, and procedures are detailed.⁶

Intermodal – 1) the ability to connect, and make connections between, modes of transportation; 2) those issues or activities that involve or affect more than one mode of transportation, including transportation connections, choices, cooperation and coordination of various modes.

Intermodal integration – service coordination between two or more different transportation modes; may include joint (transfer) stations, coordinated scheduling, joint fares, and combined public information activities.

J

Jaywalk – illegally crossing a street in the middle of the block or against a pedestrian signal.

K

Kiss-and-ride (kiss 'n ride, K&R) – an access mode to transit whereby passengers (usually commuters) are driven to a transit stop and left to board a transit unit and are met after their return trip; transit stations, usually rail, often provide a designated area for dropping off and picking up such passengers.

L

LED – Light Emitting Diodes.

LEED – Leadership in Energy and Environmental Design; a voluntary, consensus-based, market-driven program that provides third-party verification of green buildings.¹¹

LOS – level of service.

Loading island – 1) a pedestrian refuge within the right-of-way and traffic lanes of a highway or street, provided at designated transit stops for the protection of passengers from traffic while they wait for and board or alight from traffic vehicles; also known as a *pedestrian* or *boarding island*; 2) a protected spot for the loading and unloading of passengers; may be located within a rail transit or bus station; 3) for streetcar and light rail systems, a passenger loading platform is in the middle of the street, level with the street, or, more usually, raised to curb height; often protected with a *bollard* facing traffic; also known as a *safety island*.

Lane, bicycle – a portion of roadway that has been designated for preferential or exclusive use by bicyclists by pavement markings and, if used, signs.²

Lane, bus (bus priority lane, preferential bus lane, priority bus lane) – a highway or street lane reserved primarily for buses, either all day or during specified periods; may be used by other traffic under certain circumstances, such as making a right or left turn, or by taxis, motorcycles, or carpools that meet specific requirements described in the traffic laws of the specific jurisdiction.

Lane, contraflow – a highway or street lane on which vehicles operate in a direction opposite what

would be the normal flow of traffic in that lane; may be permanently-designated contraflow lanes, or, more usually, used as contraflow lanes only during certain hours of the day. Frequently, the use of a contraflow lane is restricted to public transit and (possibly) other specially-designated vehicles.

Lane, high-occupancy toll – one or more lanes of a highway that charges tolls as a means of regulating access to or the use of the facility, to maintain travel speed and reliability.

Lane, exclusive transit (reserved transit lane) – a highway or street lane reserved for buses, light rail vehicles, or both.

Lane, high-occupancy vehicle (HOV lane) – a highway or street lane reserved for the use of high-occupancy vehicles (HOVs); see *Lane, carpool*.

Lane, managed – highway facilities or a set of lanes where operational strategies are proactively implemented and managed in response to changing conditions.⁷

Lane, reversible bus – a highway or street lane that is reserved for the exclusive use of buses and other high-occupancy vehicles and that can be operated in alternate directions during the two peak-hour periods; may be the center lane in an arterial street that is used for left-turning traffic in off-peak hours. Usually, bus operators who use this facility are required to have special training and a permit, and the buses may be subject to access or operation controls or both.

Legislation, Americans with Disability Act of 1990 (ADA) – federal civil law that assures people with disabilities equal opportunity to fully participate in society, the ability to live independently, and the ability to be economically sufficient.

Legislation, Public Rights-of-Way Accessibility Guidelines (PROWAG) – new guidelines for public rights-of-way that will address various issues, including access for blind pedestrians at street crossings, wheelchair access to on-street parking, and various constraints posed by space limitations, roadway design practices, slope, and terrain; cover pedestrian access to sidewalks and streets, including crosswalks, curb ramps, street furnishings, pedestrian signals, parking, and other

components of public rights-of-way; has not yet been formally adopted; however, many of the regulations presented in PROWAG are included in this document as potential guidelines.⁸

Level of service (LOS) – 1) a set of characteristics that indicate the quality and quantity of transportation service provided, including characteristics that are quantifiable (*system performance*, e.g., frequency, travel time, travel cost, number of transfers, safety) and those that are difficult to quantify (*service quality*, e.g., availability, comfort, convenience, modal image); 2) for highway systems, a qualitative rating of the effectiveness of a highway or highway facility in serving traffic, in terms of operating conditions; the *Highway Capacity Manual* identifies operating conditions ranging from “A” (best operation; low volume, high speed) to “F” (worst conditions); 3) for paratransit, a variety of measures meant to denote the quality of service provided, generally in terms of total travel time or a specific component of total travel time; 4) for pedestrians, sets of area occupancy classifications to connect the design of pedestrian facilities with levels of service (“A” for best through “F” for worst); 5) the amount of transit service provided.

M

MUTCD – *Manual on Uniform Traffic Control Device*.

Mass transit, mass transportation – urban public transport by bus, rail, or other conveyance, either publicly- or privately-owned, providing general or special service to the public on a regular and continuing basis (not including school bus, charter, or sightseeing service); term has developed a negative connotation and its use is discouraged in favor of urban transport, transit, public transit, public transport or public transportation.

Median platform – a raised boarding platform at a median location; typically in conjunction with level bus boarding or BRT.

Memorandum of Understanding (MOU) – generally used to define roles and responsibilities of participating entities, as well as establish common direction on a particular course of action;

goes beyond a simple resolution and may serve as an intermediate step toward more extensive cooperation or may be the only form of declaration in those places where a more formal or binding agreement cannot be attained.⁶

Mid-block stop – see *Stop, mid-block*.

Middle traffic operations – the operation of transit vehicles on nonexclusive rights-of-way with non-transit vehicles.

Mobility aid – any number of devices, as regulated by the ADA, that assists in mobility; a public entity must permit individuals with mobility impairments to use wheelchairs, scooters, walkers, crutches, canes, braces, or other similar devices designed for use by individuals with mobility impairments in any areas open to pedestrian use.⁹

Mode – 1) a transport category characterized by specific right-of-way, technological, and operational features; 2) a particular form of travel, for example, walking, traveling by automobile, traveling by bus, traveling by train.

Mode, transit – a category of transit systems characterized by common characteristics of technology, right-of-way, and type of operation; examples include regular bus service, express bus service, light rail transit, rail rapid transit, and commuter rail.

N

NTD – National Transit Database.

Near-side stop – see *Stop, near-side*.

Network, radial – in transit operations, a service pattern in which most routes converge into and diverge from a central hub or activity center (e.g., central business district), like the spokes of a wheel. The hub may serve as a major transfer point.

Nub – a stop where the sidewalk is extended into the parking lane, allowing the bus to pick up passengers without leaving the travel alone, also known as bus bulbs or curb extensions.

O

Operations, mixed traffic – see *Mixed traffic operations*.

P

PD & E Manual – Project Development and Environment Manual

PPM – Plans Preparation Manual

PROWAG - Public Rights-of-Way Accessibility Guidelines.

Paratransit – forms of transportation services that are more flexible and personalized than conventional fixed-route, fixed-schedule service but not including such exclusory services as charter bus trips; vehicles are usually low- or medium-capacity highway and service offered is adjustable in various degrees to individual user desires; categories are public, which is available to any user who pays a predetermined fare (e.g., taxi, jitney, dial-a-ride), and semipublic, which is available only to people of a certain group, such as the older adults, employees of a company, or residents of a neighborhood (e.g., vanpools, subscription buses).

Park-and-ride (park 'n ride, P&R) – an access mode to transit in which patrons drive private automobiles or ride bicycles to a transit station, stop, or carpool/vanpool waiting area and park the vehicle in the area provided for that purpose (park-and-ride lot, park-and-pool lot, commuter parking lot, bicycle rack or locker, then ride the transit system or take a car or vanpool to their destinations.

Parking facility – an area, either enclosed or open and attended or unattended, in which automobiles may be left, with or without payment of a fee, while the occupants of the automobiles are using other facilities or services.

Passenger amenity — an object or facility (such as a shelter, telephone, or information display) intended to enhance passenger comfort or transit usability.

Peak (peak period, rush hours) – 1) the period during which the maximum amount of travel

occurs; may be specified as the morning (AM) or afternoon or evening (PM) peak; 2) the period when demand for transportation service is heaviest.

Pedestrian refuge – a space designed for the use and protection of pedestrians, including both the safety zone and the area at the approach that is usually outlined by protective deflecting or warning devices; see also *Loading island*.

Permeable pavements – a variety of types of pavement, pavers, and other devices that provide storm water infiltration while serving as a structural surface.¹²

Person Hours of Delay – The time difference between the average speed and the free-flow speed on a roadway segment, for all vehicle occupants. The segment length is divided by the average speed and the result is subtracted from the segment length divided by the free-flow speed. This hourly value is subsequently multiplied by the segment's AADT and vehicle occupancy to determine the total vehicle hours of delay. To determine the peak person hours of delay, the average peak speed is used in the delay equation. Similarly, the average daily speed is used to determine the daily person hours of delay.

Persons with disabilities – people who have physical or mental impairments that substantially limit one or more major life activities; in the context of transportation, usually refers to people for whom the use of conventional transit facilities would be impossible or would create a hardship.

Platform – the front portion of a bus or streetcar where passengers board.

Platform, passenger – that portion of a transit facility directly adjacent to the tracks or roadway at which transit units (vehicles or trains) stop to load and unload passengers. Within stations, it is often called a *station platform*.

Platform, high – a platform at or near the floor elevation of the transit unit (vehicle or train), eliminating the need for steps on the transit unit.

Platform, low – a platform at or near the top of the running surface of the transit unit (vehicle or train) that requires the passenger to use steps to board and alight.

Platform, mini-high (high block platform) – a small high-level platform that usually provides access only to the first door of a light rail train in order to allow boarding by wheelchairs, scooters, etc.

Public transit – passenger transportation service, usually local in scope, that is available to any person who pays a prescribed fare; operates on established schedules along designated routes or lines with specific stops and is designed to move relatively large numbers of people at one time; examples include bus, light rail, rapid transit.

Public way – any public street, road, boulevard, alley, lane, or highway, including those portions of any public place that have been designated for use by pedestrians, bicycles, and motor vehicles.

Q

Queue – a line of vehicles or people waiting to be served by a system in which the rate of flow from the front of the line determines the average speed within the line; slow-moving vehicles or people joining the rear of the queue are usually considered a part of the queue.

Queue jumper – 1) a short section of exclusive or preferential lane that enables specified vehicles to bypass an automobile queue or a congested section of traffic; often used at signal-controlled freeway on-ramps in congested urban areas to allow high-occupancy vehicles preference; also known as a *bypass lane* or *queue bypass*; 2) a person who violates passenger controls.

Queue jumper bus bay – a bus bay designed to provide priority treatment for buses, allowing them to use right-turn lanes to bypass queued traffic at congested intersections and access a far-side open bus bay.

Queue jumper lane – right-turn lane upstream of an intersection that a bus can use to bypass queue traffic at a signal.

R

Rider, captive transit – Persons who do not have immediate access to private transportation or who otherwise must use public transportation in order to

travel. Also, persons limited by circumstance to use one mode of transportation. Or, having to rely on public transportation to meet one's travel needs.

Right-of-way (ROW) – 1) general term denoting land, property, or interest therein, usually in a strip, acquired for or devoted to transportation purposes; for transit, may be categorized by degree of separation: fully controlled without grade crossings, also known as *grade separated*, *exclusive*, or *private ROW*; longitudinally physically separated from other traffic (by curbs, barriers, grade separation, etc.) but with grade crossings; or surface streets with mixed traffic, although transit may have preferential treatment; 2) the precedence accorded to one vehicle or person over another.

Right-of-way, exclusive – roadway or other right-of-way reserved at all times for transit use and/or other high occupancy vehicles.

Right-of-way, exclusive transit – a right-of-way that is fully grade-separated or access-controlled and is used exclusively by transit.

Roadway – that portion of a highway built, designed, or ordinarily used for vehicular travel, except the berm or shoulder; if a highway includes two or more separate roadways, means any such roadway separately but not all such roadways collectively.

Roadway geometry – the proportioning of the physical elements of a roadway, such as vertical and horizontal curves, lane widths, cross sections, and bus bays.

Roundabout – a circular intersection with yield control at entry that permits a vehicle on the circulatory roadway to proceed, and with deflection of the approaching vehicle counter-clockwise around a central island.²

Route – 1) the geographical path followed by a vehicle or traveler from start to finish of a given trip; 2) a designated, specified path to which a transit unit (vehicle or train) is assigned; several routes may traverse a single portion of road or line; 3) in traffic assignments, a continuous group of links that connects two centroids, normally the path that requires the minimum time to traverse; 4) in rail operations, a determined succession of

contiguous blocks between two controlled interlocked signals.

S

Service, express bus – bus service with a limited number of stops, either from a collector area directly to a specific destination or in a particular corridor with stops en route at major transfer points or activity centers; usually uses freeways or busways where available.

Service, feeder – 1) local transportation service that provides passengers with connections with a major transportation service; 2) local transit service that provides passengers with connections to main-line arterial service, an express transit service station, a rail rapid transit, commuter rail, or intercity rail station, or an express bus stop or terminal; see also *Service, community*.

Service, frequency – the number of transit units (vehicles or trains) on a given route or line, moving in the same direction, that pass a given point within a specified interval of time, usually 1 hour; see also *Headway*.

Shared-use path – facilities that are physically separated from motorized vehicular traffic by an open space or barrier and either within the highway right-of-way or an independent right-of-way. Shared use paths are used by bicyclists, pedestrians, skaters, runners and others.

Shelter – see *Transit shelter*.

Shoulder – the edge or border running along either side of a roadway, generally kept clear of all traffic, and used in the event of a breakdown, for evasive action, for use by emergency vehicles, or by cyclists when a bicycle lane is not present.

Sight distance – the portion of the highway environment visible to the driver.

Station – an off-street facility where passengers wait for, board, alight, or transfer between transit units (vehicles or trains); usually provides information and a waiting area and may have boarding and alighting platforms, ticket or farecard sales, fare collection, and other related facilities; also known as a *passenger station*.

Station, off-line – a station at which a transit unit (vehicle or train) stops outside the main track or travel lane so that other units can pass while passengers board and alight; rare but found on a few automated guideway transit systems and busways.

Station, on-line – a station in which transit units (vehicles or trains) stop on the main track or travel lane; this is the common design; term used only to distinguish this station from off-line stations.

Stop, far-side – a transit stop located beyond an intersection; requires that transit units (vehicles or trains) cross the intersection before stopping to serve passengers.

Stop, mid-block – a transit stop located at a point away from intersections.

Stop, near-side – a transit stop located on the approach side of an intersection; transit units (vehicles or trains) stop to serve passengers before crossing the intersection.

Stop, transit – an area where passengers wait for, board, alight, and transfer between transit units (vehicles or trains); usually indicated by distinctive signs and by curb or pavement markings; may provide service information, shelter, seating, or any combination of these; stops are often designated by the mode offering service, for example, bus stop, car stop.

Street, transit – a street reserved for transit vehicles only.

Street-side factors – factors associated with the roadway that influence bus operations.

System planning – in transportation, a procedure for developing an integrated means of providing adequate facilities for the movement of people and goods, involving regional analysis of transportation needs and the identification of transportation corridors involved.

T

TCP – Traffic Control Plan.

TCRP – Transit Cooperative Research Program.

TDM – see *Transportation Demand Management*.

TSP – Transit Signal Priority; see *Transit signal priority*.

Terminal – the end station or stop on a transit line or route, regardless of whether special facilities exist for reversing the vehicle or handling passengers; also known as a *terminus*.

Time, dwell – the time a transit unit (vehicle or train) spends at a station or stop, measured as the interval between its stopping and starting.

Timetable – 1) usually refers to a printed schedule for the public; 2) a listing of the times at which transit units (vehicles or trains) are due at specified time points; also known as a *schedule*; 3) in railroad operations, the authority for the movement of regular trains subject to the rules. It contains classified schedules with special instructions for the movement of trains and locomotives.

Transfer – 1) a passenger change from one transit unit (vehicle or train) or mode to another transit unit or mode; 2) a slip of paper, card, or other instrument issued to passengers (either free or with a transfer fee) that gives the right to change from one transit unit or mode to another according to certain rules that may limit the direction of travel or the time in which the change may be made.

Transit center – a transit stop or station at the meeting point of several routes or lines or of different modes of transportation; located on or off the street and designed to handle the movement of transit units (vehicles or trains) and the boarding, alighting, and transferring of passengers between routes or lines; also known as a *transfer center* (between routes) or *modal interchange center*, *intermodal transfer facility* or an *hub* (between modes).

Transit Cooperative Research Program – a major transit research program provided for in the Intermodal Surface Transportation Efficiency Act of 1991 and established by the Federal Transit Administration in 1992; administered by the Transportation Research Board on behalf of the Federal Transit Administration and the American Public Transit Association; emphasizes the distribution of research information for practical use.

Transit dependent – having to rely on transit services instead of the private automobile to meet one's travel needs; see also *Rider, captive; Rider, captive transit; and Transportation disadvantaged*.

Transit shelter – a building or other structure constructed at a transit stop; may be designated by the mode offering service, for example, *bus shelter*; provides protection from the weather and may provide seating or schedule information or both for the convenience of waiting passengers.

Transit signal priority (TSP) – a system of traffic controls in which buses are given special treatment over general vehicular traffic (e.g., bus priority lanes, preemption of traffic signals, bus on shoulder, or adjustment of green times for buses).

Transit system – the facilities, equipment, personnel, and procedures needed to provide and maintain public transit service.

Transit system, accessible – a transit system that can transport any mobile person, including those who are physically disabled, and in which the vehicles and stops or stations are designed to accommodate patrons who are confined to wheelchairs.

Transit system, bus rapid – an inexact term describing a bus operation providing service similar to rail transit, but at a lower cost; characterized by several of the following components: exclusive transitways, enhanced stations, easily identified vehicles, high-frequency all-day service, simple route structures, simplified fare collection, and ITS technologies; integrating these components is intended to improve bus speed, reliability, and identity.

Transitway – a dedicated right-of-way, most commonly in a mall, that is used by transit units (vehicles or trains), usually mixed with pedestrian traffic; locally used term for *busway*.

Transportation demand management (TDM) – the concept of managing or reducing travel demand rather than increasing the supply of transportation facilities; may include programs to shift demand from single-occupant vehicles to other modes such as transit and ridesharing, to shift demand to off-peak periods, or to eliminate demand for some trips.

Transportation Research Board – a unit of the National Research Council, operating under the corporate authority of the private and non-profit National Academy of Sciences; purpose is to advance knowledge concerning the nature and performance of transportation systems by stimulating research and disseminating the information derived therefrom; affiliates and participants include transportation professionals in government, academia, and industry.

Trip – 1) a one-way movement of a person or vehicle between two points for a specific purpose; sometimes called a *one-way trip* to distinguish it from a round trip; 2) in rail operations, a mechanical lever or block signal that, when in the upright position, activates a train's emergency braking system; 3) the movement of a transit unit (vehicle or train) in one direction from the beginning of a route to its end; also known as a *run*.

Trip generation – in planning, the determination or prediction of the number of trips produced by and attracted to each zone.

Trip generator – a land use from which trips are produced, such as a dwelling unit, a store, a factory, or an office.

U

Universal Design – a paradigm that calls for environments to be designed so as to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design; intent is to simplify life for everyone by making the built environment more usable by more people at little or no extra cost; targets all people of all ages, sizes, and abilities.

U.S. DOT – U.S. Department of Transportation.

Upstream – toward the source of traffic.

U.S. Department of Transportation (DOT) – a cabinet-level federal agency responsible for the planning, safety, and system and technology of national transportation, including highways, mass transit, aircraft, and ports.

V

Vehicle, high-occupancy – any passenger vehicle that meets or exceeds a certain predetermined minimum number of passengers, for example, more than two or three people per automobile; can be buses, carpools, and vanpools.

Vehicle Hours of Delay – Vehicle hours of delay is defined as the difference between vehicle hours traveled under congested conditions and vehicle hours of travel that would otherwise be expected under free flow conditions. It is calculated using travel times and travel speeds.

W

Waiting or accessory pad – a paved area that is provided for bus patrons and may contain a bench or shelter.

Wheelchair lift – a device used to raise and lower a platform that facilitates transit vehicle accessibility for wheelchair users and other persons with disabilities; may be attached to or built into a transit vehicle or located on the station platform (*wayside lifts*).

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APPENDIX B

Quick Reference Guide

STANDARDS & MINIMUM REQUIREMENTS

Bus Stop B&A Areas
The dimensions of bus stop B&A areas may be adjusted as necessary to accommodate site conditions. However, the minimum size of bus stop B&A areas shall be 8' (perpendicular to roadway) by 5' (parallel to roadway).*
Bus stop B&A areas shall have a firm, stable surface. ¹ ADA Standards further stipulate that floor and ground surfaces must also be slip resistant.
Bus stop B&A areas shall be connected to streets, sidewalks, or pedestrian paths by an accessible route. ¹
Parallel to the roadway, the slope of the bus stop B&A area shall be the same as the roadway, to the maximum extent practicable. Perpendicular to the roadway, the slope of the bus stop B&A area shall not be steeper than 1:48 (2.08%). ¹
Bus stop B&A areas must be designed to maintain a minimum clear width of 4' and vertical clearance of 7' minimum along the pedestrian access route.
If a B&A area includes a concrete pad or other structure, it must be located within the specified clear zone for the roadway environment being used, according to <i>FDOT Design Standards</i> , Index 700.
A sidewalk and/or ramp provided to access the B&A area shall be a minimum of 60" in width, and the ramp shall not exceed a slope of 1:12. ²
A detectable warning is required on the surface of any curb ramp or where a sidewalk associated with access to a B&A area connects to the roadway at grade. ²
Except for the area adjacent to the 5" Type E curb, the areas surrounding the B&A area shall be flush with the adjacent shoulder and side slopes and designed to be traversable by errant vehicles. ²
On state roadways, the B&A area (and ramp and level landing, if needed) are to be constructed with 6" thick concrete. ²
The B&A area on flush shoulder roadways shall use a Type E (5" curb height) and be connected to the sidewalk along the roadway, or to the roadway when no sidewalk is present.
When establishing a new or altered route with new bus stop locations, the public transit provider must, if not constructing them with current bus stop plan, take into account the future construction of B&A areas.
For a bus stop designated by only a sign on a post and no other amenities (shelter, bench, trash can, etc.) and where complementary ADA paratransit service is provided, the B&A area is still required, but it may not have to be a concrete pad.

*The U.S. DOT adoption of ADA Standards provides one exception for this requirement at 810.2.2 Dimensions: Bus boarding and alighting areas shall provide a clear length of 96" measured perpendicular to the curb or vehicle roadway edge, and a clear width of 60" measured parallel to the vehicle roadway. Public entities shall ensure that the construction of bus boarding and alighting areas comply with 810.2.2, to the extent the construction specifications are within their control.

¹ Florida Building Code Online, 2012, *Florida Accessibility Code for Building Construction*, http://www.floridabuilding.org/fbc/committees/accessibility/aac/Changes_to_Law/Florida_Accessibility_Code_2012_ICC_FINAL.pdf, accessed February 22, 2012.

² Florida Department of Transportation, 2012, *Plans Preparation Manual, Volume 1*, <http://www.dot.state.fl.us/rddesign/PPMManual/PPM.shtm>, accessed February 23, 2012.

Bus Stop Signs
Bus stop signs must be posted at all bus stops and bus passenger facilities and must include the route or routes available to passengers from that bus stop.
Signs shall provide a minimum 7' vertical clearance from the paved surface (sidewalk or roadway pavement). If the vertical clearance is less than 7' and is placed along an accessible route, a barrier to warn people with visual impairment should be provided. Signs that have a vertical clearance of less than 7', but a leading edge greater than 27", must not protrude into the circulation path more than 12" from the post.
Sign and signpost placement must conform to ADA as well as Florida-specific requirements for height, width, visibility, and other design and location criteria.
Sign panels must be located to provide a minimum sidewalk clearance of 4'. Per the <i>PPM</i> , 5' is the requirement, but if the area is constrained, 4' can be an acceptable variance.
The sign panel must be securely mounted at an angle perpendicular to the street.
Sign characters shall be selected from fonts where the width of the uppercase letter "O" is 55% minimum and 110% maximum of height of uppercase letter "I." Characters shall be uppercase or lowercase or a combination of both. Characters shall be conventional in form. Characters shall not be italic, oblique, script, highly decorative, or of other unusual forms. ¹ Characters and their background shall have a non-glare finish and shall contrast with their background with either light characters on a dark background or dark characters on a light background. To the maximum extent practicable, bus route identification signs shall comply as follows: Minimum character height shall comply with Table 3.2.1 (see Chapter 3, Section 3.2). Viewing distance shall be measured as the horizontal distance between the character and an obstruction preventing further approach toward the sign. ¹
Bus schedules, timetables, and maps that are posted at the bus stop or bus bay shall not be required to comply with the above requirements. ¹
For curb and gutter sections, <i>FDOT Design Standards</i> , Index 17302, requires a minimum 2' distance from the face of the curb to the nearest edge of the sign.
Refer to <i>FDOT Design Standards</i> for guidance on bus stop sign on state roads. <i>FDOT Design Standards</i> , Index 700, requires a minimum clearance of 4' from the face of the curb to frangible signposts.
<i>FDOT Design Standards</i> , Index 17302, stipulates that on flush shoulder roadways or non-curbed roads, the lateral offset from the nearest edge of the sign itself must be at least 12' from any travel lanes and at least 6' from the edge of any paved shoulder. The minimum distance will vary according to the design speed of the road.
Bus stop signs must comply with all the applicable requirements set forth in the <i>MUTCD</i> . The most stringent standard must be followed.
Post-mounted signs shall be crashworthy (breakaway when struck leaving a stub of no more than 4" above the ground, yielding, or shielded with a longitudinal barrier or crash cushion) if within the clear zone.
Signposts placed near intersections must be of an omni-directional design, meaning that the support is symmetrical and will break safely when struck from any direction.
Signposts in the clear zone (a roadside that is traversable and unobstructed by fixed objects to allow vehicles that leave the roadway to recover safely) must be designed with breakaway mechanisms or else protected by a barrier or crash cushion. All sign supports, except overhead cantilever, truss type or bridge, or barrier wall-mounted, shall be breakaway as defined in the <i>AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals</i> and the <i>AASHTO Roadside Design Guide</i> . Sign supports shall be of an acceptable and crashworthy design as described in the <i>FDOT Design Standards</i> .
The bus stop sign must neither block jurisdictional signs nor be blocked by other signs, trees, or buildings.

Bus Stop Signs (cont'd)

Signs shall not be installed where signing interferes with the functions or visibility of existing traffic control devices. This does not negate the ADA Standards requirement for bus stop signs at all bus stops.

Transit bus stop signs shall be attached to supports meeting the location, height, and lateral placement requirements established in *FDOT Design Standards*, Index 17302.

¹ Florida Building Code Online, 2012, *Florida Accessibility Code for Building Construction*, http://www.floridabuilding.org/fbc/committees/accessibility/aac/Changes_to_Law/Florida_Accessibility_Code_2012_ICC_FINAL.pdf, accessed February 22, 2012.

² Florida Department of Transportation, 2012, *Plans Preparation Manual, Volume 1*, <http://www.dot.state.fl.us/rddesign/PPMManual/PPM.shtm>, accessed February 23, 2012.

Bus Stop Shelters

Bus shelters shall be connected by an accessible route to a bus stop B&A area.

When a shelter is located on the street side of a sidewalk (between sidewalk and edge or roadway), a minimum 4' pedestrian pathway, per State requirements, shall be maintained on three sides of the shelter.

The B&A area can be extended into the clear space within the shelter (no obstructions to the 5'-by-8' area allowed).

The shelter shall provide a minimum clear floor or ground space of 30" by 48" and entirely within the shelter.¹ The minimum clear floor or ground space and accessible route shall comply with 2012 *Florida Accessibility Code*, Sections 305 and 402, respectively.²

Shelter access entry and exit points shall provide a minimum clear width of 4', per State requirements.

There shall be no change in elevation greater than 1/4" untreated or 1/2" treated to a slope of 1:2 along the walking surfaces between the sidewalk or bus stop B&A area and the shelter. Changes in level greater than 1/2 inch must be ramped in compliance with 405 or 406 of the ADA Standards.

Shelters within the clear zone shall incorporate breakaway mechanisms in order to be frangible or breakaway. Breakaway mechanisms include slip-bases and bases incorporating a component with low impact strength.

Proper horizontal clearance (distance away from the edge of the roadway) to shelters must be provided. Shelters shall not be placed on sidewalks where they could obstruct the movement of pedestrians.

Per FAC 14-20.003, the maximum height of a shelter cannot exceed 10 feet.

To meet ADA Standards, the sidewalk adjacent or connected to the shelter must be designed with a width of at least 5' or, at every 200', a space at least 5' by 5' must be provided so that two wheelchair users can pass traveling in opposite directions.

Shelter and bus stop amenities must comply with Florida Wind-Borne Debris Region Requirements to ensure they do not become the source of flying debris during high wind events. Shelters must be built in compliance with the Florida Building Code wind-loading criteria. See the Florida Building Code for detailed requirements.

Bus shelters provided by the private sector, whether located on the public right-of-way or private property, must meet all applicable local building codes, permit requirements, land development codes, and these guidelines.

Shelters are prohibited in medians and on limited access roads. Shelters shall not be located within 15' of any fire hydrant or accessible parking space.³

A shelter may be erected only at bus stops designated by a public transit agency or the local school board and identified as having service a minimum number of 10 times in a 5-day period, excluding weekends and holidays.³

Shelters erected outside of the urban limits shall be spaced so that no more than two shelters are erected per mile of a two-lane highway and no more than four shelters are erected per mile on highways with four or more lanes.³

Bus Stop Shelters (cont'd)

The Florida Building Code has minimum requirements to ensure that bus shelters in hurricane-prone areas can withstand high winds and the impacts of wind-borne debris. In addition, transit stops, if identified in an emergency evacuation plan, must be provided with signage indicating the same.

The shelter location must meet the setback and minimum clear zone requirements as established in the *FDOT Design Standards*, Index 700.³

Shelters located adjacent to a sidewalk within the right-of-way of any road on the state highway or county road system shall be located to leave at least 48" of clearance for pedestrians and persons in wheelchairs.

Prior to the installation of a shelter, the impacted utility companies must be notified to determine location of utilities and prevent conflicts.³

The owner of abutting property shall be notified by certified mail of the proposed shelter location if there will be advertising.³

Companies engaged in the business of outdoor advertising shall obtain and maintain a current license pursuant to Section 479.04, F.S., and Rule 14-10.003, FAC.

Sides and internal dividers in shelters shall be constructed in a manner to provide visibility of waiting passengers to passing traffic and pedestrians. All transparent materials must be shatterproof. No shelter shall be located in such manner or constructed of such materials as to adversely affect sight distances at any intersection or obstruct the view of traffic signs or other traffic control devices.³

There shall be no more than one advertisement per side, including the roof, and said advertisement shall be no greater than 6' by 5' in size.³

Shelters must be securely attached to their foundations and must provide for a clear opening between the structure and the ground or foundation to facilitate cleaning, preclude the accumulation of debris, and increase security.

Flashing lights on shelters are prohibited. All lights must be placed or shielded so they do not interfere with motorists on the roadway.

Lights are not permitted for the sole purpose of illuminating advertising.

When connecting power to a shelter, all shelter utility connections shall comply with Rule 14-46.001, FAC, and must be approved by the appropriate city or county building department.

For complete and most up-to-date requirements on shelters, refer to the Index of Resources provided in this handbook.

¹ U.S. DOJ, *2010 ADA Standards for Accessible Design*, <http://www.ada.gov/regs2010/2010ADASTandards/2010ADASTandards.pdf>, accessed October 8, 2011.

² Florida Building Code Online, 2012, *Florida Accessibility Code for Building Construction*, [http://www.floridabuilding.org/fbc/committees/accessibility/aac/Changes to Law/Florida Accessibility Code 2012 ICC FINAL.pdf](http://www.floridabuilding.org/fbc/committees/accessibility/aac/Changes%20to%20Law/Florida%20Accessibility%20Code%202012%20ICC%20FINAL.pdf), accessed February 22, 2012.

³ Florida Administrative Code Online, 2008, <https://www.flrules.org/gateway/ruleNo.asp?id=14-20.003>, accessed February 22, 2012.

⁴ FDOT, 2007, *Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways (Florida Greenbook)*.

Bicycle Racks at Shelters

Bicycle racks shall not be placed on or obstruct access to ADA-mandated B&A areas.

Bicycle racks shall not be placed such that they obstruct pedestrian traffic either on the sidewalk or to and from the bus stop B&A area.

The upper elements of a bicycle rack shall not protrude, creating an obstacle for a traveler with visual impairment, in accordance with ADA Standards Section 307. Bicycle rack locations must meet the setback and minimum clear recovery zone requirements established in *FDOT Design Standards*, Index 700.

Bicycle rack locations must meet the setback and minimum clear recovery zone requirements established in *FDOT Design Standards*, Index 700.

Shopping Carts at Shelters

To maintain accessibility, bus stop B&A areas must not be used for shopping cart storage.

Shopping cart locations must meet the setback and minimum clear recovery zone requirements established in *FDOT Design Standards*, Index 700.

Bus Stop Benches

According to Rule 14-20.0032, FAC, benches shall be placed only at agency-established transit stops. However, only a minimum number of benches necessary to accommodate comfort and convenience of the general public shall be erected or maintained.

Clear floor or ground space of minimum 30" by 48" with slopes not steeper than 1:48 (2.08%) shall be provided and shall be positioned at the end of the bench seat and parallel to the short axis of the bench.¹ See ADA Standards for Transportation Facilities for additional requirements on clear floor or ground space.

The bench shall provide for back support or shall be affixed to a wall.¹

Bench dimensions shall be as follows:¹

- Maximum 74" in length, 28" in depth, and 44" in height.
- Seats shall be 42" long minimum, shall not exceed 74" in length, and 20" (minimum) to 24" (maximum) deep.
- The top of the bench seat surface shall be 17" minimum and 19" maximum above the finish floor or ground.
- Back support shall be 42" long minimum and shall extend from a point 2" maximum above the seat surface to a point 18" minimum above the seat surface. Back support shall be 2.5" maximum from the rear edge of the seat measured horizontally.

Allowable stresses on benches shall not be exceeded for materials used when a vertical or horizontal force of 250 pounds is applied at any point on the seat, fastener, mounting device, or supporting structure.¹

Any bench placed on any part of a sidewalk shall leave clearance for pedestrian traffic between the bench and the nearest edge of the road. Sidewalk width shall never be less than 4' in clear width unless approved by the District Engineer governing the work being performed. Regardless, in no cases shall the clear width be less than 36".

Bench placement must be in an accessible location (i.e., not on the far side of a drainage ditch from the actual bus stop), and appropriately connected to the path of travel on an accessible path to the bus B&A area.

Bench location must meet the setback and minimum clear recovery zone requirements established in *FDOT Design Standards*, Index 700.

Benches shall not be placed in the median of any divided highway or on limited access facilities.

Bus Stop Benches (cont'd)

Commercial advertising, if allowed by the governing jurisdiction, shall be displayed upon a bench only on either the front or rear surface of the backrest area.

Advertising displayed on a bench shall not be greater than 6' in length nor greater than 2' in height, and no advertising displayed on a bench shall be of a reflectorized material.

Benches must not obstruct the full 5'-by-8' B&A area or passenger access to loading and unloading areas.

If any bench is found to be in violation of FAC Rule 14-20.0032, except those determined to be a safety hazard, FDOT shall provide written notice of the violation to the owner of the bench, or the appropriate city or county government, who shall correct the violation or remove the bench within 30 days after receipt of the notice. If FDOT finds any bench to be a safety hazard, it will provide notice to the owner of the bench, or the appropriate city or county government, who shall take immediate steps to make the bench safe or remove the bench.

Where installed in wet locations, the surface of the seat shall be slip resistant and shall not accumulate water.¹

Refer to FAC Rule 14-20.0032—Placement of Benches, *FDOT Design Standards, PPM, and ADA Standards for Transportation Facilities* for more information on placement and design of bus benches on State rights-of-way.

¹ U.S. DOT, *ADA Standards for Transportation Facilities*, November 26, 2006, <http://www.access-board.gov/ada-aba/ada-standards-dot.cfm>, accessed February 22, 2012.

² FDOT, 2007, *Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways (Florida Greenbook)*.

Bus Stop Leaning Rails

Leaning rails must not intrude on the accessible path or B&A area clear space and must not be a protruding object. Refer to *2012 Florida Accessibility Code for Building Construction* for details on clear space and protruding object requirements.

ADA Standards specify that handrail and grab bars must be mounted at 34–38" above the surface.

Bus Stop Information and Wayfinding Devices

Text should be large and easy-to-read and must comply with all ADA requirements for text and pictogram size, placement, and contrast.

Signs must be installed to eliminate any protruding objects hazards.

Where public address systems convey audible information to the public, the same or equivalent information shall be provided in visual format.¹

¹ Florida Building Code Online, 2012, *Florida Accessibility Code for Building Construction*, http://www.floridabuilding.org/fbc/committees/accessibility/aac/Changes_to_Law/Florida_Accessibility_Code_2012_ICC_FINAL.pdf, accessed February 22, 2012.

Bus Stop Trash Receptacles

Trash receptacles must be placed appropriately to ensure the accessibility of the site and provide clear and unobstructed passage along any connecting sidewalk and the B&A area.

Trash receptacles shall not be placed in B&A areas, in compliance with the ADA Standards.

Trash receptacle locations must meet the setback and minimum clear zone requirements established in *FDOT Design Standards*, Index 700.

Bollards

Bollards must not interfere with the accessibility of pedestrian routes connecting to and from bus stop B&A areas. Bollards may not obstruct a required accessible route.¹

Where security bollards are installed at transit stops, they must not obstruct the clear space at B&A areas or reduce the required clear width of pedestrian access routes.¹

Bollard location must meet the setback and minimum clear recovery zone requirements established in *FDOT Design Standards*, Index 700.

¹ Florida Building Code Online, 2012, *Florida Accessibility Code for Building Construction*, http://www.floridabuilding.org/fbc/committees/accessibility/aac/Changes_to_Law/Florida_Accessibility_Code_2012_ICC_FINAL.pdf, accessed February 22, 2012.

Public Telephones

Where public telephones are provided, at least one telephone must be accessible to persons using wheelchairs. This involves mounting height, clear approach area, knee and toe space, and telephone accessibility features, as specified in ADA Standards Section 704.

Public telephones must be located so that the receiver, coin slot, and control are no more than 4' above the floor.

Public telephones shall be fixed on a clear floor or ground space at least 30" by 48"; not impeded by bases, enclosures, or fixed seats; and allow either a forward or parallel approach by a person using a wheelchair.

Phones shall be hearing-aid compatible and volume-control equipped.

Objects with leading edges more than 27" and not more than 80" above the finished floor or ground shall protrude 4" maximum horizontally into the circulation path.

Operable parts of a telephone shall comply with clear floor space, height, and operation, as required in ADA Standards, Section 309.

Emergency Call Box

The ADA Standards for operable parts state that operable parts of a telephone shall comply with clear floor space, height, and operation requirements. The clear space requirement is 30" by 48" minimum.

A call box must be located in such a place that it does not obstruct access to the bus stop B&A area and connecting pathways.

A call box must be located according to ADA Standards for protruding objects and operable parts. Objects with leading edges more than 27" and not more than 80" above finished floor or ground may protrude 4" maximum horizontally into the circulation path.

Vending Machines

Vending machines, newspaper boxes, and other street furniture cannot reduce clear spaces required by ADA Standards. A 30"-by-48" minimum clear space must be provided.¹ The bus stop B&A area and connecting pathways cannot be obstructed by such amenities placed at bus stops.

Vending machine locations must meet the setback and minimum clear zone requirements established in *FDOT Design Standards*, Index 700.

ADA guidelines also state that any operable parts shall comply with clear floor space, height, and operation requirements.

According to ADA Standards, when affixed to an existing structure, a vending machine may not protrude more than 4" into the accessible path when mounted at 27" to 80" above the finished floor or ground surface.

¹ Florida Building Code Online, 2012, *Florida Accessibility Code for Building Construction*, http://www.floridabuilding.org/fbc/committees/accessibility/aac/Changes_to_Law/Florida_Accessibility_Code_2012_ICC_FINAL.pdf, accessed February 22, 2012.

Landscaping

All landscaping along FDOT rights-of-way must comply with standards in the latest editions of the *PPM, Florida Highway Landscape Guide*, and *FDOT Design Standards*, Index 546 and Index 700. Consult the FDOT Environmental Management Office website for the most current information on this topic, <http://www.dot.state.fl.us/emo/>.

Trees shall be pruned to allow a minimum 9' 10" of vertical clearance from sidewalks or B&A areas.¹

To maintain a defensible space and preserve visibility, the height of groundcover plants should not exceed 2' and the height of shrubs should not exceed 3' at maturity.

Transit agencies shall coordinate landscape installation with the state or local agency assigned the responsibility of maintaining the landscaping.

¹ FDOT, 1995, *Florida Highway Landscape Guide*.

Transit Vehicle Characteristics

The PPM requires 10'–12'-wide lanes for commercial and transit vehicles, and also states that an agency should provide lanes as wide as practical.¹

The ADA requires that passengers using mobility aids be allowed on buses, per 49 CFR Sec. 37.165, "(b) All common wheelchairs and their users shall be transported in the entity's vehicles or other conveyances. (d) The entity may not deny transportation to a wheelchair or its users on the ground that the device cannot be secured or restrained satisfactorily by the vehicle's securement system."

In accordance with ADA Part 38, Subpart B-Buses, Vans and Systems, Sections 38.21 through 38.39, the following accessibility features must be provided on buses used for public transportation (this list is not exhaustive and Subpart B should be consulted prior to vehicle specification development):

- Must provide a level change mechanism or boarding device (e.g., lift or ramp) complying with Part 38 requirements to permit a wheelchair or other mobility aid user to reach the designated securement locations and devices.
- At least two securement locations and devices shall be provided on vehicles in excess of 22' in length and at least one securement location and device shall be provided on vehicles 22' in length or less.
- The securement system shall be placed as near to the accessible entrance of the vehicle as practicable and shall have a clear floor area of 30" by 48" minimum. Such space shall adjoin, and may overlap, an access path. Securement areas may have fold-down seats to accommodate other passengers when a wheelchair or mobility aid is not occupying the area, provided the seats, when folded up, do not obstruct the clear floor area required.
- The securement system shall secure common wheelchairs and mobility aids and shall be either automatic or easily attached by a person familiar with the system and mobility aid having average dexterity.
- All vehicle aisles, steps, floor areas where people walk, and floors in securement locations shall have slip-resistant surfaces.
- All step edges, thresholds, and the boarding edge of ramps or lift platforms shall have a band of color(s) running the full width of the step or edge that contrasts from the step tread and riser, or lift or ramp surface, either light-on-dark or dark-on-light.
- For vehicles in excess of 22' in length, the overhead clearance between the top of the door opening and the raised lift platform, or highest point of a ramp, shall be a minimum of 68 inches. For vehicles of 22' in length or less, the overhead clearance shall be a minimum of 56".
- Each vehicle shall contain sign(s) that indicate that seats in the front of the vehicle are priority seats for persons with disabilities, and that other passengers should make such seats available to those who wish to use them. At least one set of forward-facing seats must be so designated.

Transit Vehicle Characteristics (cont'd)

- Each wheelchair or mobility aid securement location shall have a sign designating it as such.
- Interior handrails and stanchions shall permit sufficient turning and maneuvering space for wheelchairs and other mobility aids to reach a securement location from the lift or ramp.
- Handrails and stanchions shall be provided in the entrance to the vehicle in a configuration that allows persons with disabilities to grasp such assists from outside the vehicle while starting to board, and to continue using such assists throughout the boarding and fare collection process.
- Any stepwell or doorway immediately adjacent to the driver shall have, when the door is open, at least 2 foot-candles of illumination measured on the step tread or lift/ramp platform. Other stepwells and doorways, including doorways in which lifts or ramps are installed, shall have, at all times, at least 2 foot-candles of illumination measured on the step tread or lift/ramp when deployed at the vehicle floor level.
- The vehicle doorways, including doorways in which lifts or ramps are installed, shall have outside light(s) that, when the door is open, provide at least 1 foot-candle of illumination on the street surface for a distance 3' perpendicular to the bottom step tread or lift outer edge. Such light(s) shall be shielded to protect the eyes of entering and exiting passengers.
- Where provided, the farebox shall be located as far forward as practicable and shall not obstruct traffic in the vestibule, especially wheelchairs or mobility aids.
- Vehicles in excess of 22' in length used in multiple-stop, fixed-route service, shall be equipped with a public address system permitting the driver or recorded or digitized human speech messages to announce stops and provide other passenger information within the vehicle.
- Where destination or route information is displayed on the exterior of a vehicle, each vehicle shall have illuminated signs on the front and boarding side of the vehicle.

¹ FDOT, 2012. *Plans Preparation Manual, Volume 1*. <http://www.dot.state.fl.us/rddesign/PPMManual/PPM.shtml>, accessed February 23, 2012.

Bus Stop Placement

The operator of a transit bus system may designate a “bus stop” within the boundaries of the right-of-way of a state road. The location of a transit bus stop site on a state road right-of-way is dictated by the needs of the riding public and the route availability of the public transit system.¹ The transit agency is required by the ADA to choose a site for a bus stop that affords the greatest accessibility practicable.

The site selection and establishment of a transit bus stop shall provide the maximum safety to the users of the public transit system and vehicular and pedestrian traffic. If a transit bus stop is located at a site deemed to be unsafe by FDOT, modification or removal shall be required by FDOT and shall be at the expense of the transit bus system.¹

A minimum 15' distance shall be maintained between a bus stop and a fire-hydrant or on-street parking space for persons with disabilities.

The operator of a transit bus system shall indicate or mark the bus stop in accordance with the *MUTCD*, incorporated by reference under Rule 14-15.010, FAC.

The actual passenger B&A area for a stop must not be located in a driveway where slopes exceed ADA Standards.

ADA-compliant curb ramps (at all curbs along accessible routes) shall be provided at all crosswalks, marked and unmarked. Curb ramps must be fully within striped crosswalks.

Where shared-use paths (facilities not immediately adjacent to the travel lane) are provided, bus stops must be connected so that they are located in a manner providing accessible shared-use path access points to the roadway. Refer to the *AASHTO Guide for the Development of Bicycle Facilities* for information on the design of bicycle facilities. Refer to *PPM* Chapter 8.6 for information on the design of shared-use paths.

When a bus stop is located in a bus bay, dashed line pavement markings consistent with *MUTCD* must be used to notify bicyclists and transit operators of a potential conflict.

Bus Stop Placement (cont'd)

The District Pedestrian/Bicycle Coordinator shall be consulted during planning and design to establish appropriate bicycle facility elements on a project-by-project basis.

Refer to the most current version of the *MUTCD* when designing bicycle lanes.

Green color in a bicycle lane is permitted on the State Highway System in traffic conflict areas when certain additional conditions are met. Refer to *PPM* Chapter 8.4.2 for more details.

Adequate canal flows must be maintained in areas where the bus stop encroaches into the canal section.

Rural shelters must meet hurricane wind load design strength requirements found in the Florida Building Code. Any associated amenities also must either be placed outside of the clear zone or meet frangibility requirements.

When designing intersections and crosswalks, curb ramps must be included wherever a curb is encountered along the circulation path. Pedestrian crosswalks must be lighted.

¹ Florida Administrative Code, 2008. <https://www.flrules.org/gateway/ruleNo.asp?id=14-20.003>, accessed February 22, 2012.

Bus Bays, Bulbs, and Nubs

Where new bus stop B&A areas are constructed at bus bays and bus nubs, they shall have a firm, stable surface, minimum clear length of 96 inches (measured from the curb or vehicle roadway edge), minimum clear width of 60 inches (measured parallel to the vehicle roadway) to the maximum extent allowed by legal or site constraints, and shall be connected to streets, sidewalks, or pedestrian paths by an accessible route.¹

Signing/pavement markings near bus bays shall differentiate bus bays from travel lanes.

Bus stop B&A areas at bus bays shall comply with surface, dimension, connection, and slope requirements for an ADA-compliant B&A area.

Bus bays must meet all requirements in the *PPM*, *Florida Greenbook*, and *FDOT Design Standards*.

F.S. 316.0815 specifies that the driver of a vehicle shall yield the right-of-way to a publicly-owned transit bus traveling in the same direction that has signaled and is re-entering the traffic flow from a specifically-designated pullout bay.

See Chapter 3 for requirements for bus stop components (B&A area, shelter, etc.) located in bus bays, bus bulbs, and nubs.

¹ FDOT, 2007. *Manual of Uniform Minimum Standards for Design, Construction, and Maintenance for Streets and Highways (Florida Greenbook)*.

Traffic Signals and Transit Priority

Refer to the *MUTCD* for design or application of any traffic control device contained in this section. The *MUTCD* is incorporated by reference in 23 CFR, Part 655, Subpart F, and shall be recognized as the national standard for all traffic control devices installed on any street, highway, bicycleway, or private road open to public travel.

Construction procedures related to the applications in this section along state roads must comply with FDOT requirements. Under all conditions, all facilities must comply with applicable FDOT and local regulations.

Refer to the applicable sections in this handbook for accessibility, design, and location requirements for any transit facilities/features associated with the transit preferential treatment applications discussed in this section.

For additional and the most up-to-date regulatory requirements and guidelines on transit preferential treatment applications, refer to the Index of Resources provided at the end of this handbook.

Transit and Bus Stop Provisions During Construction

Where existing pedestrian routes are blocked or detoured, information should be provided about alternative routes that are usable by pedestrians with disabilities, particularly those who have visual disabilities.¹ The ADA prescribes that the level of accessibility existing prior to an alteration must not be reduced during the alteration. This means that alternative accessible routes and features must be provided during renovation projects. Proper use of signage and other pedestrian guidance methods are necessary to ensure that an accessible circulation path is maintained.

Access to temporary bus stops must be considered where temporary pedestrian routes are channelized. Barriers and channelizing devices that are detectable by people with visual disabilities should be provided.¹

When designing detours around transit stops, applicable ADA requirements must be considered.

If a transit stop or route needs to be relocated, appropriate signage and advance notification to passengers must be provided to maintain accessibility of the facility.

Refer to *MUTCD* and *FDOT Design Standards*, Index 660, for additional requirements on transit and bus stop provisions during construction.

According to *FDOT Design Standards*, Index 660, any temporary sidewalk must be a minimum of 4 feet wide with a maximum of 2 percent cross-slope and a maximum of 5 percent running-slope between ramps.

Temporary walkways less than 5' in width shall provide for a 5'-by-5' passing space at intervals not to exceed 200'.

Temporary ramps shall meet the requirements for curb ramps specified in *FDOT Design Standards*, Index 304.

Temporary walkway surfaces and ramps shall be stable, firm, and slip-resistant and kept free of any obstructions and hazards such as holes, debris, mud, construction equipment, and stored materials.

According to *FDOT Design Standards*, Index 660, measures are required to provide a temporary path anytime a vehicle, equipment, or workers or their activities encroach on a sidewalk for a period of more than 60 minutes. If a barrier is constructed, it must be a detectable barrier to encourage compliance and communicate with pedestrians that a sidewalk is closed.

¹ U.S. DOT, 2009. *Manual on Uniform Traffic Control Devices*. <http://mutcd.fhwa.dot.gov/pdfs/2009/mutcd2009edition.pdf>, accessed November 7, 2011.

Roadway

Construction procedures to build transit facilities along state roads must comply with FDOT requirements. Under all conditions, all facilities must comply with applicable FDOT and local regulations.

For complete and the most up-to-date regulatory requirements and guidelines on general and exclusive/special use lanes refer to the Index of Resources provided at the end of this handbook.

Pavement markings shall be in compliance with maintaining agency regulations and standards in the *MUTCD*.

Physical obstructions in and around bus stops, if identified as a hazard to vehicular or pedestrian safety, must be removed or adequately marked by painting or by use of other highly-visible material.

Exclusive and Special Use Lanes

Construction procedures to build transit facilities along state roads must comply with FDOT requirements. Under all conditions, all facilities must comply with applicable FDOT and local regulations.

According to FAC 14-20.003(3), shelters are prohibited in medians and on limited access facilities.

For complete and the most up-to-date regulatory requirements and guidelines on exclusive/special use lanes, refer to the Index of Resources provided at the end of this handbook.

BRT Station Design

Because BRT is designated as bus and not rail service, the minimum ADA Standards design elements for bus stops are applicable to all BRT services unless rail station amenities are included, which must also comply with ADA Standards requirements. See Chapters 3 and 4 of this handbook for curb-side and street-side design standards.

In Florida, the FAC disallows the building of a shelter in the median of a state roadway; therefore, this type of station is not acceptable for BRT applications until/unless new legislation is passed or if the project is granted a variance from the rule.

The following documents provide regulatory practices in roadway markings and should be referred to for further details on how to properly mark separated BRT running ways: *FDOT Manual of Uniform Minimum Standards for Design, Construction, and Maintenance for Streets and Highways (Florida Greenbook)*, *FDOT Design Standards*, *FHWA Manual of Uniform Traffic Control Devices*, *ADA Standards for Transportation Facilities*.

Rail Station Design

The height and position of a platform must be coordinated with the floor of the vehicles it serves to minimize the vertical and horizontal gaps passengers will encounter while boarding or alighting the vehicle, in accordance with the *ADA Accessibility Guidelines for Transportation Vehicles* (36 CFR Part 1192).

Low-level platforms shall be 8 inches minimum above the top of the rail.¹

The horizontal gap between a car at rest and the platform shall be no greater than 3", and the height of the car floor shall be within plus or minus 1.5" of the platform height to comply with the ADA regulations.² However, according to the Florida Accessibility Code for Building Construction, for rail systems subject to Department of Transportation regulation 49 CFR 37.21 (light rail, commuter rail, and intercity), where it is not operationally or structurally feasible to meet the horizontal gap or vertical difference requirements of Part 1192 or 49 CFR Part 38, mini-high platforms, car-borne or platform-mounted lifts, ramps or bridge plates, or similar manually-deployed devices that meet the requirements of 49 CFR Part 38 shall suffice.¹

For stations with non-level boarding, a mini-high platform, a mechanical lift, or other form of accessible boarding must be provided to facilitate access for passengers with disabilities.²

Based on ADA guidance on slope requirements, newly-constructed rail platforms shall not exceed a slope of 1:48 (2%) in all directions. However, where platforms serve vehicles operating on existing track or track laid in an existing roadway, the slope of the platform parallel to the track shall be permitted to be equal to the slope (grade) of the roadway or existing track.³

Platforms must be designed, at a minimum, to allow passengers to walk, wait, board, and alight the rail vehicles in a safe and efficient manner.

ADA Standards require a clear width of at least 60" (5') to allow a person in a wheelchair to make a turn around an obstruction. This distance may include the required 24" (2') detectable warning surface along the platform boarding edge.

Platform boarding edges not protected by platform screens or guards shall have 24" of detectable warning material along the full length of the public use area of the platform.³ The detectable warnings shall comply with ADA Standards Section 705.

Adjacent platforms configured for opposing travel shall be separated by a low fence or other physical barrier.

Rail Station Design (cont'd)

Proper signage to identify a station or its entrance must be provided in accordance with ADA Standards for passengers to easily locate the station and its entrances. At least one sign at each station entrance shall comply with ADA tactile signage requirements (see ADA Standards Section 703.3 for requirements on tactile signage). Tactile signage shall also be placed in uniform locations to the maximum extent practicable. Where signs identify a station that has no defined entrance, at least one sign shall be placed in a central location.³

Other than route maps, these signs shall comply with the following ADA requirements:

- At least one tactile sign identifying the specific station and complying with ADA requirements for raised characters and Braille shall be provided on each platform or boarding area.
- Signs, to the maximum extent practicable, shall be placed in uniform locations within the system. Signs must meet ADA Standards for character stroke, width, spacing, line spacing, contrast, glare, and character height.

ADA Standards require that where public address systems convey audible information to the public, the same or equivalent information shall be provided in a visual format.

Crossing of rail tracks at platforms must comply with appropriate ADA Standards.

At a minimum, existing bus and rail facilities must be connected by at least one accessible path, and rail and bus aspects of the facility must meet ADA Standards for accessibility.

Because of multiple modes of travel being offered, a bus terminal at a rail station must be well marked to communicate effectively which routes intersect.

For park-and-ride lot facilities connected to rail stations, ADA Standards must be followed. Refer to FDOT's *Park-and-Ride Guide* for additional information.

¹ Florida Building Code, 2012. *Florida Accessibility Code For Building Construction*. http://www.floridabuilding.org/fbc/committees/accessibility/aac/Changes_to_Law/Florida_Accessibility_Code_2012_ICC_FINAL.pdf, accessed February 22, 2012.

² FDOT, 2010. *Guidelines for Enhancing Intermodal Connections at Florida Transit Stations*. <http://www.dot.state.fl.us/transit/Pages/EnhancingIntermodalConnections.pdf>, accessed February 22, 2012.

³ US DOJ, 2010. *2010 ADA Standards for Accessible Design*. <http://www.ada.gov/regs2010/2010ADAStandards/2010ADAStandards.pdf>, accessed October 8, 2011

APPENDIX C

Bus Stop Checklist

Route Name:	Location:	Weather Conditions:	Stop No.:
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PART A: IDENTIFICATION/LOCATION				
A1	Is there a bus shelter?			Yes No N/A <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
	If YES, what is the number of the shelter?			
	If NO, is there an exterior alternative shelter nearby (i.e. - awning, overhangs, underpass)?			Yes No N/A <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
A2	Street Name:			
A3	Nearest Cross Street (street name or landmark if mid-block):			
A4	Bus Route Direction:			
	North Bound <input type="checkbox"/>	South Bound <input type="checkbox"/>	More than one direction <input type="checkbox"/>	
A5	What is the purpose of the stop?			
	Park and Ride <input type="checkbox"/>	Boarding <input type="checkbox"/>	Both Boarding and Alighting <input type="checkbox"/>	Other (specify): <input type="checkbox"/>
	Kiss and Ride <input type="checkbox"/>	Alighting <input type="checkbox"/>	Transfer <input type="checkbox"/>	
A6	What is the average number of daily boardings at the stop?			
A7	Where is the bus stop positioned in relation to the nearest intersection?			
	Nearside (Before the bus crosses the intersection)			<input type="checkbox"/>
	Far Side (After the bus crosses the intersection)			<input type="checkbox"/>
	Mid-block			<input type="checkbox"/>
	Not near an intersection			<input type="checkbox"/>
	Freeway bus pad			<input type="checkbox"/>
A8	Distance from bus stop pole to curb of cross street in feet:			
A9	Adjacent property address or name of business (only if readily visible):			

Date	Time:	Surveyor:
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Toolkit for the Assessment of Bus Stop Accessibility and Safety • Easter Seals Project ACTION

Route Name:	Location:	Weather Conditions:	Stop No.:
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A10	Adjacent Property Description:			
	Apartment Building <input type="checkbox"/>	Industrial Site/Bldg. <input type="checkbox"/>	Park <input type="checkbox"/>	School <input type="checkbox"/>
	Day Care <input type="checkbox"/>	Library <input type="checkbox"/>	Park and Ride <input type="checkbox"/>	Supermarket <input type="checkbox"/>
	Government Building <input type="checkbox"/>	Mall/Shopping Center <input type="checkbox"/>	Place of Worship <input type="checkbox"/>	Transit station/center <input type="checkbox"/>
	Hospital <input type="checkbox"/>	Nursing Home <input type="checkbox"/>	Residence – townhouse <input type="checkbox"/>	Vacant lot <input type="checkbox"/>
	Human Service Agency <input type="checkbox"/>	Office Building <input type="checkbox"/>	Residence – detached <input type="checkbox"/>	Other (specify): <input type="checkbox"/>
		Retail Store <input type="checkbox"/>		
A11	Distance from previous bus stop (in feet):			

PART B: PEDESTRIAN ACCESS FEATURES

Section B-1: Landing Area Assessment

B1	Is there a landing area at least 5 feet wide and 8 feet deep adjacent to the curb/street?	Yes No <input type="checkbox"/> <input type="checkbox"/>		
B2	Where is the landing area positioned in relation to the curb/street?			
	Below street level (low ground or shoulder) <input type="checkbox"/>	Shoulder <input type="checkbox"/> Adjacent <input type="checkbox"/>		
	Sidewalk <input type="checkbox"/>	Bus Bulb <input type="checkbox"/> Off-Road/No sidewalk <input type="checkbox"/>		
B3	What is the material of the landing area?			
	Asphalt <input type="checkbox"/>	Dirt <input type="checkbox"/> Gravel <input type="checkbox"/>		
	Concrete <input type="checkbox"/>	Grass <input type="checkbox"/> Pavers <input type="checkbox"/>		
B4	Are there problems with the landing area surface?		Yes No <input type="checkbox"/> <input type="checkbox"/>	
	<i>If YES, rank resulting accessibility potential:</i>			
		Not Accessible	Minimally Accessible	Accessible
	Uneven	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Slopes up from the street	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Slopes down from the street	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Requires stepping over drain inlet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (Specify)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
B5	Are there any obstacles that would limit the mobility of a wheelchair?		Yes No <input type="checkbox"/> <input type="checkbox"/>	
	<i>If YES, describe obstruction:</i>			
B6	Additional landing area comments:			
B7	Landing area recommendations:			
	Widen sidewalk to expand landing area to 5 feet wide and 8 feet deep	<input type="checkbox"/>		
	Install curb bulb or remove on street parking	<input type="checkbox"/>		
	Move object to improve accessibility (specify where):			
	Make the following repairs (specify):			
Other (specify):				

Date	Time:	Surveyor:
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Route Name:	Location:	Weather Conditions:	Stop No.:
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Section B-2: Connections (Trip Generators)

B8	What are the primary trip generators for passengers at this stop? (Check all that apply)		
	Apartments - large building/complex <input type="checkbox"/>	Human service agency – what kind? <input type="checkbox"/>	School –Elementary/Middle <input type="checkbox"/>
	Apartments - small building <input type="checkbox"/>	Library <input type="checkbox"/>	School -High <input type="checkbox"/>
	Townhomes <input type="checkbox"/>	<u>Major Shopping/employment</u> (Mall, Wal-Mart, Kmart, Target, other big department store) <input type="checkbox"/>	School - College/University/ Technical school <input type="checkbox"/>
	Detached homes <input type="checkbox"/>	<u>Neighborhood Shopping</u> (supermarket, drugstore, Goodwill, strip mall with basic needs shopping) <input type="checkbox"/>	Senior center <input type="checkbox"/>
	Day care/pre-school <input type="checkbox"/>	Nursing home/assisted living <input type="checkbox"/>	Transfer to other bus routes <input type="checkbox"/>
	Gas station <input type="checkbox"/>	Office building/employment <input type="checkbox"/>	Transit station/center <input type="checkbox"/>
	Government building <input type="checkbox"/>	Park and Ride lot <input type="checkbox"/>	Other (Specify): <input type="checkbox"/>
	Hospital/major clinic <input type="checkbox"/>	Place of worship <input type="checkbox"/>	
Hotel <input type="checkbox"/>	Restaurant <input type="checkbox"/>		

B9	How wide is the sidewalk?			
	No sidewalk <input type="checkbox"/>	less than 3' <input type="checkbox"/>	3'-5' <input type="checkbox"/>	5' or greater <input type="checkbox"/>

B10	Are there physical barriers that constrict the width of the sidewalk within the block on which the bus stop is located?		Yes <input type="checkbox"/>	No <input type="checkbox"/>
	<i>If YES, what is the narrowest useable width:</i>			
	Less than 3' <input type="checkbox"/>		3' or greater <input type="checkbox"/>	

B11	Rank the condition of the sidewalk:			
	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>
	5 <input type="checkbox"/>			
	<i>1=hazardous – large breaks, cracks, root uplifting, someone could get hurt from normal use or use of a wheelchair would be difficult</i>			
	<i>2=in poor shape though not hazardous – very rough, some root uplifting, cracks, breaks</i>			
	<i>3=fair – minor root uplifting, minor cracks or breaks</i>			

B12	Does the landing pad connect to the sidewalk?		Yes <input type="checkbox"/>	No <input type="checkbox"/>
	<i>If YES, what does the sidewalk connect to:</i>			
	One of the trip generators listed in Question B8 <input type="checkbox"/>		The nearest intersection <input type="checkbox"/>	

B13	Where is the nearest street crossing opportunity?		
	The nearest intersection <input type="checkbox"/>		Mid-block crosswalk <input type="checkbox"/>

B14	What pedestrian amenities are at the nearest intersection (or other crossing opportunity)?		
	Curb cuts all corners/ both sides <input type="checkbox"/>	Pedestrian crossing signal <input type="checkbox"/>	Traffic Light <input type="checkbox"/>
	Visible crosswalk <input type="checkbox"/>	Audible crosswalk signal <input type="checkbox"/>	Crossing guard assistance <input type="checkbox"/>
	Curb cuts at some corners/one side <input type="checkbox"/>	Accessible Pedestrian Signal (APS) <input type="checkbox"/>	Tactile warning strip on curb cut <input type="checkbox"/>

Date	Time:	Surveyor:
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Route Name:		Location:		Weather Conditions:		Stop No.:		
B15	Is there a companion bus stop across the street?						Yes No N/A <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
	B16	Are there connections to other transportation services at this bus stop?						Yes No <input type="checkbox"/> <input type="checkbox"/>
<i>If YES, check all that apply</i>								
Bus services, same or other agency <input type="checkbox"/>		Local Rail <input type="checkbox"/>		Commuter Rail <input type="checkbox"/>				
Greyhound <input type="checkbox"/>		Other (Specify):				<input type="checkbox"/>		<input type="checkbox"/>
B17	Pedestrian connection recommendations:							
	Construct sidewalk						<input type="checkbox"/>	
	Widen sidewalk						<input type="checkbox"/>	
	Improve landing area connections to sidewalk						<input type="checkbox"/>	
	Install curb cut(s) at:							
	Move object to improve accessibility (specify where):							
	Make the following repairs (specify):							
Other (specify):								
B18	Additional pedestrian connection comments:							

PART C: PEDESTRIAN COMFORT AMENITIES

Section C-1: Shelters (move to Section C-2 if there is no shelter)

C1	What is the orientation of the bus shelter in relation to the street?							
	Facing towards the street						<input type="checkbox"/>	
	Facing on-coming traffic						<input type="checkbox"/>	
Facing away from the street						<input type="checkbox"/>		
C2	What kind of shelter is it? Insert shelter relevant to your system.							
	Own transit agency <input type="checkbox"/>		Another transit agency (shared stop) <input type="checkbox"/>		Other (Specify):			<input type="checkbox"/>
C3	If non-standard shelter, what are the approximate dimensions (width, height and depth in feet) of the interior standing area?							
	Width:							
	Height:							
Depth:								
C4	Does the shelter have a front center panel (i.e. two openings)?						Yes No <input type="checkbox"/> <input type="checkbox"/>	
	<i>If YES, what are the dimensions of the opening?</i>							
C5	Could a person using a wheelchair maneuver into the shelter?						Yes No <input type="checkbox"/> <input type="checkbox"/>	
Date		Time:			Surveyor:			

Route Name:		Location:		Weather Conditions:		Stop No.:					
C6	Could a person using a wheelchair fit completely under the shelter (minimum space of a common mobility device is 30 in. by 48 in. (760 mm by 1200mm))?						Yes	No			
							<input type="checkbox"/>	<input type="checkbox"/>			
What are the dimensions of the clear space in the shelter?											
C7	What is the distance of the front of the shelter from the curb in feet?										
	0 - 2'	<input type="checkbox"/>	2' - 4'	<input type="checkbox"/>	4' - 6'	<input type="checkbox"/>	6' - 8'	<input type="checkbox"/>	8' - 10'	<input type="checkbox"/>	>10'
C8	Are there damages to the bus shelter?						Yes	No			
							<input type="checkbox"/>	<input type="checkbox"/>			
	<i>If YES, check all that apply:</i>										
	Broken panels						<input type="checkbox"/>				
	Graffiti						<input type="checkbox"/>				
	Holes in the roof						<input type="checkbox"/>				
	Missing panels						<input type="checkbox"/>				
	Needs repainting						<input type="checkbox"/>				
Other (specify):						<input type="checkbox"/>					
C9	What is the approximate age of the shelter?										
C10	Rank the condition of the shelter:										
	1	<input type="checkbox"/>	2	<input type="checkbox"/>	3	<input type="checkbox"/>	4	<input type="checkbox"/>	5	<input type="checkbox"/>	
<i>1=hazardous – broken glass, unstable</i> <i>2=in poor shape though not hazardous</i> <i>3=fair – needs repainting, glass panels need thorough cleaning, protruding but not hazardous bolts</i> <i>4=good – not perfect but no immediate repair need</i> <i>5=cosmetically excellent; new</i>											
C11	Additional shelter comments:										
C12	Shelter recommendations:										
	Remove center panel						<input type="checkbox"/>				
	Make the following repairs (specify):						<input type="checkbox"/>				
	Move object to improve accessibility (specify where):										
	Move shelter to improve accessibility (specify where):										
	Other (specify):										
Date		Time:			Surveyor:						

Route Name:	Location:	Weather Conditions:	Stop No.:
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Section C-2: Seating Assessment (move to Section C-3 if there is no seating)

C13	What is the type of seating available?						
	Bench inside shelter – <i>skip to question C15</i> <input type="checkbox"/>						
	Freestanding bench <input type="checkbox"/>						
	Fold down bench <input type="checkbox"/>						
	Leaning bench <input type="checkbox"/>						
	Other (specify): <input type="checkbox"/>						
C14	If not inside shelter, what is the distance of the seating from the curb in feet?						
	<table style="width:100%; border:none;"> <tr> <td style="border:none; padding: 0 10px;">0 - 2' <input type="checkbox"/></td> <td style="border:none; padding: 0 10px;">2' - 4' <input type="checkbox"/></td> <td style="border:none; padding: 0 10px;">4' - 6' <input type="checkbox"/></td> <td style="border:none; padding: 0 10px;">6' - 8' <input type="checkbox"/></td> <td style="border:none; padding: 0 10px;">8' - 10' <input type="checkbox"/></td> <td style="border:none; padding: 0 10px;">>10' <input type="checkbox"/></td> </tr> </table>	0 - 2' <input type="checkbox"/>	2' - 4' <input type="checkbox"/>	4' - 6' <input type="checkbox"/>	6' - 8' <input type="checkbox"/>	8' - 10' <input type="checkbox"/>	>10' <input type="checkbox"/>
0 - 2' <input type="checkbox"/>	2' - 4' <input type="checkbox"/>	4' - 6' <input type="checkbox"/>	6' - 8' <input type="checkbox"/>	8' - 10' <input type="checkbox"/>	>10' <input type="checkbox"/>		
C15	Are there problems with the seating? Yes No <input type="checkbox"/> <input type="checkbox"/>						
	<i>If YES, check all that apply:</i>						
	Broken pieces <input type="checkbox"/>						
	Needs painting <input type="checkbox"/>						
	Graffiti <input type="checkbox"/>						
	Not securely installed <input type="checkbox"/>						
	Other (specify): <input type="checkbox"/>						
C16	Rank the condition of the seating:						
	<table style="width:100%; border:none;"> <tr> <td style="border:none; padding: 0 10px;">1 <input type="checkbox"/></td> <td style="border:none; padding: 0 10px;">2 <input type="checkbox"/></td> <td style="border:none; padding: 0 10px;">3 <input type="checkbox"/></td> <td style="border:none; padding: 0 10px;">4 <input type="checkbox"/></td> <td style="border:none; padding: 0 10px;">5 <input type="checkbox"/></td> </tr> </table> <p style="margin-left: 20px; font-size: small;"> 1=hazardous – broken, someone could get hurt from normal use 2=in poor shape though not hazardous 3=fair – needs repainting, needs cosmetic attention,, protruding but not hazardous bolts 4=good – not perfect but no immediate repair need 5=cosmetically excellent; new </p>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	
1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>			
C17	Additional seating comments:						
C18	Seating recommendations:						
	Move seating to improve accessibility (specify where):						
	Make the following repairs (specify):						
	Other (specify):						

Date	Time:	Surveyor:
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Route Name:	Location:	Weather Conditions:	Stop No.:
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Section C-3: Trash Assessment (move to Section C-4 if there is no trash receptacle)

C19	What is the type of installation for the trash receptacle?	
	Attached to the shelter	<input type="checkbox"/>
	Free standing	<input type="checkbox"/>
	Garbage bag	<input type="checkbox"/>
	Bolted to sidewalk	<input type="checkbox"/>
	Other (specify):	<input type="checkbox"/>
C20	Are there problems with the trash receptacle and surrounding area?	Yes No <input type="checkbox"/> <input type="checkbox"/>
	<i>If YES, check all that apply:</i>	
	Trash can very full	<input type="checkbox"/>
	Graffiti at bus stop	<input type="checkbox"/>
	Bus stop littered	<input type="checkbox"/>
	Grocery carts left at stop	<input type="checkbox"/>
	Trash can not securely installed	<input type="checkbox"/>
	Adjacent property littered	<input type="checkbox"/>
	Other (specify):	<input type="checkbox"/>
C21	Additional Comments:	
C22	Trash recommendations:	
	Install trash can due to litter problem	<input type="checkbox"/>
	Make the following repairs (specify):	
	Move trash can to improve accessibility (specify where):	
	Other (specify):	

Section C-4: Newspaper Boxes (move to Part D if there are no newspaper boxes)

C23	Are the newspaper boxes a barrier to sidewalk use?	Yes No <input type="checkbox"/> <input type="checkbox"/>
C24	Are the newspaper boxes a barrier to bus access/egress?	Yes No <input type="checkbox"/> <input type="checkbox"/>
C25	Are they chained to the bus stop pole, shelter, or bench?	Yes No <input type="checkbox"/> <input type="checkbox"/>
C26	Are they blocking access to posted bus schedule info?	Yes No <input type="checkbox"/> <input type="checkbox"/>
C27	Additional newspaper box comments:	
C28	Newspaper box recommendations:	
	Move trash can to improve accessibility (specify where):	
	Other (specify):	

Date	Time:	Surveyor:
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Route Name:	Location:	Weather Conditions:	Stop No.:
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PART D: Safety and Security Features

Section D-1: Traffic and Pedestrian Issues

D1	Where is the bus stop area located?		
	In travel lane		<input type="checkbox"/>
	Bus lane/pull off area		<input type="checkbox"/>
	Paved shoulder		<input type="checkbox"/>
	In right turn only lane		<input type="checkbox"/>
	Unpaved shoulder		<input type="checkbox"/>
	Off street		<input type="checkbox"/>
	"No Parking" portion of street parking lane		<input type="checkbox"/>
	Other (specify):		<input type="checkbox"/>
D2	Is the bus stop zone designated as a no parking zone?		Yes No <input type="checkbox"/> <input type="checkbox"/>
	<i>If YES, indicated by:</i>		
	One "No Parking" sign		<input type="checkbox"/>
	2 or more "No Parking" signs		<input type="checkbox"/>
	"Bus Only" sign		<input type="checkbox"/>
	Painted curb		<input type="checkbox"/>
	Painted street		<input type="checkbox"/>
D3	Are cars parked between the landing area and the bus stopping area?		Yes No <input type="checkbox"/> <input type="checkbox"/>
D4	What is the posted speed limit in MPH?	Not posted	<input type="checkbox"/>
D5	What are the traffic controls at the nearest intersection for the street?		
	Traffic signals		<input type="checkbox"/>
	Flashing lights		<input type="checkbox"/>
	Stop/Yield sign		<input type="checkbox"/>
	None		<input type="checkbox"/>
	Other (specify):		<input type="checkbox"/>
D6	How many total lanes are on both sides of the road?		
	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
	4 <input type="checkbox"/>	Other (specify): <input type="checkbox"/>	N/A <input type="checkbox"/>
D7	Is there on-street parking permitted just before or after the bus stop zone?		Yes No N/A <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
	<i>If YES, what is the length of the "No Parking" area in feet:</i>		
D8	Are there potential traffic hazards?		Yes No <input type="checkbox"/> <input type="checkbox"/>
	<i>Yes, check all that apply:</i>		
	The bus stop is just over the crest of a hill		<input type="checkbox"/>
	The bus stop is just after a curve in the road		<input type="checkbox"/>
	The bus stop is near an at-grade railroad crossing		<input type="checkbox"/>
	Waiting passengers are hidden from view of approaching bus		<input type="checkbox"/>
	A stopped bus straddles the crosswalk		<input type="checkbox"/>
	Bus stop just before crosswalk		<input type="checkbox"/>
	High speed traffic		<input type="checkbox"/>
	No crosswalk		<input type="checkbox"/>
	Other (specify)		<input type="checkbox"/>
D9	Additional traffic safety comments / recommendations:		

Date	Time:	Surveyor:
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Route Name:	Location:	Weather Conditions:	Stop No.:
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Section D-2: Lighting Assessment (assessment preferably taken in the evening or at night)
Go to Section D-3 if no lighting

D10	What type of lighting is available?	
	Street light	<input type="checkbox"/>
	Shelter lighting	<input type="checkbox"/>
	Outside light on adjacent building	<input type="checkbox"/>
	Other (specify):	<input type="checkbox"/>
D11	Does the light produce a glare?	Yes No <input type="checkbox"/> <input type="checkbox"/>
D12	How even is the light distributed?	Yes No <input type="checkbox"/> <input type="checkbox"/>
D13	Additional comments:	

Section D-3: Pay Phone

D14	Is there a pay phone within the immediate vicinity?	Yes No <input type="checkbox"/> <input type="checkbox"/>
	<i>If NO, skip to Question D16.</i>	
D15	Is the pay phone within reach of a wheelchair user?	Yes No <input type="checkbox"/> <input type="checkbox"/>
D16	If no pay phone is provided, is there a police call box?	Yes No <input type="checkbox"/> <input type="checkbox"/>
D17	Additional comments:	

Section D-4: Landscaping Assessment

D18	Are there problems with the landscaping around the bus stop?	Yes No <input type="checkbox"/> <input type="checkbox"/>
	<i>If YES, check all that apply:</i>	
	Trees/bushes encroaching on the landing area	<input type="checkbox"/>
	Trees/bushes encroaching on the sidewalk	<input type="checkbox"/>
	Tree branches that would hit the bus	<input type="checkbox"/>
	Other (specify):	<input type="checkbox"/>
D19	Additional comments:	

Section D-5: Safety Recommendations

D20	Improve pedestrian safety by:	<input type="checkbox"/>
	Trim trees or branches	<input type="checkbox"/>
	Move bus stop to:	
	Other (specify):	

Date	Time:	Surveyor:
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Route Name:	Location:	Weather Conditions:	Stop No.:
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PART E: Information Features

E1	Is there a bus stop sign? <i>If NO, move to question E6.</i>	Yes No <input type="checkbox"/> <input type="checkbox"/>
E2	What provider name is on the bus stop (<i>list all providers utilizing stop</i>)?	
	Provider 1:	
	Provider 2:	
	Provider 3:	
	Provider 4:	
E3	Are bus routes indicated on the bus stop sign? <i>If YES, what routes?</i>	Yes No <input type="checkbox"/> <input type="checkbox"/>
E4	How is the sign installed?	
	On its own pole	<input type="checkbox"/>
	On a building	<input type="checkbox"/>
	On a utility pole	<input type="checkbox"/>
	On a shelter	<input type="checkbox"/>
	Other (specify):	<input type="checkbox"/>
E5	Are there problems with the signage? <i>If YES, check all that apply:</i>	Yes No <input type="checkbox"/> <input type="checkbox"/>
	Sign in poor condition	<input type="checkbox"/>
	Pole in poor condition	<input type="checkbox"/>
	Sign position hazardous to pedestrians	<input type="checkbox"/>
	Sign not permanently mounted	<input type="checkbox"/>
	Lighting on sign is poor	<input type="checkbox"/>
	Other (specify):	<input type="checkbox"/>
	E6	Is there route/schedule/map (circle as appropriate) information posted? <i>If NO please move to question E9.</i>
E7	Where is the route/schedule/map (circle as appropriate) information posted?	
	On Pole under bus stop sign	<input type="checkbox"/>
	On its own pole	<input type="checkbox"/>
	On a building	<input type="checkbox"/>
	On a utility pole	<input type="checkbox"/>
	On a shelter	<input type="checkbox"/>
	In a shelter	<input type="checkbox"/>
	Other (specify):	<input type="checkbox"/>
E8	Is the information at eye level of a wheelchair user?	Yes No <input type="checkbox"/> <input type="checkbox"/>
E9	Is there a schedule rack?	Yes No <input type="checkbox"/> <input type="checkbox"/>
	<i>If YES, are repairs needed?</i>	Yes No <input type="checkbox"/> <input type="checkbox"/>
E10	Is there real time information display?	Yes No <input type="checkbox"/> <input type="checkbox"/>
	<i>If YES, is it at eye level of a wheelchair user?</i>	Yes No <input type="checkbox"/> <input type="checkbox"/>
E11	Is signage text ADA compliant (refer to the <i>Toolkit for the Assessment of Bus Stop Accessibility and Safety</i> for guidelines)?	Yes No <input type="checkbox"/> <input type="checkbox"/>

Date	Time:	Surveyor:
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<i>Route Name:</i>	<i>Location:</i>	<i>Weather Conditions:</i>	<i>Stop No.:</i>
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E12	Is information provided in Braille or by a Talking Signs® transmitter for people with visual impairments?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
E13	Additional signage & information comments:		
E14	Signage & information recommendations:		
	Make the following repairs:	<input type="checkbox"/>	
	Other (specify):	<input type="checkbox"/>	

PART F: Diagrammatic Sketch or Photograph

Sketch or photograph the layout of the bus stop area and any traffic controls. On sketch or photograph, be sure to note locations of:

Bus stop sign pole	Newspaper boxes	Traffic signals/stop signs
Other poles	Anything else installed at bus stop	Railroad tracks
Landing Pad	Sidewalks	Bus stop across the street
Shelter	Sidewalk barriers	Heating units in shelters
Bench	Crosswalks	Bike racks
Trash can	Curb cuts	North/South/East/West

<i>Date</i>	<i>Time:</i>	<i>Surveyor:</i>
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Toolkit for the Assessment of Bus Stop Accessibility and Safety • Easter Seals Project ACTION

