Accessing Transit

Design Handbook for Florida Bus Passenger Facilities

Version IV, 2023

FDOT
PUBLIC TRANSIT

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DESIGN HANDBOOK FOR FLORIDA BUS PASSENGER FACILITIES

Version IV

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January 2023

Acknowledgements

The Public Transit Office of the Florida Department of Transportation would like to thank the following members of Florida's public transit provider community for their contribution and input in the development of this handbook.

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Dawn Huff, LeeTran
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Chris Wiglesworth, FDOT

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List of Acronyms

AASHTO	American Association of State Highway and Transportation Officials
ACEEE	American Council for an Energy-Efficient Economy
ADA	Americans with Disabilities Act
ADAAG	Americans with Disabilities Act Accessibility Guidelines
APTA	American Public Transportation Association
AV	Autonomous Vehicle
AVL	Automatic Vehicle Location
B&A	Boarding and Alighting
BAT Lane	Business Access and Transit Lane
BBS	Bus Bypass Shoulder
BOB	Bike on Bus
BOS	Bus on Shoulder
BRT	Bus Rapid Transit
CBD	Central Business District
CCTV	Closed Circuit Television
CNG	Compressed Natural Gas
CPTED	Crime Prevention Through Environmental Design
DOJ	Department of Justice
DOT	Department of Transportation
EMS	Emergency Medical Services
ESMS	Environmental and Sustainability Management System
EV	Electric Vehicle
FAC	Florida Administrative Code
FDM	FDOT Design Manual
FDOT	Florida Department of Transportation
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GBI	Green Building Initiative
GHG	Greenhouse Gas
HOV	High-Occupancy Vehicle
HOT Lane	High-Occupancy Toll Lane
IESNA	Illuminating Engineering Society of North America
IGA	Intergovernmental agreement
ITS	Intelligent Transportation System
LED	Light Emitting Diode
LEED	Leadership in Energy and Environmental Design
LOS	Level of Service
MUTCD	Manual on Uniform Traffic Control Devices
MOD	Mobility on Demand
MOU	Memorandum of Understanding
MOT	Maintenance of Traffic
MPO	Metropolitan Planning Organization
NACTO	National Association of City Transportation Officials
NTD	National Transit Database
PROWAG	Public Rights-of-Way Accessibility Guidelines
PD&E	Project Development and Environment
PDMS	Portable Dynamic Message Sign
ROW	Right-of-way
SSD	Stopping Sight Distance
TAM	Transit Asset Management
TCP	Traffic Control Plan
TCP/IP	Transmission Control Protocol/Internet Protocol
TCRP	Transit Cooperative Research Program
TDM	Transportation Demand Management
TOD	Transit Oriented Development
TPA	Transportation Planning Agency
TPO	Transportation Planning Organization
TSP	Transit Signal Priority
TTC	Temporary Traffic Control
UA or UZA	Urbanized Area
USDOT	United States Department of Transportation
USGBC	United States Green Building Council

Chapter 01

ROLE OF BUS PASSENGER FACILITIES

FDOT

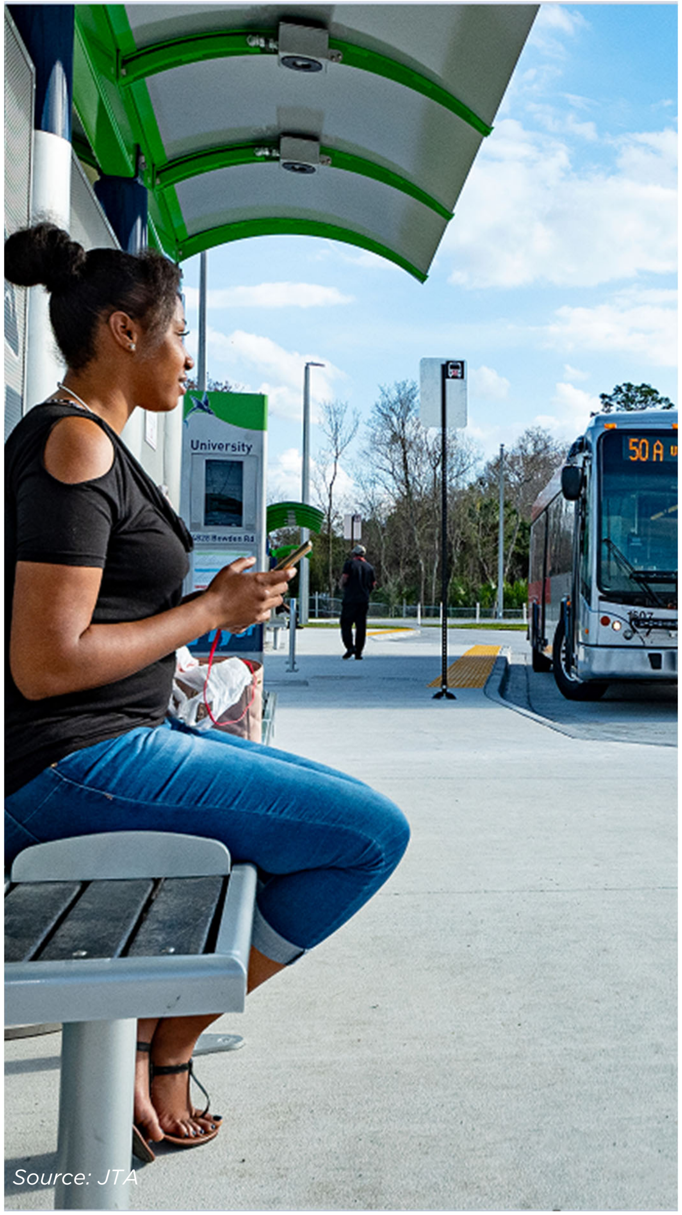
FDOT

1.1 THE FIRST POINT OF CONTACT

A bus stop functions as the point of first contact between a transit agency and its customers. To a potential rider, the characteristics of the bus stop send signals about how the agency views itself and the value of its service. What do the various physical components of the bus stop communicate about the quality of the transit services being offered? If the features of the bus stop project an image of a bare-bones, minimal-investment service, that image is likely to be adopted by the riding public and they will see service in a similar poor light. However, if a bus stop offers a place of shelter to rest and Wi-fi for waiting patrons to access their smart devices, the prevailing message is one of hospitality; that the transit agency cares about its riders and their comfort. In this instance, the transit agency is using its bus stop infrastructure and amenities to encourage its patrons to value it services as much as it does.

To someone who uses a mobility device such as a wheelchair, a bus stop with a well-maintained concrete pad connected to the surrounding sidewalk network in accessible fashion indicates the agency's intention to appropriately accommodate such riders. The bus stop with no pad nor any accessible pathway connectivity implicitly sends a message that such riders are not truly welcomed on the system. Intended or not, this can suggest to both existing and potential patrons that the transit agency is indifferent (at best) or insensitive (at worst).

Therefore, properly designed and placed bus stops can play a significant role in helping transit agencies reach their common goal of making transit a convenient, comfortable, and viable travel alternative in their communities. This handbook has been prepared by the Florida Department of Transportation (FDOT) Public Transit Office to provide basic guidelines and best practices to help agencies reach this goal of making access to transit at Florida's bus stops a safe, convenient, and welcoming experience. By providing a useful and informative resource with guidance and best practices on how to place, design, and coordinate on the implementation of bus stops that are safe, secure, comfortable, and meet Americans with Disabilities Act (ADA) and other regulatory guidelines, the FDOT Public Transit Office wants to support and benefit agencies involved in making transit a viable mobility option.



Source: JTA

1.2 OVERARCHING CONSIDERATIONS

The role of bus stops as the first point of contact has evolved over time and will continue to do so with changes and advancements in design and engineering techniques, public and policy requirements and attitudes, and the fast-evolving technology and communication environment. To respond to these changes, transit agencies must continue to adapt how they serve the patrons they welcome each day at thousands of bus stops on more than four million miles of roadways across the nation. Some of the key, overarching considerations for bus stop facilities in Florida are presented in this section.

AMERICANS WITH DISABILITIES ACT

The Americans with Disabilities Act (ADA) was signed into law on July 26, 1990, by President George H.W. Bush. It represents one of America's most comprehensive pieces of civil rights legislation that prohibits discrimination against persons with disabilities and guarantees that they have the same rights and opportunities as other Americans to participate in all areas of public life, including jobs, schools, and transportation, among others. The ADA was codified in the United States Code (U.S.C.), in Title 42, Chapter 126, §12101 et seq. and includes five (5) titles, with Title II governing public entities, including public transportation. The ADA was enhanced by the ADA Amendments Act of 2008, which became effective on January 1, 2009, and includes a significant broadening of the definition of "disability."

The ADA Accessibility Guidelines (ADAAG) have been developed and are maintained by the United States Architectural and Transportation Barriers Compliance Board in Washington, D.C., which also is known as the "Access Board." They have been adopted by the Departments of Justice and Transportation as the design standards for new construction and alteration under the ADA. As a result, the ADA and ADAAG are the basis for compliance guidance and best practices for agency coordination, bus stop components, bus stop placement, and BRT station design. In this way, the ADA and its applicable regulations govern the accessibility to public transit services and include the major standards and design criteria for public transportation facilities.

State and local transportation agencies need to consider and comply with all applicable ADAAG requirements when implementing projects and services. In Florida, the State's accessibility standards include some that are more restrictive than the US requirements. Therefore, FDOT criteria are the premiere governing source for accessibility requirements in the State of Florida when they are the most stringent. Reverting to less restrictive federal minimums is not permitted. These guidelines also must be used by private developers and builders that develop and construct transit supportive projects. Successfully providing transit that is accessible to all individuals requires local and state agency coordination, as well as consideration of all federal and state regulations. This handbook is designed to provide basic guidelines and best practices for making transit accessible in accordance with both federal and state accessibility guidelines. As such, ADA criteria are integrated throughout this handbook in each and every section.

EMPHASIS AREA IMPACTS ON TRANSIT FACILITIES

FDOT's adopted Mission statement is: The department will provide a safe transportation system that ensures the mobility of people and goods, enhances economic prosperity, and preserves the quality of our environment and communities. In light of this mission, FDOT adopts planning priorities and project emphasis areas periodically to help guide project development. Recently adopted planning emphasis areas encompass four core tenets, including Safety, Mobility (Accessibility), Innovation, and Retention. These tenets provide more than basic guidance and give true priority in decision-making regarding infrastructure investment and project priorities.

For transit, bus stops help enhance mobility and accessibility within the transportation system and provide a level of safe connectivity between pedestrians and bus services. Transit agencies are required to set safety targets, and bus stops should be included in this process as well as be graded for safety as part of any ongoing monitoring program. FDOT's commitment to safety is evident with the development of this design handbook and through a recently completed research project to provide a toolkit for assessing safety at bus stops. All transit agencies should make use of these resources and tools to integrate accessibility and safety into their respective bus stop designs. Additionally, these agencies also should develop a strong link between any new and/or enhanced services in their plans and the operational implementation of these services to help ensure that bus stop locations are optimal in terms of location, safety, and design for the overall mobility of their patrons and the communities that they serve.

UNIVERSAL DESIGN

Universal Design is defined as "the design and composition of an environment so that it can be accessed, understood, and used to the greatest extent possible by all people regardless of their age, size, ability, or disability."[1]

The Universal Design concept is based on the following seven principles and can be applied to any product, whether that be a building, service, or tool. The intent is that solutions designed using this approach serve not only the needs of a single group of individuals, but create an environment that is accessible and convenient for all. All in all, Universal Design is good design.[1]

- Equitable Use - The design is useful and marketable to people with diverse abilities.
- Flexibility in Use - The design accommodates a wide range of individual preferences and abilities.
- Simple and Intuitive Use - Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.
- Perceptible Information - The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.
- Tolerance for Error - The design minimizes hazards and the adverse consequences of accidental or unintended actions.
- Low Physical Effort - The design can be used efficiently and comfortably and with a minimum of fatigue.
- Size and Space for Approach and Use - Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility.

At this time, Universal Design is only a best practice and not enforced by law, as is the case for the ADA. However, since ADA requirements and Universal Design precepts have some of the same underlying principles, it is likely that ADA-compliant bus stop facilities generally will meet many of the Universal Design principles, as well.

SHARED MOBILITY

Some elements of the ongoing shared mobility evolution, such as app-based on-demand transit and micromobility, have direct impacts on bus facilities and must be considered in facility design and placement. The Shared-Use Mobility Center has defined "shared mobility" as transportation services and resources that are shared among users, either concurrently or one after another. This includes public transit, micromobility (e.g., bike-sharing, scooter-sharing), automobile-based modes (e.g., carsharing, rides on demand, and microtransit), and commute-based modes or ridesharing (e.g., carpooling, vanpooling).

Currently popular as an efficient first-mile/last-mile travel solution, Mobility on Demand (MOD) service models have continued to be adopted in Florida and elsewhere. While the pick-up and drop-off of passengers with these services typically can be accommodated anywhere safe along a curbside, some of these models may use bus stops, adding even more patrons and activity at such transit facilities. Micromobility programs, such as scooter- and bike-sharing, also may use bus stops to locate their docking stations to serve those riders who may want to use such a mode to complete the first or last leg of their trip.

EV ACCESS AT BUS STOPS

Another key technological advancement that has entered the world of transit in recent years includes electric vehicle (EV) propulsion. While EV technology has been getting more significant attention in the personal automobile market since its advent, EV buses also are slowly but steadily permeating transit agency bus fleets across the country. EV buses have become a popular alternative to both standard fuel and hybrid-electric buses as agencies seek to further reduce their carbon footprint and monopolize on the public appeal of greener propulsion systems. EVs utilize electric charging stations to recharge the battery-arrays that power their engines and other equipment. Currently, many transit agencies attempt to do most of this charging at their maintenance facilities overnight before pullout. However, due to the current range limitations of these vehicles, many agencies are having to consider the implementation of charging facilities along major routes to help limit deadhead mileage and increase the revenue service hours of their EV buses. Some already have equipped selected bus stops with charging gantries or plates to allow for quick charging capabilities along various bus routes.

PANDEMIC-READY TRANSIT SERVICES & BUS STOPS

The American Public Transportation Association (APTA) has concluded that, based on recent findings compiled from global research and its best practices study, there is no direct correlation between the use of urban public transit and the transmission of COVID-19, and that what riders do at the end of a trip affects the probability of contracting the virus far more than the mode of travel. Nevertheless, the general public's perception still may be that using public transit could possibly pose a higher risk for contracting COVID than other forms of transportation.

Source: APTA

Therefore, planning accordingly for the ongoing pandemic and the possibility of other similar global health emergencies in the future also should be kept in mind when planning, designing, and implementing various transit amenities. For example, one method identified in a recent FDOT publication[1] is the efficient use of web and mobile platforms, which can enhance public safety by limiting the need for riders to interact with physical objects like information kiosks and turnstiles. Other similar innovations include integrated online or mobile payment apps that support contactless payment systems instead of fareboxes, the capability to pre-book seats, and the provision of bus capacity information via smart phones to help concerned patrons avoid crowded buses. Mobile notifications about agency cleaning policies and when buses were last cleaned can help, as well.

Given that this pandemic continues to have impacts and the ongoing concern that another similar situation can occur again in the future, FDOT's publication also has identified opportunities for implementing safety measures at bus stops, including:

- Signage encouraging waiting patrons to stay six feet away from one another
- Provision of hand sanitizer dispensers
- Wi-Fi access for contactless trip planning and fare payment, and ability to reserve seating on the bus

While these measures may not be applicable at every bus stop or fit every situation, and given that global pandemics are rare, bus stop design and placement still should be carried out with such considerations in mind.

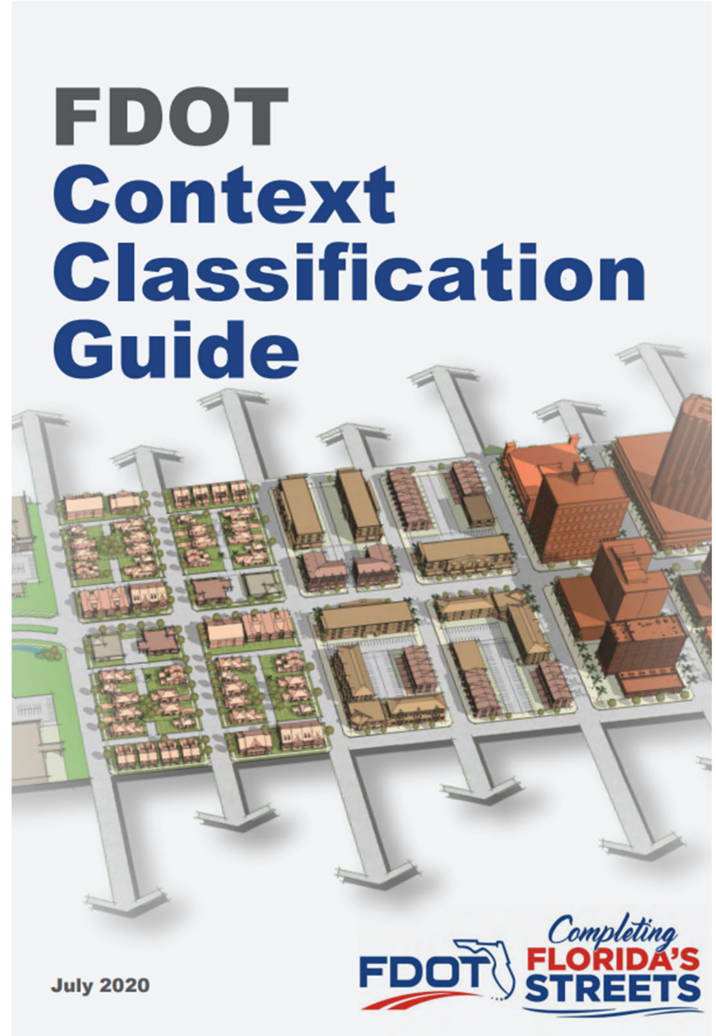
ASSET MANAGEMENT

Starting in 2018, transit agencies have been required to develop asset replacement targets and detailed plans for Transit Asset Management (TAM). These TAM targets establish thresholds for replacement of capital equipment and facilities. Additionally, an agency's TAM plan should include identification of various thresholds for when a bus stop is due for upgraded amenities or equipment. Bus stop facilities can include numerous amenities that have replacement targets and should be included in capital replacement plans.

When bus stops are due for upgrade, accessibility must be a key consideration in the redesign of the stops and in the placement of new and/or upgraded amenities and

Source: Benesch

infrastructure at any stop, including when placing new stops along bus routes. In addition, when replacing older or obsolete facilities or amenities, accessibility is a key design requirement and referencing this handbook in these cases is prudent and justified.



FDOT CONTEXT CLASSIFICATION

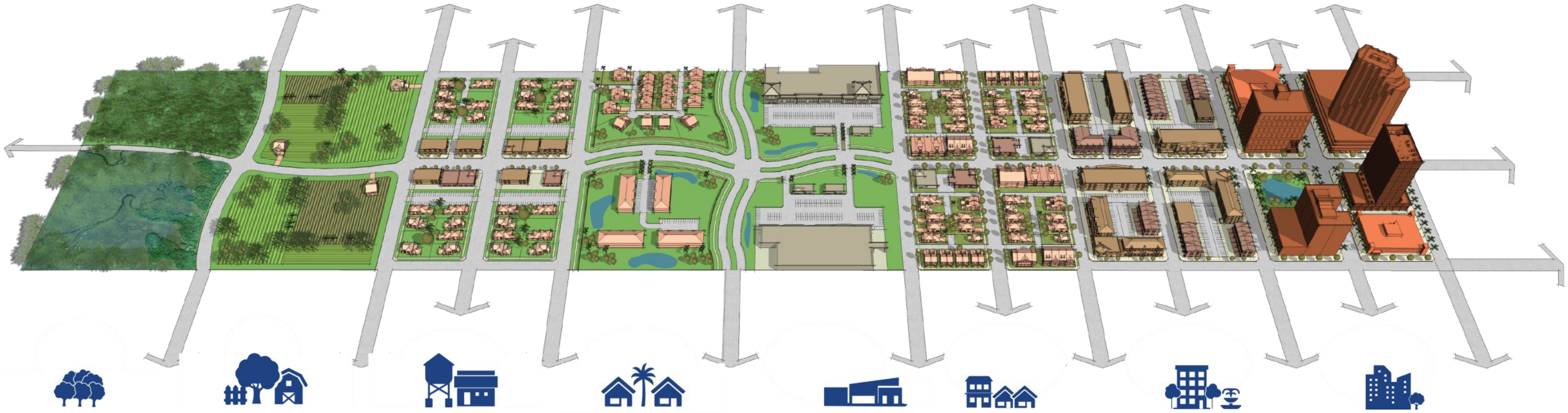
As part of its Context Classification process, FDOT has recently developed guidance for transit agencies, local governments, and its own planners and designers who are working to better incorporate transit service and infrastructure along state roadways. This guidance helps FDOT advance its mission to support safe and efficient transit services to enhance mobility and economic prosperity in the State, while preserving the quality of Florida's environment and communities.

The FDOT Context Classification system broadly identifies the various built environments existing in Florida. The system describes the general characteristics of the various types of land use, development patterns, and roadway connectivity that can occur along a roadway, providing cues as to the types of uses and user groups that will likely utilize the roadway. Identifying the context classification is a critical step in the overall planning and design process, as different context classifications will have different design criteria and standards. Transit agencies should refer to the FDOT Context Classification Guide for more details on context classification.

Figure 1.2.1 shows how bus-based transit fits into each of the FDOT Context Classification categories, including bus stop related elements suitable for typical state roadways in each context classification. For a complete list, including bicycle/pedestrian and vehicular elements that relate to the classification categories and other information on FDOT Context Classification, go to the FDOT Public Transit Office website at https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/roadway/completestreets/files/fdot-context-classification.pdf.

This framework can be used as general guidance and a starting point for planning and designing for transit along state roadways in each of the different land use types. However, the final selection of bus stop components to include on actual projects should be tailored to recognize local conditions, opportunities, and constraints.[2]

Figure 1.2.1 | Bus facilities by FDOT Context Classification type.



	Natural	Rural	Rural Town	Suburban Residential	Suburban Commercial	Urban General	Urban Center	Urban Core
	Lands preserved in a natural or wilderness condition.	Sparsely settled lands; may include agricultural land, grassland, woodland, and wetlands.	Small concentrations of developed areas immediately surrounded by rural and natural areas.	Mostly residential uses within large blocks and a disconnected or sparse roadway network.	Mostly non-residential uses within large blocks and a disconnected or sparse roadway network.	Mix of uses set within small blocks with a well-connected roadway network. The roadway network usually connects to residential neighborhoods.	Mix of uses set within small blocks with a well-connected roadway network, identified as part of a civic or economic center.	Areas with the highest densities and building heights, and within FDOT classified Large Urbanized Areas (population >1,000,000).
Bus Stop Pad	Desired Amenities	Desired Amenities	Both	Both	Both	Both	Both	Both
Basic Bus Stop Shelter			Basic Amenities	Basic Amenities	Basic Amenities	Basic Amenities	Basic Amenities	Basic Amenities
Large Bus Stop Shelter					Desired Amenities	Desired Amenities	Desired Amenities	Desired Amenities
Boarding Island				Desired Amenities	Desired Amenities	Desired Amenities	Desired Amenities	Desired Amenities
Level Boarding Platform					Desired Amenities		Desired Amenities	Desired Amenities
Queue Jumps				Desired Amenities	Desired Amenities	Both	Both	Both
TSP/Signals, ITS				Desired Amenities	Desired Amenities	Desired Amenities	Desired Amenities	Desired Amenities
Stops in Bus Pull-Out				Both	Both	Basic Amenities		
Stops in Travel Lane				Desired Amenities	Desired Amenities	Desired Amenities	Both	Both
Shared (Mixed-Flow) Lane	Both	Both	Both	Both	Basic Amenities	Basic Amenities	Basic Amenities	Basic Amenities
BAT Lane					Both	Desired Amenities	Both	Both
Exclusive Lane					Desired Amenities		Desired Amenities	Desired Amenities

○ Basic Amenities ● (light) Desired Amenities ● (dark) Both

1.3 ABOUT THIS HANDBOOK

The purpose of this handbook is to provide guidance to transit agencies, state and local governments, and other interested entities on the planning, design, placement, and installation of transit bus stops and related facilities and infrastructure consistent with state and federal laws, regulations, and best practices.

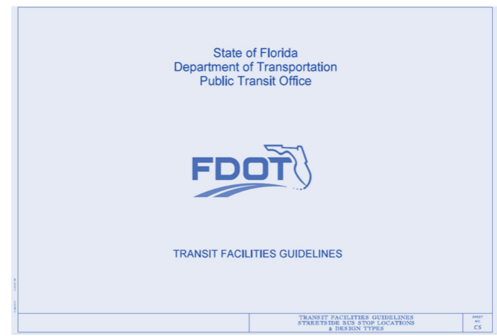
Each transit agency provides a network of services and facilities whose implementation and ongoing operation often require coordination among multiple agencies, patrons, and the local community. The development of the facilities and infrastructure to support these transit services often requires a long-term mindset to address the myriad short-term challenges that can be encountered. Even developing the most basic bus stop requires more than just the simple incorporation of the engineering standards required for the poured concrete to anchor a bus stop sign post.

REQUIREMENTS VS. BEST PRACTICES

This handbook attempts to differentiate, where feasible, requirements in state or federal law or rules from industry best practices. Most key requirements are listed separately and usually indicated by statements using “shall” and “must.” Industry best practices are typically indicated by statements using “should” or similar language. In addition, this handbook also attempts to maintain the exact language of any requirements as they are shown in their original reference documents. For this reason, for example, some requirements may show measurements in inches while others are shown in feet.

REFERENCES & RESOURCES

The references throughout this handbook and in the Index of Resources at the end provide compilations of the key resources used to develop this handbook. Most also provide live Web links for users accessing this handbook via the Internet, linking them to many of the listed resources. These links, where applicable, are intended to provide access to any additional, as well as updated, standards and best practices not included in this handbook.



It should be recognized that a major resource for this handbook, and likely one of the first resources that Florida’s transit agencies should use as a supplementary reference, is FDOT’s Transit Facilities Guidelines. The most recent version of this document can be found at https://www.fdot.gov/fdotransit/transitofficehome/transitplanning.shtm/newtransitfacilitiesdesign.shtm. This resource, prepared by FDOT’s Public Transit Office, includes updated guidance and numerous detailed engineering schematics for the design and placement of bus stops in Florida.

“LIVING” DOCUMENT

While this publication attempts to address the most current standards available, it should be noted that it also is a “living” document. From the time of handbook publication to when agencies use it to design a facility, standards may change, develop, or evolve. **To ensure that agencies are accurately following the latest standards and guidelines, the most recent standards documents must 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. For example, the Access Board's Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way, which are included in the draft Public Rights-of-Way Accessibility Guidelines (PROWAG), have been addressed as feasible. These are standards that the Department of Justice (DOJ) still has not yet adopted and are still in development; they are more stringent than existing US Department of Transportation (USDOT) and DOJ guidelines.

APPENDICES

The appendices are intended to provide supplemental information for the handbook. An overview of transit service types and facilities, a glossary of key terms used in the handbook, a quick reference guide of standards and minimum requirements, and checklists for locating and designing bus stops are included, as summarized below.

APPENDIX A: QUICK REFERENCE GUIDE

The Quick Reference Guide provides the user with standards and minimum requirements for each essential part of a bus stop or the associated amenity. This includes both state and federal guidance. As previously mentioned, the most recent standards documents must be consulted prior to any planned projects.

APPENDIX B: GLOSSARY

The glossary is included to assist the user with definitions for terms used throughout the handbook.

APPENDIX C: BUS STOP CHECKLISTS

Two bus stop checklists, one comprehensive and the other a quick reference checklist, are provided and intended for use by transit and public works agencies in Florida. These checklists have been developed by Easter Seals Project ACTION, which is funded by USDOT and the Federal Transit Administration (FTA). These checklists have been field-tested, but the user still is encouraged to customize the checklist according to local needs, issues, and concerns. The Quick Bus Stop Checklist is a shortened version of the Comprehensive Checklist and is suggested for use by advocates and the general public. In addition, an equipment/tools checklist also is included that may be needed to acquire data for the survey site. This supplementary checklist was developed using data from Easter Seals Project ACTION as well as reviewing recent bus stop accessibility field data collection processes in Florida.

APPENDIX D: TRANSIT SERVICE TYPES AND FACILITIES

This appendix includes a discussion of transit service and bus stop types across Florida. The bus stop types are showcased with descriptions of adjacent land uses, approximate dimensions, street characteristics, curbside elements, shared mobility/bicycle/pedestrian connections, and climate/sustainability considerations.

The different bus stop configurations discussed include the following:

- Basic Bus Stop
- Enhanced Bus Stop
- Transit Mall
- Transfer Center
- BRT Station
- Park-and-Ride
- Intermodal Center

REFERENCE GUIDE

CHAPTER 1

1. FDOT, December 2020. Context Classification Framework for Bus Transit.
2. General Services Administration, US Access Board, 2017. www.Section508.gov.

Chapter 02

COLLABORATION FOR BETTER BUS FACILTIES

2.1 NEED FOR COLLABORATION

Bus stops do not get implemented without careful planning and coordinated efforts by staff at multiple agencies and departments at various levels. For transit agencies desiring better designed, placed, and maintained bus stops and other related facilities—as well as the best utility for their investment as measured in terms of effective and efficient use of either financial resources or staff time (or both)—the key is productive and ongoing collaboration. By definition and at its core, collaboration defines the project's purpose, involves the right people in the effort, and achieves "buy-in" from the involved parties to collectively reach the desired goal.

The various entities involved and levels of required coordination for bus stop design, placement, and maintenance have continued to grow over the years and now require a more concerted and emphasized focus than at any time in the past. In many cases, a range of agencies have to be involved in the planning, design, location, construction, and maintenance of transit facilities, including state and local agencies, metropolitan/transportation planning organizations or agencies (Metropolitan Planning Organization [MPO]/Transportation Planning Organization [TPO]/Transportation Planning Agency [TPA]), other regional bodies, and even 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, engineering, utilities, advanced technologies, traffic operations, right-of-way, and maintenance.

Prior to providing guidance on the design and placement of bus stops on or with access to Florida's roadways, this handbook first seeks to assist Florida's local and state agencies with appropriate guidance and best practices to help them understand how to collaborate better on the planning and implementation of those facilities, as summarized in the remainder of this chapter.

Source: Benesch

2.2 COLLABORATION PARTNERS

Transit service is provided on roadways that are owned, maintained, and operated by various entities and often cross multiple jurisdictions. Those 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. Working in advance with roadway and property owners to determine the locations and designs of routes, bus stops, and/or passenger access facilities can yield solutions that are most feasible and appropriate for implementation.

No matter whether a new bus stop is being designed and placed, an existing bus stop is being retrofitted or moved to a different location, or a bus stop is slated for outright removal, the process to accomplish any of these is complex, relatively costly, and involves a variety of engineering and safety considerations. Because of this, better collaboration to accomplish any of these means the timely involvement of a host of partner agencies.

The key partners that should be involved in such a process are identified and generally described in this section. It should be noted that this is not necessarily a comprehensive list for all transit infrastructure applications. For example, the planning, design, and implementation of a major transfer center with significant infrastructure may require the involvement of a number of other local entities in addition to the ones listed here. However, regardless of which partners ultimately are involved, it is important to recognize that while their individual priorities may vary, these entities really do have a mutual interest in the implementation of safe, accessible, and convenient bus stop facilities.

TRANSIT AGENCY

The transit agency is usually the primary provider of transit service and the main entity planning, siting, and developing bus stop facilities and infrastructure. Transit agencies may include city or county jurisdictions, often being a department within the municipal government structure. Additionally, transit agencies may be a transit or transportation authority established by state law.

CITY/COUNTY AGENCIES

The authority with jurisdiction over most of the streets and sidewalks within the transit service area is usually a city or county agency. In Florida, the permitting and locating of transit facilities on state roads is delegated to the appropriate local city/county agency in whose jurisdiction the state road is located. The local city or county agency is responsible for issuing permits to transit agencies using state right of way as outlined in Chapter 14-20, Florida Administrative Code (F.A.C.). However, FDOT offices should be contacted and coordinated with before permitting new facilities in the State right of way to ensure that safety and operational compatibility are maintained. State and federal agencies will become involved in more regional projects, such as Bus Rapid Transit (BRT) or rail, that impact Florida's Strategic Intermodal System or other significant state facilities.

FLORIDA DEPARTMENT OF TRANSPORTATION

FDOT is the state agency charged with developing and maintaining the transportation network in Florida. The agency includes both the FDOT Central Office, where state policy is established, and the seven District Offices throughout the state that carry out the development and management of transportation projects in local or regional areas. Specifically, transit agencies most often will coordinate with FDOT's Public Transit Office or the local District Office of Modal Development. Additional coordination may be required with the Statewide or District-level ADA Coordinator, and bus stop placement may be coordinated with the local operation centers within the districts, as well.

DESIGN TIP

Start Early

Transit agencies should start the collaboration process for bus stop design early. Establishing the stakeholder engagement process early can identify the stakeholders and clarify the roles each has to play in the placement and design of the facilities. In addition, it also may provide a framework for public input to get integrated into the placement and design process.

LOCAL/REGIONAL PLANNING AGENCY

The MPO (in some cases known as a TPO or TPA) is a planning and coordination entity established in each urban area by federal requirement. The MPO includes several boards or committees as well as professional staff support. A Policy Board comprised of elected and appointed officials from each jurisdiction and various agencies within the urbanized area sets policy and approves plans and priorities for investing federal and state transportation funding. The MPO includes several advisory committees to the Policy Board, with one comprised of citizens, one of technical professionals, and others that may include bicycle/pedestrian, transit, and/or other representatives. The Policy Board also hires the professional staff to manage the MPO's day-to-day activities and carry out the Policy Board's projects and direction. All transit agencies are required to coordinate with their local MPO on planning their system development.

PRIVATE SECTOR (DEVELOPERS/KEY TRIP GENERATORS)

The private sector partners typically include representatives of developers and entities who are key trip generators (e.g., employers, central business districts, shopping malls, major public buildings, medical facilities, etc.) within the transit service area. The private sector community often partners in transit-related endeavors to ensure appropriate representation of their interests as well as those of the individuals who live in, work at, and/or visit these locations for various purposes. Additionally, this group also can include privately owned and operated transit service providers.

Source: Benesch

UNDERSTANDING FDOT'S PROJECT TIMELINE

It also is important that local agency staff are aware of the various types of FDOT projects and the timeframes for the different processes used to implement these projects. Decision-making at FDOT is driven by these procedures, thus making timely coordination a key factor for successful bus facility location and design on state roads. Following are examples of some of the FDOT project types and their associated timelines:

- Major capacity projects can take 8-20 years to develop, starting with the MPO long range planning process.
- Resurfacing projects are usually completed within just 2-5 years of being programmed in FDOT's Work Program.
- Operational improvements that are minor can be completed within 1 year of the decision, with some of the more involved projects taking 2-5 years.

It is important to note that major capacity projects like realigned corridors, major widening and lane additions, and new road segments, mostly start during the 2-20 years of Planning with the MPOs before getting to the Project Development & Engineering (PD&E) phase that typically lasts 2 years. Projects then move into the Design phase for approximately 2 years. If Right-of-Way is needed, the acquisition process will last at least 2 years to be cleared. Finally, the Construction phase varies but can last 2-5 years depending on the complexity of the facility, before being opened for operation and placed in the Maintenance phase.

CASE STUDY

Lack of Collaboration Can Be Costly

As part of a larger sidewalk project, Alachua County in Florida upgraded a bus stop on SW 24th Avenue in the City of Gainesville without contacting the local transit agency, Regional Transit System (RTS), and made the mistake of building a curb ramp right into a high speed road. However, this was unnecessary as the bus stop already was connected to an existing sidewalk for safe access to/from the stop. In addition, the County also was going to invest funds to build a crosswalk with flashing yellow lights for the bus stop.


Source: RTS

Fortunately, at that point, the County reached out to RTS and the transit agency was able to advise/educate staff about bus stop design and assure that the curb ramp at the bus stop (and the crosswalk) was not needed and undesirable from a safety and operational point of view. RTS also observed that the County had not used the correct curb design at the stop, as well as at a number of other bus stops it was improving. Offset curbs had been used that had resulted in extensive damage to the asphalt from only a few months of bus operation at the stop. RTS is now collaborating with Alachua County to remedy both the curb ramp issue and the offset curb situation and rebuild the bus stop.

2.3 ROLES FOR BETTER COLLABORATION

To assist the key partner agencies with their respective efforts when collaborating on bus stops and other transit infrastructure, this section presents a number of action steps to consider when facilitating the engagement of various entities in the planning, development, and implementation of transit facilities. Effective collaboration in any transit facility design project is critical as it can help ensure the most desirable outcome for the parties involved. Less obvious is the complementary role collaboration can play in also helping to promote and foster the attractiveness of transit as a safe and viable mobility alternative for the community it serves.

Agencies use various formal and informal strategies to establish these collaborative relationships. The typical formal methods include Intergovernmental Agreements (IGAs) and Memorandums of Understanding (MOUs). However, regardless of mechanism used to formalize such interaction, the most important element to support true collaboration is for all partners involved to find common ground and mutually understand the parameters under which each participating agency must operate. Each partner also must do its "homework" so that it will know the applicable regulatory requirements involved and understand the need to follow the most stringent regulations, either using this handbook and/or other additional resources.

ROLE AS A COLLECTIVE OF AGENCIES

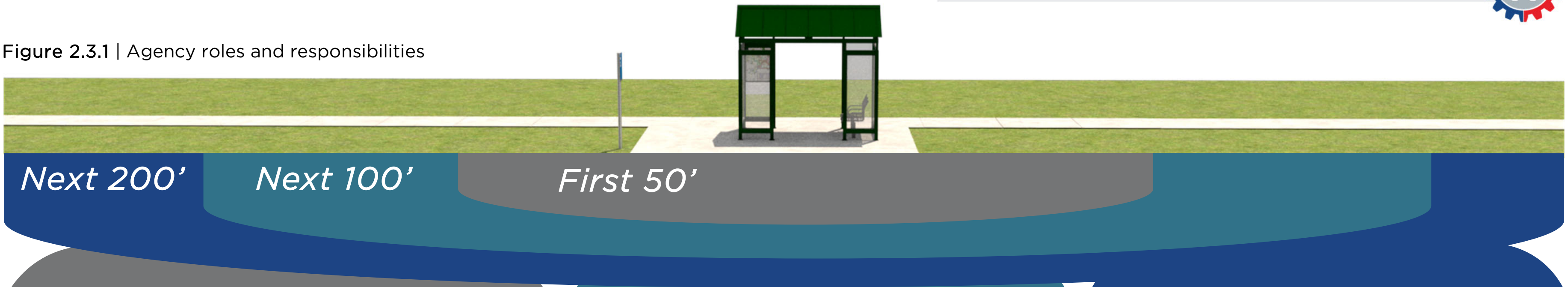
Collaboration also is critical to improve safety and accessibility to/from and at bus stops; no single agency or organization can accomplish this on its own. Transit agencies do not control the street or sidewalk network around bus stops, cities and counties usually do not make transit routing and facility placement choices, and MPOs/TPOs/TPAs are the local entities with the capacity and mandate to identify and plan for long-range transportation opportunities and needs at the local and regional scale. The same holds true when it comes to funding for bus stops and other transit infrastructure as it typically comes from multiple sources.

FDOT's role also is significant, especially when an improvement is located along a state road, as the Department maintains safety data and can provide other resources to help ensure the application of safe and accessible bus stops. FDOT also is one of the key partner agencies, along with MPOs/TPOs/TPAs and cities/counties, that often have many other competing transportation needs to consider. So, when it comes to the determination of how much of a priority a particular transit bus stop project may be, it is prudent to adequately involve these partner agencies. Their involvement will help establish where the project fits among other needs and the best timing for its advancement, including the possibility of it being included with another planned project. Further, their collaboration will be key to ensuring the development of the best overall bus stop project possible.

FDOT has identified the potential agencies[1] involved and their respective areas of influence in the selection, placement, design, and maintenance of a transit stop. As shown in Figure 2.3.1, transit agencies have direct oversight and control over most aspects of bus stop decisions. However, that responsibility evolves into more of a coordination and review capacity beyond the first 50 feet around the bus stop.

As summarized below, FDOT also has identified opportunities for the partnering agencies[1] to work together to improve the current culture on collaboration, as well as public attitudes toward transit in Florida.

Figure 2.3.1 | Agency roles and responsibilities



Next 200’

Transit Agency
- Shelter Location
- Shelter Lighting
- Shelter Maintenance
- Real Time Information
- Safety Warnings
- Leverage Land Use & Roadway Projects
- Guide Rider to Push Button

Roadway Owner
- Sidewalk Connection, ADA Access
- Connectivity to Local Departments
- Landscaping
- Review for Mid-Block Crossings
- Electrical Connection
- Leverage Projects to Build Transit Amenities
- Input From Transit Agencies Required

Public Works/Utilities/Water
- ADA Access
- Canal Maintenance (as applicable)

Law Enforcement
- Enforce Speed Limits & Safe Driving
- Prevent Jaywalking

Private Property Owner
- Developer Commitments
- On Site Pedestrian/Bicycle Connections

Next 100’

Transit Agency
- Safety Warnings
- Leverage Land Use & Roadway Projects
- Guide Rider to Push Button

Roadway Owner
- Sidewalk Connection, ADA Access
- Pavement Markings
- Landscaping
- Review for Mid-Block Crossings
- Push Buttons & Signals
- Input from Transit Agencies Required

Public Works/Utilities/Water
- ADA Access
- Canal Maintenance (as applicable)

Law Enforcement
- Enforce Speed Limits & Safe Driving
- Prevent Jaywalking

Private Property Owner
- Developer Commitments
- On-Site Pedestrian/Bicycle Connections
- Input from Transit Agencies Required

First 50’

Transit Agency
- Leverage Land Use & Roadway Projects

Roadway Owner
- System & Network Connections
- Landscaping
- Review for Mid-Block Crossings
- Signal Optimization
- Maintenance of Traffic Agreements

Public Works/Utilities/Water
- ADA Access
- Canal Maintenance (as applicable)

Law Enforcement
- Enforce Speed Limits & Safe Driving
- Prevent Jaywalking

Private Property Owner
- Developer Commitments
- On-Site Pedestrian/Bicycle Connections
- Input from Transit Agencies Required

- **Create Transit-Inclusive Development Review Process** to include institutionalizing transit stop access into the regular order of business processes associated with roadway improvements, access management, and site/development plans. Agencies should refer to FDOT's recommendations and guidance in its 2020 publication, Don't Stop at the Stop: Actualizing Safe Access to Transit, to help set this up. The recommended "Transit Inclusive" process and corresponding flowchart provide a template for institutionalizing transit safety and access throughout the context of the review and development permitting process, particularly for site/land development and roadway improvement projects. The illustrative template not only provides a mechanism for appropriate screens that would warrant a higher level of transit engagement and review, but also integrate an FDOT Context Classification assessment with respect to the appropriate transit stop design and amenities based on local development and place typologies.
- **Utilize GIS-based tools to screen for access and stop needs,** and support proactive, interagency dialogue and coordination around transit accommodations. Various GIS tools can enable the quick display of area demographic profiles, ridership, big box/convenience store uses, and land use context measures that help indicate transit propensity and provide a useful, data-driven warrant at the beginning of the development review process to ensure that safe and accessible transit features are planned and integrated into construction documents well before site development, driveway permits, and roadway improvements are implemented.
- **Conduct "bus stop influence area" walking and infrastructure audits,** where necessary, to ensure the optimal placement and design of bus stops. Conducting walking audits in conjunction with FDOT and extending the timeline for 3R (i.e., rehabilitation, restoration, and resurfacing) projects may also help with engaging stakeholders earlier so they have time to coordinate their improvements.
- **Coordinate among key agency stakeholders,** including transit agencies, public works, private developers, and/or FDOT to:
    - Assess local, arterial, and collector road layouts, and analyze costs and feasibility of serving the proposed development (e.g., route length per number of residents served)
    - Review actual physical walking distances to transit stops (versus the "as the crow flies" radii) and ensure that they are properly sited and designed to enhance user access and comfort
    - Review proposed staging of development with respect to planned expansion of transit services and the costs/benefits of providing transit services if development is located away from the current transit service area
    - Provide comment on the orientation and design of buildings to ensure that they are appropriately addressing key pedestrian routes leading to and from transit stations and that there is a positive relationship between the location of entrances and transit stops

In addition to these roles and responsibilities as a collective group, the following sections highlight some of the key roles specific to each agency.

TRANSIT AGENCY ROLE

For its part as the primary beneficiary of this collaboration, a transit agency's role includes the following action items to help foster partnerships with other local, regional, and state transportation agencies, as well as private partners.

- **Take the lead** role in the improvement of the direct accessibility of transit.

- **Create and adopt agency standards** for location and design that must be followed by jurisdictions, developers, and FDOT.
- **Coordinate with jurisdictions and FDOT** during all phases, from planning through permitting and construction, and establish communication protocols to better facilitate uniformity and optimal stop placement.
- **Establish MOUs** with FDOT and develop and formally adopt local government ordinances that thoroughly integrate transit review and coordination into development services and permitting processes.
- **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, for 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, when appropriate, to ensure all parties are at the table for decisions on facility placement and design of new stops.
- **Serve on MPO advisory committees,** such as the MPO Technical Advisory Committee.
- **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 with 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 in them. Understand FDOT priorities and plans and know 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.
- **Do the homework--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 when asked.

FDOT ROLE

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 actions.

- **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 impacts and long-term consequences.
- **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 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 existing 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, and to what extent, to which road users, and under what circumstances. In addition, it also can help identify what opportunities exist to eliminate or mitigate identified safety concerns.
- 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.

LOCAL/CITY/COUNTY AGENCY ROLE

- 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 needs to 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 a 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. Having detailed and complete development plans is important and can provide ways to illustrate needs and document/justify requests.

- **Manage and maintain** your facilities on a regular basis to ensure compliance with all laws and regulations, specifically the ADA, and maintain safe, accessible pathways to transit stops and buses. Establish a process of public notification to announce bus stop problems and for issuing work orders to fix problem areas.

MILESTONES FOR COLLABORATION

As has been discussed, collaboration on bus stop improvements should be early, ongoing, and often, with applicable stakeholders. Here are some of the milestone actions or activities where agencies should initiate or continue collaborative efforts on bus stop development and improvements.

- When initiating facility permitting for bus stops, shelters, benches, or other amenities.
- When placing new bus stops within the public right-of-way, especially adjacent to existing uses and/or planned developments.
- When designing bus stops and their related access as part of joint efforts with developers.
- For routine cleaning and maintenance of bus stops, to help establish partnerships and/or support local match for grant funding.
- For advertising at bus stops to support potential generation of revenue.
- When working with the private sector to adopt bus stops or buy and implement amenities.
- When expanding bus stops to include more amenities or handle more bus activities.
- Before and during roadway construction that may impact bus stops and bus operations.
- When improving bus stop accessibility issues.
- When removing or relocating a bus stop for safety reasons or operational improvement.

Source: Benesch

BUS STOP PERMIT PROCESS

While every transit agency develops criteria and standards for the location and placement of bus stops along roadways, coordinating the permits necessary to build and install bus stops and amenities fall on the local jurisdiction (county or municipality) where the stop is planned. In Florida, FDOT also has placed permitting for state-owned rights-of-way with the local jurisdiction where the road and facility is located. This is detailed and the process outlined in Rule Chapter 14-20, Florida Administrative Code (F.A.C.).

Regardless of the permitting jurisdiction, all FDOT design and accessibility standards still apply and it is the responsibility of the permitting jurisdiction and the permit recipient to adhere to these ADA standards and ensure that bus stops in the state right-of-way are compliant. When FDOT finds bus stops to be in non-compliance or pose a safety hazard, it will notify the local jurisdiction and/or stop owner to correct the issue, or FDOT will have the violating facility or elements removed.

It is recommended that when pursuing a permit along an FDOT roadway, the agency should not only coordinate with the local jurisdiction, but also with the local FDOT Operations Center and the applicable Maintenance staff, as well as the District ADA Coordinator and/or Transit Office. When construction occurs on roadways, bus stops and their access are to be maintained, and existing facilities are required to be brought up to current standards. Local investment in amenities should be retained and is another key reason for collaboration.

INITIATING COLLABORATION

When beginning the process to coordinate the implementation and/or improvement of transit facilities at bus stops and within public rights-of-way, taking that first step to contact and involve other entities can seem cumbersome or even insurmountable. Just remember that most professional staff, regardless of agency affiliation, desire to do the right thing and want to work cooperatively and be actively engaged. Planning and/or participating in joint training opportunities to establish relationships, common ground, and references can help facilitate the development of contacts and relationship-building. Seeking and attending activities and workshops where common issues may be discussed and consensus could be initiated or developed is another helpful strategy to engage other professional staff.

NEXT: DEVELOPING SAFE & ACCESSIBLE BUS STOPS

With the right mix of agency partners collaborating with the transit agency to reach a common goal, the transit agency should now be ready to lead the development of safe and accessible bus stops, for which this publication provides valuable guidance and resources, as presented in the remainder of this handbook.

REFERENCE GUIDE

CHAPTER 2

1. FDOT, November 2020. “Don’t Stop at the Stop: Actualizing Safe Access to Transit.”

Chapter 03

BUS STOP COMPONENTS


CAB
JANUARY
FEBRUARY

3.1 BUS STOP B&A AREAS

Providing a designated bus stop boarding and alighting (B&A) area benefits all transit users, especially riders using a mobility aid (wheelchair/scooter), who will have less difficulty getting on and off the bus when there is a clear, firm, stable, and slip-resistant area in which to operate their mobility aid adjacent to the transit vehicle's ramp or lift. In addition to a B&A area that provides a well drained, non-slippery surface with adequate space for passenger movement on and off buses, the other minimum requirements for a bus stop are a bus stop sign and a connection from that bus stop to an accessible path.

DESIGN

Per ADA standards, the minimum dimensions of a bus stop B&A area shall be 8 feet (perpendicular to roadway) by 5 feet (parallel to roadway). The dimensions of B&A areas may be adjusted as necessary to accommodate site conditions as long as they still meet the minimum design requirements. Though the standards do not dictate a specified B&A area material, transit agencies always should consider providing concrete B&A areas at bus stops that are regularly used by patrons using mobility aids and/or with water drainage issues. Figure 3.1.1 shows an ADA-compliant B&A area at a rural bus stop.

Buses operating in urban areas today often have two doors that could use B&A areas. Rather than building two separate 5-foot-by-8-foot B&A pads, for bus operator and passenger ease of operation, a minimum 30-foot-long area along the roadway is recommended. While not required, providing an area the length of the bus for transit purposes would accommodate a comfortable waiting, alighting, and boarding area for both front and rear door access, as well as enable the transit agency to implement beneficial amenities at the bus stop, thereby improving its presence and visibility.

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-deep concrete pad along the entire length of the bus stop (40 feet to accommodate a

Design Dimensions

- Minimum dimensions are 8' (perpendicular to roadway) by 5' (parallel to roadway).[1]
- A continuous 8'-deep concrete pad along the entire length of the bus stop (40' for a standard bus and 60' for an articulated bus) adjacent to the curb and gutter is recommended for sheltered stops in urban areas.[12]
- For continuous pads, an additional 50' length is recommended for each additional bus stopping concurrently.[12]

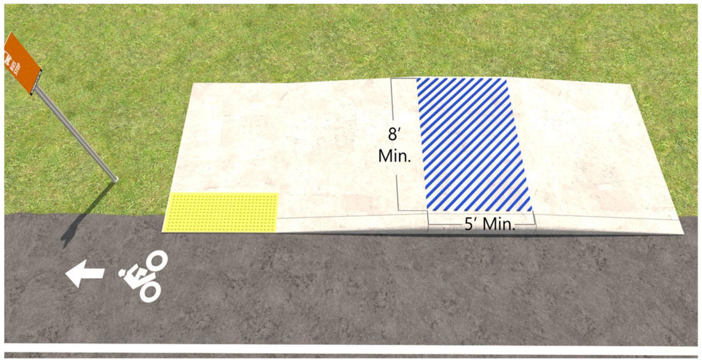


Figure 3.1.1 | Dimensions of a rural bus stop B&A area.

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.

At sheltered bus stops, the B&A area 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 pad should extend 2 feet beyond the pad. B&A areas for sheltered stops may include conduits and junction boxes for utilities.

Bus stop B&A areas should be constructed of reinforced concrete over an aggregate base or, alternatively, made of recycled plastic or rubber aggregate. The installed B&A area concrete pad thickness can vary according to the design of the anchoring

Figure 3.1.2 | Bus stop B&A area with a shelter.

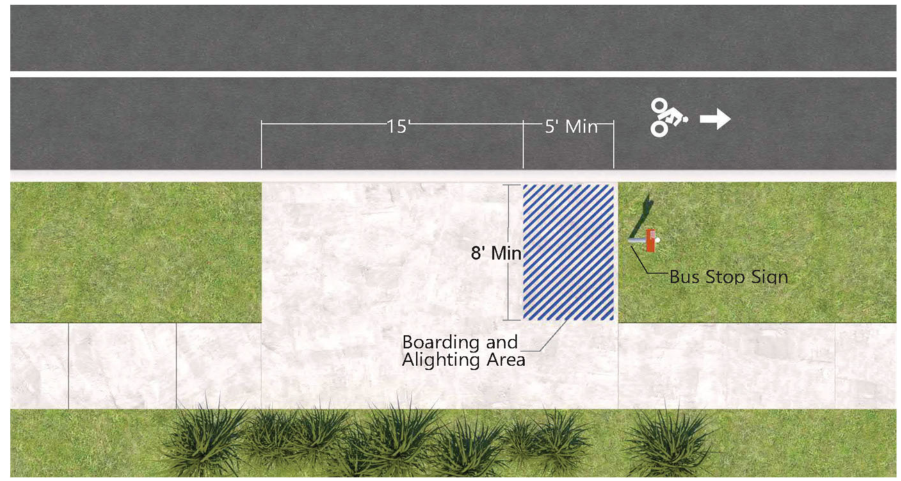


Figure 3.1.3 | Bus stop B&A area without a shelter and bench.

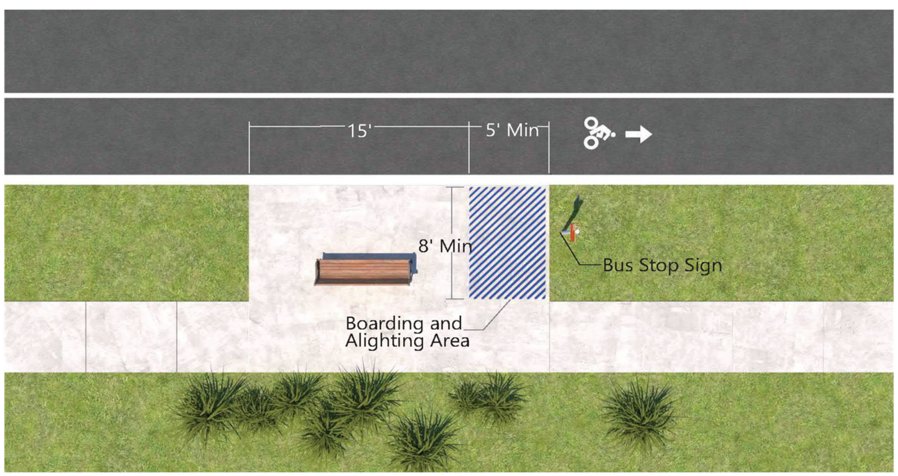


Figure 3.1.4 | Bus stop B&A area with an adjacent bench.

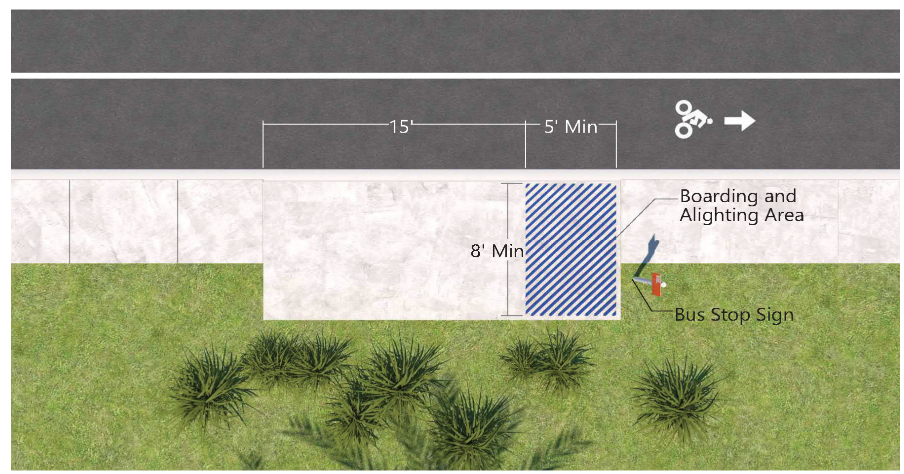


Figure 3.1.5 | Bus stop B&A area when the sidewalk is directly adjacent to curb.

REQUIREMENTS

- *A B&A area must have a firm, stable, and slip-resistant surface with a minimum clear length of 8 feet (measured perpendicular to the curb or roadway edge), and a minimum clear width of 5 feet (measured parallel to the roadway).*[2]
- *Firm, stable, and slip-resistant B&A areas are required if amenities such as benches or shelters are added to a bus stop.*[2]
- *An accessible path to a bus stop B&A area must be provided and designed to maintain a minimum clear width of 60 inches and vertical clearance of 84 inches, unless approved design variation by the District Design Engineer.*[2]
- *On flush shoulder roadways, B&A areas should be constructed at the shoulder break (or edge of shoulder pavement on roadways with a posted speed of 45 mph or less) to create an accessible bus stop.*[2]
- *The B&A area on flush shoulder roadways shall use a Type E curb and gutter (5" curb height) and be connected to the sidewalk along the roadway, or to the roadway when no sidewalk is present.*[2]
- *Except for the area adjacent to the 5-inch curb, the areas surrounding the B&A area on flush shoulder roadways shall be flush with the adjacent shoulder and side slopes and designed to be traversable by errant vehicles.*[2] *On the upstream side of the B&A area's landing, a maximum slope of 1:12 should be provided, and may be grass or a hardened surface.*[2]
- *A sidewalk and/or ramp provided with a B&A area shall be a minimum of 60 inches (5 feet) in width, and the ramp shall not exceed a slope of 1:12 (8.33%).*[2]
- *Bus stop B&A areas shall be connected to streets, sidewalks, or pedestrian paths by an accessible route.*[1]
- *A detectable warning surface is required where a sidewalk associated with a B&A area connects to the roadway at grade.*[2]
- *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 1:50 (2%).*[2]
- *The B&A area can be located either within or outside the shelter, and shall be connected to streets, sidewalks, or pedestrian circulation paths by an accessible route.*[7]
- *If a concrete B&A area (and ramp and level landing, if needed) are to be constructed, requirements include 6-inch-thick concrete.*[2]
- *The design of vehicles shall be coordinated with the boarding platform design such that the horizontal gap between each vehicle door at rest and the platform shall be no greater than 3 inches and the height of the vehicle floor shall be within plus or minus 5⁄8-inch of the platform height under all normal passenger load conditions. Vertical alignment may be accomplished by vehicle air suspension or other suitable means of meeting the requirement.*[11]
- *For drainage purposes, a maximum slope of 1:50 (2%) measured perpendicular to the roadway is allowed.*[2]

required for various bus stop elements as affected by expected wind loads. Free edges of pavement should be strengthened with reinforcement.

Figures 3.1.2 through 3.1.5 show examples of bus stop B&A area designs at typical urban and suburban bus stops. Refer to the requirements and other guidance provided in this section and in the Index of Resources prior to the design and placement of B&A areas at bus stops. Also refer to FDOT's Transit Facilities Guidelines for detailed design and engineering details for bus stop B&A areas in urban, suburban, and rural settings.

PLACEMENT

Better accessibility to, from, and within the bus stop area is critically important as it 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]

To create an accessible bus stop on flush shoulder roadways (i.e., roadways without curb and gutter

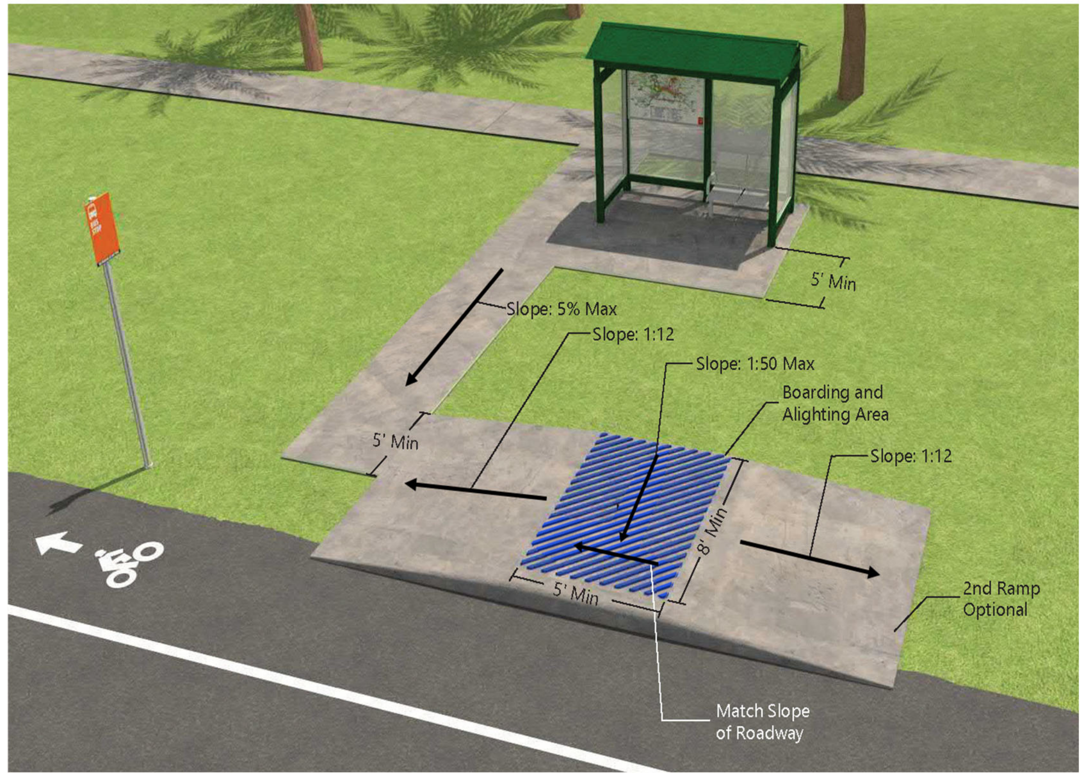


Figure 3.1.6 | | Layout of a B&A area at a suburban bus stop with a shelter and bench.

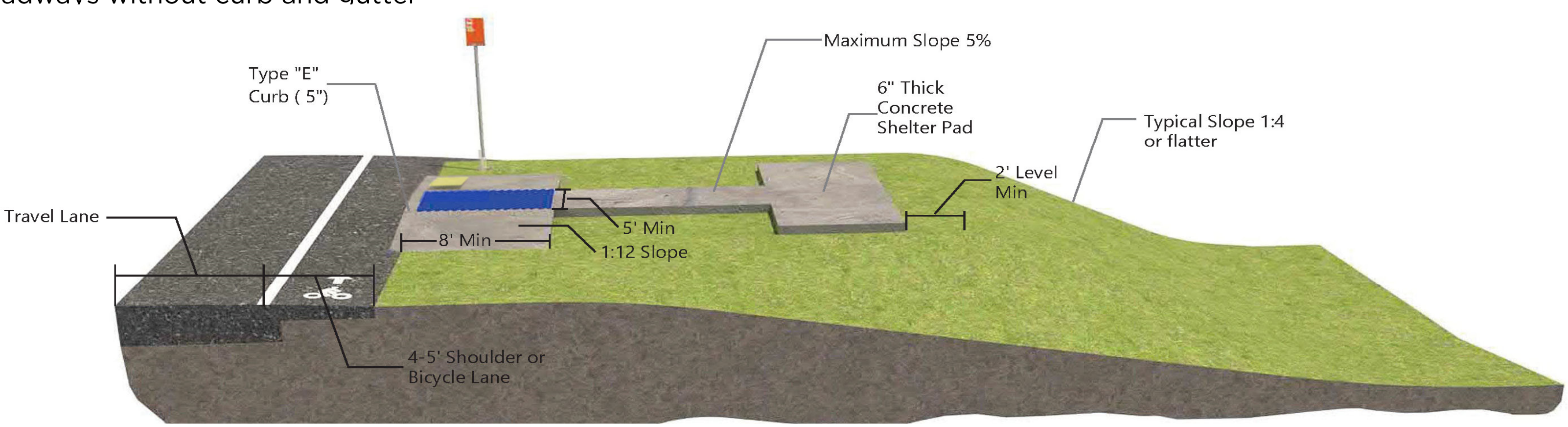


Figure 3.1.7 | Cross-
B&A area at a rural b
with no shelter or be

where the shoulder and the roadway are at the same level), 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 posted speed of 45 mph or less).[2] When a B&A area for a shelter is present at rural bus stops, which are typically located on flush shoulder roadways, care should be taken to not visually obstruct the shelter with any bus stop or road signage. See Figures 3.1.6 and 3.1.7 for flush shoulder bus stop examples in suburban and rural areas.

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 FDOT Design Manual (FDM). The local government is responsible for location and permitting approvals for bus stop amenities, compliance with ADA, and maintenance.

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.[1]

SAFETY

For facilities located within the state right-of-way, if FDOT determines that the bus stop and/or stop amenities are a safety hazard or are not compliant with ADA, the Department may remove the bus stop and/or amenities consistent with 14-20 of the Florida Administrative Code (F.A.C.).

Design Dimensions

- Use Type E curb (5” curb height) and gutter for B&A areas on flush shoulder roadways.[2]
- Maximum slope of 1:12 (8.33%) should be provided on the upstream side of the B&A area’s landing.[2]
- A sidewalk and/or ramp provided with a B&A area must be a minimum of 60” (5’) in width, and the ramp must not exceed a slope of 1:12 (8.33%).[2]
- Parallel to the roadway, the slope of the B&A area must be the same as the roadway, to the maximum extent practicable.[2]
- Perpendicular to the roadway, the slope of the B&A area must not be steeper than 1:50 (2%).[2]

DESIGN TIP

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.

Figure 3.1.8 | B&A area connected to sidewalk and bus stop shelter along a flush shoulder roadway.

3.2 BUS STOP SIGNS

Bus stop signs are necessary to identify the various locations throughout a transit agency's service area where passengers can safely and conveniently access a bus. The bus stop sign marks the area where passengers should stand while waiting for the bus and also serves as a guide for the bus operator in positioning the vehicle at the stop. Bus stop signs often are the only kind of communication that a passenger has with a transit service and/or its facilities. So, transit agencies rely on these signs to effectively communicate route information, timing, location, and other basic characteristics of its transit service to its patrons.

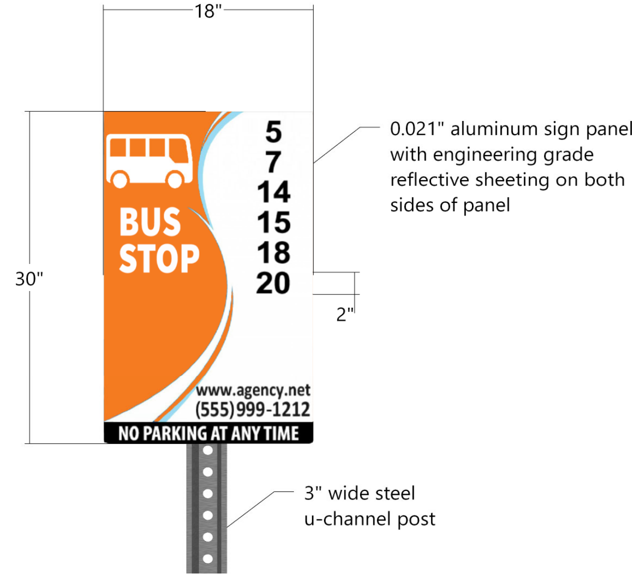


Figure 3.2.1 | Typical dimensions for rectangular bus stop sign.

DESIGN

Bus stop signs should be designed with a uniform size and shape and coordinate with the agency's brand and identity package. By coordinating signs with its overall brand, a transit agency can help ensure that its patrons are able to clearly identify their specific bus stops and routes. Signs also should clearly display information and, when possible, easily-understood symbols should be used in lieu of written information.

While only the system and route(s) served at the stop are required to be displayed on a bus stop sign, other beneficial information to display 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, should be considered for use along high-volume routes.

Typical (but not mandatory) dimensions for a rectangular bus stop sign are depicted in Figure 3.2.1. Bus stop signs should be easy to read and visible. To enhance readability, high-contrast colors on bus stop signs can be employed. Specific standards for visual characters are federally-mandated through the ADA. These standards help to ensure an easily-readable sign for all individuals that can be seen in clear, crisp text.

Design Dimensions

- The dimensions and shapes of bus stop signs can vary. The typical height and width of a rectangular bus stop sign are 30" by 18".[12]
- The minimum height of the bus stop sign, measured vertically from the bottom of the sign to the top of the curb or, in the absence of curb, measured vertically from the bottom of the sign to the elevation of the near edge of the traveled way, must be 7'.[5]
- To the maximum extent practicable, minimum character heights must comply with Table 3.2.1 in this handbook. [1]

REQUIREMENTS

- *For curb and gutter roadway sections in business or residential areas, a minimum 2-foot distance from the face of the curb to the nearest edge of the sign is required.[10]*
- *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.[10]*
- *All signs must comply with the requirements set forth in the Manual on Uniform Traffic Control Devices (MUTCD).[5]*
- *The minimum height, measured vertically from the bottom of the sign to the top of the curb, or in the absence of curb, measured vertically from the bottom of the sign to the elevation of the near edge of the traveled way, of signs installed at the side of the road in business, commercial, or residential areas where parking or pedestrian movements are likely to occur, or where the view of the sign might be obstructed, shall be 7 feet.[5]*
- *Provide a minimum 7-foot vertical clearance over the entire walking surface. If the vertical clearance is less than 7 feet and is placed along an accessible route, a barrier to warn people with visual impairment must be provided.[2]*
- *Objects with leading edges more than 27 inches and not more than 80 inches above the finish floor or ground shall protrude 4 inches maximum horizontally into the circulation path.[1]*
- *All sign supports, except overhead cantilever, truss type or bridge, or barrier wall-mounted, shall be breakaway as defined in AASHTO's Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, and the AASHTO Roadside Design Guide.[10] Signs shielded by a barrier wall or guardrail do not require breakaway support.[10]*
- *Sign supports shall be of an acceptable and crashworthy design as described in the FDOT Standard Plans.[2] Signs and poles must be located in accordance with FDOT Standard Plans.[2]*
- *Signs shall not be installed where such signing interferes with the functions or visibility of existing traffic control devices.[4]*
- *Non-discrimination requirements of ADA pertaining to visual signage requirements specify that route indicators must be present on bus stop signs.[1]*
- *Characters and their background shall have a non-glare finish. Characters shall contrast with their background with either light characters on a dark background or dark characters on a light background.[1]*
- *Visual characters on the sign must comply with the following:[1]*
  - *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 other unusual forms.*
  - *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".*
  - *Stroke thickness of the uppercase letter "I" shall be 10% minimum and 30% maximum of the height of the character.*
  - *Character spacing shall be measured between the two closest points of adjacent characters, excluding word spaces. Spacing between individual characters shall be 10% minimum and 35% maximum of character height.*
- *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."[1]*
- *Bus schedules, timetables, and maps that are posted at the bus stop or bus bay shall not be required to comply with bus stop sign requirements.[1]*

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.

Unique features should be incorporated into the design of bus stop signs so that passengers with visual disabilities can distinguish a bus stop from other street furniture. Stops that have shelters are more easily-identifiable, but 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 have holes running down its length or have a tactile collar to act as a non-visual queue. An agency also may 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. Figure 3.2.2 shows a branded bus stop sign example.

Table 3.2.1[1]
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'

PLACEMENT

Bus stop signs are necessary to identify safe and convenient locations for passengers to board and alight a bus and are considered the single most important element in designating a bus stop. Therefore, the most important aspects to be considered in placing transit signs are passenger convenience, public safety, and bus stop visibility. The placement of bus stop signs also play a key role in helping generate the desired ridership for a bus route.

Accessible signs are essential to creating an environment free of barriers 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 bus operator for where the safest B&A area is located.

Signs at bus 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. Additional factors affecting

Figure 3.2.2 | Branded bus stop sign, Key West, Florida.

FDOT

DESIGN TIP

Bus stop sign design can help a transit agency brand its bus stops. A sign branded with the transit agency's colors and design styles helps passengers locate the stop more easily and understand the agency's available services there.

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.

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 also may be used to include bus stop information, depending on the policies of the sign-maintaining agency and the transit agency's design specifications. Figure 3.2.3 shows a bus stop sign with the agency's phone number and website address, as well as a Quick Response (QR) code for accessing more agency information.

Figure 3.2.3 | Bus stop sign in Pensacola, Florida.

If desired to highlight the accessibility of a bus stop, bus stop signs could include the international symbol of accessibility (wheelchair logo). Also note that restricting sidewalk width by mounting signs within the sidewalk travel way is prohibited. For a bus stop in rural conditions, the bus stop sign should be located outside the clear zone of the road.[8] On flush shoulder roadways, clearance is measured from the edge of the travel lanes or paved shoulders. The minimum distance will vary according to the design speed of the road.

On non-state roads, according to the MUTCD, a minimum offset of 2 feet 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 and to avoid contact with vehicle side mirrors.

With bus stop signs, vertical and horizontal clearance is critical to keep bus stops safely accessible. Refer to the minimum requirements provided in this chapter. Use of existing poles also should be considered to minimize the number of posts and poles in the roadway right-of-way. Figures 3.2.4 through 3.2.6 show dimensions for placing bus stop signposts at typical rural, suburban, and urban bus stop locations. Prior to designing and placing bus stop signs, agencies should refer to the accessibility guidance provided in this section as well as in the reference material listed in the Index of Resources.

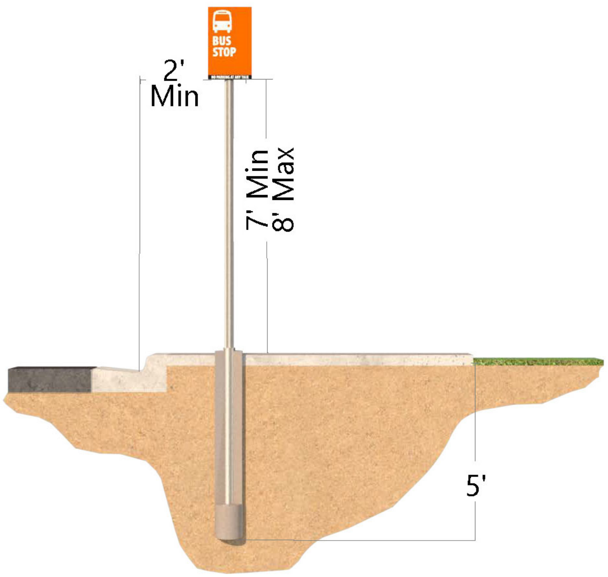


Figure 3.2.4 | Bus stop sign placed on near side of sidewalk.

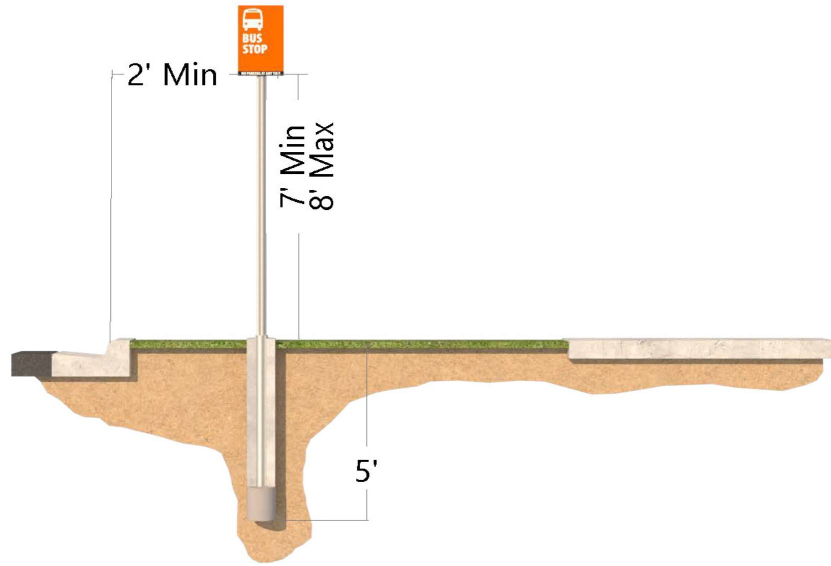


Figure 3.2.5 | Bus stop sign placed in planting strip adjacent to travel lane.

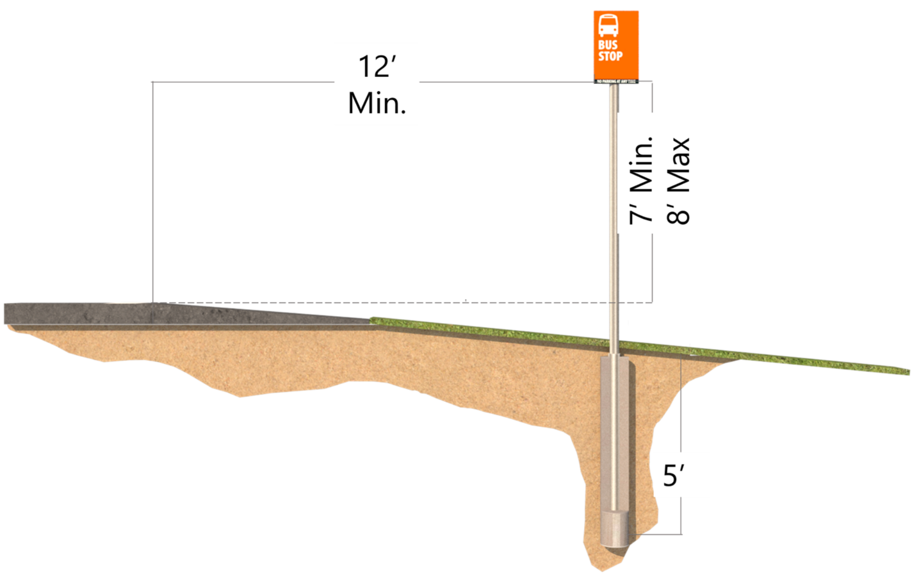


Figure 3.2.6 | Bus stop sign placed adjacent to travel lane without curb and gutter.

Note: According to FY2017-2018 FDOT Design Standards, a minimum 2-foot distance from the face of the curb to the nearest edge of the sign is required. This distance increases to 12-foot minimum when curb and gutter is not present.

3.3 BUS STOP BENCHES

Benches provide comfort for waiting passengers, especially when bus headways or transfer times are longer. They also can help identify a bus stop and are a much lower-cost bus stop amenity when compared to the installation of a shelter. In addition, benches can provide opportunities to generate advertising revenue, which can be used to cover the cost to maintain them. Benches are not required at bus stops, but, when provided, they must be accessible. Benches are recommended when a shelter with seating is not provided and if bus headways are longer than 15 minutes. At bus stops with high ridership, multiple benches may be provided (inside and outside of a bus shelter) to accommodate demand from patrons.

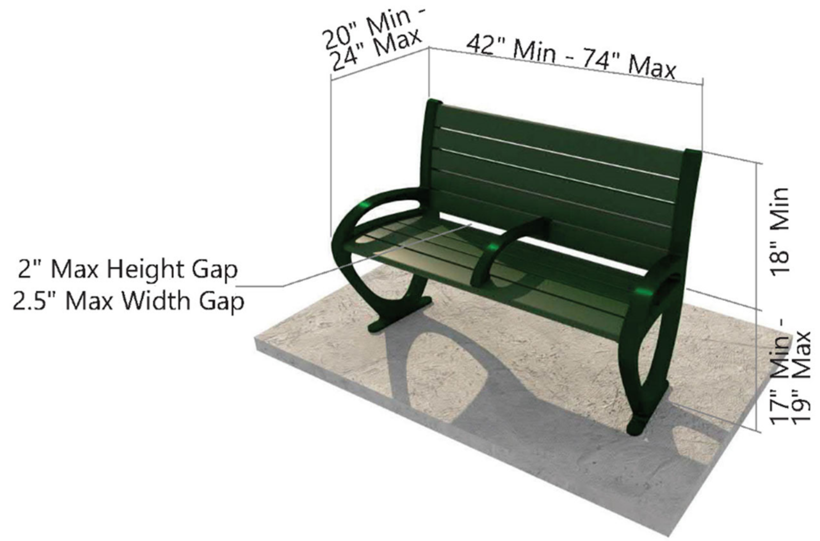


Figure 3.3.1 | Required dimensions for a bus bench.

DESIGN

The design of benches is determined by desired seating patterns and number of patrons to accommodate. Two-person benches can be placed at bus stops with medium ridership levels. These usually are placed inside shelters, but also can be freestanding. Freestanding, three-person benches can be placed at bus stops with high ridership levels and/or high visibility.

Figure 3.3.1 shows a bus bench design with required dimensions. An additional requirement is that at least 50 percent of the benches, but no less than one, at each bus stop location should be fully accessible. An accessible bench must provide a 30-inch-by-48-inch clear space adjacent to the bench. The clear space should be located either at one end of the bench or should not overlap the area within 1.5 feet from the front edge of the bench.[6] Figure 3.3.2 shows an example of a bus bench inside a bus shelter.

Grab bars are sometimes provided to assist in transferring to/from the bench. Providing such 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.[1] In interior locations, grab bars should be provided for those with difficulty standing up.

Design Dimensions

- Bench seat depth: min. 20” to max. 24”.[1]
- Bench height: min. 35”.[1]
- Bench width: min. 42” to max. 74”.[1,8]
- Bench seat height above ground or floor: min. 17” to max. 19” (17” preferred).[1]
- Back support: extends from a point 2” max. from above the seat surface to a point 18” min. above the seat surface.[1]
- Max. width gap of 2.5” between back support and rear edge of bench seat.[1]

REQUIREMENTS

- *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 at the end of the bench seat and parallel to the short axis of the bench.[1]*
- *Benches must be able to support 250 pounds of force applied at any point on the seat, fastener, mounting device, or supporting structure.[1]*
- *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.[1]*
- *Benches shall be placed only at agency-authorized transit stops. Convenience or comfort benches, if located at a transit bus stop, are not limited to a minimum number of benches to accommodate the comfort and convenience of the general public.[4]*
- *Commercial advertising shall be displayed upon a bench only on either the front or rear surface of the backrest area.[4]*
- *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.[4]*
- *Any bench placed on any part of a sidewalk shall leave a clear, unobstructed width of five feet standard (four feet minimum) for pedestrian traffic wholly within the improved walking surface (measured between the edges of the improved surface, not including the top of any roadway curbs).[4]*
- *Benches are prohibited in medians except when maintained by bus rapid transit providers utilizing an inside lane for passenger transport.[4]*
- *Bench location must meet the setback and minimum clear recovery zone requirements as established in the FDM. 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 60 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.[4]*
- *Benches must not obstruct the full 5-foot-by-8-foot B&A area or passenger access to loading and unloading.[1]*

Arm rests on benches are not required by the 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 the bench.

PLACEMENT

If a bench is provided at a bus stop, it should be on an accessible path and not blocking that accessible path. Where provided, benches may be sheltered or unsheltered. Figures 3.3.2 and 3.3.3 show two placement examples when including benches inside bus shelters.

Sheltered or unsheltered, bench material should be weather resistant, discourage vandalism and vagrancy, and require minimal maintenance. Concrete bases (end pieces) are recommended for stand-alone, non-secured benches, as weight discourages persons from moving or stealing the benches.

Bus benches should be set back at least 10 feet from the travel lane in curbed sections with a design speed of 45 mph or less, and located outside the clear zone in flush shoulder sections.[7] Benches should be placed so that no part of a bench is less than a minimum of 5 feet from the back of curb.[4]

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 also should be placed so that streetlights or other objects do not obscure the visibility of waiting passengers or oncoming buses. Bench placement also should accommodate passenger legs and feet without placing them too close to traffic or potentially reducing the unobstructed clear width of a walking surface.

To alleviate discomfort and exposure to traffic, bus benches should be outside the clear zone in non-curbed sections, as well. 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. See FDM 215.

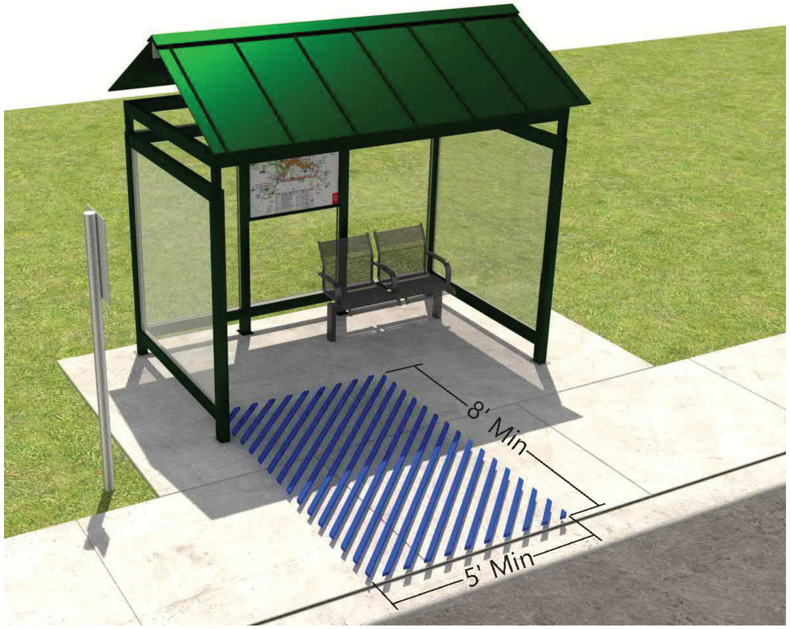


Figure 3.3.2 | Placement of bench in shelter with B&A area partially extending into shelter.

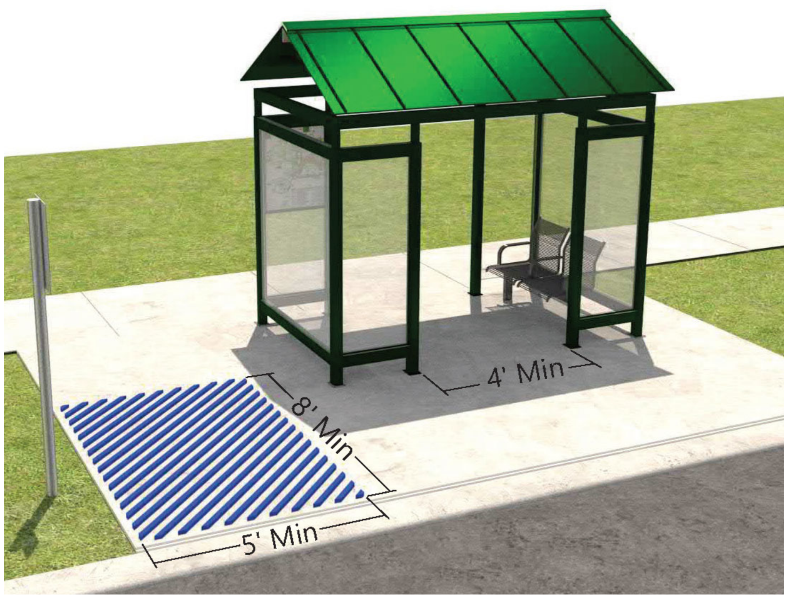


Figure 3.3.3 | Placement of bench in shelter with centrally-located opening.

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.[4] Bus bench guidelines are applicable to both public- and private-sector benches located at transit stop locations. The local government is responsible for bus bench location and permitting approvals, compliance with ADA, and bus bench maintenance.

Private-sector convenience benches may be placed at bus stop locations with approval from the appropriate government authority. Coordination with the local public transit provider is necessary to determine how and where the connectivity can be provided.[7]

Transit agencies use various criteria for the placement of benches at stops along bus routes. Table 3.3.1 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.

PLACEMENT TIP

Consider unsheltered benches at 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.

SAFETY

For better safety, benches should be placed on non-slip, properly drained concrete pads or on grass, gravel, or rubber sidewalks, if possible, as long as the walking surface remains firm, stable, and slip resistant. They also 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. Benches also should discourage opportunities for sleeping or reclining and should be durable and graffiti-resistant. Regular maintenance and upkeep of benches helps maintain the overall look and appeal of bus stops, as poorly-maintained benches often discourage use by patrons.

Bus benches also should be located properly in relation to sidewalks, shared-use paths, and other accessible pathways to avoid conflicts with pedestrians and bicyclists.

Table 3.3.1
Example Bench Placement Criteria

Type	Length	Criteria for Placement	Placement Considerations
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

CASE STUDY

Responding to Existing Conditions to Meet Desired Infrastructure Goals

Orange County, FL

LYNX, the transit agency that mainly serves Orange, Seminole, and Osceola counties in Florida, providing over 17 million trips annually, has continued to improve and upgrade connectivity at its bus stops. The agency attempts to install bus shelters at applicable stops as part of this process, but regularly runs into issues with existing topography and already-existing sidewalk infrastructure. For example, at a site along US 192 in Orange County, the ditch at the bus stop, which was mildly graded, was too shallow to pipe underneath. The shelter would be too low if it were located adjacent to the sidewalk, and there also was no right-of-way available behind the sidewalk.

To remedy this issue and proceed with the sheltered bus stop LYNX had planned for this location, a shelter was placed to allow for a ramp down to the sidewalk, which required a curb transition along the shelter edge. The sidewalk transitions (at a 5% max slope) were needed to get down to the existing grade.

Figure 3.3.4 | Before accessibility improvements.

Figure 3.3.5 | After accessibility improvements and adding the bus shelter.

3.4 BUS STOP SHELTERS

Bus stop shelters, together with the other amenities within or near them, enhance the image of the transit agency and its service and help provide a more comfortable and convenient overall transit experience for patrons. While bus stop shelters are not required at bus stops, when provided, they must be accessible. With the natural environmental factors in Florida, especially in the summer, waiting for the bus can become extremely uncomfortable for passengers. Shelters can significantly help and provide a comfortable waiting area for passengers and protect them from exposure to the sun, rain, and heavy wind. Additionally, a shelter clearly marks a bus stop, supplies infrastructure on which to post route and timetable information, and provides refuge for waiting passengers, separated from the public way.

Figure 3.4.1 | Recommended minimum dimensions for a medium bus shelter.

DESIGN

The design of shelters, including size and features, can vary with the number of boardings at a bus stop and space availability. Per FDOT's 2017 Transit Facilities Guidelines, the recommended minimum dimensions for a medium bus shelter are 10 feet by 3 feet by 7 feet high (interior clearances), as shown in Figure 3.4.1. The figure also shows the required space for wheelchair clearance inside bus shelters when a bench is provided. Recommended dimensions for a small shelter are 10 feet by 1.5 feet by 7 feet, and for a large shelter are 10 feet by 6 feet by 7 feet, examples for both of which are shown later in this section. An example application of a large shelter is shown in Figure 3.4.2, while the recommended dimensions for a large shelter are shown in Figures 3.4.3 and 3.4.4. When available right-of-way is limited, it is better to provide a smaller shelter than not to provide a shelter at all.

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. All pedestrian infrastructure and amenities should be without any sharp edges or protruding elements.[1]

Figure 3.4.2 | Bus shelter with adjacent extra seating and other amenities in Pensacola, Florida.

FDOT

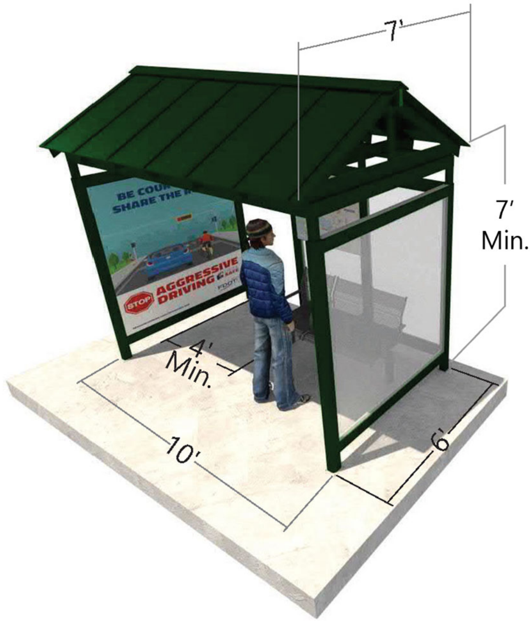


Figure 3.4.3 | Large bus shelter with seating.

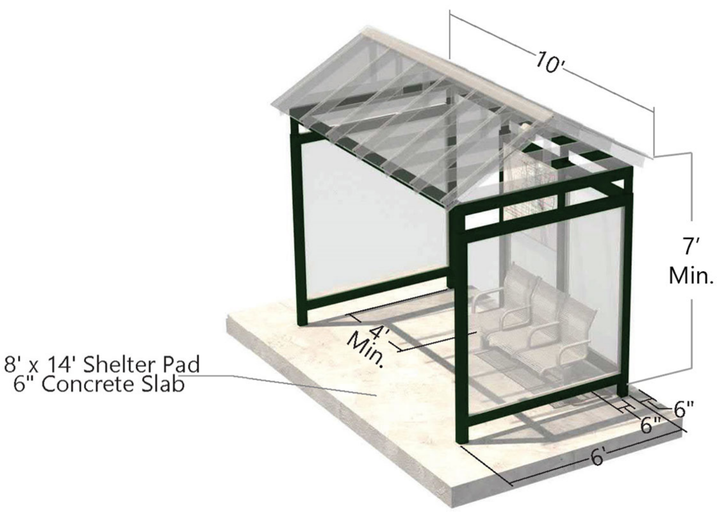


Figure 3.4.4 | Typical large bus shelter.

If an agency employs a variety of shelter types, the architecture of a shelter should be indicative of nearby land uses; that is, 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 a more specific local flair that the community will appreciate. With local participation comes a feeling of ownership, which may help reduce vandalism.

Seating

Shelters should incorporate seating whenever possible, both to make overall transit 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.). When a bench is provided within a bus shelter, the ADA-required 30-inch-by-48-inch clear floor area located adjacent to the bench allows shoulder-to-shoulder seating with a companion wheelchair user (see Figure 3.4.1), as well as the ability for a patron to transfer from a mobility aid to the bench and back, if desired. Shelters also can be designed to incorporate leaning rails (typically in lieu of a bench) and also may include additional amenities such as transit service literature, telephones, newspaper vending, and trash receptacles.

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. Transit agencies also should identify opportunities for incorporating local, recycled, or renewable materials into bus shelter designs and should consider re-using existing bus shelters when possible.

Shelters also should provide a clear opening between the shelter and the ground to allow for cleaning and increased security, and a minimum clear area of 2 feet should be provided behind the shelter for maintenance.[8] Shelters should not be placed in front of the store windows of adjacent properties.

Advertising

For some agencies, advertising is an important revenue source when providing shelters. If used, agencies should follow the necessary guidelines with advertising placement and size. The current guidelines do not allow more than one advertisement per shelter side, including the roof, and the size is limited to 6 feet by 5 feet or less.

Figure 3.4.5 shows an example of a bus shelter with advertising, while Figure 3.4.6 shows the required maximum dimensions of an advertisement at a shelter. It is important to recognize, however, that it is better to have no advertising panels on a shelter at all if they contribute to limited visibility.

Figure 3.4.5 | Example of a shelter with advertisement in Hillsborough County, Florida.

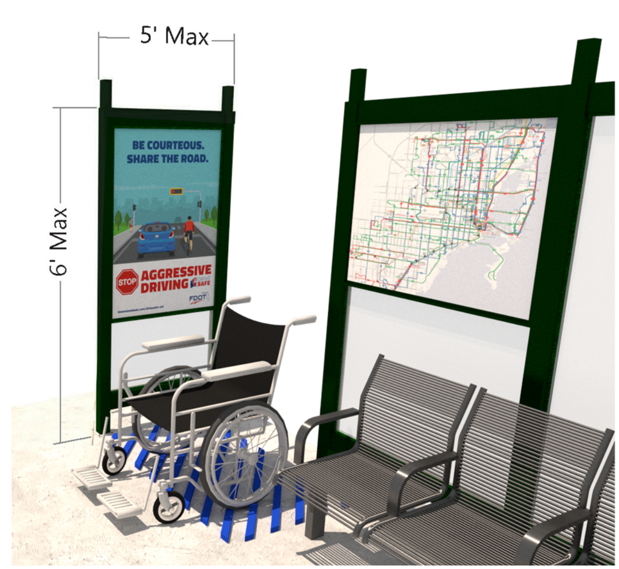


Figure 3.4.6 | Maximum dimensions of a bus shelter advertisement.

Design Dimensions

- Recommended minimum interior clearances for bus shelters:[8]
  - Small shelter (10’ wide, 1.5’ deep, and 7’ tall)
  - Medium shelter (10’ wide, 3’ deep, and 7’ tall)
  - Large shelter (10’ wide, 6’ deep, and 7’ tall)
- Minimum 30”-by-48” clear floor area adjacent to the bench is required when a bench is within the shelter.[1]
- Minimum clear area of 2’ should be provided behind the shelter for maintenance.[8]
- At least 3.5’ between the back of the curb and the edge of roof or panels of the shelter must be provided. [8]
- Shelter access entry and exit points must have minimum clear width of 4’.[8]
- Maximum dimensions of an advertisement in bus shelters is 6’ by 5’.[4]
- No more than one advertisement that meet the minimum dimension requirements are allowed per each side of a bus shelter, including the roof.[4]

REQUIREMENTS

- *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.[1]*
- *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.[1]*
- *Shelter access entry and exit points shall provide a minimum clear width of 4 feet to meet State requirements (ADA requirement is 3 feet).[8]*
- *Changes in level greater than ½-inch must be ramped in compliance with Sections 405 (Ramps) and 406 (Curb Ramps) of the ADA Standards.[1]*
- *In shelters, 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.[4]*
- *No advertising shall be of a reflectorized material or otherwise cause a glare. 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.[4]*
- *Per FAC 14-20.003, a shelter may be erected only at bus stops designated by a public transit agency and identified as having service a minimum number of 10 times in a 5-day period, excluding weekends and holidays.[4]*
- *Shelters are prohibited in medians, except when maintained by bus rapid transit providers utilizing an inside lane for passenger transport, and on limited access roads.[4]*
- *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.[4]*
- *Shelter locations must meet setback and minimum clear recovery zone requirements as established in the FDM.[2]*
- *A shelter shall not obstruct any sidewalk, bike path, pedestrian path, driveway, drainage structure, or ditch, and shall provide a clear, unobstructed width of five feet standard for pedestrian traffic between the edges of the improved surface, not including the top of any roadway curbs.[4]*
- *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.[1]*
- *Shelters shall not be located within 15 feet of a disabled parking space.[8]*
- *Prior to the installation of a shelter, the impacted utility companies must be notified to determine the location of utilities and prevent conflicts.[4]*
- *Shelters also 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.[4]*
- *New or replaced bus shelters shall be installed or positioned to provide an accessible route from the public way (sidewalk or roadway) to reach a location that has a minimum clear floor area of 30 inches by 48 inches, entirely within the perimeter of the shelter.[7]*

REQUIREMENTS

- *Shelters shall be connected by an accessible route to a B&A area.[1]*
- *Lights are not permitted for the sole purpose of illuminating advertising, per Rule 14-20.003, FAC. All lights within a shelter must be placed or shielded so they do not interfere with motorists on roadways. Flashing lights on shelters are prohibited.[4]*
- *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.[4]*
- *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.[3]*
- *Transit agencies must refer to the Florida Building Code for any minimum requirements to ensure that bus shelters in hurricane-prone areas can withstand high winds and the impacts of wind-borne debris.[3]*
- *In addition, transit stops, if identified in an emergency evacuation plan, must be provided with signage indicating the same.[12]*
- *Shelters and any appurtenant totem signs shall not be located within 15 feet of any fire hydrant.[4]*
- *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.[4]*
- *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.[10]*
- *Lighting design for bus stops should meet the same criteria for minimum illumination levels, uniformity ratios, and max-to-min ratios that are being applied to the adjoining roadway.[7]*

PLACEMENT

When necessary financial resources are in place, 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. Bus 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. The criteria shown in Table 3.4.1 can be used in determining the placement of a bus shelter.

Figure 3.4.7 shows a small shelter placed adjacent to a building. To allow clear passage of the bus and its side mirror, shelters should be placed such that there is at least 5 feet between the face of the curb and the edge of 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. In addition, Table 3.4.2 shows preferred locations for placement of shelters by type and size.

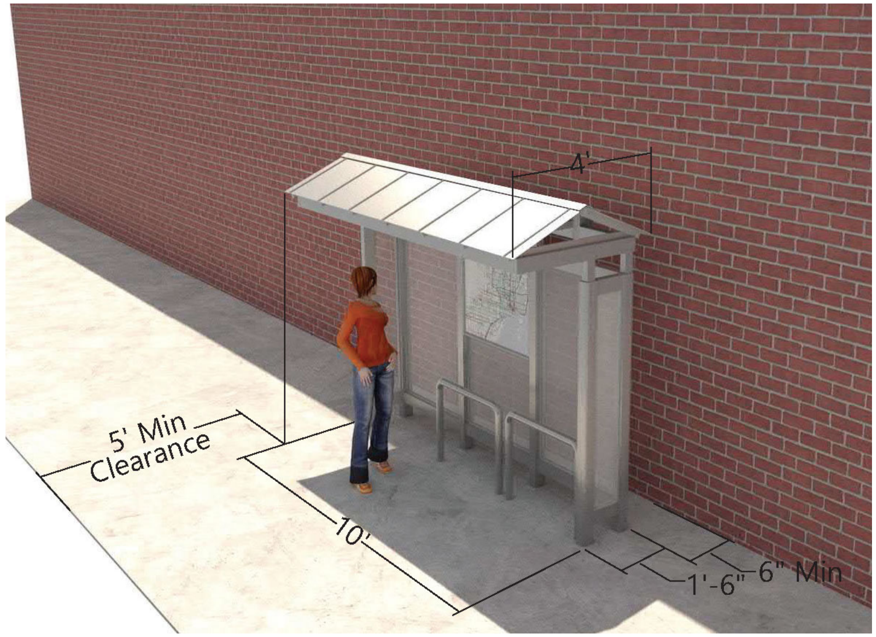


Figure 3.4.7 | Small bus shelter adjacent to building.

Table 3.4.1 Suggested Criteria for Shelter Placement	
Heavy Patronage	• At inbound transit stops in the outer system. • Near major trip generators/clusters of commercial or residential developments. • At outbound transit stops in central business districts.
Transfer Points	• Locations where relatively high numbers of riders must wait to transfer from one transit vehicle to another.
Older Adults and People with Disabilities	• Locations where there are heavy concentrations of older adults and/or people with disabilities.
Park-and-Ride Lots	• Lots in a Park-and-Ride program where riders congregate and wait for transit service.
Topography	• Bus stops restricted by the surrounding development and/or situated close to the roadway such that waiting patrons are subject to flying dirt, debris, and water from passing traffic.
Weather	• Stops in exposed locations where riders are subject to high winds and inclement weather.

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, as well as 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. 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.[8]

Table 3.4.2
Suggested Shelter Type by Location

Shelter Type	Preferred Location
Small Shelter (10'x 1'6" x 7')	At stops with low to medium ridership; e.g., stops in business and retail districts, residential neighborhoods, industrial/ manufacturing areas, etc.
Medium Shelter (10' x 3' x 7')	At stops with medium to high ridership; e.g., stops heavily used by tourists/recreational users.
Large Shelter (10' x 6' x 7')	At stops with high to very high ridership; e.g., stops serving large activity centers, park-and-rides, etc.

On flush shoulder roadways, the horizontal clearance distance will vary according to the design speed of the road (see the FDM). In areas with high pedestrian volumes, a 6-foot sidewalk on one side of the shelter is preferred.

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 applicable guidelines included and referenced in this handbook.

SAFETY

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

Lighting

The purpose of shelter lighting is to enhance the safety of patrons waiting at bus shelters. Adequate lighting can help improve safety as well as a passenger's perception of safety, especially at off-street facilities. Lighting also 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

PLACEMENT TIP

Seek to improve personal security and safety of patrons by maximizing visibility, which can be enhanced by providing shelter lighting, lowering vegetation heights (or increasing tree height/clearance), and removing any potential hiding places.

Source: FDOT

physical environment. Adequate lighting enables the bus operator to see waiting passengers and to safely approach and depart from a bus stop. Lighting should be directed toward illuminating passengers so passing drivers also can see them (i.e., natural surveillance).

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. Local transit stops without a shelter should be located within 30 feet of an overhead light source. Shelter lighting also can help illuminate system maps and other passenger information at bus stops, where applicable.

Light fixtures should be visually non-obtrusive so they do not attract the attention of vandals. Light patterns should concentrate light within the shelter or at the bus stop while minimizing the casting 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. Such shadows also may cause a "fishbowl" effect, where the waiting patron in the shelter can easily be seen by others but cannot see outside. If a bus shelter is provided, the level of lighting at the shelter pavement should be in accordance with the roadway classification described in the Greenbook.

If pedestrian paths adjacent to transit stops are illuminated, the height of the light fixture should be appropriately scaled. 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.

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 bus stop. Portable solar lighting may be used when transit service is detoured during

DESIGN TIP

One method being deployed by transit agencies for achieving damage- and vandal-resistant bus shelters is to incorporate the use of adherent protection films for glass. This is an inexpensive and holistic measure to repairing vandalism quickly—by removing and replacing a transparent film that protects costly infrastructure elements. Protective films for this purpose are designed to protect shelter surfaces from scratching, scuffs, graffiti, and general discoloration and deterioration, which greatly expands the life span of a bus shelter.

Figure 3.4.8 | Bus stop using solar panels in Palm Beach County, Florida.

construction projects. 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 3.4.8 shows a bus shelter with solar panels.

Choosing the light source color is an important variable for ensuring a safe environment for bus stops during the evening hours, or in locations that are not well lit. Light source color and temperature both affect mood and environmental surroundings; improper light source selection could compromise the safety of a bus stop. The Illuminating Engineering Society of North America (IESNA) provides a detailed scope of best practice lighting guidelines for transit use, based on characteristics of lighting density, rendering index, and lumens suggested based on location and site property. For more information, refer to the IESNA Lighting Design Guide – Transportation Locations and Tasks. Figure 3.4.9 shows a bus shelter with unique lighting.

Visibility

Shelters with good lighting and visibility from surrounding land uses can enhance the safety at the bus stop. 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.

Transit agencies should address any line-of-sight issues and visual barriers to drivers seeing passengers waiting inside shelters at bus stops (advertising panels, information panels, signage, trash receptacle location, vegetation, lighting, etc.). If shelter sides or internal dividers are used, glass panels should be marked with a distinctive pattern or by using contrasting colors to indicate their presence. Best practice design elements for bus stop shelters include side and rear panels constructed of clear, shatterproof, glass.


Source: LYNX

Figure 3.4.9 | Bus shelter with unique lighting design in Orlando, Florida.

Use of glass side panels for bus stop shelters promotes visibility for riders and transit vehicles, while increasing general safety in the area and extending the area in which lighting inside the shelter can illuminate. Glass rear panels promote further visibility, safety, and awareness of surroundings to passengers waiting at the bus stop. When glass panels are utilized, it is important to indicated with reflectors or other techniques to indicate their presence. In standard cases, panels should not be included on the curbside of the shelter. However, in situations where the bus stop is located on a narrow road with heavy traffic, a curbside panel may be of use.

Frangibility

When anchoring a shelter structure to its concrete pad, breakaway mechanisms should be used, including slip-bases and bases incorporating a component with low impact strength. Breakaway supports utilized for this purpose 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.

Florida Weather

Shelters should be oriented to provide patrons with as much protection as possible from environmental factors such as sun, cold, rain, and wind. Shelters also should be designed to maximize shading and air circulation. Particularly in Florida, sun shade protection also is 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. Figures 3.4.10 and 3.4.11 show the potential impacts of sun and rain at a bus shelter in Florida.

Impervious side panel materials are poorly suited to Florida's climate. Pervious side panels allow for ventilation. 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.

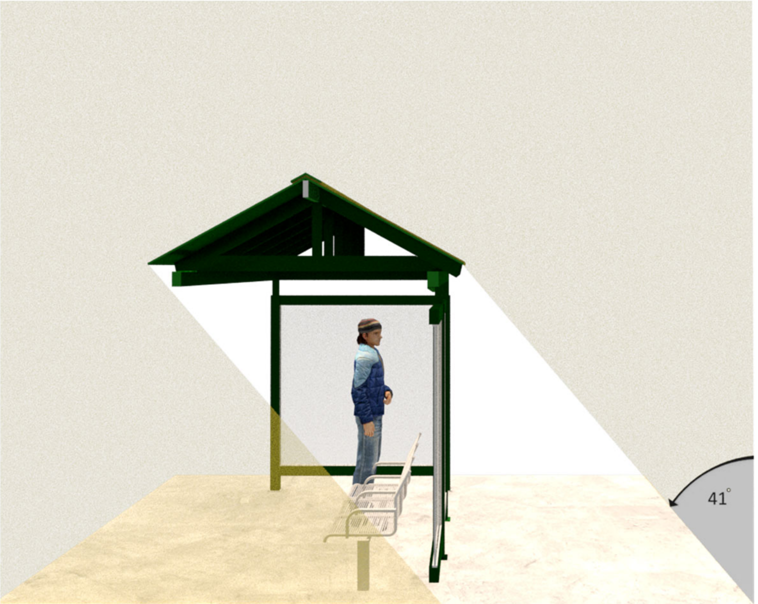


Figure 3.4.10 | Approximate angle of sun in Florida for southwest-facing shelter.

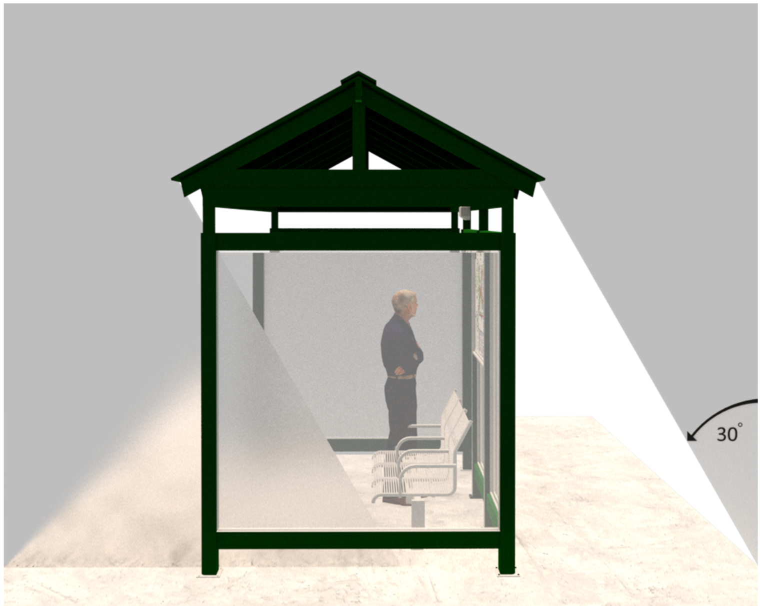


Figure 3.4.11 | Typical angle of falling rain in Florida.

3.5 BICYCLE PARKING & SHARED MOBILITY

Implementing bicycle parking facilities at bus stops makes using transit more convenient and supports ridership growth. It also may help mitigate the increasing need for on-bus bicycle storage. The need for bicycle parking at bus stops has increased greatly with the increase in people using bicycles to travel. While bicycle parking should be applied at most bus stops along routes with bicycle accessibility, consideration should be given to at least place them at bus stops with high ridership activity and at stops for routes on which the bus-mounted bicycle racks are at capacity/cannot accommodate more bicycle passengers without causing passengers to wait for the next bus.

DESIGN

While various designs are in use, the "inverted U" bicycle racks continue to be effective for bicycle parking at bus stops. The design supports a bicycle by its frame at two points (as opposed to supporting it by the wheel, as is common in "comb" and "toast" racks). Figure 3.5.1 shows the design dimensions for a typical inverted U bicycle rack, as recommended by AASHTO's Guide for Geometric Design of Transit Facilities on Highways and Streets.

The height of bicycle racks should not exceed 3 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.

Transit agencies also may consider installing multiple bicycle racks. Depending on the size of the transit bus stop and projected bicycle usage, multiple bicycle racks may create a "bicycle parking lot." For bus stops or transfer hubs with high density ridership and/or bicycle usership, enclosing the bicycle parking lot may provide added benefit.

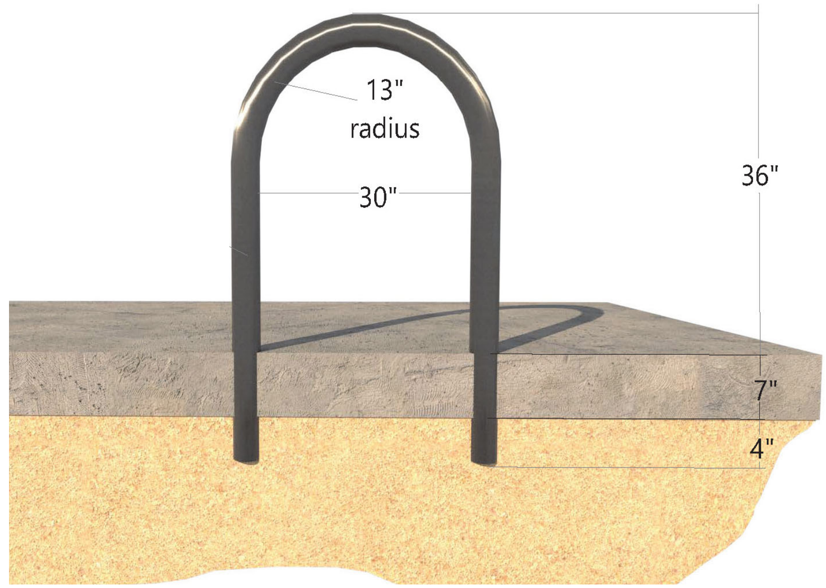


Figure 3.5.1 | Dimensions for installing an inverted "U" bicycle rack.

Design Dimensions

- Maximum recommended height of a bicycle rack is 3' from the paved surface. [13]
- Space between the two poles in the inverted "U" rack should be 30" and the radius should be 13".[13]
- The inverted "U" rack should be secured 11" below ground level. [13]
- Bicycle racks should provide 48" aisles.[13]
- Racks should be located no less than 2' from walls.[13]
- Inverted "U" racks should be placed no less than 3' apart width-wise.[13]

FDOT

As bicycling becomes more desirable to transit riders, transit agencies with increased bicycle ridership at key bus stops may opt to enhance the bicycle accommodations at those locations. Enhanced bicycle parking may increase bus ridership, allows for more bicycle storage space, and aids in preventing theft. Vertical and semi-vertical bicycle racks also can be beneficial in providing bicycle storage where space may be limited.

PLACEMENT

Bicycle parking should be provided at bus stops where they can be physically and visually accessible. Bicycle parking areas should be provided on the upstream side of the B&A area. Figure 3.5.2 shows typical spacing dimensions for a properly placed and accessible bicycle parking area.

Figure 3.5.2 | Dimensions for accessible bicycle rack placement.

REQUIREMENTS

- *Bicycle racks must not be placed on the B&A area.*[1]
- *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.*[1]
- *Bicycle racks must not interfere with pedestrian facilities and meet lateral offset requirements.*[2]
- *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.*[1]
- *Bicycle rack locations must meet the setback and minimum clear recovery zone requirements established in the FDM.*[2]

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 in areas without unnecessary potential for water damage, such as adjacent to landscape watering systems or in areas where rainwater accumulates.

Bike racks, inverted U or otherwise, also can be designed and placed to enhance a transit agency's identity and branding, as shown in Figure 3.5.3.

To help enhance bicycle access and connectivity, where shared-use paths (pedestrian/bicycle 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. When placed at these access points, bus stops should be located so they do not hinder sight distance or create congestion at path-roadway connections.

Bicycle & E-Scooter Sharing

Transit agencies now work with other partners to implement bicycle sharing programs where users may rent bicycles temporarily for short trips, for a minimal one-time fee or by enrolling in membership programs, and then return them when the trip is over. Pricing is designed to encourage shorter one-way trips, for example, to the bus station or the grocery store, where the bicycle can be returned to a different kiosk. When linked with the existing public transit providers, bicycle sharing can provide the critical first-mile/last-mile solution to connect riders to buses.

Figures 3.5.4 and 3.5.5 show bicycle and e-scooter sharing at or near bus stops. Many bicycle sharing programs now utilize mobile applications that allow riders to access bicycles from docking stations or other dedicated spaces by using their smart phones to unlock and purchase bike-share fares. Bicycle sharing services expand accessibility and provide potential to increase bus ridership throughout the area. Bicycle sharing is most prominent in downtown areas, but success has been seen in suburban communities offering bicycle sharing services where ample bicycle lane infrastructure is present.

Figure 3.5.3 | Branded bicycle rack at a bus stop in Orlando, Florida.

Figure 3.5.4 | Docked bicycle parking in Tampa, Florida.

Figure 3.5.5 | E-scooter parking in Jacksonville, Florida.

Bicycle sharing services can use either docking stations or be "dockless." Docking stations provide dedicated areas, dispersed throughout the service area, to retrieve and drop off bicycles. Dockless bicycle sharing, however, allows riders to leave bicycles at an array of acceptable locations, such as on sidewalks or near standard bicycle rack fixtures. Dockless bicycle sharing may permit riders to travel even closer to where they are going by being able to park the bicycle near or at their destination.

Transit agencies should coordinate on ideal locations for bicycle sharing hubs for the benefit of their riders. Ease of access to bicycle sharing hubs at key bus stops and transfer locations can increase the utilization of both this service and the transit service, as well as help attract more discretionary bus riders. Transit agencies should follow applicable accessibility guidelines and review best practices on street furnishings when determining bicycle sharing locations to ensure proper placement that decreases sidewalk congestion and interference with bus stop B&A areas.

In addition to bicycle sharing, e-scooter sharing also has become popular in cities where such programs are allowed. E-scooter sharing provides mostly the same benefits as bicycle sharing, such as first/last mile connections, and also can help encourage further use of transit services. E-scooter sharing often is handled in the same fashion as bicycle sharing, with dedicated parking spaces or docking stations for the devices. Figure 3.5.6 shows an example of e-scooter sharing near a bus stop.

SAFETY

As with any infrastructure at a bus stop, safety is paramount when placing bicycle racks. Bicycle parking and/or storage should not be placed in the corner of a parking garage or in areas with low visibility. Placement along heavily-trafficked streets and walkways is encouraged as the natural surveillance this provides can help protect bicycles from theft and vandalism. Posting visible safety material and standard bicycle lane etiquette near bicycle sharing hubs and docks at bus stops can expand safety outcomes for cyclists. Pedestrians opting to utilize bicycle sharing services may not be accustomed to typical roadway bicycling on urban streets and may benefit from visual education and safety aids when using the service.

DESIGN TIP

An option for providing high security bicycle parking can be found in "Bike Lids," utilizing durable plastic shields combined with standard bike racks that provide protection from theft, vandalism, and natural elements. Bike Lids can be branded with transit agency graphics, paid advertisement space, or public art.

Source: Google

Source: Benesch

Figure 3.5.6 | E-scooter parking in Orlando, Florida.

CASE STUDY

Unsafe & Narrow to Compliant & Comfortable

Lee County, FL

LeeTran, the fixed-route bus service in Lee County, had experienced a safety and space issue at its bus stop in front of Habitat for Humanity, located northbound on North Tamiami Trail/Business 41 near Pondella Road in North Fort Myers. North Tamiami Trail is a busy state road. The bus stop was not ADA compliant and, overall, was generally unsafe for waiting passengers, as shown in Figures 3.5.7 and 3.5.8. In order to make the stop safe and compliant, a bus bay with sidewalk improvements was necessary; however, the available area was not suitably large enough to build the necessary facilities. Therefore, a conveyance of property and an easement were needed. LeeTran coordinated with both FDOT and Habitat for Humanity to remedy the issues. The services provided by Habitat for Humanity already benefit the community and the agency was willing to convey an easement to continue to support the surrounding community. FDOT requires that when a bus bay and sidewalk are adjacent to a state road, the land on which the improvement is to be located must be incorporated into the right-of-way.

After LeeTran communicated with both entities, the design and permitting processes began. An FDOT construction agreement was created followed by a conveyance of property from Lee County to FDOT. Additionally, both FDOT and Habitat for Humanity properties required a legal sketch as well as formal approval by all parties. Finally, construction followed this process and the improvements were able to be completed by mid-2020. Figure 3.5.9 shows the improved bus stop.

Figure 3.5.7 | Bus stop with fence limiting waiting space.

Figure 3.5.8 | Bus stop after fence was moved back.

Figure 3.5.9 | Completed bus stop with bus bay and shelter.

FDOT

3.6 TRASH RECEPTACLES

While not all bus stops may require or even accommodate trash receptacles, they should still be treated as a standard amenity for bus stop facilities. However, when receptacles are provided, maintenance and trash pickup are important considerations. As such, the availability of a regular maintenance program and pick-up schedule should be considered prior to adding trash receptacles at any bus stops.

Design Dimensions

- Maximum capacity must be 110 gallons and maximum height must be 4'.[4]
- Locate bus stop trash receptacles at least 4' from face of curb by securely attaching to their foundations or another permanent fixture.[12]

DESIGN

Trash receptacle designs should coordinate with shelters, benches, and other furniture at the bus stop with regard to material and finish color. Figure 3.6.1 shows the conceptual trash receptacle type/design typically used at bus stops in Florida. Any design used should be consistent with the overall bus stop furnishing and themes and easy to use. If vandalism is a concern, agencies should consider trash receptacles with lockable lids or other anti-vandalism features.

PLACEMENT

Figure 3.6.1 also shows an example placement option for a trash receptable at a bus stop. Trash receptacles should be located at least 4 feet back from the face of the curb and should be anchored to the pavement to prevent unauthorized movement. Trash receptacles should not impede pedestrian circulation in and around the bus stop. Additionally, transit agencies should choose receptacles that can be used by those who have difficulty manipulating

Figure 3.6.1 | Example concept of trash receptacle placement at sheltered stop.

objects with their hands, such as those with arthritis or other disabilities.

The receptacles should be placed so that they do not obstruct a driver's vision when turning from an adjacent street or driveway. If possible, trash receptacles should not be placed in direct sunlight. Direct sunlight exposure may result in odors.

In addition, trash receptacles may not intrude upon the required clear path for ADA accessibility requirements. A maintenance agreement with the local agency that performs recycling also may be necessary to ensure timely pick-up of recyclable materials.

Recycling Receptacles

At high-ridership bus stops or transit facilities, transit agencies should consider using recycling receptacles in addition to trash receptacles. Figure 3.6.2 displays an example of a simple 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.

See Section 3.10 in this handbook for additional guidance on recycling and energy-saving strategies for designing, placing, and managing trash collection and removal at bus stops.

Figure 3.6.2 | Typical trash and recycling receptacles at a transit facility.

REQUIREMENTS

- *Waste disposal receptacles are prohibited on limited access facilities and where provided, shall be no greater than 110 gallons in capacity and no taller than 4 feet.*[4]
- *Trash receptacles shall not obstruct any sidewalk, bike path, pedestrian path, driveway, drainage structure, or ditch.* [4]
- *Trash receptacles must be securely attached to their foundations or another permanent fixture.*[4]
- *Advertising on a waste disposal receptacle must be affixed to the side of the receptacle and may not extend beyond the receptacle. No advertising shall be of a reflectorized material or otherwise cause a glare.*[4]
- *Trash receptacles are required to be properly maintained as to aesthetics, function, and safety, and their responsible agencies must maintain regularly scheduled garbage pick-up to preclude the accumulation of debris surrounding the receptacle.*[4]
- *Transit agencies or city or county governments must refer to 14-20.008 FAC for additional guidance on placement, construction, repair, improvement, maintenance, safe and efficient operation, alteration, or relocation of all, or any portion of a state road.*[4]
- *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.*[1]
- *To maintain accessibility, trash receptacles shall not be placed on bus stop B&A areas.*[1]
- *Trash and recycling receptacles must meet clear zone requirements as put forth in the FDM.*[2]

3.7 LANDSCAPING

Landscaping at bus stops can make them more inviting, both visually and physically, to existing and potential riders of a transit system. It also may contribute to safety, security, and the comfort of passengers, reducing heat islands (thermal gradient differences between developed and undeveloped areas) and minimizing the facility's impact on the microclimate. Figure 3.7.1 shows an example of landscaping at a bus stop.

DESIGN

Designing landscaping at bus stops primarily refers to the selection of appropriate planting elements to use. For example, 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.

Transit agencies should consider the following elements during the development of the landscape design for various bus stops and other transit facilities.[2]

- Change the characteristics of the roadway corridor to encourage lower operating speeds.
- Protect, conserve, complement, and enhance natural roadside vegetation, scenic resources, and natural features.
- Screen unfavorable views.
- Reduce stormwater runoff.
- Sequester carbon.
- Create high-quality transportation facilities and travel experiences that create value for residents and Florida's tourism sector.
- Provide shade and comfort for pedestrians, bicyclists, and transit riders.
- Mitigate heat-island effect.
- Support community efforts for economic development, urban revitalizations, and aesthetic enhancements.

Figure 3.7.1 | Landscaping at a bus stop in Hillsborough County, Florida.

- Relocate existing vegetation.
- Selectively clear and thin existing vegetation.
- Provide time and space for natural regeneration and succession of native plants.
- Reforest with native trees.
- Use Florida-native plants with known provenance (original source of plant stock) as close to planting site as possible.
- Select and place plants to minimize impacts to natural areas.
- Choose and place plants to minimize the need to maintain uniform height and spacing to sustain design intent.
- Use recycled and recyclable materials if and as needed in the design.
- Select a diverse mix of plants. A rule of thumb is that the most sustainable landscapes have an uneven aged mix of no more than 10 percent of the same species, 20 percent of the same genus, and 30 percent of the same family.

REQUIREMENTS

- *Landscape design must preserve required sight distance, lateral offset, and clear zone.*[2]
- *Select ground cover plants (i.e., naturally low-growing plants) with maximum mature height of 18 inches within clear sight triangles, do not select plants that will require routine maintenance to preserve sight distance, and select trees with clear trunk(s) or limbed up to 5 feet minimum above the sight line datum.*[2]
- *The line of sight datum between roadways is 3.5 feet above both pavements.*[2]
- *The canopies of trees and trunked plants must be at least 5 feet above the sight line datum.*[2]
- *All landscaping along FDOT rights-of-way must comply with standards in the 2022 FDM section 228.2.*[2]

Landscapes should be designed to permit sufficiently wide, clear, accessible, and safe pedestrian walkways and transit waiting areas. In coastal areas, plants also should be salt-tolerant. Exotic plants should be avoided. To maintain a defensible space and preserve visibility, the height of groundcover plants should not exceed 18 inches and the height of shrubs should not exceed 3.5 feet at maturity, as shown in Figure 3.7.2. Vegetation should not block accessways and views of bus operators, drivers, or pedestrians.[10]

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.

CPTED principles also provide specific standards for landscape design surrounding bus stop shelters and B&A areas. Trees with dense, low-growth foliage are not recommended as they could hinder sightlines and visibility for pedestrians waiting at the bus stop. Additionally, shrubbery and groundcover should remain at low levels to ensure an equal level of visibility. In instances where a protective or deterrent barrier could be used, such as a bus stop with rear facing access to dense trees/forestry, thorny plants can be used as an effective barrier to deter individuals from hiding behind the bus stop shelter or other infrastructure.

Figure 3.7.2 | Appropriate vertical dimensions for landscaping at bus stops.

Efforts should be made to shade as many constructed surfaces as possible, especially given the sun exposure in Florida. If provided, 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. If 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. Regular landscaping maintenance should ensure that all sidewalks and pedestrian crossing areas are free of obstructions or debris and requirements for site distances and clearance to obstructions are observed, especially at intersections.

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.

Design Dimensions

- Use low-growing plants with maximum mature height of 18”.[2]
- Clear tree trunks or limbed up to 5’ minimum above the sight line datum.[2]
- The line of sight datum between roadways is 3.5’ above both pavements.[2]
- The canopies of trees and trunked plants must be at least 5’ above the sight line datum.[2]

Bus Stop Shading

Shading at bus stops, particularly in the summertime in Florida, makes waiting for the bus more comfortable. At any bus stop without shelter, thoughtful landscaping can help protect passengers from the Florida elements and make the overall riding experience better. The use of trees is encouraged to provide shade to passengers exposed to sun. Additionally, trees offer environmental benefits by removing carbon dioxide from the air, storing carbon in the trees and soil, and releasing oxygen into the atmosphere. They also provide stormwater retention and reduce pollution. However, trees should be high-branching, deciduous shade trees and should not provide a visual barrier. Selecting native trees that require minimal maintenance is suggested.

PLACEMENT

Landscaping should be placed 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. Low vegetation should not block air movement beneath the shelter. Figure 3.7.3 shows an example of appropriate landscaping at a bus stop.

Coordinating bus stop locations with existing shade trees helps to provide protection from the wind and other elements. Uncomfortable and unwelcoming bus stop environments, such as those with heat and direct sun, can discourage the use of bus stops or benches and may force patrons to find other locations to wait for their bus.[9] However, maintenance is a primary consideration when deciding whether to provide landscaping at bus stops.

Figure 3.7.3 | Bus stop benefiting from nearby tree shade in Lee County, Florida.

3.8 OTHER COMPONENTS

Design and placement guidance on other bus stop components, typically included depending on a bus stop's urban, suburban, or rural location characteristics and/or due to the level of ridership activity, are included in this section. While some of these components, such as shopping cart corrals or newspaper vending machines, may not be widely used at bus stops for many agencies, guidance is included for those who still may apply them at bus stops on occasion. For the most complete and up-to-date requirements on the components included herein, transit agencies should also refer to the list of resources provided at the end of this handbook.

BUS STOP LEANING RAILS/BARS

Bus passengers sometimes prefer leaning to sitting while waiting at bus stops. Leaning rails also provide a place to shelve objects passengers may be carrying. Transit agencies that have placed leaning rails at their bus stops claim that they are inexpensive to install and heavily used by passengers.

Design

Figure 3.8.1 shows the typical design dimensions of a bus stop leaning rail inside a shelter. As shown, 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 an outside diameter of 1.25 to 2.5 inches.[1] 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.

Figure 3.8.1 | Dimensions of a bus stop leaning rail.

Placement

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 3.8.2 shows a conceptual placement of a leaning rail outside a sheltered bus stop.

A new element gaining popularity is the leaning bar, which is typically recommended for high ridership bus stops. These bars complement a bus stop's benches by providing another opportunity for transit riders to rest as they wait for the bus. Leaning can be especially appealing to people for whom sitting requires greater effort . Figure 3.8.3 shows an example of a leaning bar at a bus stop.

REQUIREMENTS

- *Handrails 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.*[1]

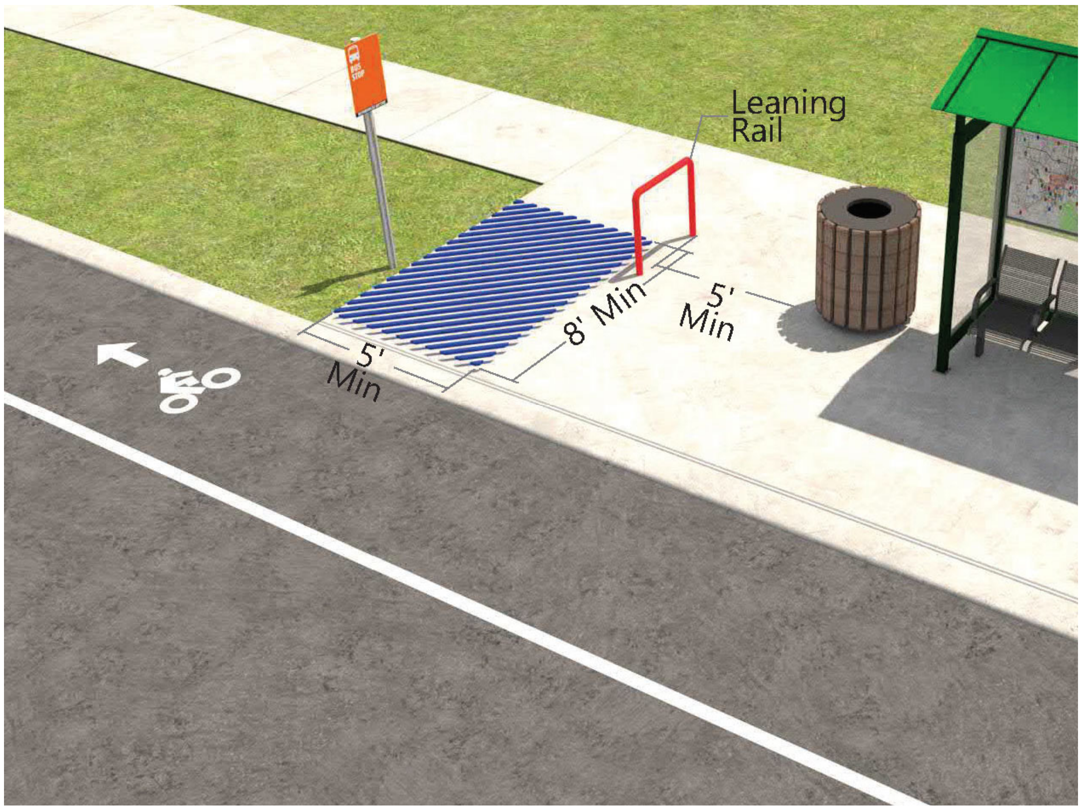


Figure 3.8.2 | Placement of leaning rail outside of shelter at a bus stop.

Figure 3.8.3 | Leaning bar in use at a bus stop in New York City.

BUS STOP INFORMATION

Service information provided at bus stops can be used effectively to help increase ridership by retaining existing riders and attracting potential new riders to the transit system. System maps and fare information are typically available at all bus stops to provide patrons with beneficial information on available routes and services, as well as how to pay for fares. At key bus stops, real-time service information displays can give patrons up-to-the-minute information on bus arrival times and potential delays. In addition, wayfinding has become an essential element in travel planning and transit connectivity. For example, wayfinding signage can be used in and around major bus facilities to help patrons gather directional information about the various uses and activity centers around the facilities. Technological innovations also are assisting riders with bus stop information and wayfinding. Smart phone applications are available now that can be used to easily find transit stop locations and even access walking or driving directions to them.

Figure 3.8.4 | Pushbutton-activated system at a bus stop.

Design

Information displays should not block the clear zone or B&A area, and all signs should be accessible to individuals who use mobility aids. The design of maps and schedules at bus stops should 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 can provide voice annunciation of bus information. Figure 3.8.4 shows an example of a bus pushbutton-activated route information system. When designing displays and

REQUIREMENTS

- *Signs must be installed in a manner that eliminates any protruding objects hazards.*[1]
- *Where public address systems convey audible information to the public, the same or equivalent information shall be provided in visual format.*[3]
- *Text should be large and easy-to-read and must comply with all ADA requirements for text and pictogram size, placement, and contrast.*[1]

signage, including park-and-ride signs at bus stops, agencies also should refer to the most current MUTCD. In addition, reference also should be made to the FDOT State Park-and-Ride Guide, when applicable.

Intuitive and adaptable wayfinding tools also may increase the usability and success of navigation for bus transit as well as increase overall accessibility. Some wayfinding devices can be more informal in presentation and add to the branding of the transit system, such as graphic markers at ground level, directing riders to bus stops located around the corner or across the street.

Placement

Ridership and the prevailing rider profile have been the primary considerations in selecting locations to provide bus stop information and wayfinding devices, as these tools 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 be designed and placed at shelters or bus 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. The use of text should be minimized and pictograms and other symbols should be used where possible. Figure 3.8.5 shows a real-time bus information display.

The use of multiple languages should be considered in areas with large visitor and tourist populations that may include non-English speaking persons. Maps and schedules should adopt uniform graphic standards, sizes, and color codes. Color schemes should be highly contrasting.

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.[9]

Figure 3.8.5 | Real-time bus information display in Volusia County, Florida.

Passenger information displays sometimes can be implemented by retrofitting them onto existing shelter elements instead of constructing new elements to house them. Also, passenger information displays should be located upstream of and oriented toward the bus stop, allowing waiting passengers to view the information display and view an approaching bus at the same time. Information displays should not hinder visibility of standard signage or of passengers and pedestrians. Size, color, brightness, and exposure to elements all should be considered when both designing and choosing locations for passenger information displays.

BOLLARDS

Bollards sometimes are used at applicable bus stops to separate pedestrian and vehicular areas and typically are used to protect people, buildings, and site elements. They sometimes are illuminated to provide path lighting and are especially important in areas where errant buses or other vehicles may threaten waiting passengers or pedestrians. Figure 3.8.6 shows a detailed cross-section for a typical bollard.

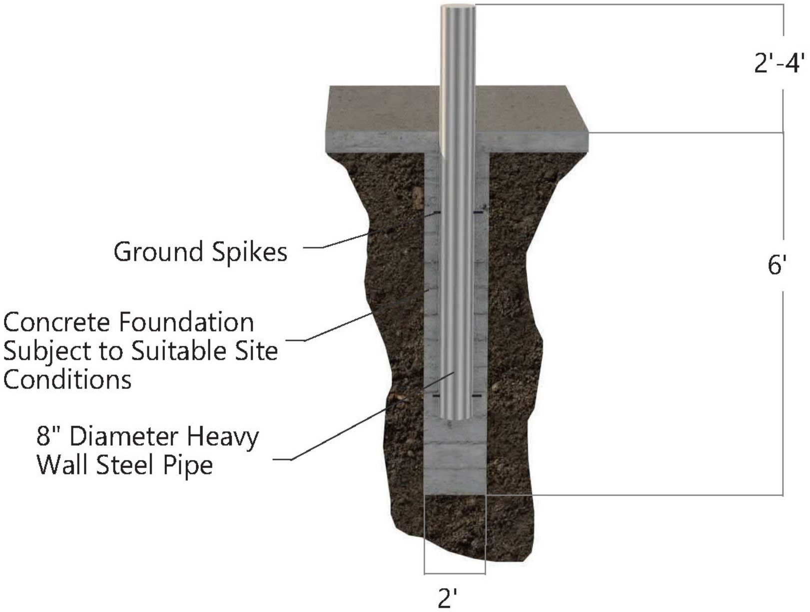


Figure 3.8.6 | Detailed cross-section of a typical bollard.

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. Bollards should be tall enough to discourage vehicle access (standard height of 2 to 4 feet), but spaced far enough apart to allow bicycle, wheelchair, and pedestrian access (minimum clear width of 60 inches).[8] 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. They should be spaced at 5 feet on center across heavily-trafficked locations to protect pedestrian-only zones.[8]

Bollards should be solid for durability and stability. They either can 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.

Placement

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

REQUIREMENTS

- *Bollards are not to be located in the road right-of-way.[8]*
- *Security bollards shall not obstruct a required accessible route or accessible means of egress.[1]*

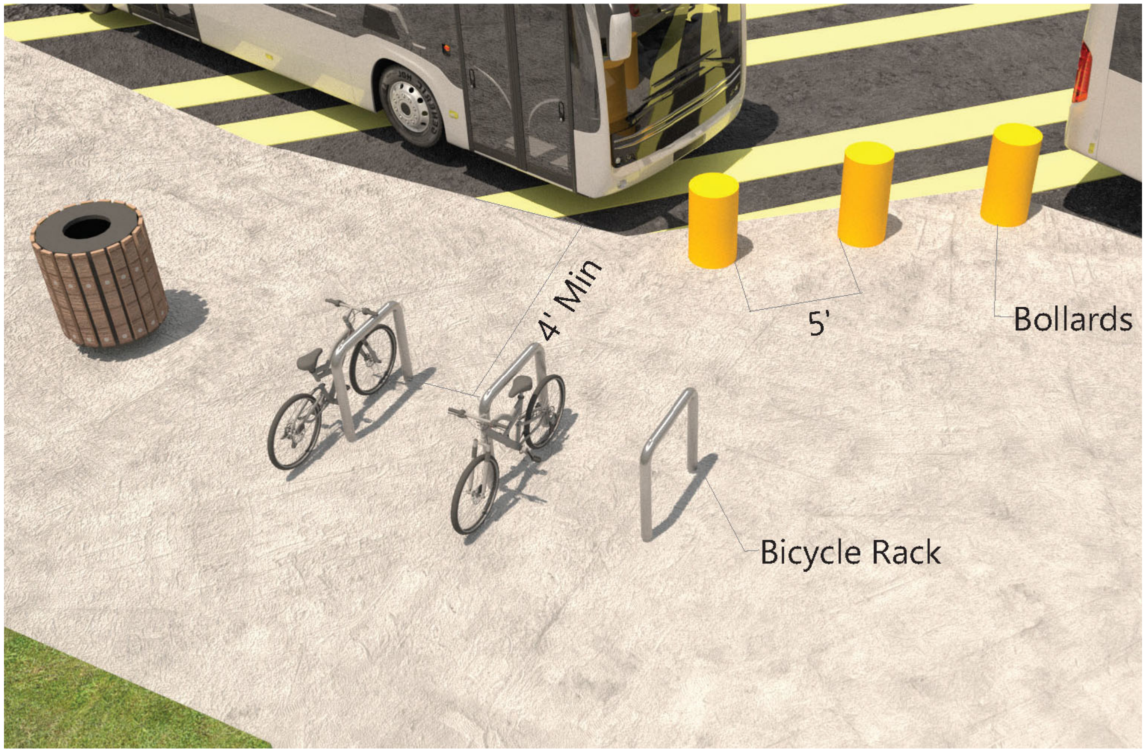


Figure 3.8.7 | Placement of bollards at a half saw-tooth bus bay.

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 3.8.7 shows an example of the placement of bollards.

SHOPPING CART STORAGE

While not applicable to a vast majority of bus stop locations, some bus stops with nearby retail shopping centers continue to see bus riders bring shopping carts to them, making shopping cart storage a need.

REQUIREMENTS

- *Shopping cart locations must meet the setback and minimum cl zone requirements established in 20 FDM section 215.2.3 and 215.2.4.[2]*

Design & Placement

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. Figure 3.8.8 illustrates the recommended dimensions of a shopping cart corral.

When applicable, shopping cart storage should be provided at bus stops adjacent to retail centers. Figure 3.8.9 shows the placement of a shopping cart corral at such a bus stop. They should be located at least 4 feet back from the face of curb and clear of sidewalks.[2] To maintain accessibility, bus stop 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.

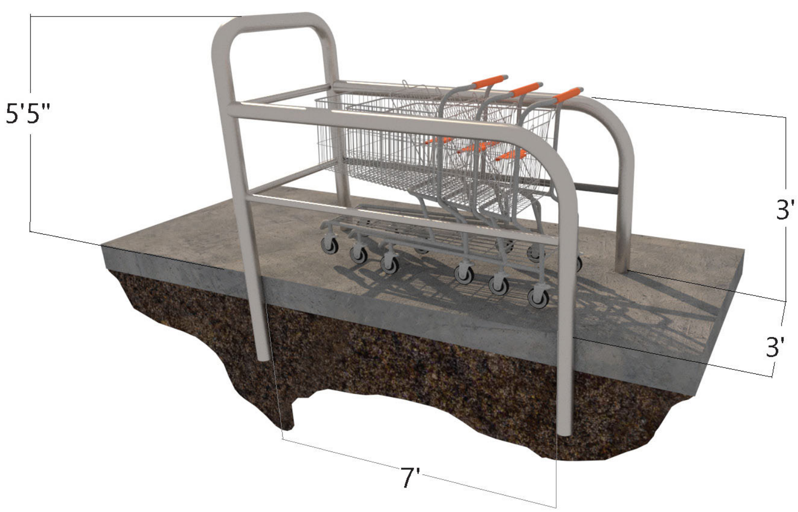


Figure 3.8.8 | Typical dimensions of a shopping cart corral.

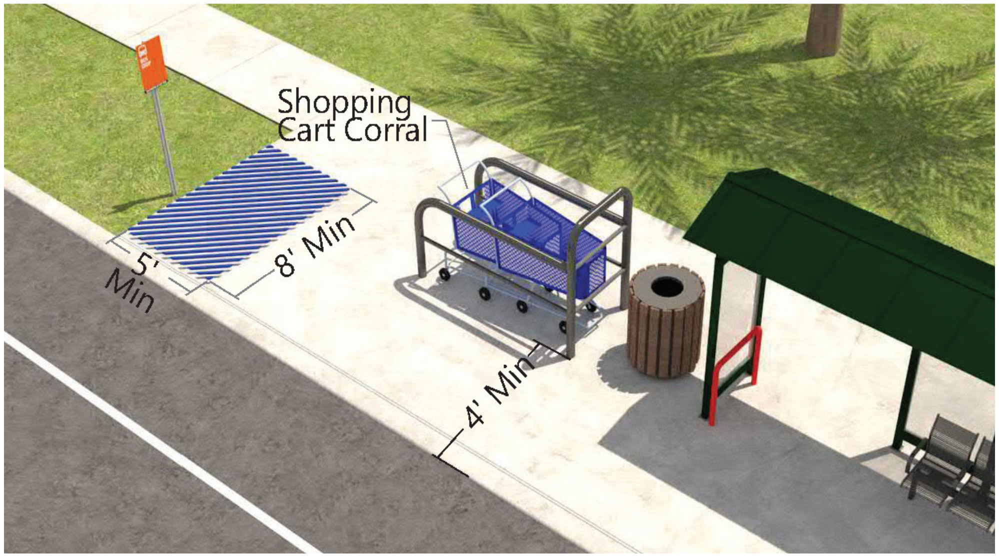


Figure 3.8.9 | Placement of a shopping cart corral at a bus stop.

PUBLIC TELEPHONES

While increasingly rare due to the use of wireless phones, wired public telephones at bus stops can offer many potential benefits and are still used at applicable bus stops.

Design & Placement

The design of the public telephones at bus stops depends on where the agency intends to provide them, ranging from within the shelter to a location in the general area of the bus stop. Regardless of where it is provided, the highest operable part of the telephone and telephone books should be located within the reach of wheelchair users (48 inches maximum).[9]

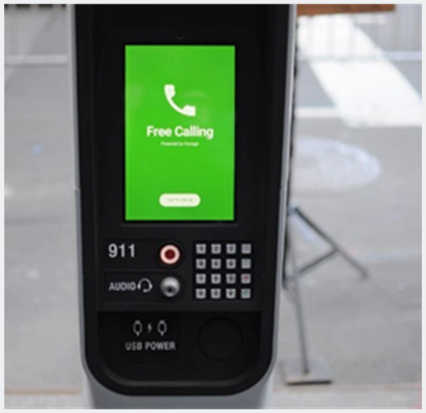
The phone and the bus stop waiting area should be separated by a short distance when possible. Wherever it is placed, the telephone base or enclosure cannot obstruct the 5-foot-by-8-foot B&A area.

REQUIREMENTS

- *The length of the telephone handset cord shall be a minimum of 29 inches. Phones shall be hearing-aid compatible and volume-control equipped.*[1]
- *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.*[1]
- *Where a parallel approach is provided, the distance from the edge of the telephone enclosure to the face of the telephone unit shall be 10 inches maximum. Where a forward approach is provided, the distance from the front edge of a counter within the telephone enclosure to the face of the telephone unit shall be 20 inches maximum.*[1]
- *Public telephones also must be located according to ADA Standards for protruding objects and operable parts. The ADA Standards for protruding objects state 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 state that operable parts of a telephone shall comply with clear floor space, height, and operation requirements.*[1]

DESIGN TIP

New public telephones at bus stops may come with new features such as charging hubs for mobile devices, an emergency call button, and an LCD screen for paid advertisements to be displayed on the side of the unit, which increases lighting near the payphone, as well. New York City has replaced nearly 2,000 traditional payphones with such modern payphones with advanced upgraded technologies. LinkNYC payphones offer touchscreen displays and free Wi-Fi calling to pedestrians using the device. While New York has led the advancement of modernizing the payphone, other cities, such as Chicago and Seattle, have begun to implement similar systems, as well.
Source: LinkNYC



EMERGENCY CALL BOX

Emergency call boxes establish a safe communication element, especially at stops located in areas that may be perceived as relatively unsafe during the day or night. Emergency call boxes mostly are used at college campus bus stops as part of university public safety programs. Figure 3.8.10 shows a typical emergency call box applied in a campus setting, and Figure 3.8.11 shows a solar-powered call box.

Design & Placement

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. New technologies are used increasingly in call box designs, including the use of fiber and network (Transmission Control Protocol/Internet Protocol [TCP/IP]) connectivity, allowing them to support both informational and emergency needs.

These call boxes should be placed to ensure that they meet the clear space requirement 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.

Figure 3.8.10 | Emergency call box at a bus stop on the University of Florida campus in Gainesville, Florida.

Figure 3.8.11 | Solar-powered emergency call box.

REQUIREMENTS

- *A call box must not obstruct access to the stop.*[9]
- *A call box must be accessible to those that are deaf, hard of hearing, or people who use wheelchairs.*[9]
- *A call box also must be located according to ADA Standards for protruding objects and operable parts. The ADA Standards for protruding objects state 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.*[1]
- *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 48 inches by 30 inches minimum.*[1]

PUBLIC ART

Efforts in promoting placemaking into transit facilities such as bus stops may promote civic pride and help establish transit systems and facilities as components of a community rather than a standalone operation. Placemaking at bus stops can help enhance rider perception of a transit agency's services, while also potentially boosting the community's engagement with those services. When transit agencies implement public art or create unique, aesthetically-pleasing bus stops, such components of placemaking and environmental design can contribute to increased ridership and enhanced safety at bus stops.

REQUIREMENTS

- *The object's highest point must not be greater in elevation than 25 feet above the nearest point of the traveled way.*[2]
- *The location must be outside the appropriate lateral offset or clear zone as defined in FDM and should be as close to the right of way line as practical.*[2]
- *As public art at bus stops can vary by purpose, place, and the population it serves. Refer to all applicable ADA and FDM requirements.*[1,2]

Design & Placement

Public art designs can vary drastically and be installed as standalone features or integrated into the environment as dual use. Bike racks, benches, and even entire shelters can be integrated into the built environment as public art. Coordination with local agencies and residents can facilitate relationships with artists who are willing to partner with the transit agency for the development of unique, locally-flavored, and brand-supportive art designs.

Efforts in placemaking can contribute to creating a cohesive environment throughout the transit route, and potentially throughout the area. Incorporating design features that relate to the community or area surrounding the bus stop contributes to placemaking and encourages positive ridership and heightened transit system perception. Considerations in placemaking can include historic settings, nearby architecture type, use of space in the area, and local demographic character.

Source: Bike/Walk Tampa Bay

Figure 3.8.12 | Public art at bus stop in Pinellas County, Florida.

Source: Google

Figure 3.8.13 | Public art at bus stop in Tallahassee, Florida.

Placemaking design efforts should be implemented consistently throughout the transit system, except in cases where altering the design serves the unique properties of a specific location. Figures 3.8.12 and 3.8.13 show some public art examples at Florida bus stops.

VENDING MACHINES

Vending machines can be provided at bus stops for passengers, whether to conveniently access refreshments or purchase bus tickets or load fare cards before they get on the bus. In addition, newsprint companies also seek high profile locations for their vending machines, including certain bus stops.

Design & Placement

Vending machines, including those for off-board fare collection, refreshments, or newspapers, and other street furniture should be designed and placed so that they do not reduce the clear space required by ADA Standards. Vending machines also 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. They cannot be placed within 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. Figure 3.8.14 shows an example of newspaper vending machines at a bus stop.

Figure 3.8.14 | Newspaper vending machines at a bus stop in Sarasota County, Florida.

REQUIREMENTS

- *Vending machine locations must meet the setback and minimum clear recovery zone requirements established in the FDM.[2]*
- *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. ADA guidelines also state that any operable parts shall comply with clear floor space, height, and operation requirements.[1]*

Design Dimensions

Bus Stop Leaning Rails/Bars

- Recommended height is 27" min. and 42" max.[1]
- Provide a round section of the rail with an outside diameter of 1.25" to 2.5".[1]
- Use anodized aluminum to enhance durability.[12]

Bus Stop Information

- Use large and easy-to-read text that comply with ADA requirements for text and pictogram size, placement, and contrast.[1]

Bollards

- Recommended height is 2' to 4'.[12]
- Provide minimum clear width of 5' between each bollard for bicycle, wheelchair, and pedestrian access.[12]
- Each bollard should be designed to stop a 36,000-pound vehicle traveling at 4 mph.[12]
- Provide 3 bollards of concrete-filled, 8" diameter, heavy-wall steel pipe ahead of each bus. The pipes should be set vertically in a 6' auger-drilled hole, and retained by reinforced concrete. [12]

Shopping Cart Storage

- Minimum clearance for the cart storage area is 3' wide and 3' high.[12]
- Use standard hot-dipped galvanized steel pipe construction. Surface-mounted flanges should be use flat steel bars.[12]
- Install at least 4' back from the face of curb and clear of sidewalks.[12]

Public Telephones

- Provide min. 29" length for the telephone handset cord.[1]
- Where a parallel approach is provided, the distance from the edge of the telephone enclosure to the face of the telephone unit must be 10" max. [1]
- Where a forward approach is provided, the distance from the front edge of a counter within the telephone enclosure to the face of the telephone unit must be 20" max.[1]

Emergency Call Boxes

- Call boxes also must be designed and located according to ADA Standards for protruding objects and operable parts.[1]

Public Art

- Design can vary by purpose, place, and the population it serves. Refer to all applicable ADA and FDM requirements.[1,8]

Vending Machines

- Design not to protrude more than 4" into the accessible path when mounted at 27" to 80" above the finished floor or ground surface.[1]
- Follow accessibility and safety requirements on clear floor space, height, and operation requirements.[1]

3.9 TECHNOLOGY & INNOVATION AT BUS STOPS

Recent technological advancements have provided many efficient tools to make accessing transit more convenient. Some of these advancements have become well established and incorporated into best practice transit procedures, while others, on the cusp of more widespread applicability, continue to develop and slowly expand throughout transit agencies. Innovations in transit technology components aim to increase usability of services, provide expanded continuity, and improve safety, rider perception, transit system navigation, and overall effectiveness of transit. Impacts of key technological advancements in the last decade are discussed in this section as they relate to bus passenger facilities.

DIGITAL WAYFINDING

Interactive digital touchscreen displays and kiosks can help transit patrons and passing pedestrians explore nearby destinations, look at local event calendars, view maps, and see transit options and travel times all on screen. Pedestrians can choose destinations they would like to visit and send transit directions and real-time bus route information from the on-screen display directly to their cell phones to aid in navigating their route. Figure 3.9.1 shows an example of a digital wayfinding kiosk.

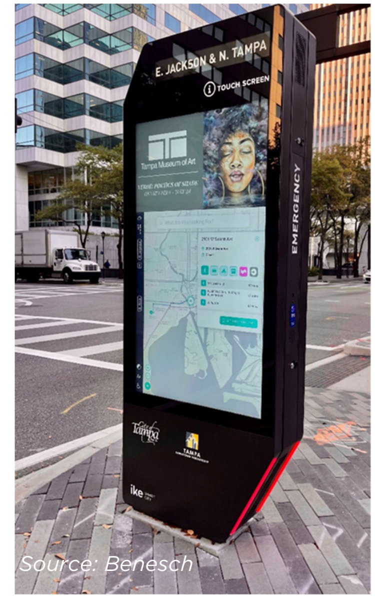


Figure 3.9.1 | Digital wayfinding kiosk in Tampa, Florida.

Digital wayfinding applications also can prove to be a useful tool for visually impaired riders who are able to utilize their smart phone to aid in navigating the transit system. APTA reports that over 80 percent of visually-impaired transit riders utilize their smart phones as a navigation aid when resources are available.

DIGITAL INK DISPLAYS

Transit agencies have begun providing “digital paper” signage for use at bus stops for both wayfinding and advertising purposes, as well. These types of digital displays are more cost effective than comparative electronic installment, can be supported with minimal electricity or by solar power, and can continue displaying information with no power supply for an extended amount of time, thus allowing for continuity of use during power outages or natural disasters. Utilizing digital ink signage provides agencies with the option to update information in real time or display standard signage. Digital ink displays also do not contribute to light pollution and can be implemented without establishing a new power source, resulting in minimal cost to implement throughout a transit system. Figure 3.9.2 shows a digital ink display example.

Figure 3.9.2 | Digital ink display in Tampa, Florida.

ELECTRIC BUS CHARGING

A growing number of transit agencies in Florida are switching to partial or full electric bus fleets. Fully electric buses emit zero carbon emissions and align with ongoing Smart City and associated sustainability efforts. While they improve air quality and significantly reduce noise, the time needed for recharging the batteries of EVs, typically about 4 hours, has been an obstacle to implementation.

However, recent advances in this technology have introduced the use of inductive wireless charging stations, which reduce the previous charging time by nearly 50 percent. Inductive charging works by stopping the vehicle on top of a charging plate installed in the ground or roadway. This charging method can provide electric vehicles with approximately 15 hours of service in as little as 10 minutes of charging. Figure 3.9.3 shows an example of an inductive charging station.

In Summer 2022, Pinellas Suncoast Transit Authority debuted the first inductive wireless charging station in the State of Florida and on the East Coast of the U.S.

ELECTRIC VEHICLE CHARGING

To promote park-and-rides for transit users, installing EV charging stations near major bus stop hubs and transfer centers can provide a useful amenity for many transit riders. EV charging can be implemented into traditional parking zones either within standard parking lots, park-and-ride lots, or at curbside parking located near bus stops.

Implementing the use of EV charging stations can help expand upon agency-wide and/or regional Smart City advancements and carbon emission reduction efforts. Parking spots dedicated for and retrofitted with EV charging capabilities should be clearly marked to prevent standard passenger vehicles from utilizing dedicated parking spaces. To ensure that all charging facilities and elements are compliant with pertinent accessibility and safety guidelines, transit agencies should collaborate with relevant local, state, and federal agencies, including the U.S. Department of Energy. Figure 3.9.4 shows an example of EV charging station spaces.

Source: PSTA

Figure 3.9.3 | Inductive bus charging station in St. Petersburg, Florida.

Source: City of Venice Beach

Figure 3.9.4 | EV charging stations in Venice Beach, Florida.

MOBILE APPLICATIONS

Smart phone applications now can be used to find transit stop and/or bus service information provided by larger transit systems. Transit agencies can develop their own mobile applications, or work with other existing providers to create digital wayfinding platforms for riders. These mobile applications can be used to locate bus stops, get real-time arrival updates, and receive turn-by -turn directions to bus stops, transfer points, and final destinations once travel on a bus route has been completed.

Mobile applications can receive real-time bus locations and arrival times to stops using either GPS or Bluetooth technology. Buses and bus stops are retrofitted with the technology to allow such information to be provided to riders using the mobile application. Other features can be provided through mobile applications, as well, such as the ability to purchase fares online, find destinations close by, and look at available maps/routes for trip planning purposes.

WI-FI & DEVICE CHARGING

Transit agencies across the state and country are increasingly providing Wi-Fi connections at bus stops and on bus routes, using traffic signal boxes, streetlights, and bus stop shelters as "repeater" sites to provide continued connectivity to riders and pedestrians throughout the service area. This service allows riders to easily access community and transit information as needed, provides disadvantaged communities with additional resources through the transit system, assists in keeping transit and city staff connected while in the field, and helps ensure ongoing communication capabilities during emergencies and evacuations.

With increased technology-based amenities and wayfinding options available to transit riders, enabling riders to stay connected through their smart phones and wireless devices is vital to continuity of services. Integrating mobile device charging into bus stops and on board transit vehicles has become a common, and necessary, component to modernizing transit systems. USB outlets and plug-in stations are typically free to use, and are placed in shaded, convenient, and well-lit locations unhindered from visibility obstructions, without causing pedestrian conflicts. If possible, the integration of charging ports should utilize solar power captured by photovoltaic panels on the shelter, as feasible. Figure 3.9.5 shows an example of the application of charging ports at a bus stop.

Figure 3.9.5 | Charging ports at a bus stop in Orlando, Florida.

INNOVATIVE DESIGN AT BUS STOPS

Transit agencies also have used innovative design concepts as another tool to promote transit use and attract ridership, including unique shelter designs such as the example shown in Figure 3.9.6. These uniquely-designed structures also may help add to the pedestrian friendliness, enhance the streetscape, and improve the opportunities for multimodalism in an urban environment. However, creating and implementing these designs such that they meet the intended and desired "look" while also keeping the infrastructure accessible to all patrons may prove to be difficult, so careful coordination between all parties involved may be necessary.

Figure 3.9.6 | Innovative bus shelter design in Palm Beach County, Florida.

3.10 SUSTAINABLE PRACTICES AT BUS FACILITIES

More than ever, transit agencies across the state and country are dedicating themselves to implementing energy efficient practices and operations. Adhering to sustainable operations goes beyond cutting energy costs and aims to reduce adverse environmental impacts, lower the carbon footprint of transportation, and leverage an array of new federal and state renewable energy grants. Transit agencies and state and local governments can strive to adhere to Leadership in Energy and Environmental Design (LEED) certification standards, as well as various other self-rating systems to address energy efficiency.

FTA encourages useful initiatives among transit agencies, such as implementing an Environment and Sustainability Management System (ESMS). Best practices, guidelines, and additional resources on ESMSs are all provided by FTA. Resources also can be found through the U.S. Green Building Council (USGBC), the Green Building Initiative (GBI), the American Council for an Energy-Efficient Economy (ACEEE), as well the LEED program. These initiatives strive to encourage factors such as:

- Site potential optimization;
- Minimizing non-renewable energy consumption;
- Protecting and conserving water;
- Use of environmentally-preferable products;
- Water and ground contamination;
- Enhancements to indoor environmental quality; and
- Operational and maintenance practices optimization.

Many agencies throughout the State of Florida already have implemented LEED-certified buildings or policies, including the following examples.

- The Seventh Avenue Transit Village project in Miami, Florida, received Silver LEED-Certification for the construction of its housing and multimodal transportation hub project.

Figure 3.10.1 | Solar-powered bus stop sign with bus signalizing and lighting capabilities, Pinellas County, Florida.

- The Key West Transit Facility received a Silver LEED-Certification for its construction.
- Sarasota County Area Transit is in the process of LEED-certification for the construction of a bus-transfer facility.
- The City of Jacksonville is in the process of LEED-certification for the construction of a new Transportation Center.
- Lauderhill Mall Transit Center, in Lauderhill, Florida, is in the process of LEED-certification for its new construction.

The remainder of this chapter reviews potential energy saving options that are typical for small 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 sustainable design even on smaller components, especially when these are repeated at many locations, may help transit agencies and local governments become more energy efficient and sustainable at their transit facilities. Figure 3.10.1 shows a bus stop sign that uses solar power to support its bus signaling and lighting functions.

SOLAR ENERGY

Given the significant cost involved in adding electrical service to an existing bus stop or implementing it at a new one, many transit agencies have begun seeking alternative energy options for powering various amenities at their bus stops and facilities. A key energy option, especially in Florida, is solar energy. As noted in the previous section, some transit agencies have begun using solar energy to power electrical outlets and USB ports at bus stops for riders to charge their mobile devices. Such strategies, once aggregated, can contribute to the agency bottom line in a number of ways, including facilitating safer stops, reducing vandalism, and improving system attractiveness and community perceptions of transit, all of which will help increase system usage.

Figure 3.10.2 | Bus shelter with a solar panel, Polk County, Florida.

Bus Shelters

Shelters using solar 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 infrared technology, giving the passenger increased security and comfort. LED lighting in combination with solar power also can 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. Figure 3.10.2 shows an example of a bus stop with a solar panel, which reduces the energy required to light it at night.

Bus Stop Signs

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 expected buses. Figure 3.10.3 shows details of the touch switches from a stop sign on a pole with solar-powered lamps that can be illuminated at night. Agencies also should maintain landscaping adjoining the bus stop area to ensure that it does not block the light source.

Figure 3.10.3 | Details of a solar-powered bus stop signpost with bus flagging capability and security lighting, Pinellas County, Florida.

Larger Transit Facilities

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

Transit agencies also have continued to implement the installation of solar panels at their larger terminals and administration facilities to help reduce their energy consumption and carbon footprint. Operations and maintenance facilities also 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.

USING SUSTAINABLE RESOURCES

Transit agencies looking to reduce resource consumption and save energy also 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 benefits. 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 require less maintenance so they also help save resources.

Sidewalks & Pavements

During construction and design, being aware of sustainable options in creating sidewalks, B&A areas, or any other use of pavement is important. One alternative to traditional concrete or asphalt sidewalks 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. For a list of approved

Figure 3.10.4 | Recycled sidewalk in Siesta Key, Florida.

materials, FDOT should be contacted for state and federal highways, and local agencies should be contacted for city and county roadways.[5] Figure 3.10.4 shows an example of recycled sidewalk.

Salvaged and recycled-content materials also can 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; and
- Recycled plastic and composite lumber for decking, railings, and raised beds.

Figure 3.10.6 | Recycled plastic bench, Hillsborough County, Florida.

Figure 3.10.5 | Multi-use trail crossing in Indianapolis, Indiana, with decorative inlaid thermoplastic design.

Thermoplastic Pavement Markings

Recent studies increasingly report levels of water, ground, and air pollution attributed to traditional pavement marking practices. Thermoplastics can reduce these effects while also providing increased safety benefits through higher reflectivity and visibility in wet and nighttime environments. Utilizing thermoplastic traffic markings near bus stops results in lower costs, as well, due to the lower maintenance/upkeep required. Figure 3.10.5 shows an example of the use of thermoplastic markings for a trail crossing.

Recycled Material Benches

Benches and selected other bus stop amenities can be made from recycled materials. Such benches can help save resources as they require less maintenance . They also are beneficial in that they are cooler to sit on, so they are more useful year-round. 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 Figure 3.10.6 for an example of a recycled plastic bench. Agencies also would be wise to avoid uncoated, dark metal seating surfaces, as they become hot in the summer and cold in the winter.

Recycled Plastic Bollards

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 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. Additionally, bollards can be designed as light fixtures with retrofitted solar panels to contribute to lighting at bus stops and shelters where needed.

Figure 3.10.7 | Examples of solar-powered trash receptacles at bus stops.

TRASH & RECYCLING RECEPTACLES

Transit agencies employ various sustainable and energy-saving strategies for managing trash collection and removal at bus stops. Some use trash receptacles made from recycled plastic materials. Compacting trash receptacles can reduce the quantity of litter at bus stop sites; their increased capacity also helps reduce the trip frequency for trash pickup. Such receptacles can reduce 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 3.10.7 shows examples of solar-powered trash receptacles at bus stops.

Figure 3.10.8 | Landfill, recycle, and compost receptacles at a bus stop.

Compost Receptacles

In addition to waste and recycling collection, compost collection is becoming a popular means of reducing waste and contributing to sustainable practices. Partnerships within communities are increasingly working to help make composting programs available to the public. Where these programs arise, transit agencies may choose to incorporate composting receptacles for transit riders and pedestrians to utilize throughout the community. Figure 3.10.8 shows a compost receptacle along with recycling and landfill receptacles at a bus stop.

STORM WATER DRAINAGE/RECLAIMED WATER

Agencies also must consider storm water run-off and impacts to water quality when building in Florida. There are numerous methods available to handle the drainage issues and to mitigate their impacts. Working with environmental experts, retention ponds and drainage swales can be designed to improve the water and remove impurities before allowing it back into the natural environment. Additionally, finding ways to use reclaimed water for landscaping and for plants or trees that help in mitigating facility impacts can be beneficial. As always, required maintenance for any implemented elements should be considered to help reduce expensive and recurring upgrades.

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CHAPTER 3

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Chapter 04

BUS STOP PLACEMENT

4.1 PLACEMENT CONSIDERATIONS

Placing a bus stop at the most effective location is the goal of every transit agency striving to better serve its existing riders and attract potential new riders. Bus stops should be placed at locations where they effectively can serve a wide range of passengers with various accessibility concerns. Regardless of the location, whether it is near an intersection, a driveway, or a bridge, all key elements related to accessibility at a bus stop must be addressed.

PLACEMENT BASICS

The basic considerations in placing bus stops have continued to include proximity/access to major trip generators, having adequate right-of-way to provide safe waiting and B&A areas, and, most importantly, the availability of safe and convenient access to and from the bus stops for transit patrons. A general rule of thumb also entails avoiding bridges, driveways, and areas with very little usable right-of-way width when locating a bus stop.

Due to the many benefits that result, such as safer crossings and enhanced transfer opportunities, placing bus stops near intersections is common practice. However, placement of bus stops in exclusive right-turn lanes is not recommended. If a local decision is made to allow this practice, then the bus stop also should 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 also should 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 typically are placed near intersections (where a bus stop may be located) and usually are located right next to the crosswalk. Refer to the Florida Greenbook and FDM for more guidance on drainage issues.

REQUIREMENTS

- *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]
- *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]
- *F.A.C. Section 14-20.003 requires that a minimum 15-foot distance be maintained between a bus shelter and a fire hydrant or an accessible parking space.*[1]
- *The shelter for a stop must not obstruct a driveway.*[1]
- *All bus stops in urban areas (curb & gutter and sidewalk) shall be situated so that passengers board and alight at a location where full height curb and gutter is present and not a driveway.*[2]
- *All bus stops in urban areas (curb & gutter and sidewalk) shall be situated to be 20' or more away from the edge of a drainage structure.*[2]

Table 4.1.1 provides a bus stop placement checklist that reviews some of the key elements of bus stop accessibility, and highlights important considerations to address when placing stops.

SELECTING TYPE OF BUS STOP

Prior to placing a bus stop, a transit agency must decide on the type of stop it is going to implement. The type of stop will help determine its scale, its placement, and even the particular infrastructure components and amenities that the agency may want or need to include. Typically, selecting the type of bus stop depends on the ridership activity expected at that stop, as well as the land use, street environment, and other conditions at the location where it will be sited.

Table 4.1.1
Bus Stop Placement/Accessibility Checklist

Presence, Design, and Placement	✓	Is the bus stop 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	✓	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 sufficient area available to provide waiting, boarding/alighting of passengers, and through pedestrian traffic at peak times?
	✓	Is sufficient area available to provide amenities like trash receptacles, additional seating, bike and shared mobility parking, etc.?
	✓	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/ Connectivity	✓	Is the nearest crossing opportunity free of potential hazards for pedestrians?
	✓	Can the bus stop be connected to a continuous network of pedestrian facilities, including sidewalks and/or shared use paths?
Lighting	✓	Are access ways to transit facilities well lit to accommodate early morning, late afternoon, and evening travel?
Visibility	✓	Are open sight lines maintained between approaching buses and passenger waiting and loading areas?
Traffic Concerns	✓	Do passengers boarding and alighting buses conflict with cars, bicycles, or pedestrians?
Signs and Pavement Markings	✓	Are appropriate signage, wayfinding, and pavement markings provided for transit stops?

Table 4.1.2 Example Bus Stop Classification Criteria				
Name	Description	Amenities		
		Essential	Beneficial	Optional
Local Stop	Less than 15 boardings per day, low residential land use	Transit Sign, ADA Compliance	Stop Lighting	Bench, Bicycle Storage, Kiosk
Primary Local Stop	16 to 35 boardings per day, mixed land use, higher intensity of use than local stops	Transit Signs, ADA Compliance, Bench, Trash Receptacle, Stop Lighting	Bicycle storage, Kiosk, Leaning Rail, Back door landing pad	Bus Shelter, System Map
Super Stop	36 to 80 boardings per day, high-density mixed-use land use, located near neighborhood focal points, community centers, parks and schools	Transit Signs, ADA Compliance, Bench, Trash Receptacle, Stop Lighting, Bus shelter, Kiosk, Landscaping	Bicycle storage, Kiosk, Leaning Rail, Back door landing pad, Bus Bays	Emergency Telephone, Retail Kiosk
Primary Super Stop	More than 80 boardings per day, high density mixed-use land use, major trip generators	Transit Signs, ADA Compliance, Bench, Trash Receptacle, Stop Lighting, bus shelter, kiosk, Landscaping, Back door landing pad, bicycle storage, bus bays	System map, leaning rail, newspaper stand, emergency telephone	Retail Kiosk

Some agencies may have a set of specific criteria they use for selecting the type of bus stop while others may select on a case-by -case basis. Table 4.1.2 shows example bus stop type classification criteria used by Regional Transit System in Gainesville, Florida. It is important to note, however, that any agency with an established methodology still must recognize that each bus stop placement and the components that will be included at that stop should be considered as unique to that location and have to be adjusted as appropriate.

PLACEMENT PROCESS

As most bus-oriented transit operates in mixed traffic on streets, bus stop locations usually are 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-lane” at curbside of a travel lane, on a soft shoulder, or “off-lane” on a bus bay/pullout to allow buses to pick-up and drop-off passengers at an area outside of the travel lane. Figure 4.1.1 shows an example bus stop placement process flowchart. It shows the various decision points and pathways that typically are involved in the bus stop placement process, from selecting a potential location to establishing a location for an on- or off-lane bus stop. Figure 4.1.2 shows an example of an off-lane bus stop in Florida.

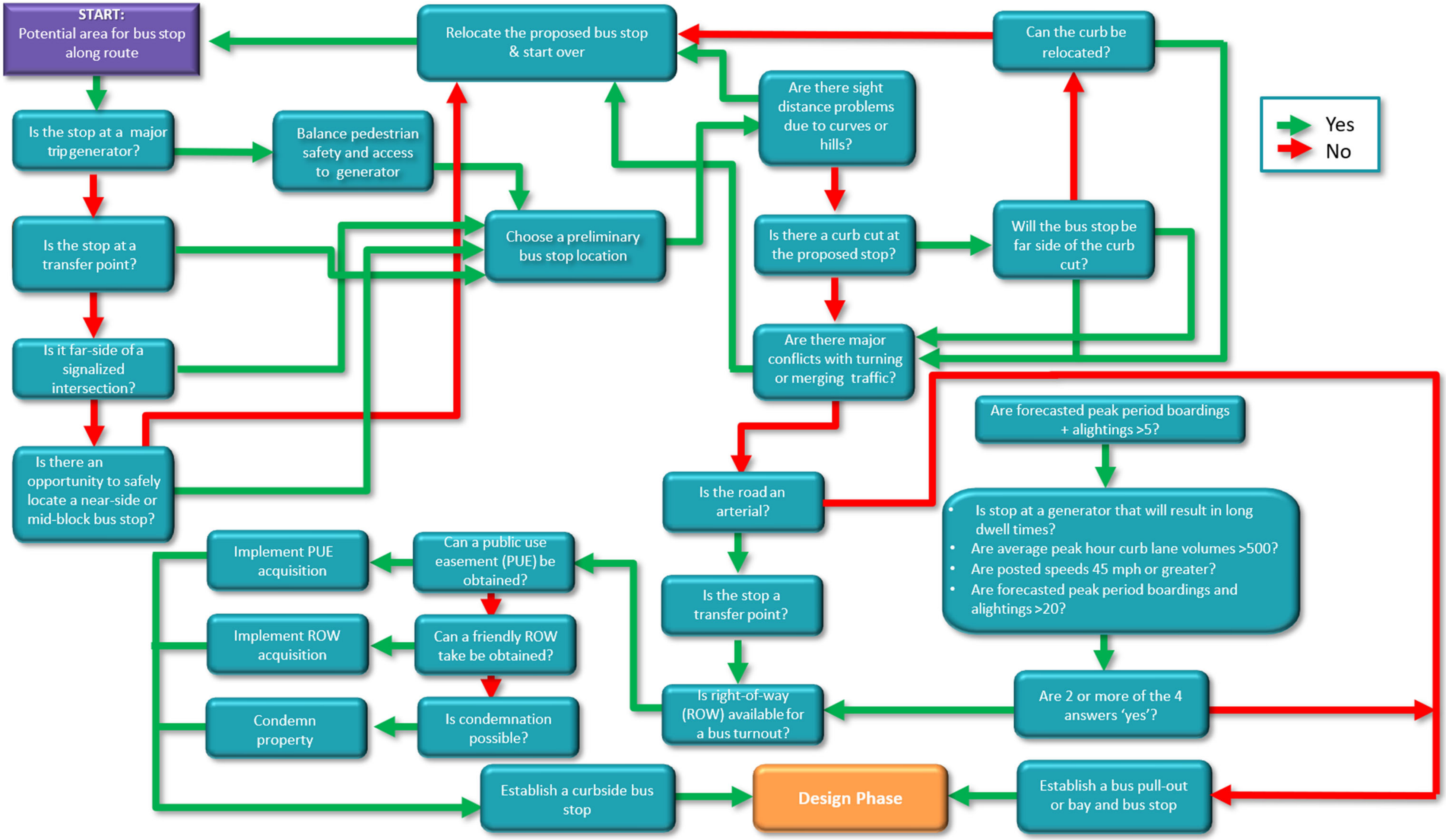


Figure 4.1.1 | Example Bus Stop Placement Process Flowchart

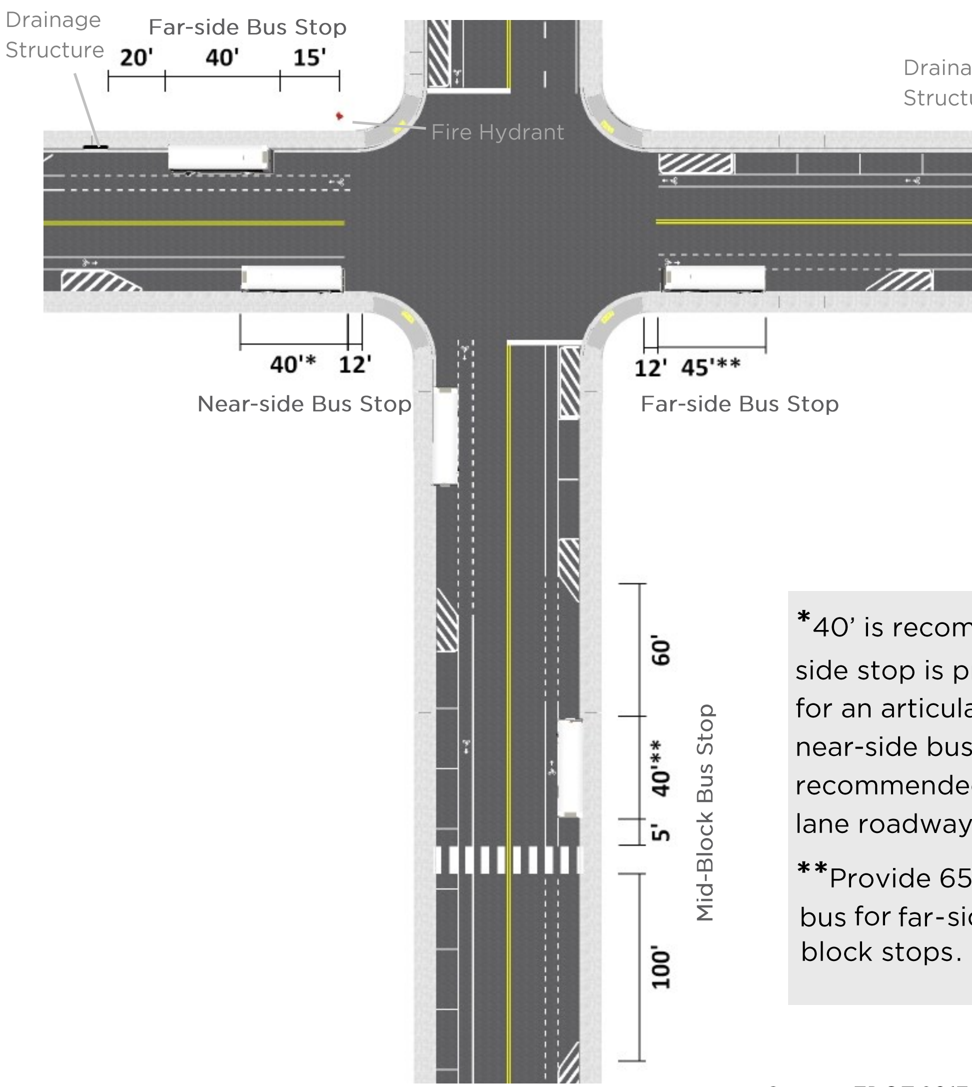
When placing a bus stop at an unsignalized (sometimes called minor) intersection, a minimum distance of 12 feet from the intersection point of curve/tangent or edge of crosswalk, whichever is farther back from the intersection, should be maintained. If the intersection is signalized (or major), the minimum 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.[2] Figures 4.1.3 and 4.1.4 show placements of bus stops at both minor and major intersections.

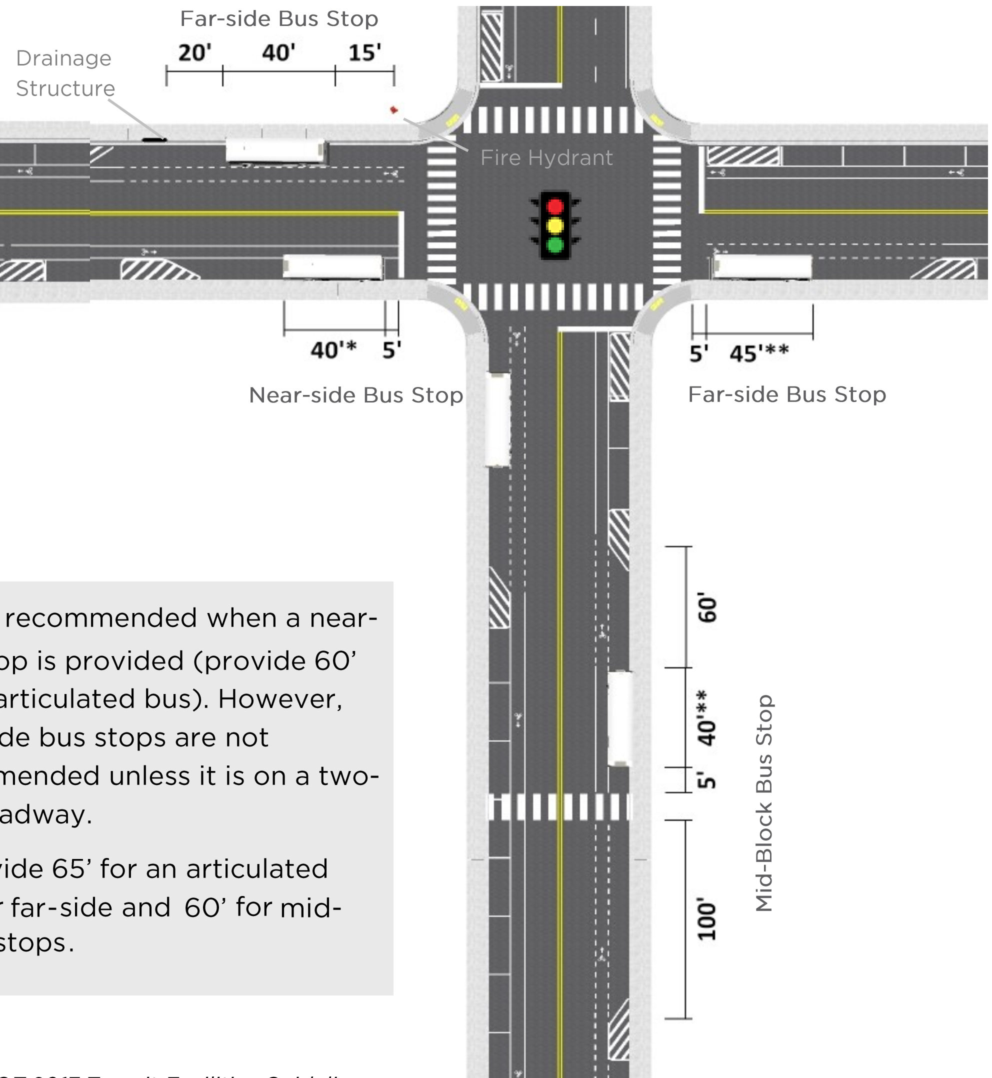
Placing bus stops in rural areas requires special consideration, due to roadway design speeds, right-of-way constraints, sight distances, and accessibility concerns. Refer to FDOT Design Standards, Index 546, for sight distances at intersections. The Florida Greenbook should be referenced for any roadways not on the State Highway System. Refer to the FDM for clear zone requirements. Any associated amenities also either should be placed outside of the clear zone or meet frangibility requirements.

OTHER CONSIDERATIONS

- If the bus stop includes a shelter, it should be placed at least 15 feet away from a pole (i.e., any non-frangible pole existing in the clear zone); under all circumstances, a minimum distance of 8 feet should be maintained.
- 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.
- A bus stop should not be placed in free-flow right-turn lanes.
- When possible, provide a bus stop at an existing roadway light pole.[2] (The recommended minimum illumination level is 1.4 horizontal foot-candles for the entire bus stop area.[6])
- 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 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.

Figure 4.1.2 | Bus stop in Volusia County, Florida.





*40’ is recommended when a near-side stop is provided (provide 60’ for an articulated bus). However, near-side bus stops are not recommended unless it is on a two-lane roadway.

**Provide 65’ for an articulated bus for far-side and 60’ for mid-block stops.

Source: FDOT 2017 Transit Facilities Guidelines.

Figure 4.1.3 | Recommended bus stop placement at a minor intersection.

Figure 4.1.4 | Recommended bus stop placement at a major intersection.

CASE STUDY

Correct Placement of Bus Stop Components - A Team Effort that Can Save Later

Alachua County, FL

A bus stop for the Reginal Transit System (RTS) in Alachua County has a properly designed and placed bus bay; but, the bus stop, designed without close coordination with RTS, has resulted in a few operational, safety, and accessibility issues for RTS. The bus stop on North Main Street has been located too close to a pre-existing oak tree, which prevents the bus from being able to pull up to the front of the stop. Thus, the bus is not fully pulled into the bay when it serves this bus stop.

While the designers did reference the correct length for the bus bay, the fact that the bus must be able to pull its front door up to the beginning of the parallel portion of the stopping area was missed, resulting in the placement of the bus stop in the middle of the bay. In addition, the designers also placed a bench such that it obstructs the bus stop's B&A area.

Currently, despite limited financial resources, RTS is using maintenance crews to move this bench and few others with similar accessibility concerns. RTS also has started to have more discussions with project managers and on-site construction managers in order to solve this issue and prevent similar ones in the future. RTS staff have found that it is crucial to emphasize conducting site visits and consulting with the local transit agency before implementing these designs. By educating their counterparts on FDOT's written guidance and strengthening these relationships, RTS is working on ensuring that these design mistakes do not happen in the future.

Source: RTS/Google

Source: RTS/Google

4.2 SPATIAL LOCATION

Selecting an appropriate location for a bus stop spatially, with respect to an intersection, bridge, driveway, or other key feature on the roadway, can be critical to any transit agency's efforts to provide safe and accessible transit. The following section discusses the options, as well as advantages and disadvantages, of spatial location typologies typically used in bus stop placement.

When choosing a spatial location for a bus stop, it is important to consider several key aspects relative to the bus stop, such as visibility of waiting transit patrons, the ability for riders to easily access other routes for transfers, the potential for minimizing impact on traffic congestion, and possible impact from driveways and other variables surrounding the bus stop. Proper placement of a bus stop will promote the safe, accessible, and effective use of that bus stop.

TYPICAL LOCATIONS

Far-Side of an Intersection

Far-side bus stops generally are preferred to near-side stops (unless near-side stops are the only option given site conditions and/or operational considerations) because they may result in fewer traffic delays, provide better vehicle and pedestrian sight distances, and cause fewer conflicts with other vehicles and pedestrians/bicyclists. Far-side stops are recommended especially when transit preferential treatments such as bus lanes or transit signal priority are used.

Near-Side of an Intersection

Near-side bus stops should be located upstream of an intersection far enough to avoid conflicts with vehicles. They are preferred on two-lane roadways without a bus bay/pullout, 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 or when street crossings and other pedestrian movements are safer on the near side than the far side. It also is applicable when the cross-street is one-way from right to left or if the bus route needs to turn right at an intersection. However, near-side stops are discouraged at intersections with dedicated right-turn lanes where right-on-red turning is permitted.

PLACEMENT TIP

FDOT Recommendations—Based on the Transit Facilities Guidelines and the Design Manual from FDOT's Public Transit Office:

- Far-side bus stops are generally preferred over near-side stops and bays
    - Exception is at two-lane roadways where vehicles are restricted from going around the bus stopped at a curbside stop
- Bus bays are generally preferred over curbside bus stops in travel lanes
    - Particularly for arterial design speeds greater than or equal to 45 mph
    - Where there is significant bus and passenger volumes
    - When placed downstream from a traffic signal
- Closed bus bays are generally preferred over open bus bays
    - Exception would be at a physically constrained site.

Mid-Block Between Intersections

Mid-block stops are appropriate only when traffic or street/sidewalk conditions at the intersection are not conducive for either a near- or far-side stop. 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 bus stop spacing standards of the local transit agency.

Additionally, mid-block stops sometimes may be used when the bus stop design is part of a larger plan for a corridor or district. If provided, mid-block crosswalks to facilitate pedestrians crossing to reach the bus stop should be evaluated carefully. For example, mid-block crosswalks are discouraged immediately downstream from an intersection, i.e., within 1/8 mile or 600 feet, because such a distance to the intersection is near enough to walk and drivers may not expect a mid-block pedestrian crossing so close to the intersection. When placed appropriately near a bus stop, mid-block crossings should be well-lit and well-marked, and on-street parking should be prohibited in advance of all mid-block crosswalks.

PLACEMENT TIP

If near-side bus stop is the appropriate option, locate it in advance of the leading taper for the right-turn lane to provide sufficient distance for drivers to see and access the turn lane.

If mid-block bus stop is the appropriate option, avoid them near schools.

Tables 4.2.1 provides recommendations and guidance on when agencies should consider placing far-side, near-side, and mid-block bus stops, including the pros and cons of such placements. In addition, Table 4.2.2 provides additional bus stop location criteria to consider based on the type of intersection involved when planning bus stop placement along a state road facility without on-street parking.

UNCOMMON LOCATIONS

A number of placement scenarios that are less common but sometimes occur when siting bus stops are discussed below. Agencies also should refer to FDOT Design Standards, Design Manual, and the Transit Facilities Guidelines provided by FDOT's Public Transit Office, as well as coordinate, as needed, with the FDOT Design Office when placing bus stops at these locations.

Near Bridges

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 bus 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 also must 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.

Table 4.2.1
Recommendations for Placement of Bus Stops at Intersections[5B]

	When to Consider	Pros	Cons
Near-Side	• Where traffic is heavier on the far-side of the intersection • Existing pedestrian conditions and movements are better than on the far-side • Bus route continues straight through the intersection, or the stop is set back a reasonable distance to enable right turn • When a curb extension prevents vehicles from turning right directly in front of a bus • Where accumulation of buses at a far-side stop spill over into intersection	• 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.
Far-Side	• Traffic is heavier on the near-side of an intersection • At heavy right turns on major approach of heavy left and through movements from side street • When pedestrian conditions are better than the near-side • At complex intersections with multiphase signals or dual turn lanes; this removes buses from the area of complicated traffic movements	• 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	• 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
Mid Block	• Where traffic or street/sidewalk conditions at the intersection are not conductive to a near- or far-side stop • Trip generators are located mid block and/or adjacent intersections are not too far apart	• Minimizes sight distance problems for vehicles and pedestrians • May allow passenger waiting areas to experience less pedestrian congestion • Conflicts with intersection traffic is minimized	• Requires additional distance for no-parking restrictions • Mid-block crosswalk may need to be implemented • Increases walking distance for patrons crossing at intersections

Table 4.2.2
Bus Stop Placement Criteria by Type of Intersection[2]

If the selected locations is at	When there is no turn lane upstream	When there is a right turn lane upstream	When there is a right turn lane upstream and an auxiliary lane downstream**	There is only an auxiliary lane downstream***
Near-side of major intersection	Not recommended* unless 2-lane roadway	Not recommended unless 2-lane roadway 10' before entry taper for turn bay 100' before if it is a drop lane	Not recommended unless 2-lane roadway	Not recommended* unless 2-lane roadway
Far-side of major intersection	Provide 45' for a standard bus (65' for an articulated bus)	Provide 45' for a standard bus (65' for an articulated bus)	110'**	Provide 45' for a standard bus (65' for an articulated bus)***
Near-side of minor intersection	Not recommended unless 2-lane roadway or located outside of sight triangle	As close to entry taper as feasible and located outside of sight triangle	N/A	N/A
Far-side of minor intersection	Provide 45' for a standard bus (65' for an articulated bus)	Provide 45' for a standard bus (65' for an articulated bus)	N/A	N/A

**If necessary, 12' minimum dimension is required*

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

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

Note: This table is prepared as a guideline for the location of bus stops along a state road facility where on-street parking does not exist.

Adjacent to Canals

Where right-of-way is constrained, a bus stop could be designed to encroach into a canal right-of-way or be built partially or wholly over a canal. A continuous handrail or pedestrian/bicycle rail on a barrier wall should be provided around bus 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.

REQUIREMENTS

- *Locate guardrail no closer than 6 feet from the canal front slope.*[3]
- *Locate High Tension Cable Barrier no closer than 15 feet from the canal front slope.*[3]

Near Guardrails

Bus stops should be located outside a guardrail that runs parallel to a roadway. An opening should be provided in the guardrail to permit pedestrian access. When a guardrail exists on a roadway that has or will have transit service, 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 drop-off or is located near drainage or a canal. Figure 4.2.1 shows an example of a bus stop near a guardrail and adjacent to a canal.

Figure 4.2.1 | Bus stop located near a canal and adjacent to a guardrail.

Near Driveways

Figures 4.2.2 and 4.2.3 provide examples of acceptable bus stop placements near driveways. Bus stops should 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. In the case of a property having two adjacent driveways, the downstream driveway would be the preferred driveway to block, requiring vehicles to make needed turns behind a stopped bus. Bus stop infrastructure and amenities should not block the view of traffic entering or exiting the driveway. Bus stops where a vehicle must block an access way should not be layover points or transfer locations. However, when there is a possibility of a transit vehicle blocking the only access route to a property, the agency placing the bus stop should consult roadway authorities and the property owner.

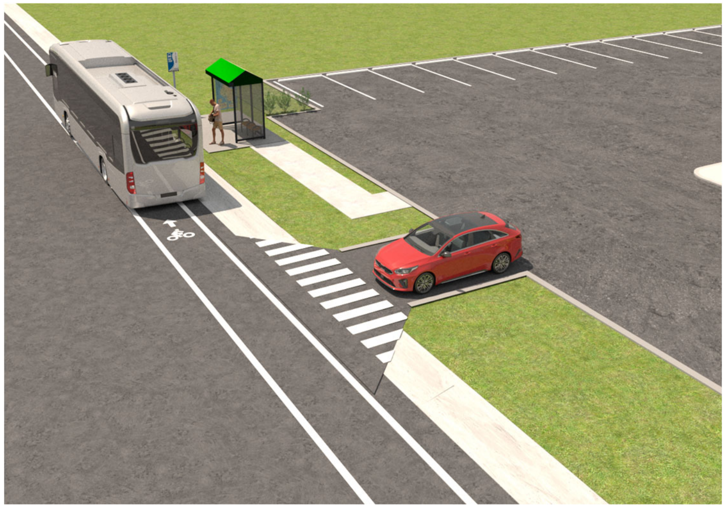


Figure 4.2.2 | Acceptable bus stop placement near single driveway.

Based on FDOT's Transit Facilities Guidelines on placing bus stops near driveways, agencies should:

- Avoid bus stops that block the driveway of a lot with a single driveway.
- Not locate bus stops within the area of influence of a driveway to avoid sight distance and other conflicts. However, if the situation cannot be avoided:
    - Locate the stop as far downstream (far side) from the driveway as feasible.
    - Avoid upstream (near side) stops in the travel lane; upstream bays are acceptable.
    - Locate the bus stop to allow appropriate visibility for vehicles entering or leaving the development and to minimize vehicle/bus conflicts.
    - Locate the bus stop so that passengers are not forced to wait for a bus in the middle of a driveway.
    - Locate the bus stop so that patrons board or alight directly from the curb rather than from the driveway.
    - Locate the bus stop so that the front door B&A area is located outside of the driveway.
    - Attempt to keep at least one exit and entrance driveway open for vehicles accessing the development while a bus is loading and unloading passengers.

Figure 4.2.3 | Acceptable bus stop placement near two driveways.

- For unacceptable conditions at a corner parcel, moving the stop downstream to the next parcel should be evaluated.

NEAR CURVES AND HILLCRESTS

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 to avoid the bus being struck from the rear. Even with a bus bay at such stops, pulling back into the travel lane may pose a traffic safety risk. If a bus stop must be placed at such a location, approaching vehicles should be warned of the need to be prepared to stop well in advance with proper signage (refer to the most recent MUTCD for additional guidance on such signage).

REQUIREMENTS

- *Near-side bus stops shall be located so that railroad warning signs are not obstructed by a stopped bus.*[2]
- *For near-side or far-side bus bays, provide a minimum of 50 feet to the nearest rail line (per Florida Statute 316.1945 (1).* [2]

NEAR SCHOOLS

In locating transit facilities near primary schools, bus 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.

NEAR RAILWAY CROSSINGS

The following recommendations and limitations should be considered when locating bus stops near railway crossings.[2]

- Bus stops should be located so that a stopped bus does not obstruct any railroad warning signs.
- When possible, 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. These stopping sight distances apply to all instances where stopping sight distance is important. Figure 4.2.4 shows an example of a bus stop placement at a railway crossing. Figure 4.2.5 shows the placement dimensions for bus stops near an at-grade railway crossing.

See FDOT Design Standards Index 17346 and 17882 for railroad marking and sign details not shown here. Agencies should refer to FDOT Design Standards, FDM, and MUTCD for additional requirements and guidelines prior to placing bus stops near a railway crossing.

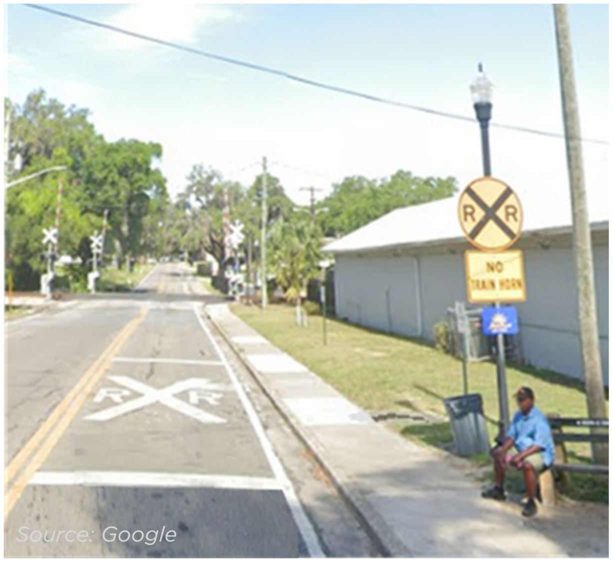


Figure 4.2.4 | Bus stop placement near a railroad in Ocala, Florida.

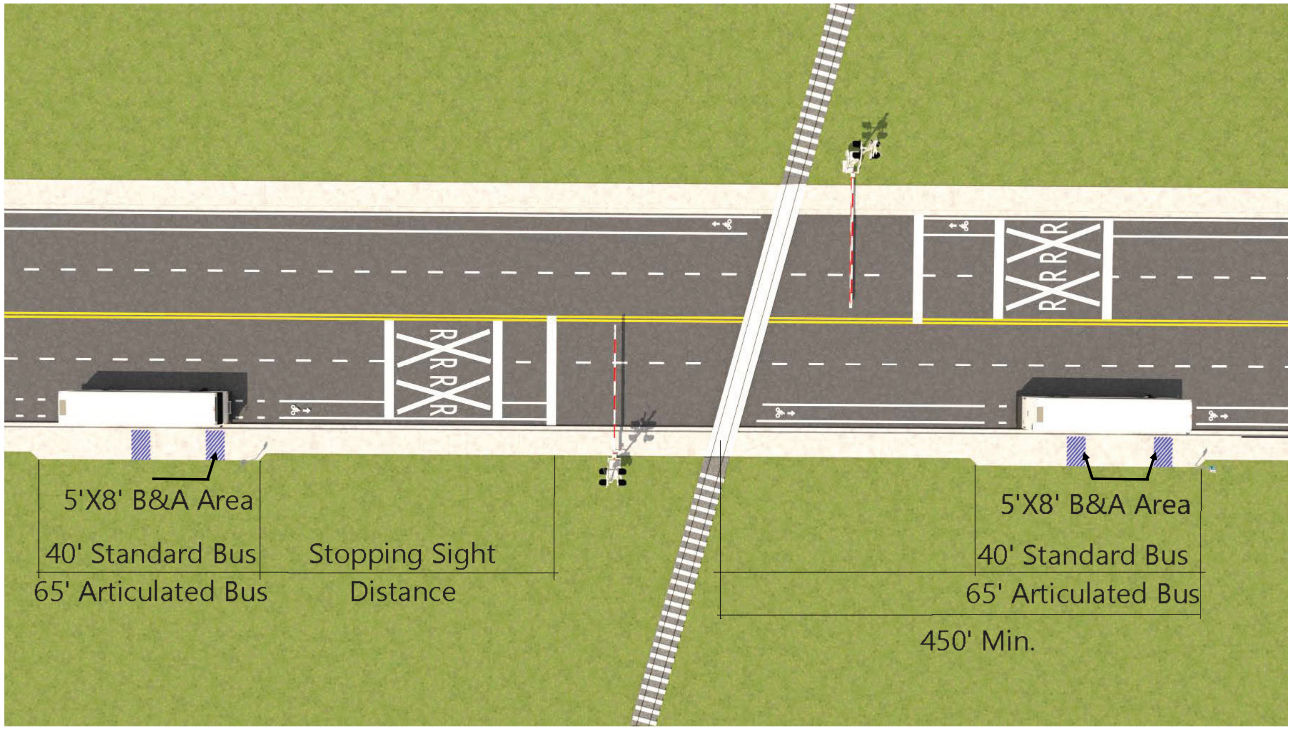


Table 4.2.3 Stopping Sight Distances for Near Side Stops[2]	
Design Speed (mph)	Stopping Sight Distance (feet)
25	155
30	200
35	250
40	305
45	360
50	425
55	495
60	570
65	645
70	730

Figure 4.2.5 | Placement of urban bus stop near at-grade railroad crossing.

Notes:

1. *Stopping Sight Distance (SSD) minimum value calculated based on providing appropriate stopping sight distance to railroad crossing; dimension should be verified based on the specific design conditions of each crossing.*
2. *450 feet minimum value calculated based on accommodating the queue that would develop during a 60-second period bus stop. Dimension should be verified based on the specific design conditions, traffic projections, and expected bus stop delays at each crossing.*

BUS STOP SPACING

Bus stop spacing considers the distance between consecutive bus stops along a fixed route. As part of stop placement, proper bus stop spacing plays an important role in overall transit system performance as it may contribute to improved service efficiency and minimized travel times if maintained appropriately.

While it may not be practical always, uniform bus stop placement is encouraged as it may promote understanding of the transit system and encourage ridership. Bus stops placed too closely together in unproductive ridership areas not only can add to bus travel time delays, but also waste valuable capital resources. Spacing bus stops too far apart also can quickly diminish overall effectiveness of the transit system, as well. The best practice in bus stop placement decisions involves considering service corridor population and job densities, accessibility needs, route purpose, destination types, and local traffic patterns. Figure 4.2.6 shows closely placed bus stops.

While bus stop placement should occur on a case-by-case basis, following general guidelines on spacing remains an effective practice during the placement process. Consideration of roadway characteristics, such as average speed and street width, pedestrian safety and access, route and shared/micromobility connections, expected ridership activity/productivity, and visibility are all important factors to consider when establishing and adjusting bus stop spacing. However, even if an agency uses sound bus stop spacing guidelines, a periodic reexamination of such spacing criteria also is recommended.

Industry practices on spacing vary, as different agencies opt for different bus stop spacing standards. Highly urbanized areas should target 1 bus stop per every quarter mile or less, totaling 4 to 8 bus stops per mile on average, as demand increases. Low density areas may aim for at least 2 bus stops per mile on average, and increase it to at least 4 bus stops per mile on average in suburban areas.

Table 4.2.4 shows typical bus stop spacing criteria that have been applied in Florida by various agencies. For each area or land use type, the table shows typical average corresponding stop spacing and also indicates the time that a passenger would take to reach a stop with that spacing criteria.

Often, bus stops also are added, relocated, and/or removed on an as-requested basis along existing bus routes. These decisions 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.

Table 4.2.4
Typical Bus Stop Spacing Criteria

Area/Land Use	Average Bus Stop Spacing	Average Maximum Walking Time to Nearest Bus Stop*
Urban/CBD/High density residential or commercial	1/8-mile to 1/4-Mile	2-4 minutes
Suburban/medium density residential or commercial clusters	1/4-Mile	4 minutes
Rural/low density residential	1/4-mile to 1/2-Mile	4-8 minutes

* *Average walking time is based on a 4-mph walking speed.*

Figure 4.2.6 | Closely placed bus stops in Pensacola, Florida.

4.3 GEOMETRIC PLACEMENT

The geometric placement of a bus stop refers to the position of the bus stop relative to the travel lanes, including on- and off-lane bus stops. On-lane bus stops are located immediately adjacent to the travel lane and require buses to complete the boarding and alighting process while stopped in the travel lane, eliminating the need to exit the lane or merge back into traffic. Off-lane bus stops allow buses to exit the travel lane momentarily into a bus bay or bus pullout to accommodate passenger boardings and alightings before merging back into traffic. Due to the differences in road geometry throughout a transit agency's service area, appropriate bus stop placement requires consideration of factors such as the usability of right-of-way, subsequent effects on traffic flow, visibility to bus operators and pedestrians, and presence of bike lanes.

ON-LANE BUS STOPS

Curbside/Shoulder

This is the most common placement of bus stops due to its often lower cost and shorter time for implementation. Available at curbside or on road shoulder, this placement offers the bus vehicle easy access to the bus stop, without the need for merging, and enabling the bus to continue its route quickly after a stop. These bus stops can increase the overall bus route speed, improve reliability, and require less right-of-way than off-lane stops, leaving more space for bus stop shelters and additional curbside amenities. However, on-lane bus stops also can encourage other drivers to pass the bus using adjacent travel lanes, or cause vehicles to line up behind the bus during its stop. Figure 4.3.1 shows an on-lane bus stop.

Figure 4.3.1 | On-lane bus stop in Jacksonville, Florida.

Table 4.3.1
Advantages and Disadvantages of On-Lane Bus Stops

Advantages	Disadvantages
• Bus vehicle can access the stop easily and no need for any merging maneuvers • Requires minimal infrastructure modifications and easy to relocate • Appropriate for low volume roadways with less frequent bus service • Increases the chances of locating bus stops more frequently or more conveniently	• Not recommended when design speeds are over 45 mph • Increased risks for bus passengers while boarding and alighting • Impacts other traffic, other vehicles that may queue behind bus • Other drivers may make unsafe lane changes to avoid stopping behind a bus • May require passengers to walk between parked cars or to get to the curb lane • Increases risk of a vehicle/pedestrian conflict

The pros and cons of on-lane stops are detailed in Table 4.3.1. Additional considerations for the placement of on-lane, or curbside, bus stops include the following:

- The design speed is less than or equal to 45 mph.
- Adequate curb length is present to accommodate a bus stop zone.
- There is adequate space in the right-of-way for the potential implementation of shelters and benches.
- Access can be provided for passengers with disabilities.
- Connections exist to pedestrian facilities.
- Street lighting exists for nighttime routes.

Rural bus stops are mostly on-lane bus stops that are located on the roadway shoulder. They typically include the minimum required components such as a bus stop sign and a B&A area (sometimes on concrete). However, when sited, on-lane stops in rural areas 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. Figure 4.3.2 shows a on-lane rural bus stop.

Figure 4.3.2 | On-lane rural bus stop in Volusia County, Florida.

Bus Bulbs/Nubs

A bus bulb, or bus nub, extends the curb-line into the roadway shoulder or a parking lane, providing additional curbside space for pedestrians to walk and transit patrons to wait for the bus. The extended area also can provide more space for bus stop infrastructure and amenities. A bus bulb (also sometimes called a curb extension) can be located on the near-side, far-side, or both sides of an intersection and takes the extension of the curb-line to the edge of the first through traffic lane.

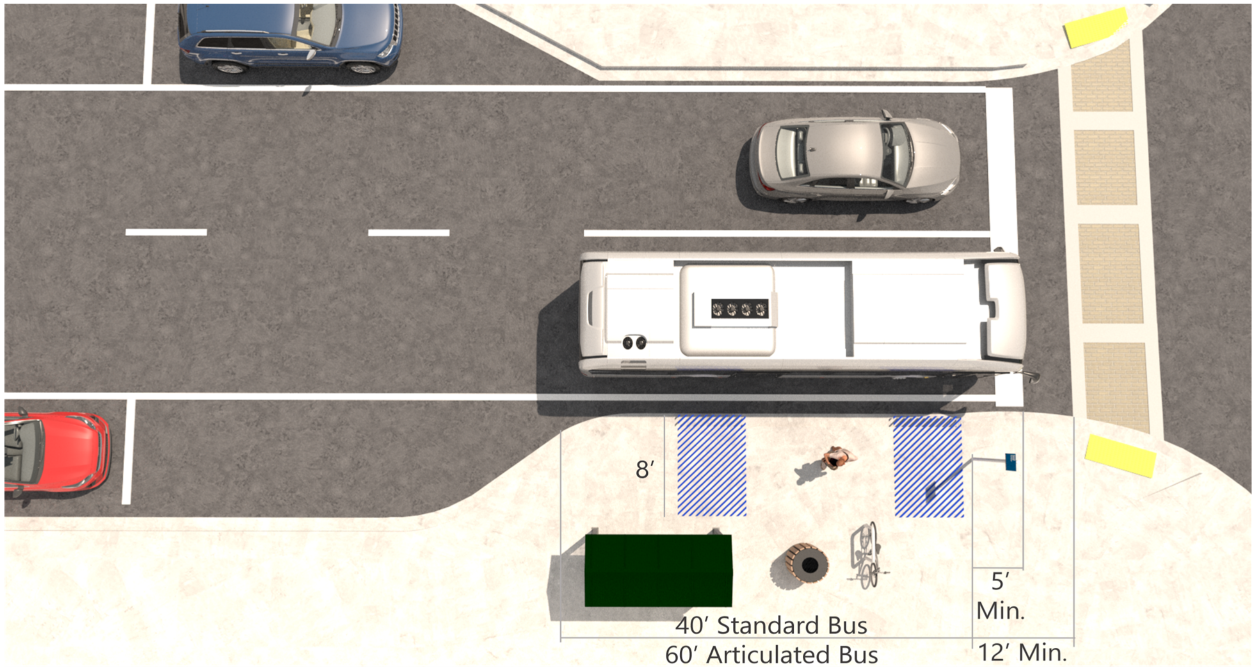


Figure 4.3.3 | Dimensions of a near-side bus bulb bus stop.

Similar to an on-lane bus stop, buses accessing a bus bulb stop in the travel lane to pick up and discharge passengers, reducing delays associated with buses having to merge back into the lane and re-enter traffic. Figure 4.3.3 shows the layout and dimensions of a typical bus bulb application.

This type of bus stop may be most appropriate in urban settings with high -density, mixed-use developments and crowded sidewalks, where a relatively higher number of people move along the street as pedestrians. The bus bulb allows transit patrons to wait comfortably within the extended bus stop space while avoiding the pedestrian foot traffic on the sidewalk.

The following areas should be considered for the placement of bus bulb/ nub bus stops:[2]

- On streets that are perceived to be pedestrian-friendly.
- Where parking is critical (and bus bays may take up too much space).
- Where buses experience delays in re-entering the traffic lane.

Design Dimensions

A bus bulb should be:[2]

- A minimum of 8' wide
- Leave a 5' offset between the bus stop sign and the stop bar
- Accommodate a 12' offset between the sign and the start of the crosswalk
- Include sufficient curb length for at least one standard (40') or articulated (60') bus (with more curb length needed at bus stops that serve as transfer points for two or more buses)

- Where traffic calming is desired.
- 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 curb parking.
- Where there is no right turn lane.
- 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 on 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.

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. The near-side bus bulb design limits opportunities for transit signal priority. However, vehicles behind a stopped bus are queued mid-block instead of at the intersection. The far-side bus bulb design better supports transit signal priority, and vehicles turning right can use the curb lane.

Table 4.3.2
Advantages and Disadvantages of Bus Bulbs/Nubs

Advantages	Disadvantages
• Allows easy access to the bus stop for the bus operator • Eliminates delay for bus returning to travel stream • Improves transit speed/travel time as compared to a bus bay • Used in combination with parking in the curb lane • Removes fewer parking spaces for the bus stop than the curbside bus stop or bus bay • Provides additional sidewalk area for pedestrians and passengers to wait for the bus • Reduces pedestrian distance to cross the street and increases visibility • Narrows the curb-to-curb distance, potentially reducing vehicle speeds	• More difficult if the bus stop needs to be moved/eliminated • Bus is not removed from the travel lane so it may impact traffic when stopped • Requires a larger capital investment than curbside bus stop • Impacts other vehicles that may queue behind the bus • Other drivers may make unsafe lane changes to avoid stopping behind the bus • Provisions for cyclists needed since bicycle lanes may have to be routed around the curb extension, creating potential vehicle and bicycle conflicts

A key design consideration for bus bulbs is that site drainage patterns may need to be reworked to prevent water from ponding in the stop vicinity. Right-turn restrictions also may be required because of the tighter curb radius associated with the treatment. Table 4.3.2 shows the pros and cons of bus bulbs and nubs.

Boarding Island/Floating Bus Stop

Like bus bulbs/nubs, boarding island bus stops allow the bus vehicle to remain in the travel lane for loading and unloading passengers. With this particular on-lane bus stop type, a bus stops at an "island" pad, fully detached from the main sidewalk structure, leaving space between the bus stop and the sidewalk, which can be used to accommodate a dedicated bike lane. Figure 4.3.4 shows an example of a boarding island and Table 4.3.3 shows the advantages and disadvantages of boarding islands/floating bus stops.

Figure 4.3.4 | Example of boarding island/floating bus stop.

Boarding islands may provide a beneficial solution to bus/bike conflicts that are

Table 4.3.3
Advantages and Disadvantages of Boarding Island/Floating Bus Stop

Advantages	Disadvantages
• Eliminates merging maneuvers • Improves transit loading time • Provides exclusive space for passengers to wait for the bus • Allows dedicated pathway for pedestrian traffic	• More difficult if the stop needs to be moved/eliminated • Requires a larger capital investment than curbside bus stop • Creates potential bus/vehicle conflicts when bus reenters busy travel lanes • May reduce curbside parking space

common at typical on-lane bus stops by redirecting bicycle traffic to the back of the bus stop. It also is useful in heavy pedestrian activity areas since the bus stop is detached from the sidewalk, which helps separate waiting transit patrons from pedestrians and reduces sidewalk congestion.

OFF-LANE BUS STOPS

Bus Bays

Bus bays, known also as bus pullouts or turnouts, are a type of off-lane bus stop that help improve safety for passengers alighting and boarding by providing a protected area for a stopped bus away from moving traffic. Bus bays also are helpful in accommodating buses with longer dwell times and/or needing 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. Bus bays are encouraged on roadways with high operating speeds, such as roads that are part of the urban principal arterial system. Bus bays also can be considered at locations where buses may have longer stop times due to large numbers of boardings and alightings occurring at the same time.

For a particular bus stop, a high frequency of crashes involving buses may be a good indicator of the need for a bus bay. Bus bays also should be considered when right-of-way width is adequate to construct the bay without adversely affecting sidewalk pedestrian movement and also when certain improvements (e.g., widening) are planned for a roadway, presenting an opportunity to include a pullout in the construction process.

REQUIREMENTS

- *Drainage structures are not to be located within the bus bay.*[2]
- *All concrete joints shall be as per the latest version of the FDOT roadway and design standards.*[2]

Figure 4.3.5 shows an example of a bus bay. Per FDM, 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.

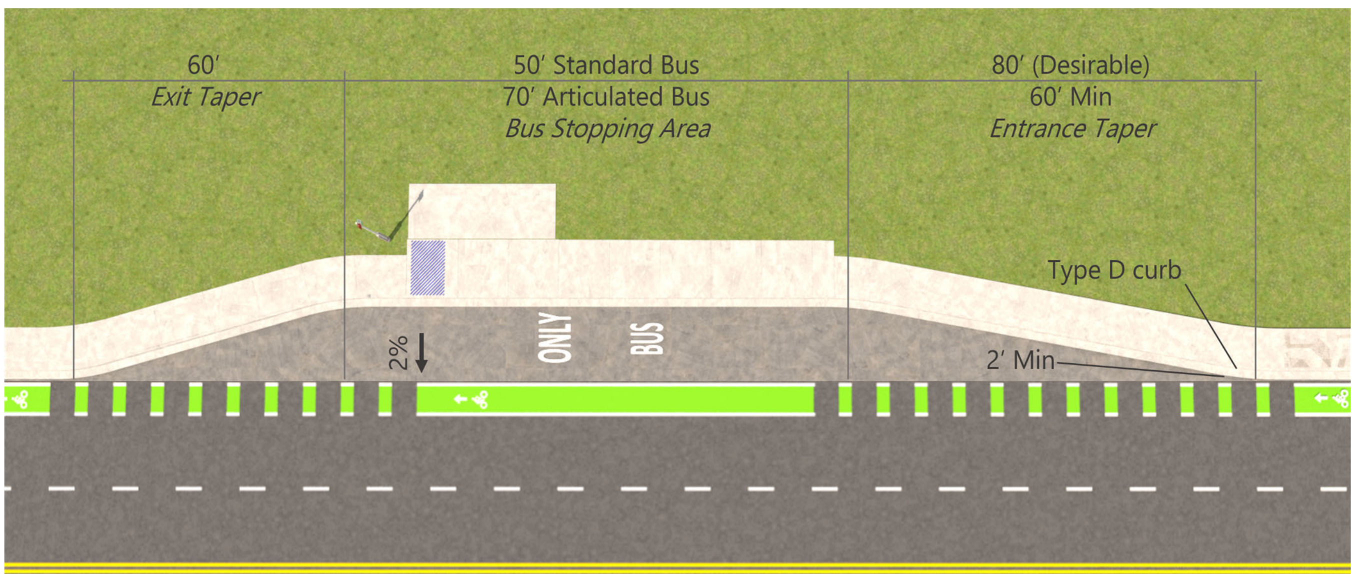


Figure 4.3.5 | Minimum components of a concrete bus bay in an urban/curb-and-gutter condition.

Bus bays also should be considered when:

- Traffic volumes are less than 1,000 vehicles per hour per lane (additional consideration necessary if it exceeds this volume).
- Traffic speed is 45 mph or greater.
- 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 (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 transit signal priority treatment exists at the intersection (near-side stop).
- 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.
- Roadway profile low points can be avoided.
- A 2% cross-slope can be achieved on the roadway.

Figure 4.3.6 | Bus bay application at a bus stop in Jacksonville, Florida.

Figure 4.3.6 shows a bus bay being used by the Jacksonville Flyer bus rapid transit service. When traffic volumes exceed 1,000 vehicles per hour per lane on a roadway, some considerations for a bus bay application include incorporating an acceleration lane, coordinating

Table 4.3.4
Advantages and Disadvantages of Bus Bays

Advantages	Disadvantages
• Allows buses to stop and drop off and pick up passengers outside the travel lanes • Provides a protected area away from moving traffic for stopped buses with long dwell times and/or layovers • Minimizes traffic delays due to bus operations • Improves safety for passenger boarding and alighting by increasing the distance between passengers and moving traffic	• May cause service delays if bus operators have difficulty reentering travel lanes, especially along high-speed and/or high-volume roadways • Requires infrastructure modifications • More difficult if the stop needs to be moved/eliminated • Creates potential bus/vehicle conflicts when bus reenters busy travel lanes • May reduce curbside parking space • May reduce sidewalk space and increase pedestrian congestion

the bay with transit signal priority, or using a far-side (rather than near-side or mid-block) placement as it may be difficult to maneuver a bus into the bay and back into the travel lane with those traffic volumes. When possible, bus bays should be located on the far-side of a signalized intersection as a best practice so that buses exiting the bay can use the signal to provide gaps in traffic for merging. Table 4.3.4 lists the key pros and cons for the provision of bus bays in Florida.

Table 4.3.5
Bus Bay Element Lengths and Speeds

Thru Speed	Enter Speed	Length					
		Entrance Taper	Decel. Lane	Stopping Area	Accel. Lane	Exit Taper	Total
<30	<20	5:1min	None	50	None	3:1 max	130min
35	25	170	185	50	250	170	825
40	30	190	265	50	400	190	1095
45	35	210	360	50	700	210	1530
50	40	230	470	50	975	230	1955
55	45	250	595	50	1400	250	2545
60	50	270	735	50	1900	270	3255

Source: AASHTO 2014 Guide for Geometric Design of Transit Facilities on Highways and Streets.

Table 4.3.5 provides suggested lengths for acceleration lanes, deceleration lanes, and entrance and exit tapers, as recommended by AASHTO in its Guide for Geometric Design of Transit Facilities on Highways and Streets. The lengths are based on the through-speed of the adjacent travel lane and the speed of the bus entering the bus bay.

Bus bays may be appropriate at mid-block stops associated with destinations that are major transit trip generators. However, near -side bus bays should be avoided because of potential conflicts with right-turning vehicles and delays in service resulting from the difficulty associated with bus re-entry into the travel lane.

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 a bus bay's stopping area or B&A areas. While drainage inlets should not be placed in the key functional areas of a bus bay, they may be placed at the exterior edge when drainage restrictions are severe.

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,

Design Dimensions

- In curb-and-gutter locations, the bus bay pavement should slope into the roadway at a 2% cross-slope that directs run-off to a drainage structure located outside the bus bay area.[3]
- 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.[2]
- A broken 6" white stripe and 2' dash by 4' skip should be used in areas where buses will be entering/leaving the bus bay (entrance and exit tapers).[3]
- A solid 6" white stripe should be used between dashed areas to delineate the travel lane for through vehicles.[3]

FDOT

and joint details. The FDM should be used for guidance on alternative pavement treatments (patterns or textures), standards, and limitations on materials used for bus bays. Signage and pavement markings must be used at bus bays to differentiate them from travel lanes. 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.

TYPES OF BUS BAY DESIGNS

Closed Bus Bay

A typical closed bus bay, as shown in Figure 4.3.7 consists of a physical entrance taper, a stopping area, and a physical exit taper (with acceleration/ deceleration lane applications generally dependent on adjacent roadway volume and speed). Closed bus bays usually are located at far-side bus stops at signalized intersections. As noted previously, the

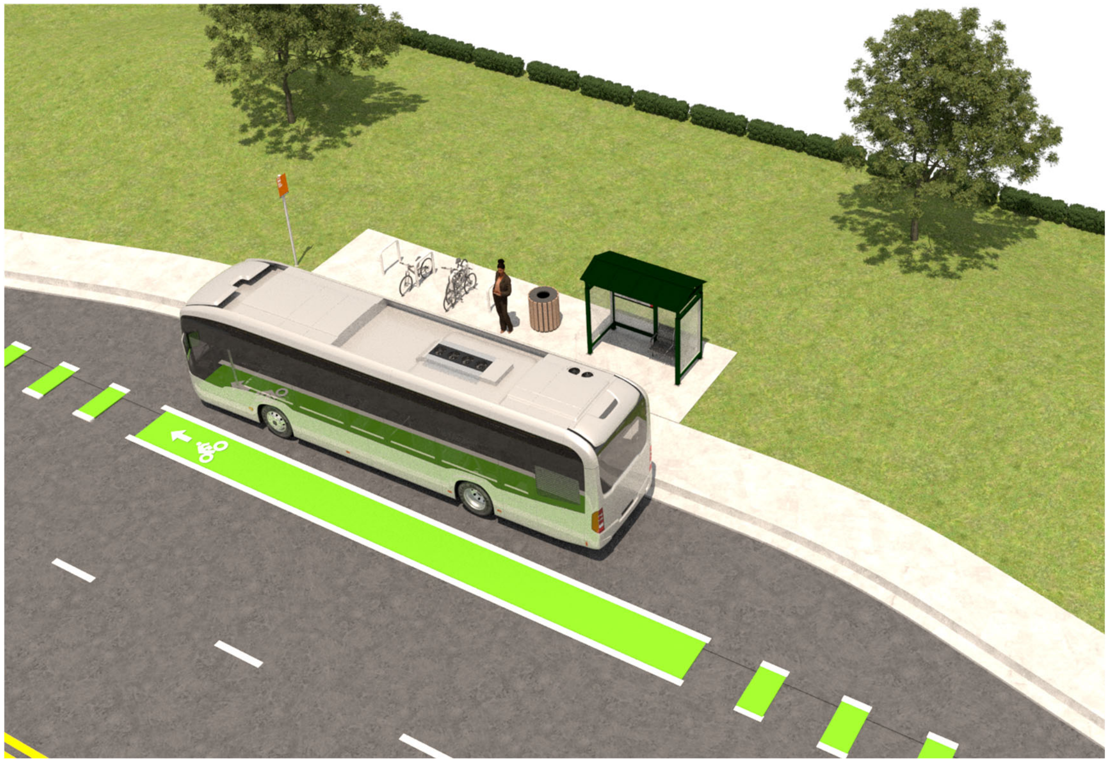


Figure 4.3.7 | Example of a closed bus bay.

Design Dimensions

- For stopping area, allow 50’ for each standard 40’ bus and 70’ for each 60’ articulated bus. Increase length of bus bay by same number of feet for each standard or articulated bus expected to be at the bus stop simultaneously.[2]
- When no bus shelter is used, extend the sidewalk to provide a boarding and alighting area with a min. clear length of 8’ and a min. clear width of 5’.[2]
- For additional guidance on curb-and-gutter transition, see FDOT Transit Design Standards Index 300.[2]
- A mid-block crosswalk can be associated with the bus bay at locations where there is a major transit-oriented activity center or the distance to the next intersection is greater than 300’. Signalization may be provided as per the MUTCD.[2]
- Drainage structures are not to be located within the bus bay.[2]
- Bus bay sidewalk should be connected to existing sidewalk or accessible to shoulder.[2]

signal creates breaks in the flow of traffic to permit bus operators to re-enter the travel lane safely. They also can be provided at mid-block bus stops near major transit destinations with high passenger activity and longer-than-average dwell time. Near-side bus bays generally are not recommended because of potential conflicts with vehicles approaching the intersection in a curb lane to make a right-turn.

Open Bus Bay

An open bus bay does not have a physical entrance taper and, therefore, is open to the upstream intersection. Figure 4.3.8 shows an example of an open bus bay. 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 used effectively as part of a queue jump bus bay.

Figure 4.3.8 | Example of an open Bus Bay.

DESIGN TIP

Using Concrete Instead of Asphalt Pavement for Bus Bays

Conventional asphalt pavement is flexible and can be moved by the force and heat generated by braking buses and trucks, leading to wave-shaped hills or hummocks along the length of a bus stop. This issue is pronounced at high-volume stops where dwelling buses further heat the roadway surface.[12]

Concrete, however, is known for its rigidity and durability, which help it withstand impacts due to bus weight and traffic. It also is reflective and lighter in color, helping bus operators see the bus stop better.

The typical size of an open bus bay for a 40-foot bus with a design speed of 40 mph consists of a 50-foot stop area for one bus and a 400-foot acceleration lane.

Queue Jump Bus Bay

This type of bus bay is part of transit preferential treatment application and 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 allow a bus to move around the traffic queue stopped at the signal. This bus bay type allows buses to bypass traffic congestion by moving ahead of other vehicles through the intersection. It provides an added benefit by removing stopped buses from the traffic stream and guiding them through congested intersections. It is most suitable for application on high-frequency bus service routes operating on roadways with high traffic volumes and where far-side open bus bays can be implemented.

Figure 4.3.9 present an illustration 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. The upstream right lane can be designed as a “right-turn-only except buses” lane. Signalization, if combined with transit signal priority, should be provided as per MUTCD guidelines.

Figure 4.3.9 | Queue jump bus bay at an intersection with transit signal priority.

Half-Sawtooth Bus Bay

Half-sawtooth bus bays should be used at off-lane 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 depth but allow for shorter stations. Half-sawtooth bus bays, as shown in Figure 4.3.10, sometimes are used where space is limited to provide the optimum number of bus loading positions. Table 4.3.6 presents key pros and cons for the main bus bay types.

Design Dimensions

- 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'.[5]
- The loading-lane width of 21' and 11", is the min. berth width required for half-sawtooth bays. The berth length shown (64' and 11") is for standard 40' buses with front-mounted bicycle racks; this would have to be extended for articulated buses by 20'.[2]

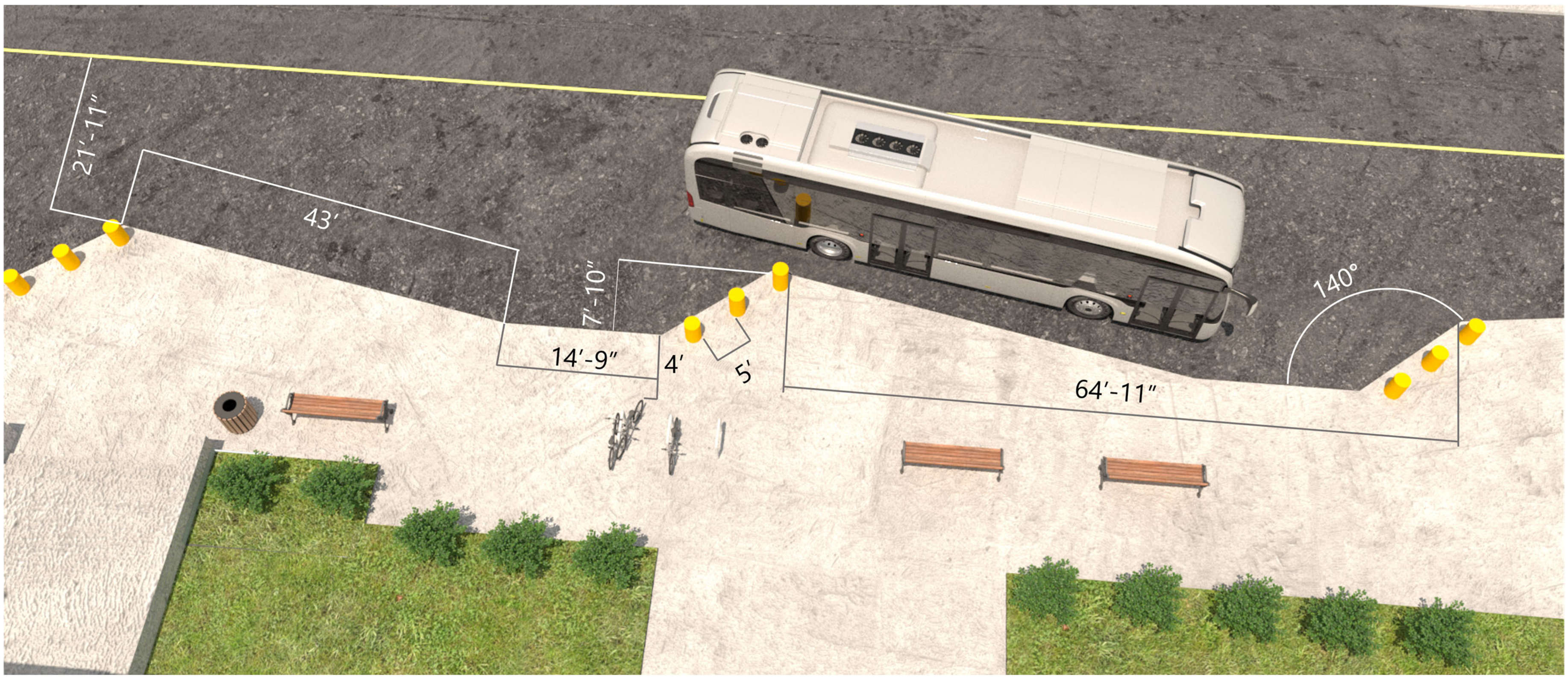


Figure 4.3.10 | Dimensions of a half-sawtooth bus bay.

Table 4.3.6
Advantages and Disadvantages of Selected Bus Bay Types

Bus Bay Type	Advantages	Disadvantages
Closed Bus Bay	• Allows bus to stop safely outside of travel lanes • Provides a protected area away from moving traffic for a bus operator to accommodate a layover or long dwell time • Allows buses to drop off and pick up passengers outside of travel lanes • Minimizes traffic delays due to bus operations • Improves safety for passenger boarding and alighting by increasing the distance between passengers and moving traffic	• May present problems to bus drivers trying to re-enter traffic, especially on roadways with high speed and/or high volume • Requires infrastructure modifications; more difficult to relocate • Creates potential bus/vehicle conflicts when buses re-enter a busy travel lane • May reduce parking space curbside • May reduce sidewalk space and increase pedestrian congestion
Open Bus Bay	• Similar advantages to the closed bus bay plus the following • Allows buses to decelerate through the intersection and move into bus bay more efficiently • Enhances the effectiveness of preferential treatments at intersections, such as transit signal priority and queue jump	• Similar disadvantages to the closed bus bay plus the following • Can create a conflict for right turning vehicles from cross-street using open bus bay for acceleration movements • Increases pedestrian crossing distance at an intersection by the width of the bus bay
Half-Sawtooth Bus Bay	• Similar advantages to the closed bus bay plus the following • Requires less length than parallel bus bays so it supports shorter transfer stations • Allows buses to leave the bay without having to wait for buses ahead of them to exit	• Requires more depth than parallel bus bays to accommodate the necessary bus maneuvers
Queue Jump Bus Bay	• Similar advantages to the open bus bay plus the following • Allows buses to proceed through intersection in advance of other traffic • Gives priority to bus movements at the intersection, which can help speed up overall traffic flow	• Similar disadvantages to the open bus bay plus the following • May cause delays to right-turning vehicles if the queue jump bus bay is used in combination with a right-turn-only lane for general traffic

BUS PREFERENTIAL TREATMENT

When operating in mixed traffic, granting preferential treatment to buses at signalized intersections can contribute significantly to faster and more reliable transit services on arterial streets. The two most common methods of preferential treatment being applied to bus service in the US and elsewhere include transit signal priority and queue jump. While each of these treatments can be implemented successfully without significant changes to existing bus stops, it is possible to modify the stops along a corridor to help improve the functionality of such treatments.

For example, the efficient placement of bus stops geometrically and spatially can enhance the effectiveness of bus preferential treatments. This is particularly true when a new bus rapid transit service is implemented along a corridor as the stop siting and design for the service can lead to more efficient boarding and alighting, as well as enhanced coordination with signal priority and other treatments, which can improve the travel time savings and on-time performance that are critical to BRT's success.

Transit Signal Priority

Transit signal priority, generally referred to as 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. It temporarily adjusts traffic signal timing at intersections to give priority to transit operating in mixed traffic or in an exclusive bus lane. Figure 4.3.11 shows a TSP application at an intersection with a far-side bus stop.

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 temporarily 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 applications are desirable in the following conditions:

- 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.
- Time saved by bus passengers and vehicle drivers and passengers along the bus route exceeds the time lost (due to increased delay) by side-street vehicle drivers and passengers.

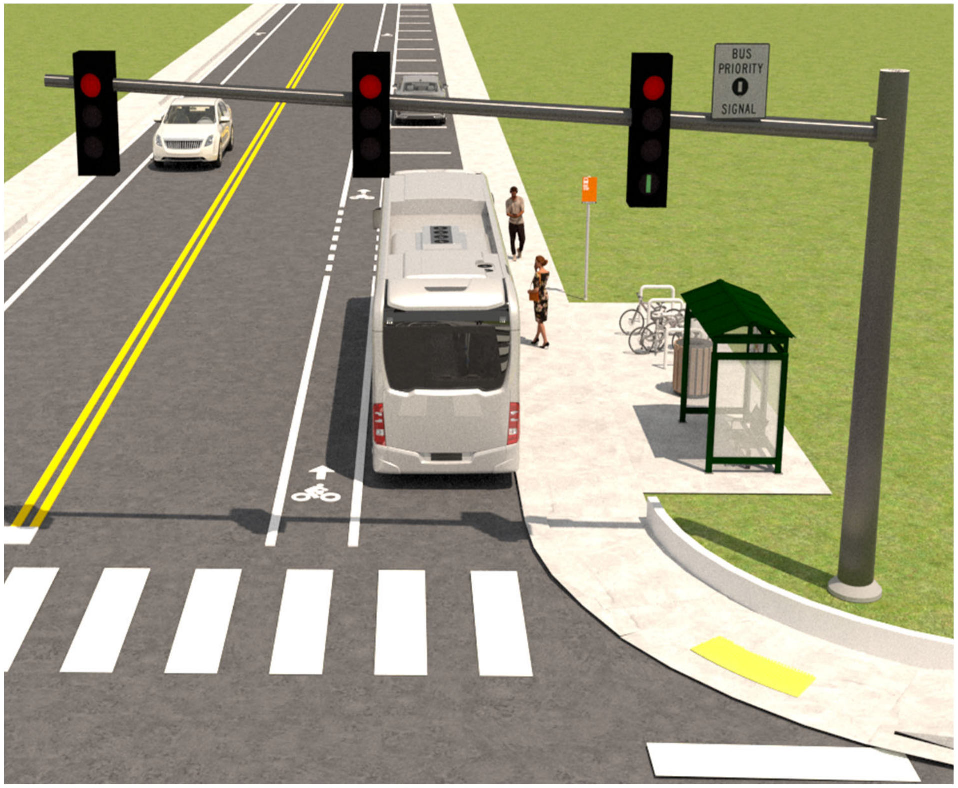


Figure 4.3.11 | TSP in use at an intersection.

- 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 at 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 conditional and 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 along a corridor. Active strategies adjust the signal timing after a transit vehicle is detected approaching an intersection.

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

The primary types of TSP are presented and further defined in the following sections, along with the key application and design considerations for their implementation.

Passive TSP/Signal Progression

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

REQUIREMENTS

- *Construction procedures related to TSP applications along state roads must comply with FDOT requirements.*

Passive priority usually is implemented only on roads with significant transit usage, often close to the bus origin point where transit schedules are most likely to be kept. Passive priority costs less, but offers limited potential to improve bus operations. Other passive improvement strategies may include adjusting signal timing plans, reducing cycle lengths, or coordinating signals along a corridor (i.e., signal progression). Passive signal priority requires no equipment and operates regardless of the presence of a transit vehicle.

Passive TSP may be considered in the following applications:

- On signalized streets with a high frequency/volume of transit vehicles, typically more than 10 per hour or with combined headways less than 4 to 6 minutes, in mixed-traffic or dedicated lanes.
- On streets with short distances between signals.
- Where active transit signal priority is less feasible or has limited benefits, including streets with short distances between signals, streets with high pedestrian activity levels, and streets with short signal cycles.
- Transit signal progressions are highly effective on one-way streets. On two-way streets, it may be necessary to prioritize the peak direction transit service if progressions are not possible in both directions.

Active TSP

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 usually is installed at specific points along the corridor associated with signalized intersections. Active TSP can reduce transit delay significantly. In some cases, bus travel times have been reduced by about 10 percent, while delay has been reduced up to 50 percent at target intersections.

Active TSP may be considered in the following applications:

- Where signals are a major source of delay for transit.
- Along corridors with relatively long distances between signals.
- At specific intersections with relatively long signal cycles.
- Where transit routes turn. There, active TSP can extend the turn phase time or reservice a turn phase to provide a clear turn lane and additional phase time for slow maneuvers.
- For BRT, as those services must rely on faster average travel speeds and reduced stop and signal delay to facilitate increased headways on high-capacity routes.

With moderate to long bus headways, it may be prudent to consider conditional TSP as it allows the signal cycle to gradually return to its non-priority timing. For corridors/intersections with high-frequency routes, agencies can determine to whether to accommodate signal priority for every bus at every signal cycle, or just conditionally for buses running behind schedule.

Active signal priority can take several forms, as described below.

Green Extension—Provides extra time for a detected transit vehicle to clear an intersection. Green extension is most applicable when

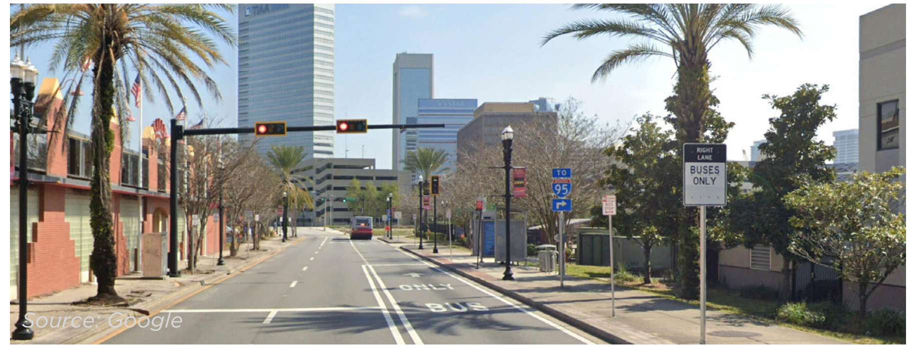


Figure 4.3.12 | Queue jump open bus bay with transit signal priority in Jacksonville, Florida.

transit runs at the back of the vehicle queue, as is common at the first signal after a far-side stop. Green extension may be the easiest form of TSP to implement on urban streets since it does not require unexpectedly truncating a pedestrian phase.

Green Reallocation—Shifts when the green phase occurs within the signal cycle. If the transit vehicle is on pace to arrive late, the green phase begins and ends late to accommodate transit. Phase reallocation provides similar benefits to phase extension, but with less impact to cross street traffic since the total green time per cycle does not change. This strategy requires automatic vehicle location (AVL) technology.

Red Truncation—Provides a green phase earlier than otherwise programmed, clearing an intersection approach with a waiting transit vehicle sooner than otherwise. Red truncation requires the detection of the transit vehicle far enough away that the crossing pedestrian phase can clear. It is easiest to implement on long blocks or on transitways with predictable travel times.

Upstream Green Truncations—Also known as a reverse queue jump, this form stops traffic behind a bus as boarding is completed, allowing the bus to re-enter the lane after a pullout stop. Upstream green truncation also can be used to stop traffic at an intersection where transit makes a far-side, in-lane stop, preventing queuing in the intersection. Green truncation is mot effective on moderate frequency transit routes where delay upon reentry due to congestion is common. It also can benefit passengers alighting and crossing the street behind the bus.

Phase Insertion & Sequence Changes—Provides special bus-only phases or prioritization of turn phases used for shared turn/queue jump lanes. Also are helpful when buses make left turns.

Phase Reservicing—Provides the same phase twice in a given signal cycle, such as a left-turn phase or a queue jump. Reservicing a phase can significantly reduce bus delay, particularly when the phase in question is relatively short.

Adaptative TSP

Adaptive priority goes beyond bus detection upon approach to an intersection and utilizes AVL to monitor the status and location of transit vehicles using GPS. The vehicle location then is communicated to the signal controller software system to optimize the flow of traffic based on the continuously updated location of the transit vehicles. This allows the TSP system to remain consistent with the real-time status of the transit vehicles based on traffic conditions and proactively process the needed transit priority measures. Adaptive transit priority is a high-cost measure, but offers significant improvements when implemented in conjunction with high volume transit corridors with considerable traffic congestion.

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 being most common) or a new exclusive bus lane developed on the intersection approach. The location and design

REQUIREMENTS

- *A queue jump bus bay requires an open bus bay on the far side of the intersection where the bus stop is located.*[5]

of various methods used for queue jumps are described below.

Queue jumps should be considered at arterial street intersections when the following factors are present:[5]

- 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.[5]

Figure 4.3.13 | Example of TSP signalization at an intersection.

Queue Jump with TSP

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 ahead of stopped, same-direction traffic, or into an open bus bay loading area on the far side of the intersection. 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. This priority treatment also can be applied in conjunction with a near-side bus stop at an intersection. Figure 4.3.13 shows an example signal head used for the purpose of a queue jump with TSP at an intersection.

At 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. Based on AASHTO's Guide for the Geometric Design of Transit Facilities on Highways and Streets, the length of the extended lane should be sufficient to exceed the traffic queue but not less than 240 feet.

Queue Jump with TSP Approaches

Queue jumps with TSP can use several approaches for bypassing through-traffic, as described below.

Shared Right Turn Lane—Provides a right-turn lane that is longer than the typical maximum queue length in the adjacent travel lanes, allowing transit vehicles sufficient space to access the lane. Since passenger vehicles waiting in this lane for right turns may block the bus from reaching a near-side bus stop, bus stops should be located far-side or before the right-turn lane begins.

Short Bus Lane—Provides an additional lane prior to the traffic signal that is sufficiently longer than the adjacent traffic queues to allow for unimpeded bus access to the lane. Short bus lanes are suitable for intersections without right-turn movements, such as T-intersections and intersections with one-way streets approaching from the right, or intersections with low right-turn volumes that can be channeled up/downstream. With exclusive bus access to the short bus lane, the bus stop can be placed at the near -side or far-side of the intersection.

Shoulder Bus Lane—Operates similarly to a short bus lane, but instead allows the bus to use the roadway shoulder when approaching an intersection. In these applications, the shoulder

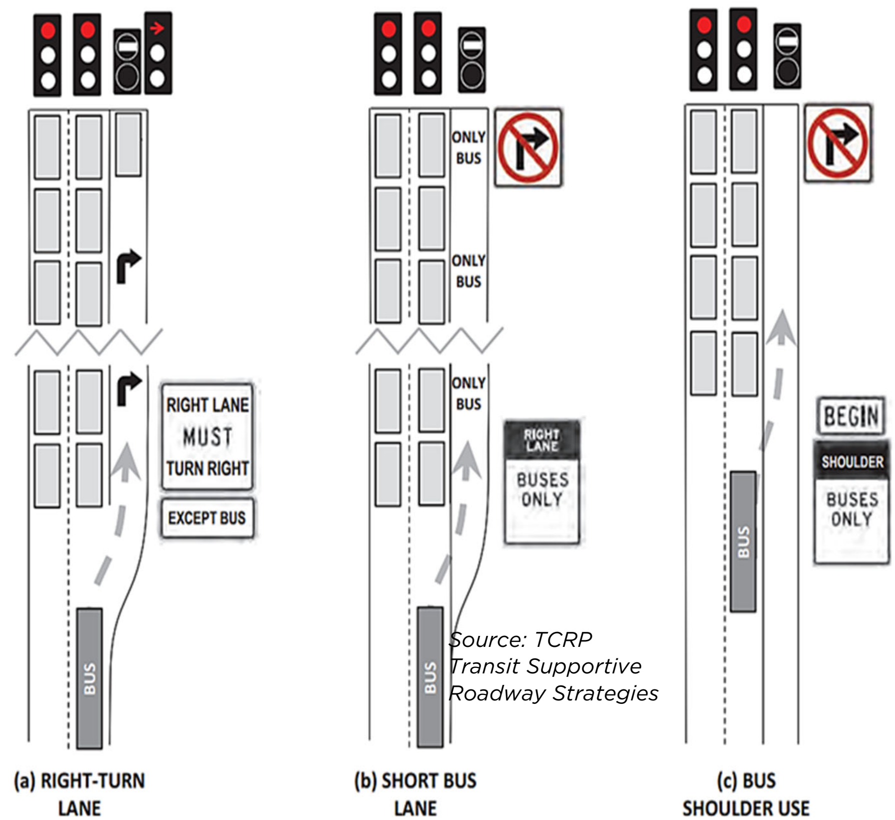


Figure 4.3.14 | TSP at various intersection types

FDOT

must be constructed or modified to support regular bus use. Shoulder bus lanes are most common on suburban arterial streets where curbs are not used. Figure 4.3.14 illustrates each of these bypass approaches.

Queue Bypass Lane

Where TSP is not provided or feasible, a queue bypass strategy would allow the bus to use a right-turn lane or a shoulder to bypass a general traffic queue, but then proceed under the normal through-signal phase into a far-side bus bay. In Figure 4.3.14, illustration (a) depicts a right-turn lane that also is used as a bus lane to bypass traffic.

Transit Approach Lane

This bypass concept includes a short bus-only lane on the approach to a major intersection and can sometimes be paired with active signal priority, allowing transit vehicles to bypass long queues that form at major cross streets. Transit approach lanes let the transit vehicle stay in its own lane as it nears the intersection. Figure 4.3.15 shows an example of a transit approach lane.

The National Association of City Transportation Officials (NACTO)'s 2016 Transit Street Design Guide identifies the following potential applications for transit approach lanes.

- At the approaches to signalized intersections where transit encounters long delays.
- At locations with a high volume of motor vehicle right turns.
- Signalized intersections with transit operating in a curbside or offset lane.
- Where a bicycle intersection approach is provided in a similar manner, with a dedicated lane and a right-turn pocket to the right.
- Where a right-turn/queue jump with signal priority application is not practical, such as at locations with long right-turn queues.

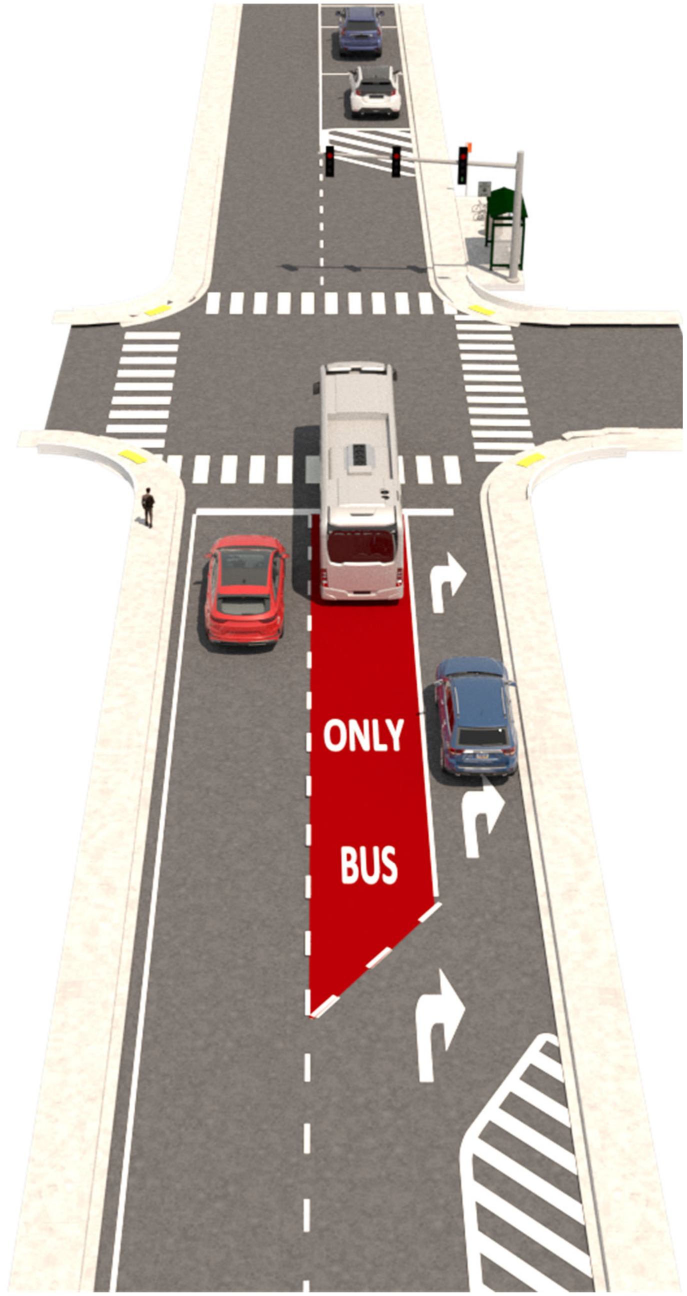


Figure 4.3.15 | Transit approach lane with TSP at an intersection.

CASE STUDY

Locating Bus Bays & Bus Stop Infrastructure—Get It Right from the Start

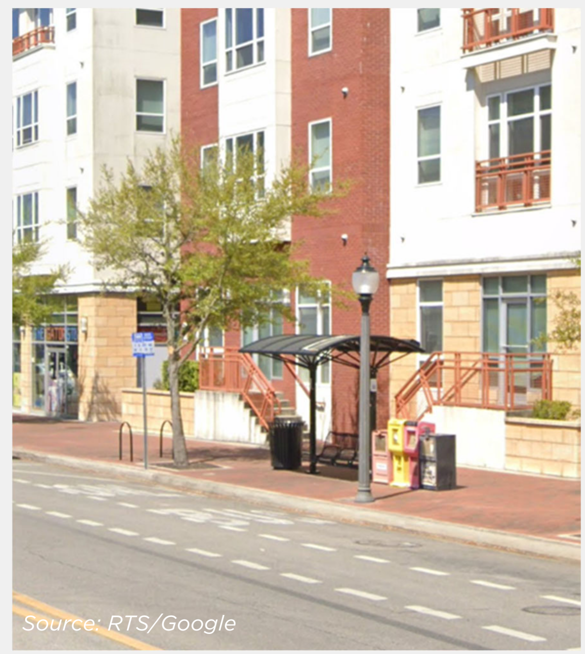
Gainesville, FL

When it comes to inadequately sized bus bays or unwarranted bus shelters, the RTS bus stop on eastbound West Newberry Road next to the Oaks Mall in Gainesville may provide an example. While the posted roadway speed of 45 mph may have suggested the need for a bus bay at this stop, the roadway routinely has approximately 30 mph speeds that may not warrant a bus bay. In addition, the bus bay also has been constructed to be much shorter in length than the 170-foot minimum length recommended by the FDOT Transit Facilities Guidelines. This has made it extremely challenging to pull the bus into and out of the bay without crossing into the middle lane, even with the bus moving very slowly (which causes ample delays). As the bus route's terminus stop is very close at the Oaks Mall, it was never necessary to have a pullout at this location. (Despite this, the pullout stop sometimes serves as a bathroom break stop for bus operators during late night and weekend trips.) Built with good intentions but not probably gauged to operational needs, the stop also has a well-designed shelter that would have been more productive elsewhere as the ridership at this stop is low due to it being so close to the route's end-of-line.

Source: RTS/Google

Another RTS bus bay on SW 2nd Avenue in Gainesville has adequate space/length, but the bus shelter and the decorative streetlight have been installed too close to the curb. In addition, the trees also have been planted too close to the curb. These encroachments have made the bus bay less functional and unsafe. To avoid hitting the bus shelter, light pole, and/or the overhanging tree branches (on which the bus mirror can get caught), bus operators at RTS have to be very cautious and often do not or cannot fully curb the bus at this open bus bay.

While the expensive street architecture, including streetlights, vegetation, and the bus stop shelter, were all pre-planned by the project designers, lack of understanding about bus stop design and transit operations, as well as not involving RTS in the planning and design process, have resulted in an unsafe and non-compliant bus stop.


Source: RTS/Google

Nevertheless, RTS currently is working with appropriate agencies and parties to find remedies to rectify these bus bay issues and avoid such situations in the future.

4.4 STOPS ON BUS LANES & BUSWAYS

Bus service can be operated within one of the street lanes that is specially designated by signs and markings for the preferential or exclusive use of transit, sometimes also allowing limited use by other vehicles. While not always separated by a physical barrier or grade, this separation from non-transit traffic may reduce bus travel times and increase service reliability.

Bus lane and busway applications, depending on the type and context, require transit agencies to focus on additional accessibility considerations when placing bus stops along such facilities. General considerations for transit agencies placing bus stops along these facilities may include:

- *Locate Stops on Far-Side of Intersections*—Bus stops along grade- or curb-separated bus lanes or ways also should be located on the far-side of an intersection to make the best use of any transit signal priority or queue jump treatment in place. If it is a median facility, bus stops are allowed and should be located within the median itself.
- *Use Off-Street Locations*—Off-street locations minimize potential conflicts between motor vehicles and buses and transit riders, and can be more easily connected to park-and-ride lots and the surrounding communities. For example, a BRT stop can be located some distance away from its dedicated bus lane, such as on the side of the highway, where buses leave the main runningway alignment to access the station, then re-enter the main alignment to continue the trip.
- *Plan Bus Stop Access on Case-by-Case Basis*—This is necessary as bus stops placed in the center median will have different pedestrian access patterns than bus stops along the curbside of the roadway. In particular, with a median facility, passengers have to cross traffic to reach the stops, making the safety and logistics of that crossing an added consideration for bus stop access.
- *Locate Freeway Stops Accordingly*—When locating bus stops for transit services on bus lanes on freeways, they should be placed in areas with major park-and-ride facilities.

BUS STOP PLACEMENT ON BUS LANES

Most of the basic accessibility guidelines that are applicable when placing bus stops along a general-purpose lane also are applicable for stops on bus lanes. However, there are some unique aspects that should be considered when placing bus stops along these lanes. While this section provides an overview of special use bus lanes and some key aspects related to locating bus stops along them, this handbook does not address all the design guidelines that are specific to special use lane applications.

Bus lane and busway types mostly applicable to Florida situations are discussed in this section. These types of facilities and their associated bus stop components and infrastructure are constantly evolving, and agencies planning for these types of bus lanes and busways are encouraged to use this section as a starting point only. Guidance on when to consider these lanes in Florida and limited guidance on bus stop placement along these lanes is presented using information and findings from FDOT’s 2013 guide, Typical Sections for Exclusive Transit Runningways, and NACTO’s 2016 Transit Street Design Guide. For further details, including conceptual typical sections for the bus lanes and busways, agencies should refer to guidance in these and other applicable documents.

Curb Bus Lane

These lanes operate by limiting the use of the outside travel lane closest to the curb to buses and, in some cases, to limited general traffic to permit vehicles to make right turns. This is the most common type of "concurrent-flow" bus lane, where buses move in the same direction as general traffic. Although this layout is common, simply designating a curbside bus lane does not imply the creation of an exclusive transit way because curb bus 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 bus lane through signs, markings, education, and ongoing enforcement is critical to ensuring the speed and reliability of bus service in these lanes. Figure 4.4.1 shows an example of a curb bus lane designated with pavement markings and colored pavement.

Figure 4.4.1 | Example of a curb bus lane.

Curb bus lanes typically should be considered when there is a need to reduce delays due to excessive traffic congestion and a corresponding desire to help improve visibility and use of a high-quality bus service. They may be created by converting a general-traffic lane, narrowing the general-traffic lanes to provide space for this purpose, converting on-street parking to this use, or simply widening the road to provide the extra space needed. These lanes may be shared with right-turning vehicles, deliveries, and other users. In some applications, they may be used only during peak periods when congestion on the roadway is most problematic for transit.

From a design perspective, the bus lane width should be determined based on the available roadway space and the needs of other users, including bicyclists, pedestrians, and motorists. Bus stops typically are located on the curb, but a bus bay/pullout also can be used to allow other buses to pass as necessary. Floating island bus stops and curb extensions are not recommended for curbside lanes. However, they are recommended if the lanes are offset. It is recommended to use an 8-foot minimum width for bus stops, and a 5- to 6-foot sidewalk is preferred to maintain the accessible pathway, resulting in an ideal total stop width of at least 14 feet. The minimum width of a curbside bus lane is 11 feet, and 12 feet is preferred.

Figure 4.4.2 | Example of a median bus stop in Orlando, Florida.

Median Bus Lane

Median bus lanes place buses on the lanes next to the center median of a multi -lane roadway and can play a key role in creating high-quality transit service, specifically where traffic congestion may significantly affect service reliability. This particular bus lane type encourages transit vehicle visibility and, without the typical interference encountered in the curbside travel lane, the bus is able to reach maximum safe traveling speeds with less potential for delay. Median bus lanes also bring bus stops to the median, thereby helping to reduce pedestrian and sidewalk congestion and providing increased dedicated space to multimodal travelers. These lanes work best when there is an extended raised median with no mid-block and only minor intersection left turn access. Figure 4.4.2 shows an example of a median bus stop.

Median bus lanes should be considered for major transit routes with frequent headways and/or on roadways where traffic congestion may significantly affect service reliability. They may be created by converting a general-traffic lane, narrowing the general -traffic lanes to provide space for this purpose, converting the median space to this use, or simply widening the road to provide the extra space needed. In some applications these lanes may be used only during peak periods. Depending on the application and need, left-turn lanes for general traffic may be located inside or outside the median bus lane to permit this movement. Bus movements may be controlled by dedicated signals at roadway intersections along the corridor.

From a design perspective, bus stops located in the median may use a central platform to serve both travel directions or separate platforms to serve each travel direction individually. Some median bus stop configurations may require doors on the left side of the bus. Based on the Florida Greenbook, medians can be 15.5-feet wide if roadway speeds are 40 mph or less. If speeds are over 45 mph, the minimum median width is 22 feet. The minimum median width on arterial and collectors with a speed limit of 50 mph or more is 40 feet.

Contraflow Bus Lane On One-Way Street

Contraflow bus lanes on one-way streets operate by allowing a bus to travel in the opposite direction of the normal traffic flow to take advantage of any available space in the other direction. Contraflow bus lanes on one-way streets are often no more than one to two blocks in length. Figure 4.4.3 shows an example of a contraflow bus lane on a one-way street.

Figure 4.4.3 | Example of a contraflow bus lane on a one-way street.

Contraflow bus lanes should be considered when a route needs a strategically-placed, efficient connection to a key land use or activity center. These lanes also are applicable when transit travel times need to be significantly reduced or the contraflow use of a one-way street segment can potentially shorten the length of a route. Typically, these lanes should not be more than one to two city blocks long or used as a continuous application along any corridor. The lanes cannot be shared with other users and may require substantial physical separation from general traffic and/or pedestrian fencing to manage driver and pedestrian expectation issues. Any separator used should be flush with the pavement if the contraflow bus lane is only a part-time application.

From a design perspective, when placing a bus stop along a contraflow bus lane, allow for a minimum of 8-foot width. If provided, a sidewalk of 5-feet (minimum) or 6-feet (preferred) should be used, bringing the total ideal width of a stop to at least 14 feet. Additionally, the minimum width of the bus lane should be 11 feet, with a 12-foot width being preferred.

Contraflow Bus Lane On Two-Way Street

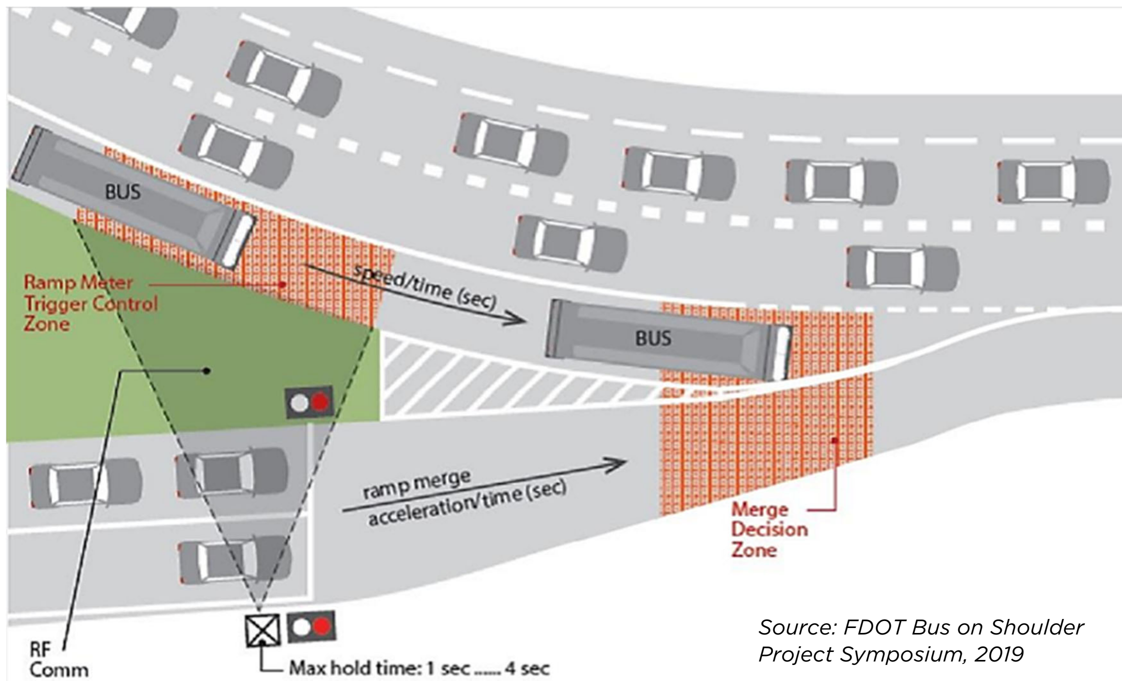
These bus lanes operate by designating a lane for buses to travel in the opposite direction of general traffic flow. The lane used for this purpose is typically in the off-peak direction of travel, so a different lane would be utilized during each peak period. With this treatment, it is critical to properly alert drivers that a lane on their side of the median is in use by buses traveling in the opposite direction. To do this, overhead lane use control signals and signing may be necessary. To further enhance the safety of such applications, it is recommended to provide a buffer zone between the contraflow bus lane and the adjacent general-purpose lane, combined with physical separators such as traffic cones or pylons.

Such contraflow bus lane applications should be considered when there is an appropriately wide median to provide sufficient space to accommodate lane and safety buffer needs. However, it will be important to take into account the impact on roadway capacity and congestion levels on the adjacent general-purpose lanes along the median if one of the existing lanes must be converted for the contraflow bus lane purpose.

From a design perspective, the implementation of contraflow lanes on two-way streets must consider the accommodation of general traffic left turns. The lanes are easier to implement if left-turn movements either are prohibited throughout the contraflow section or can be channeled such that they occur outside of and with no impact on the contraflow lane. For bus stops on these sections, when they are provided, they typically will be on the median and, therefore, right-of-way availability for median bus stop placement must be a main consideration.

Bus-on-Shoulder on Uninterrupted Flow Highway

Bus-on-shoulder (BOS) operations, sometimes referred to as Bus Bypass Shoulder (BBS) operations, can reduce bus travel times on congested roadways and help improve travel time reliability. Buses using shoulder lanes to bypass traffic congestion also can help make transit use more attractive, as travel time reliability and competitiveness are important factors in attracting discretionary



Source: FDOT Bus on Shoulder Project Symposium, 2019

Figure 4.4.4 | Conceptual example of BOS application on a highway.

riders. Figure 4.4.4 shows an example concept of the application of BOS on a highway.

BOS operations should be considered when the general traffic lanes are congested and travel speeds drop below 35 mph. However, it is important to recognize that buses operating on the shoulder of uninterrupted flow highways are typically not allowed to travel more than 15 mph faster than general traffic. In addition, the buses must yield at entrance and exit ramps, and must merge with general traffic wherever the shoulder is not suitable for BOS operations, such as when a disabled vehicle is present or where the shoulder is too narrow.

From a design perspective, BOS operations should be accompanied by signage indicating that buses are allowed to travel on the shoulder. However, no special separation or delineation is required. Most existing shoulders typically are narrower than conventional traffic lanes, but to support BOS, they should be expanded to be at least 11-feet wide, with a 12-foot width being preferred. BOS operations have historically been a retrofit strategy, not something that has been explicitly accommodated when the roadway is designed. However, some new and reconstructed uninterrupted flow highways have provided 12-foot wide shoulders in case there is a need to run BOS operations on those facilities in the future.

Although the use of BOS on limited access facilities has been legislatively authorized, it still requires the approval of the FDOT District Secretary to implement the system. Special BOS 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 typically are not located along freeways or in BOS 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 bus service to other modes. Ramp metering may be utilized in some applications, using TSP to actuate a signal to hold oncoming merging traffic so that an approaching bus traveling in a BOS lane can move through the merge point safely. When used, ramp meters typically are installed on the entrance ramp merge lanes where traffic will enter the facility and intersect the BOS lane.

BUS STOP PLACEMENT ON BUSWAYS

Busways are typically uninterrupted stretches of roadway that allow buses to move effectively and efficiently outside of general traffic. Figure 4.4.5 shows an example of a busway. They can be either at-grade or curb-separated. Busways frequently are used when designing BRT services for exclusive runningways, or can be used on 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 sufficient ridership demand and funding are available.

Figure 4.4.5 | Busway in Miami. Florida.

Busways are most suited to high-density downtown corridors. These facilities typically have one lane in each direction with dedicated right-of-way for the runningway and stations. They can be located along the curbside of the general use lanes or along the inside or median of a roadway. In median applications, it is typical to locate stations at or near signalized intersections, where pedestrians can access the station platforms using existing crosswalks and pedestrian signal phasing.

Median busways are exclusive transit facilities developed in the median of an urban street. Median arterial busways generally are 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.

Busway types most applicable to Florida situations are discussed in this section. Similar to bus lanes, these facilities and associated bus stop components and infrastructure are constantly evolving, so agencies planning for these types of transit ways are encouraged to use this section as a starting point only.

Two-Way Median Busway on Two-Way Street

A two-way (two-lane) busway in the median operates by removing buses from traffic conflicts associated with curb-lane operations and placing the buses in the center median of the roadway.

Two-way median busways should be considered in the case of a BRT application or when there is a distinct need to separate transit operations on a key corridor from the general traffic lanes because of excessive congestion, and when a suitably wide median is available or when there would be no appreciable impact on roadway capacity or existing traffic congestion if the median were to be widened (by absorbing part or all of the general traffic lanes on either side of the median).

DESIGN TIP

Creative Use of Bus Lanes

A common argument against bus lanes designated exclusively for transit use is that they are underutilized during off-service hours. However, as a pilot, the City of Orlando utilized its exclusive transitways for various other purposes during off-service times that bring additional services to the area. On weekend nights, exclusive bus lanes were dedicated to ridesharing and taxi vehicles to make pick-ups and drop-offs. Exclusive bus lanes also were used to house food trucks with pedestrian access, or for farmers market vendors during weekend mornings.

Source: Downtown Orlando Development Board.

From a design perspective, these busways need median boarding platforms at each planned bus stop along the roadway. At a minimum, an 8-foot width should be available to place a bus stop on the median; a 14-foot bus stop width is preferred. These stops must be fully accessible and lead to safe and controlled pedestrian crossings. Such safe crossings are critical since pedestrians will need to cross to the center of the street to access the median bus stops.

Reversible Lane Median Busway

This type of median busway is created by removing buses from traffic conflicts associated with curb-lane operations and placing the buses in the center lane of the roadway. This one-lane, bi-directional median busway would serve peak direction travel during each peak period, reversing its direction between peak periods.

As in the case of the two-way median busway, reversible lane median busway applications should be considered when there is a distinct service or operational need to separate transit service from general traffic and when a suitably wide median is available or when there would be no appreciable impact on roadway capacity or existing traffic congestion if the median were to be widened (by absorbing part or all of the general traffic lanes on either side of the median). Since separators often are used to delineate the busway, when implemented, access to the busway should be facilitated through the use of mountable separators or pylons so that service and emergency vehicles can reach disabled buses without issue.

Given the single-lane operation of service along such busways, they often are used only for short segments of routes and typically do not accommodate bus stops along their length because of the limited space to do so. However, from a design perspective, if these busways do accommodate any stops along their length, it will be critical to ensure safe and controlled pedestrian crossings since pedestrians will need to cross to the center of the street to access the median bus stops.

Figure 4.4.6 | Exclusive busway in roadway right-of-way in Orlando, Florida

Exclusive Busway in Roadway Right-of-Way

Exclusive busways implemented within the roadway right-of-way should be designed in accordance with the guidelines and standards used for traditional roadways. If a busway is built within the roadway right-of-way, accessory facilities such as bicycle paths and pedestrian paths that serve both the busway and the roadway can be shared. Exclusive busways that are parallel to a roadway require a transition distance to separate the two facilities. Refer to the FDM, the FDOT Design Standards, the Florida Greenbook, and the guidance and resources included in this handbook prior to the placement of bus stops along these facilities. Figure 4.4.6 shows an example exclusive busway in roadway right-of-way.

Exclusive Busway in Separate Right-of-Way

An exclusive busway facility implemented in a separate right-of-way also should be designed in accordance with the guidelines and standards used for traditional roadways. Refer to the FDM, the FDOT Design Standards, the Florida Greenbook, and the guidance and resources included in this handbook prior to the placement of bus stops along these facilities.

SIGNAL PRIORITY FOR BUS LANES/BUSWAYS

Transit signal priority is a vital element to help make the investment and implementation of dedicated bus lanes and busways worthwhile and successful. Variations in TSP methods allow for different uses and present varying benefits in different situations. Active signal priority is among the more influential TSP system configurations, as compared to standard passive TSP systems. Signal controllers at intersections, in-ground vehicle detectors, and automatic vehicle locators are among the common strategies used in active TSP for dedicated bus lanes and busways. Signal priority also is critical to BRT systems operating on dedicated runningways, allowing their transit vehicles to pass through intersections easily without significant additional delay or idling so that they can maintain speed and proceed on schedule. Table 4.4.1 shows the ideal signal treatments for various lane and bus stop types. Refer to the bus preferential treatment information presented previously in this chapter for additional guidance.

Table 4.4.1
Ideal Signal Treatments for Various Lane and Bus Stop Types

Lane Types	Stop Types	Recommended TSP Treatment
Bus Lane, Busway, Mixed Traffic	Far-Side; Pullout or In-Lane	Green Extension
Bus Lane, Busway, Mixed Traffic	Far-Side; Pullout or In-Lane	Green Reallocation
Bus Lane, Busway, Shared Right Turn/Queue Jump	Near-Side or Far-Side; Pullout or In-Lane	Red Truncation
Mixed Traffic	Near-Side or Far-Side; Pullout	Upstream Green Truncation
Bus Lane, Busway	Any	Phase Insertion/Phase Sequence Change
Bus Lane, Busway, Mixed Traffic	Any	Phase Reservice

4.5 BUS VEHICLE CHARACTERISTICS & ACCESS

To ensure that transit agencies provide safe and convenient access to transit for their passengers, it is important to also understand transit vehicle characteristics and how these vehicles interact with various transit facilities and the overall roadway environment. Transit agencies use buses of various size, ranging from smaller vehicles/mini-buses suitable for paratransit/mobility-on-demand (MOD) services to larger articulated buses used for BRT and on high transit demand corridors. It is considered best practice to plan and design 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. An agency not currently using 40-foot buses should consider planning ahead for operational and design features that can accommodate such buses in the future, at least on its major routes, to avoid costly changes.

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.

Figure 4.5.1 shows typical dimensions for a standard 40-foot bus that is commonly used for fixed-route transit services in Florida. Figure 4.5.2 shows dimensions for an articulated bus, typically used for BRT or on high ridership corridors. Figure 4.5.3 shows the dimensions for a smaller transit vehicle commonly used either for on-demand or paratransit services. Table 4.5.1 provides a selection of key design specifications for three common lengths of buses.

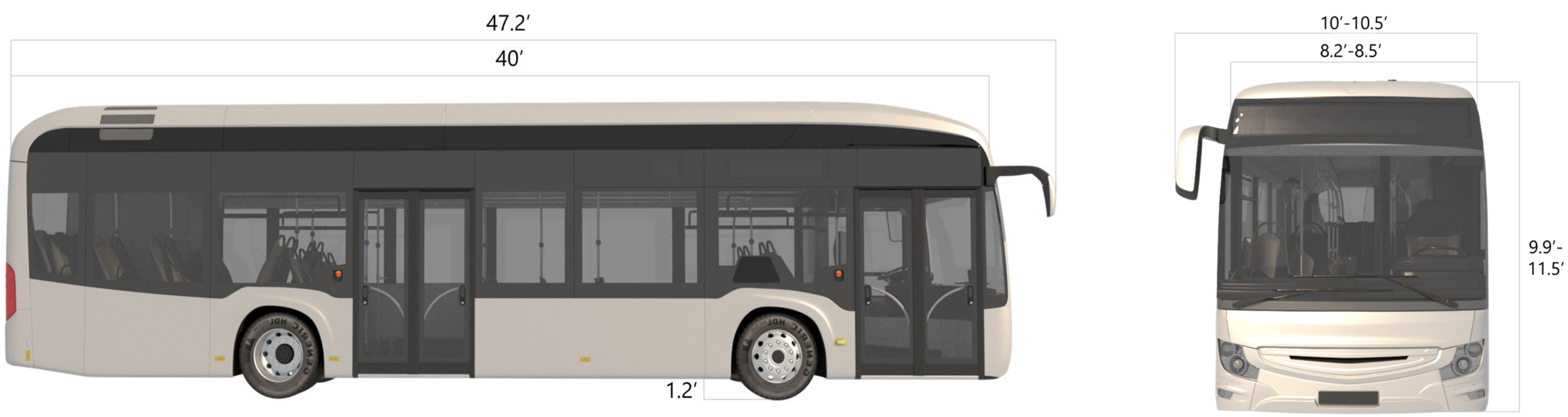


Figure 4.5.1 | Standard fixed-route bus typical dimensions.

Figure 4.5.2 | Articulated bus typical dimensions.

Figure 4.5.3 | On-demand or paratransit vehicle typical dimensions.

VEHICLE TURNING RADIUS

Figure 4.5.4 shows the key components of bus turning movements at intersections. Table 4.5.2 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 4.5.5 presents the typical turning dimensions for a standard 40-foot bus with a front-mounted bicycle rack.[5]

Table 4.5.1
General Specifications for Buses[5]

Item	Standard 40'	Standard 45'	60'
Width (without mirror)	8.2'-8.5'	8.5'	8.5'
Width (with mirror)	10'-10.5'	10'-10.5'	10'-10.5'
Height	9.9'-11.5'	12.5'	11'
Overhang			
Front	7.2'	7.9'	8.8'-8.9'
Rear	9.3'	9.8'	8.6'-9.7'
Wheel Base	25.0'	22.9'	23.3'-24.5'
Driver's Eye Height	7.0'	7.0'	7.0'
Weight			
Curb Weight	27k-28.2k lbs	38.2k lbs	38k lbs
Gross Weight	36.9k-40k lbs	55.2k lbs	66.6k lbs
Ground-to-Floor Height			
Typical	2.3'	2.3'	2.3'
Low Floor	1.2'	1.2'	-
Passenger Capacity			
Seats	30-50	50	76
Standees	20	28	38
Turning Radius			
Inside	24.5'-30'	24.5'-30'	27.3'
Outside	42'-47'	42'-47'	39.8'-42'
Outside with Overhang	45.5'-51'	45.5'-51'	44.3'
Doors (typical)	2	2	2-3
Width of Each Door	2.3'-5'	2.5'-5'	2.5'-5'
Angles			
Approach	10°	10°	10°
Breakover	10°	10°	10°
Departure	9.5°	9.5°	9.5°

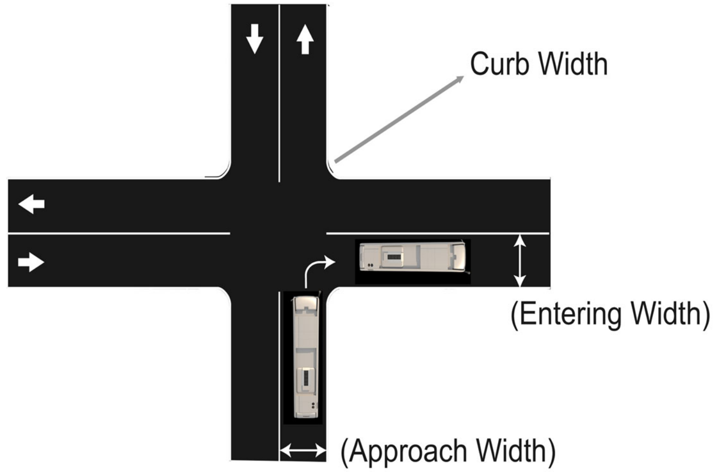


Figure 4.5.4 | Geometric components of bus turning movement at an intersection.

Table 4.5.2
Desirable Intersection Geometry Minimum Measurements for Transit Use[6]

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

DESIGN CONSIDERATIONS

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 4.5.6.[5] 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 typically is used for express bus, high volume routes, and BRT services. The 60-foot articulated bus turning movement is illustrated in Figure 4.5.7.[5]

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.
- 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.
- 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.

REQUIREMENTS

- *Turning radii requirements for a standard transit bus are:*[5]
    - *minimum inside radius = 24.5 feet*
    - *minimum design turning radius = 41.6 feet*
- *Turning radii requirements for an articulated transit bus are:*[5]
    - *minimum inside radius = 21.3 feet*
    - *minimum design turning radius = 39.4 feet*

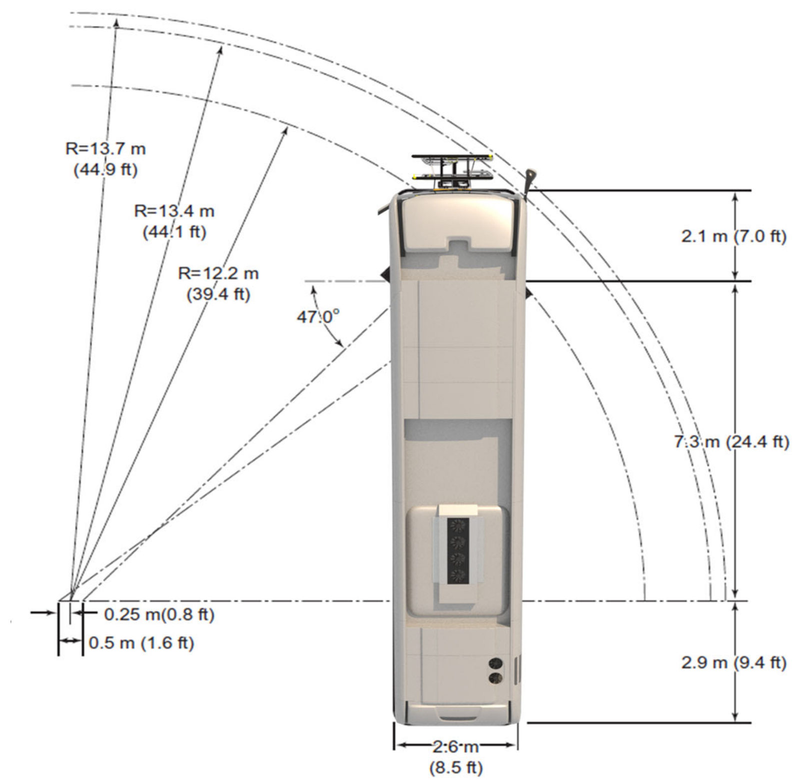


Figure 4.5.5 | Turning dimensions for a bus with front-mounted bicycle rack.

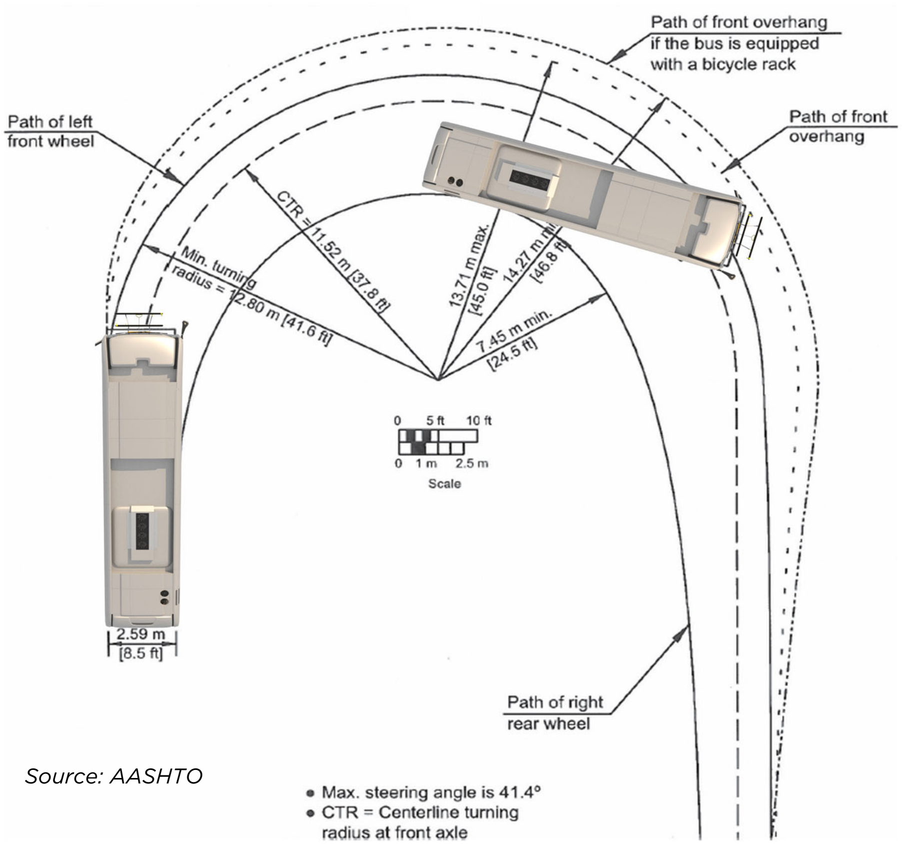


Figure 4.5.6 | Bus turning movement geometry for 40' standard bus.

- 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.

Channelized Right Turns—For instances where large curb radii are needed, a channelized right turn may be necessary. While this option is typically less pedestrian friendly, it may be suitable where higher frequencies of large transit vehicles such as articulated buses occur, or where intersections are skewed. Right-turn channelization, though, also can provide a safer crossing environment by placing refuge stations within the pedestrian crossing area. When designing channelized right turns, design speeds of less than 10 mph should be used.

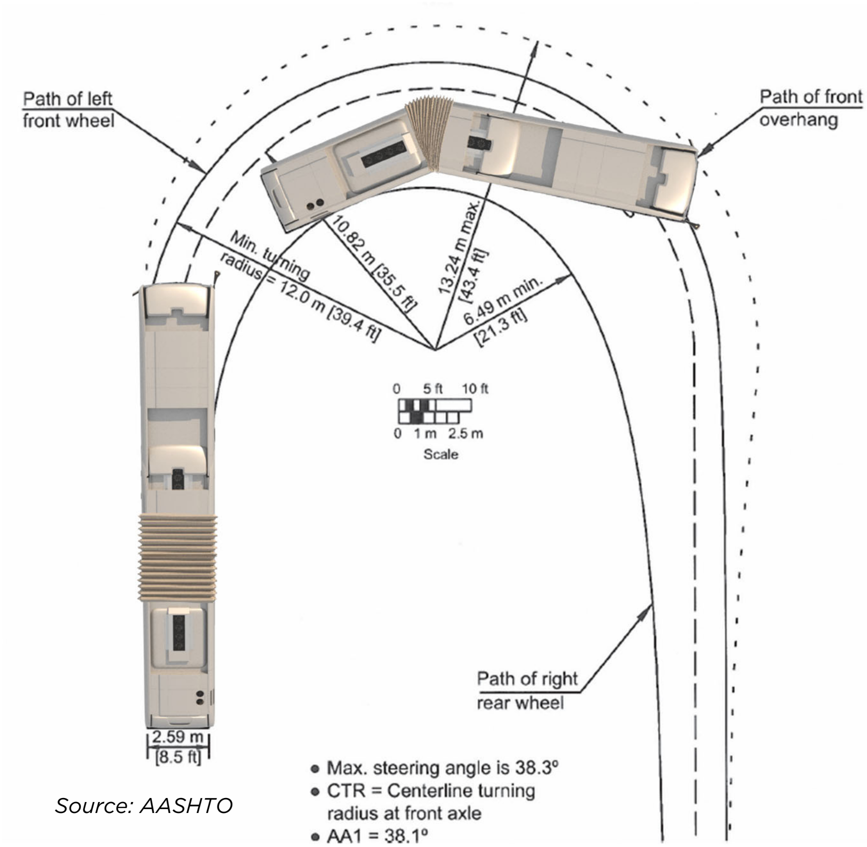


Figure 4.5.7 | Bus turning movement geometry for 60' articulated bus.

Curb Aprons—At locations where large vehicles often make turns, agencies may consider a mountable truck apron. Truck aprons deter passenger vehicles from taking high speed turns but allow for transit vehicles to make turns without off-tracking into pedestrian areas. Mountable aprons should be visibly distinct from both the travel lane and the sidewalk.

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 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.

PAVEMENT MARKINGS AT BUS STOPS

In general, 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

REQUIREMENTS

- *Pavement markings shall be in compliance with maintaining agency regulations and standards in the MUTCD.*[7]
- *The preferential lane-use marking for a bus-only lane shall consist of the word marking BUS ONLY.*[7]
- *Pavement markings shall be used to guide traffic away from fixed obstructions within a paved roadway.*[7]

Figure 4.5.8 | Bicycle lane pavement markings at a curbside bus stop.

transit vehicle operator. Figure 4.5.8 illustrates an example of a bus stop adjacent to a general use lane with pavement markings for a bike lane. Pavement markings may be in use where 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.

Major marking types include pavement and curb markings, object markers, delineators, colored pavements, barricades, channelizing devices, and islands. When planning, designing, and implementing any marking types in conjunction with bus stops and other transit facilities, the following should be considered:

- Color selections for curb markings should be conducted according to the general principals of markings.[7]
- 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. For additional guidance, see the FDM.

CONCRETE VS. ASPHALT BUS PADS

More transit agencies are switching to using concrete slabs instead of asphalt for their highly used bus pads at bus stops due to the benefits of using concrete. Over time, asphalt can shift and possibly become “rippled” due to the weight of the bus and its heat while stopping, resulting in uneven pavement and pot holes. This adverse aspect of asphalt paving at bus stops and other areas where significant, repeated bus traffic occurs has made concrete a desirable alternative. Concrete is more rigid and durable so it can handle the weight of the bus better. It also tends to be more reflective, helping the bus operators see the bus stop better.

While concrete may be a better alternative to asphalt, it also may be costlier to implement and repair than asphalt. However, due to its benefits for high-volume bus stops, especially at bus bays, transit agencies should weigh the option of using concrete for bus pads at these bus stops. Figure 4.5.9 shows an example of an asphalt bus bay.

Figure 4.5.9 | Asphalt bus bay in Key West, Florida.

4.6 BICYCLE & PEDESTRIAN ACCESS

Bus stop location can impact the convenience and safety of pedestrians desiring to access transit. Therefore, transit agencies must ensure that their bus stops are provided in locations with the safest and most convenient pedestrian access possible.

BUS STOPS AS POTENTIAL PEDESTRIAN CROSSINGS

It is important for transit planners and facility designers to recognize that bus stops and other transit facilities are potential pedestrian crossings. The following design and safety prompts should be used to initiate discussions with local agencies in the planning, design, and placement of transit stops.

- Are marked pedestrian crossings convenient to the transit stop?
- Has the project been developed in cooperation and coordination with the state or local engineering and operational agencies? Have they reviewed the transit stop plans and provided comments?
- Is there sidewalk continuity between the transit stop and adjacent pedestrian facilities?
- Is there a sufficient area provided to accommodate waiting passengers, boarding/alighting passengers, and through/bypassing pedestrian traffic at peak times?
- Are there paved connections between the bus B&A area and the passenger waiting area?
- Would someone with mobility challenges (use of wheelchair, walker, etc.) be able to access and use the transit stop safely?
- Will the location of the transit stop create operational issues for other road users (sight distance obstruction, stopping sight distance, etc.)?

The far-side of an intersection provides the safest placement option for bus stops as it encourages 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. Near-side stops are discouraged as pedestrians crossing an intersection in front of a bus at 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. Unless a crossing is provided, mid-block stops also are not recommended as they may encourage pedestrians to cross roadways at

Figure 4.6.1 | Pedestrians crossing unsafely at a bus stop in Florida.

locations where there is no traffic control. Figure 4.6.1 shows pedestrians crossing mid-block without a designated crosswalk.

Some of the most commonly used strategies for safe pedestrian crossings at bus stops are reviewed in this section and related guidance is provided, as applicable.

REQUIREMENTS

- *Newly constructed or altered streets, roads, and highways must contain curb ramps or other sloped areas at any intersection having curbs or other barriers to entry from a street level pedestrian walkway.*[9]
- *Curb ramps must be located to ensure a person with a mobility disability can travel from a sidewalk on one side of the street, over or through any curbs or traffic islands, to the sidewalk on the other side of the street.*[10]
- *Detectable warnings are required at curb ramps and blended transitions at pedestrian street crossings, pedestrian refuge islands, pedestrian at-grade rail crossings not located within a street or highway, boarding platforms at transit stops for buses and rail vehicles where the edges of the boarding platform are not protected by screens or guards, and B&A areas at sidewalk or street level transit stops for rail vehicles where the side of the B&A areas facing the rail vehicles is not protected by screens or guards.*[11]
- *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.*[9]

Pedestrian Crosswalks

Crosswalks are essential to bus passengers who may have origins or destinations on either side of the roadway. 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).

It is preferable that all streets that are directly served by transit also should 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. It also is important that a driver sees a pedestrian at night, especially when they are attempting to cross a street; proper illumination helps make a pedestrian visible. Pedestrian crashes occur disproportionately at night, with about four times more risk in relation to exposure.

Curb Ramps—Curb ramps are a critical part of any crosswalk; however, when provided, they should not interfere with free access to the bus stop. Bus stop locations (B&A areas) should not be interrupted by curb ramps.

Detectable Warnings—A detectable warning consists of a series of parallel truncated domes that warn visually-impaired pedestrians about the end of a curb ramp and the beginning of the roadway. They also must be applied at platform boarding edges and may be

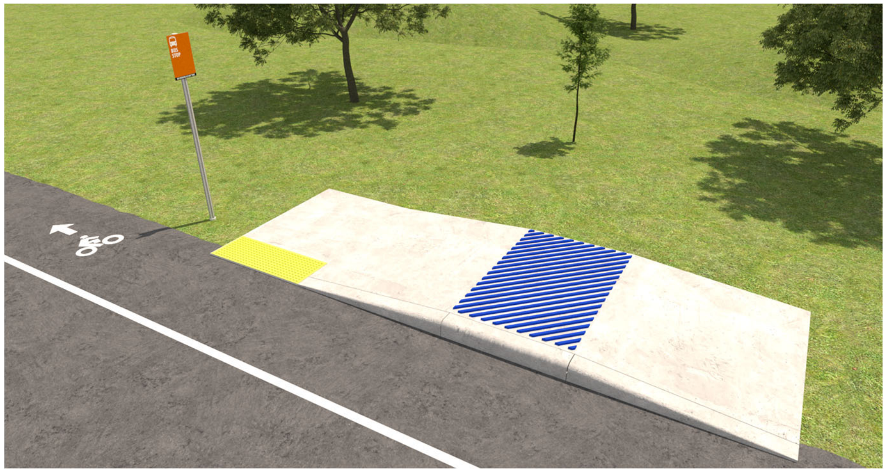


Figure 4.6.2 | Detectable warning at a rural bus stop.

DESIGN TIP

Where an unsignalized crossing exists at a bus stop, enhanced crossing treatments or actuated signals should be added. Transit stops should ideally be located so that pedestrians cross behind the bus or transit vehicle. Far-side stop placement is preferable to near-side or mid-block placement and increases the visibility of pedestrians crossing behind the bus.[12]

necessary in other applications. Agencies should refer to FDOT Design Standards for specific design specifications for detectable warnings. Figure 4.6.2 shows the appropriate placement of a detectable warning at a bus stop.

Mid-Block Crosswalks

Mid-block crosswalks can be used to supplement the pedestrian crossing needs in an area between intersections. They are located mostly at major trip generator locations or areas where bus stops may have a high volume of transferring passengers needing to cross the street. At mid-block stop locations, if a significant number of pedestrians cross the roadway, signalized crossings should be considered.

"Daylighting" in advance of a crosswalk helps make pedestrians more visible to motorists and cars more visible to pedestrians. This may be accomplished by restricting parking and/or installing a curb extension. In addition, stop lines at

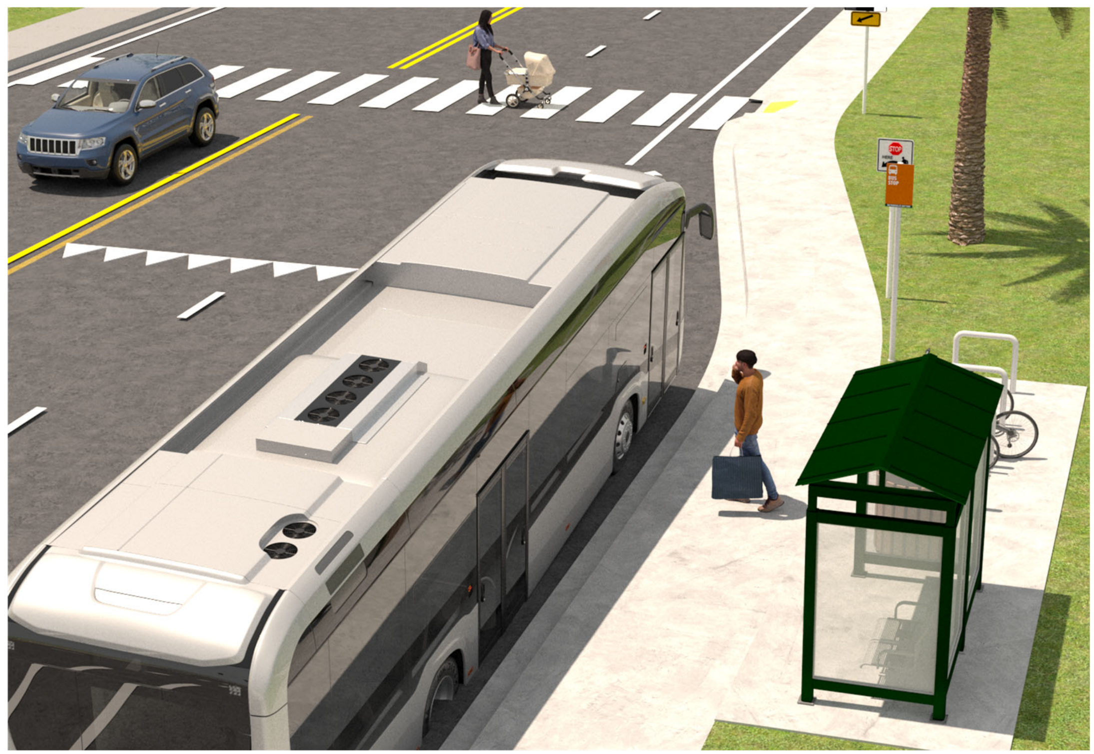


Figure 4.6.3 | Mid-block pedestrian crossing near a bus bay.

mid-block crossings should be set back 20-50 feet. This helps ensure that a person crossing the street is visible to the second driver when the first driver is stopped at the stop line.[12] An example of a mid-block crosswalk is shown in Figure 4.6.3.

Pedestrian Islands

Pedestrian islands (also known as pedestrian refuge islands) are extensions of the median into the crosswalk area to improve safety for pedestrians and vehicles. 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. Figure 4.6.4 illustrates an example pedestrian island.

According to NACTO's Urban Street Design Guide, a pedestrian refuge island reduces the exposure time experienced by a pedestrian in the intersection. While refuge islands may be used on both wide and narrow streets, they generally are applied at locations where speeds and volumes make crossings prohibitive, or where three or more lanes of traffic make pedestrians feel exposed or unsafe in the intersection.

Pedestrian refuge islands should be at least 6 feet wide, but have a preferred width of 8-10 feet. Where a 6-foot wide median cannot be attained, a narrower raised median is still preferable to nothing. The minimum protected width is 6 feet, based on the length of a bicycle or a person pushing a stroller. The refuge is ideally 40 feet long.[13]

Enhancing pedestrian refuge islands using plantings or street trees also should be considered. Plantings may require additional maintenance responsibilities and need to be maintained to ensure visibility and clear sight distances.

DESIGN TIP

Pedestrian Islands are Extensions of Medians

All medians at intersections should have a "nose" that extends past the crosswalk. The nose protects people waiting on the median and slows turning drivers. In addition, it is preferable to have the crosswalk "cut-through" the median. Where the median is wider than 17 feet, ramps are preferred. This dimension is based on a 6-inch-high curb, two 1:12 ramps, and a 5-foot-wide level landing in the center.[12]

Figure 4.6.4 | Pedestrian island.

Intersection Nubs

Intersection nubs are extensions of the sidewalk, usually into the parking lane, that reduce pedestrian 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 4.6.5 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 also should be avoided in low-speed central business districts to avoid congestion of traffic. The design of such curb extensions must take into consideration the needs of transit vehicles, drainage, and bicyclists.

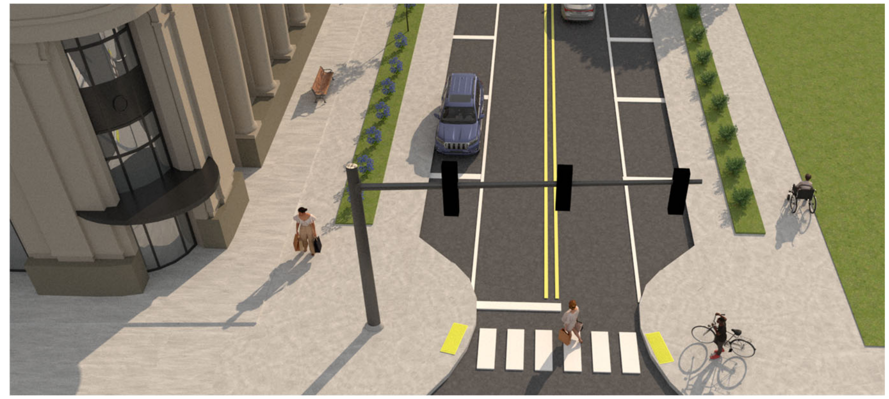


Figure 4.6.5 | Intersection with intersection nubs.

OTHER PEDESTRIAN CONSIDERATIONS

Additional placement considerations for bus stops that may impact both users and non-users of the bus stop include the following.

- *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.
- *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 can get ready to board in a timely fashion and 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, bus 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*—Bus stops where pedestrians frequently transfer between different bus routes should be located on the same side of intersections.
- *Locations of sidewalks and other pathways that provide access to the stop*—Bus stops should be located to take advantage of existing sidewalk and accessible pathway infrastructure.
- *Location of access driveways*—Bus stops located next to driveways sometimes require passengers to wait in a driveway for the bus, elevating the potential for pedestrian/vehicle conflicts. Such locations should be avoided, if possible.
- *Protected left-turn-only phasing near bus stops*—Install protected left-turn-only phasing near bus stops, as pedestrians may be struck by left-turning vehicles while crossing with the walk signal.

Close coordination with the state and local agencies that operate and maintain roadway facilities is imperative. Physical modifications to the roadways, including signage, pavement markings, and signalization, should be implemented with consent of the jurisdictional engineering agency.

BICYCLE LANES AT BUS STOPS

A bicycle lane is a portion of a roadway (either with curb and gutter or a flush shoulder) that has been designated by striping and special pavement markings for preferential use by bicyclists. 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 FDM, NACTO's Urban Bikeway Design Guide, AASHTO's Guide for the Development of Bicycle Facilities, and the MUTCD. For additional guidance related to bicycle facilities, see the Index of Resources at the end of this handbook. Figure 4.6.6 illustrates a bicyclist's typical operating space needs, which impact the layout and dimensions of bicycle lanes. Figure 4.6.7 provides an example of a bicycle lane application adjacent to a bus stop.

Figure 4.6.6 | Operating space of a bicyclist.

**if using a paved shoulder.*

***near a guardrail or barrier.*

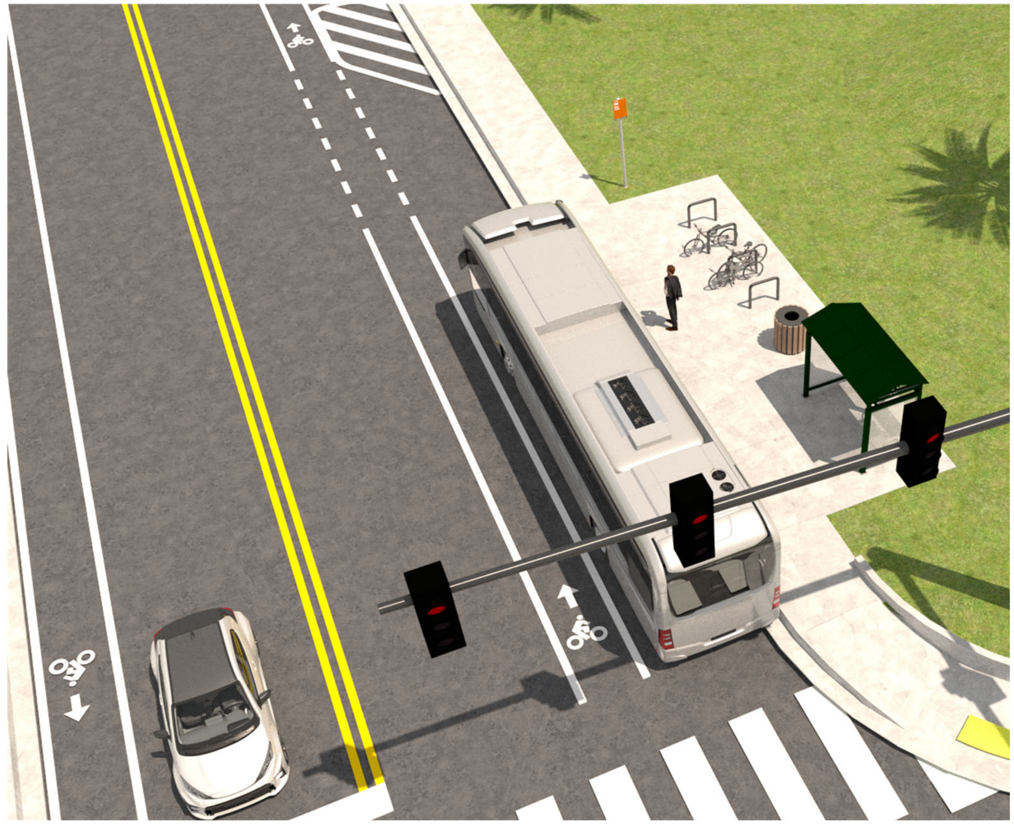


Figure 4.6.7 | Bicycle lane at a bus stop near an intersection.

Bicycle lanes typically are located on the right side of the street and frequently conflict with buses stopped at bus stops, traveling in exclusive curb lanes, or making right turns. They also can conflict with pedestrians boarding or alighting at bus stops in some situations. Where shared-use paths (i.e., combined bicycle and pedestrian use facilities not immediately adjacent to the travel lane) are provided, bus stops should be coordinated so they are located in proximity to the shared-use path's roadway access points.

Because of the number of transit riders who ride bicycles to access bus stops, bicycle lanes should be considered part of the larger transit network and should connect transit users to bus stops. They also should 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 when certain additional conditions are met (examples include "keyhole lanes," i.e., areas where bicycle lanes exist between through lanes and right-turn lanes, bus bays, or parking lanes, but are not restricted to the keyhole lanes). An example of a green-paved bicycle lane is shown in Figure 4.6.8. The dimensions associated with bicycle lane striping at a bus bay are shown in Figure 4.6.9. Refer to the most recent FDM or MUTCD for more details on any additional requirements for green-color bicycle lanes.

Green-color bicycle lanes are recommended for the primary reason of enhanced visibility of bicyclists to other motorists, especially with turning motorists. Other benefits include helping make a corridor look more multimodal, discouraging illegal parking in the bike lane, and increasing the comfort level of bicyclists due to the clearly delineated operating space for their use.

REQUIREMENTS

- *Pavement markings used for separated bicycle facilities must conform to the MUTCD.[3,7]*
- *When green-colored pavement is used in conjunction with white dotted lines, such as when extending a bicycle lane across a right-turn lane or access to a bus bay, the transverse-colored marking must match the 2-4-foot white dotted line pattern of the bicycle lane extension.[3]*
- *Bicycle lanes shall not be provided on the circular roadway of a roundabout.[7]*

Figure 4.6.8 | Green-colored bicycle lane in Miami-Dade County, Florida.

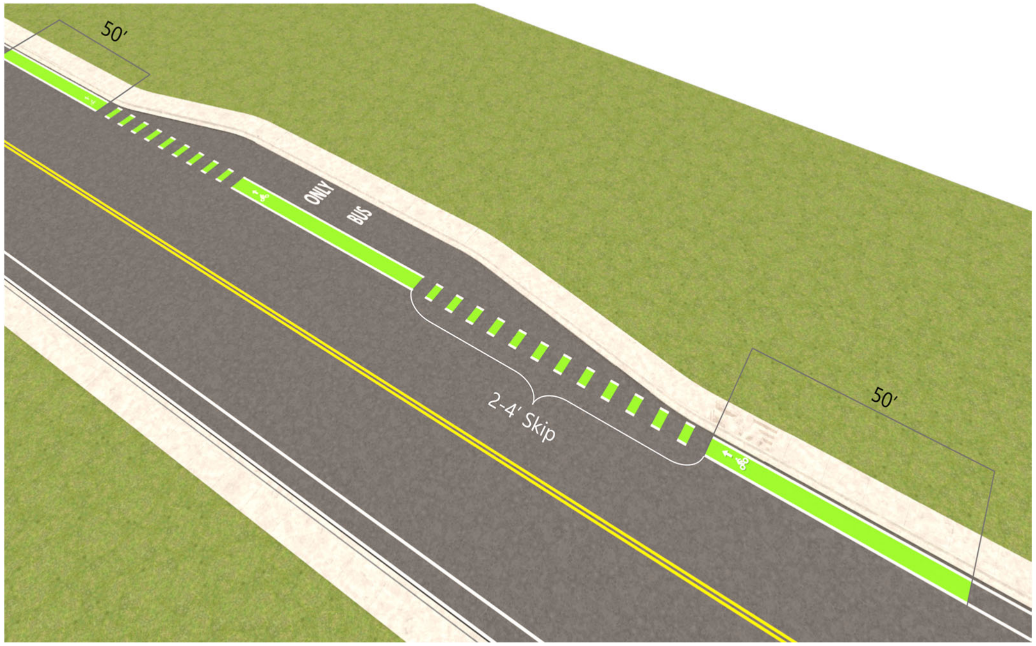


Figure 4.6.9 | Green-colored bicycle lane at a bus bay.

BICYCLE LANE CONSIDERATIONS

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 also are able to be used by shared mobility and right-turning vehicles. Because buses and bicycles will pass each other in these lanes, lane width is an important issue to consider. 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 may be 14 feet or less.

Shared-Use Paths

Instead of an exclusive bicycle lane, bicyclists also may ride on a shared-use path to and from a bus stop to access transit. Shared-use paths are paved facilities physically separated from motorized traffic by an open space or barrier, and located 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. Refer to the FDM and other resources in this handbook on the design of shared-use paths. Figure 4.6.10 shows an example of a shared-use path.

Raised Bicycle Lane

When a dedicated bicycle lane travels in front of a bus stop, the lane can be elevated to the height of the curb, bringing the bike lane to the same height as the sidewalk. This configuration improves the interaction between bus and cyclist and maximizes the available right-of-way when it is not possible to position the bike lane behind the bus stop. Raised bicycle lanes can be configured to accommodate exclusive space for bicycles and pedestrians, or to utilize shared space within the bus stop boundary. When utilizing separate-space bicycle lanes, crosswalks and detectable warning strips are used to identify bicycle travel lanes and pedestrian loading zones. Figure 4.6.11 shows a raised bicycle lane example.

DESIGN TIP

Cycle Tracks/Separated Bicycle Lanes

In urban conditions with high volumes of bicycle ridership, bicycle lanes can be developed further into comprehensive cycle tracks. Cycle tracks can utilize two-way operation and implement bicycle traffic signals and additional street markings. At bus stops, cycle tracks can be partnered with boarding islands and utilize the pedestrian crosswalks and detectable warnings to cross bicycle lanes and access the boarding island.

If a facility is important for fulfilling a connection in a community and would benefit from separation due to the characteristics of the roadway (speeds and volumes), a separated bike lane should be considered (or a shared use path). Refer to FDM 223 or the FHWA Separated Bike Lane Planning & Design Guide.

Figure 4.6.10 | Example of a shared-use path.

Figure 4.6.11 | Example of a raised bicycle lane.

Boarding Island Bicycle Lane

One of the most preferred strategies for bicycle lanes at bus stops is to route them behind the bus stops entirely, creating a bus boarding island. Bus boarding islands place passengers adjacent to the bus lane or travel lane, enabling the bus operator to load/unload passengers without having to merge back into traffic and without conflicting with bicycle traffic. This can eliminate bus-bicycle conflicts and may even help reduce bus dwell times. When deployed, pedestrian crosswalks and detectable warnings also should be used for passengers to safely enter and exit the boarding island without interfering with moving bicycles. Striping and curb ramps should be used to connect the boarding island to the sidewalk, reinforcing to bicyclists that they must yield to pedestrians at these locations.

Figure 4.6.12 | Example of a boarding island.

Figure 4.6.12 shows an example boarding island with a bicycle lane behind it. Table 4.6.1 outlines the advantages and disadvantages of various bike lane/bus stop configurations. Table 4.6.2 shows the right-of-way needed for bus stops relative to the bicycle lane configuration present at the stop. For example, a curbside stop with a typical bicycle lane between it and the adjacent travel lane needs less than 10 feet of available right-of-way for implementation. Comparatively, the right-of-way need for a boarding island with a bicycle lane behind it needs more than 21 feet.

Table 4.6.1
Advantages and Disadvantages of Various Bike Lane/Bus Stop Configurations

Bike Lane Type	Advantages	Disadvantages
Curbside Lane	• Minimal disturbance to operations • Modal zones are clearly delineated	• Potential conflict between bus and bicycle • Potential for bicyclist to merge into traffic to avoid stopped bus • Riders have to step off curb and cross bike lane to board the bus
Raised Bicycle Lane (Shared)	• Minimal disturbance to operations • Riders do not need to step off the curb • Bus/bicycle conflict removed	• Potential conflict between bicyclists and pedestrians in shared space • No clean delineation between bike and pedestrian areas • May impact site drainage
Raised Bicycle Lane (Exclusive)	• Minimal disturbance to operations • Riders do not need to step off the curb • Bus/bicycle conflict removed	• Requires more signing and striping to clarify conflicts • May impact site drainage
Behind Boarding Island	• Minimal disturbance to operations • Modal zones are clearly delineated • Bus/bicycle conflict removed • Improves pedestrian visibility • Provides additional surface for amenities	• Requires more right-of-way • May impact site drainage • Requires more signing and striping to clarify conflicts • Introduces conflict area between pedestrians and cyclists • May take away parking spaces • May delay traffic if there are no passing lanes

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. At locations with infrequent conflicts, the bike lanes should remain solid to the intersections. Dotted lane lines should be used to delineate conflict areas within the bike lane at locations where:

- Intersections are signalized and bicyclists and motorists operate concurrently:
- Right turn lanes are not provided and turning motorist volumes are high; and
- Buses frequently cross the bike lane at transit stops.

Figure 4.6.13 presents an example of a bus stop location with a potential for bicycle and bus conflicts. There are multiple solutions to help prevent as much conflict as possible. These include:

Figure 4.6.13 | Example of a bus-bike conflict.

Table 4.6.2 Bus Stop ROW Needed by Bicycle Lane Type	
Stop Type	**ROW Needed**
Curbside Stop with Bicycle Lane	Less than 10'
Raised Bicycle Lane (Shared)	Between 10'-13'
Raised Bicycle Lane (Exclusive)	Between 13'-21'
Boarding Island Bicycle Lane	Greater than 21'

- *Colored lane treatments*—These draw attention to bicyclists and helps make drivers and pedestrians aware that conflict may occur in the colored lane 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 bus passengers. However, depending on the vehicular speeds and volumes of the adjacent roadway, the merging maneuver may not be advised.
- *Physical rerouting of bicycle lanes around bus stops*—This has limited applicability in areas with limited right-of-way and also is 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 also would include signage on right-of-way hierarchy such as "Yield to Bus" or "Yield to Bike."
- *Protected intersections*—This involves implementing a comprehensive strategy for incorporating bicycle lanes with minimal disruption between transit, passenger vehicles, and/or pedestrians. Protected intersections provide dedicated bike lanes, exclusive pedestrian and bicycle crossings, and curb extensions to slow down turning vehicles and increase cyclist and pedestrian visibility.
- *Raised or boarding island bicycle lanes—Raised bicycle lanes and boarding island bicycle lanes also may help to prevent bus-bike conflicts.*
- *Left-side bicycle lanes—Bike lanes also can be located on the left side of the roadway on one-way streets where transit is operating to minimize bus-bike conflicts.*

4.7 ACCESSING TRANSIT DURING CONSTRUCTION

Safe access to transit facilities must be provided at all times and should not be interrupted. To be able to ensure that adequate provisions are made for safe access to bus stops within work zones during roadway construction requires advance preparation and coordination by all agencies involved. Figure 4.7.1 provides an example of construction occurring near a bus stop.

Given the extent of both bus transit networks and roadway construction activities in Florida, it is common to find roadway construction work areas encompassing and impacting established bus stop locations, which creates safety and mobility concerns for workers, pedestrians, and transit riders.[15] This section of the handbook reviews issues and concerns when accessing transit during such construction periods, and provides guidance for transit agencies to address the accessibility and safety issues of transit stops during the Temporary Traffic Control (TTC; formally known as Maintenance of Traffic, or MOT) process.


Source: Benesch

Figure 4.7.1 | Construction near a bus stop, Hillsborough County, Florida

REQUIREMENTS

- *Where transit stops are affected or relocated because of work activity, both pedestrian and vehicular access to the affected or relocated transit stops shall be provided.*[5]
- *When existing pedestrian facilities are disrupted, closed, or relocated in a TTC zone, the temporary facilities shall be detectable and include accessibility features consistent with the features present in the existing pedestrian facility. Where pedestrians with visual disabilities normally use the closed sidewalk, a barrier that is detectable by a person with a visual disability traveling with the aid of a long cane shall be placed across the full width of the closed sidewalk.*[5]
- *While designing detours, ADA requirements must be considered.*[9]

If a transit stop will be affected by the work zone, the agencies involved should consult the transit agencies that serve the affected stop to determine whether a temporary stop will need to be created either inside the traffic control area or external to it. If the construction zone is extensive and will impact multiple stops, it may be necessary to arrange for a shuttle or establish a temporary alternate route that transports pedestrians safely around the work area.[16] Any changes to transit stop locations or schedules due to construction must be provided in an accessible format, preferably well in advance of the TTC process.

CONSIDERATION FOR SAFE ACCESS

The following should be considered for ensuring safe access to bus stops in or near construction areas:

- Ensure that a mechanism is in place that notifies the transit agency if a road improvement project is planned and it appears to affect transit services.
- Once information on planned construction activities at or around bus stops is received, ensure that the transit agency has a designated staff person to work with roadway agencies and their contractors to ensure that adequate pedestrian access routes are provided during construction periods.
- Where applicable, the TTC 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.
- TTC should be provided for cyclists as well as pedestrians to access the transit stop.
- 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.
- Access to temporary bus stops, travel across intersections with accessible pedestrian signals, and other routing issues should be considered where temporary pedestrian routes are channelized.
- Barriers and channelizing devices that are detectable by people with visual disabilities should be provided.
- 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 alight from transit vehicles.
- 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

REQUIREMENTS

- *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.*[8]
- *According to FDOT Design Standards, Index 660, any temporary sidewalk must be a minimum of 4 feet wide with a maximum of 2% cross-slope.*[8]
- *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.*[9]
- *Temporary ramps must meet the requirements for curb ramps specified in FDOT Design Standards, Index 304.*[8]
- *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.*[9]

pedestrians, particularly in high-traffic-volume urban and urbanized areas, are not confronted with mid-block crossings.

- Protected passenger crosswalks need to be provided, depending on road conditions.[15]
- Maintain good drainage conditions for accessible paths and bus stops.[15]
- Consider using ITS technologies like closed circuit television cameras (CCTV), portable dynamic message sign (PDMS), detection devices for traffic queuing and construction zones, video monitoring stations, and telephone/web-based traveler information.[14]

PEDESTRIAN REROUTING

Safe and accessible rerouting of pedestrian traffic often is necessary during construction near bus stops and agencies use various strategies to accommodate it. Using pre-constructed interlocking barriers has been a common practice to provide safe pedestrian channels. These devices interlock in a way that allows the route to be continuous and are specially designed to be inward facing with no protruding footings into the travel pathway.

Key considerations for pedestrian and sidewalk rerouting include:

- *Explore the possibility of maintaining existing routing/ sidewalk*—When feasible, the preferred option is always to maintain the existing sidewalk.
- *Develop an alternative pedestrian circulation path*—If the current pathway to the bus stop must be closed, the preferred option is to create an alternative circulation path that is parallel to, or easily reached from the access point of the standard sidewalk. Channelization of pedestrians into alternate pathways reduces pedestrian exposure to traffic risks and unprotected street access.
- *Reroute pedestrians to nearby parallel sidewalk*—Although it is permissible to reroute pedestrians to a nearby parallel sidewalk, this option should be considered only when maintaining the existing sidewalk or utilizing a constructed alternative path are not feasible.

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.

Warnings and Signage

Warnings should be placed at the near side and far side of the intersection leading to a temporarily closed or blocked pedestrian route. Signs should be distributed to prevent the need for pedestrians to backtrack to the new route, which can be done by placing directional warnings at the beginning of a route and not only at the inaccessible site. Use of chain, rope, or tape may be applied for pedestrian channeling to guide pedestrians with visual impairments to the correct alternate route and then to the bus stop.

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 barriers and channelizing devices that are detectable to pedestrians traveling with the aid of a long cane or who have low vision. 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).

FDOT

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Chapter 05

BRT STATION DESIGN


N - Tropicana Field

5.1 BRT STATIONS

Bus rapid transit, or BRT, is defined by FTA as "a high-quality bus-based transit system that delivers fast and efficient service that may include dedicated lanes, busways, traffic signal priority, off-board fare collection, elevated platforms, and enhanced stations." This established form of rapid transit service with rubber-tire buses has been on the rise in Florida and elsewhere during the last decade. The "full" or "true" form of BRT operates on a dedicated bus lane or in an exclusive runningway to combine the flexibility of buses with the efficiency of rail. BRT in mixed traffic lanes, sometimes referred to as "BRT Lite," combines transit preferential treatments with varied levels of other elements and is applied where dedicated bus lanes or runningways are not feasible or may be under development.

Whether it is the full or lite version of BRT, stations play a critical role to make the service safely accessible to its users as well as promote the brand. This chapter highlights some of the key requirements and best practices in the design and placement of BRT stations in Florida. Figure 5.1.1 shows an example of a BRT station for the SunRunner service in Pinellas County.

Figure 5.1.1 | BRT station in Pinellas County, Florida.

REQUIREMENTS

- *BRT is designated as bus service. Therefore, design and placement guidance applicable to bus stops, as included in this handbook and in any reference documentation, also is applicable to BRT stations.*[2,4]
- *Per APTA's Standards Development Program, Recommended Practices (December 11, 2020), BRT stations shall, at a minimum, incorporate the following characteristics and amenities:*[8]
    - *Provide passengers with basic premium amenities such as waste and recycling receptacles, seating, basic covered shelter, and bicycle parking.*
    - *Provide a safe waiting environment through lighting, runningway barriers, and CPTED standards.*
    - *Provide relevant passenger information including system maps, area destinations, and real-time information.*
    - *Facilitate multi-door boarding.*
    - *Enable near-level boarding.*
    - *Facilitate improved route speeds.*
    - *Accommodate Universal Accessibility.*
    - *Be welcoming and inviting, promoting visibility and facilitating the identified brand of the system.*
    - *Coordinate with design features and identity of the surrounding neighborhood/community.*
    - *Ensure ease of transfer to other transit modes such as rail, bike share, TNCs, and e-scooters through signage.*

BRT stations should be designed to reflect the uniqueness of the mode, but also should be safe and accessible to all, similar to traditional bus stops. BRT stations also can function as potential development nodes along 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 access to functional vehicles or are unable to drive) and discretionary riders (people who choose not to drive), as well as by reducing the parking requirements for new development.

Enhanced BRT stations may provide a greater attractiveness to economic investments than basic bus stops, particularly for those systems operating in grade-separated runningways, due to BRT's unique appeal and its ability to enhance the perception of system permanence.

The size and design of BRT stations can depend on runningway type, project budget, estimated passenger demand, surrounding land uses, zoning, and available rights-of-way. As a result, BRT service may utilize stations that vary in scale and level of infrastructure due to these factors and may include a mix ranging from basic stops to large stations.

TYPES OF BRT STATIONS

Table 5.1.1 presents the major BRT station types, including an overview of the design and placement of each and the recommended scenarios/situations for installing them. Figures 5.1.2 through 5.1.5 show examples of BRT station types.

DESIGN TIP

Designing Stations & Other Components for BRT Lite vs. Full BRT

	BRT Lite	*Full BRT*
Stations	Enhanced bus stop with shelter Stations with branding possible Additional signage Bicycle parking Shared use mobility parking possible Station shared with regular fixed-route bus services	Uniquely branded stations Platforms for level or near-level boarding Enhanced stations with better amenities & accessibility options CCTV for safety Limited to no station sharing with regular fixed-route bus services
Vehicles	Branded vehicles possible Low-floor buses Sleeker vehicles than traditional fixed-route bus	Branded vehicles Level or near-level boarding Multi-door boarding High-capacity/articulated buses possible
Runningways	Mostly in mixed traffic Limited preferential treatments at intersections such as queue jumps	Mostly on dedicated runningways Distinctive pavement treatment HOV drop ramps
Fare Collection	Off-board fare collection at selected stops Mobile fare payment possible	Off-board fare collection Off-board farecard readers Mobile fare payment
Technology	Automated vehicle location TSP at selected intersections Real-time bus information at key stations	TSP at most intersections Real-time bus information at most stations Smart fare payment media and technology CCTV and digital information displays Automated guidance for precision docking
Operations	High frequency only during peak Integrated regional coordination Stop spacing mostly similar to traditional fixed-route bus service	High frequency most of the day Headways 10 minutes or better Station locations coordinated with TOD planning Wider stop spacing

FDOT

Table 5.1.1[1]
BRT Station Types and Recommended Scenarios

Type	Description	Recommended Scenario
Basic	May include a few amenities, such as a small shelter, passenger information, seating, lighting, and branding elements. Typically smaller in size and scale. Quick and easy to install and inexpensive. Platforms also can be useful where right-of-way is lacking and/or a larger station area would be out of scale with the surrounding land uses. However, these may distinguish the BRT service only moderately from traditional bus service, offer few amenities, and may provide limited opportunities to attract TOD.	• Travel demand is expected to be low • Space limitations preclude installation of stations • As transitional strategy/short-term use when an enhanced stop is planned
Premium	Substantial facility with all the attributes of basic BRT stations, plus added amenities, such as shelters, level boarding, opportunity for off-board fare collection, a unique name, distinctive branding, passenger information, lighting, security, seating, and other features typically associated with rapid or rail transit stations.	• Sufficient space permits installation • High demand is expected • Passenger experience is a high priority • Desired to protect passengers from weather conditions • TOD is desired or proposed
Highway/ Freeway	Depending on the runningway configuration, stations may be implemented with median platforms or side platforms. Bus access to the station may vary from bus-only dedicated runningways to general purpose ramps, shoulder lanes, and/or specialty lanes, such as high-occupancy vehicle or express lanes.	• Near major activity centers or park-and-ride lots • Where supporting infrastructure, including pedestrian overpasses, multi-use paths, pedestrian tunnels, or nonmotorized crossings, is available to facilitate last-mile connections
Transit Center	Located on or off a transit line, but enables passengers to transfer to other transit services, generally without leaving the physical boundaries of the station. It also may function as an end-of-line facility for some routes. May provide opportunity for commercial and food services, and transit-supportive land uses. Typically requires more space and a greater capital investment.	• Where the BRT alignment interfaces with other modes and/or other transit services • In many cases, existing transit centers have been converted to support BRT
Terminus	An endpoint that also may include a place for vehicles to turn around and layover, a rest facility for drivers, an area to perform minor vehicle maintenance or charging, the opportunity for transfers to local buses or other modes, a park-and-ride lot, and other facilities. Identifies the endpoint of the BRT guideway. May require more space to accommodate spare or replacement vehicles.	• BRT alignment ends or interfaces with a network of other transit services on local streets • Demand warrants placement of an end-point station • Operational strategies require it

Figure 5.1.2 | Basic BRT Station

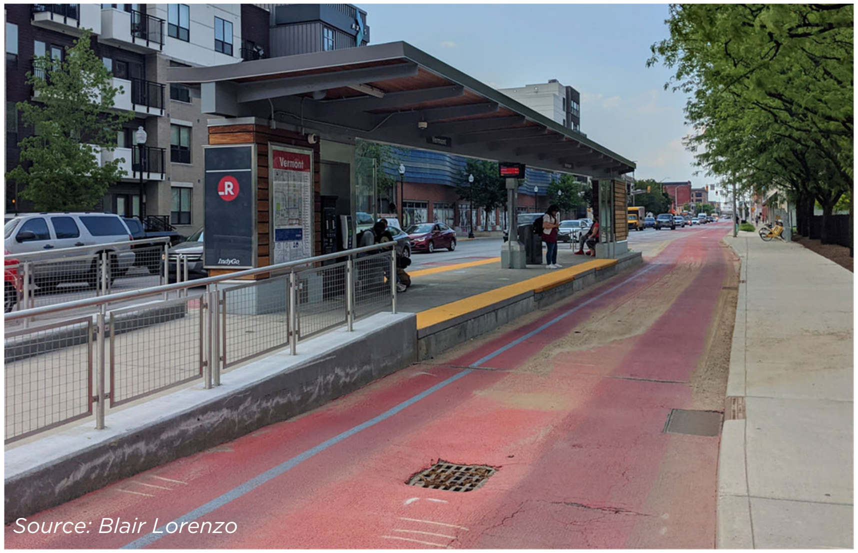


Figure 5.1.3 | Highway BRT Station.

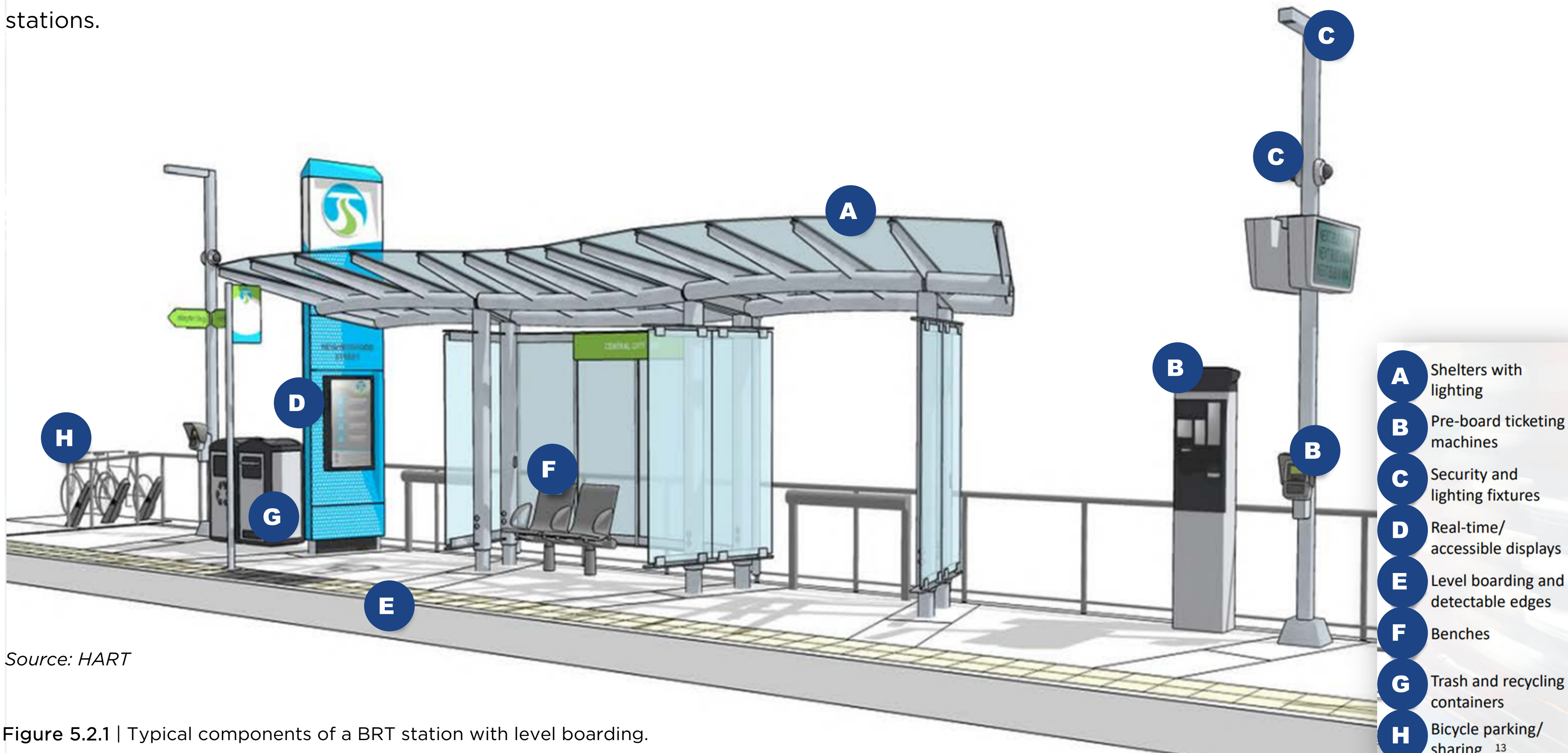
Figure 5.1.4 | Premium BRT Station

Figure 5.1.5 | BRT Terminus Station

5.2 STATION DESIGN

The design of BRT stations determines the placement of amenities and infrastructure, including shelters, benches, lighting, ticket vending machines, bike racks, electronic and static displays, branding material, etc., and the platform layout. In addition, there may be other elements, sometimes placed by another local transit agency or a vendor, such as e-scooter parking, newspaper and other vending machines, and/or wayfinding signage. Figure 5.2.1 illustrates key components that should be considered for BRT stations.

This section provides guidance and best practices for BRT station design. However, as BRT stations are still considered bus passenger facilities, applicable accessibility guidance included in the preceding chapters of this handbook and in the reference documents listed herein should be consulted prior to design (and placement) of BRT stations.



Source: HART

Figure 5.2.1 | Typical components of a BRT station with level boarding.

STATION DIMENSIONS

Dimensions of a BRT station can depend on many factors. For example, some stations may accommodate larger 60-foot articulated buses or allow local bus service to load riders at the end of the BRT platform. When multiple vehicle berths are used, loading platforms should be sufficiently far apart to ensure that passenger waiting areas are clear within the station and that vehicles do not interfere with one another when entering or departing the station. With a passing or through-travel lane scenario, the station length should be sufficient to allow vehicles to safely and efficiently merge into the traffic lane.

If the design is a center platform station in a median, the stops should be offset on each side of the platform if heavy ridership activity is expected or station width is limited. Standard design dimensions for various types of BRT stations are highlighted to the right. However, as previously indicated, these dimension may vary based on need, space availability, and investment type, among other factors.

REQUIREMENTS

- *BRT stations must meet vertical and side clearance of the vehicle, turning radius of the intersection, curb lane width, parking clear zone, and presence of driveways, among other criteria.*[1]

STATION COMPONENTS

Components of a BRT station can range based on facility size and intended investment, but still include at least the minimum elements to make it safe and accessible as well as differentiate it from a typical fixed-route bus stop. In addition to the basic components, passenger information systems, Wi-Fi, internal and external lighting, and security cameras can help make stations more attractive, comfortable, safe, and engaging. At the high-end, providing fully-equipped BRT stations with air-conditioned enclosures can completely transform the travel experience, attracting potential riders and making it a more rail-like experience.

Figure 5.2.2 shows dimensions and components by station scale and Table 5.2.1 presents station components by investment level for two proposed BRT systems in Florida.

Design Dimensions

Median Station [7,10,11]

- Station Width (overall)—30’ max. to 26’ min.
- Clear Platform Width (Each Side)—12’ desirable, 10’ min.

Curb-Side Station [7,10,11]

- Station Width (overall)—16’ max. to 10’ min.
- Clear Platform Width—12’ desirable, 10’ min.

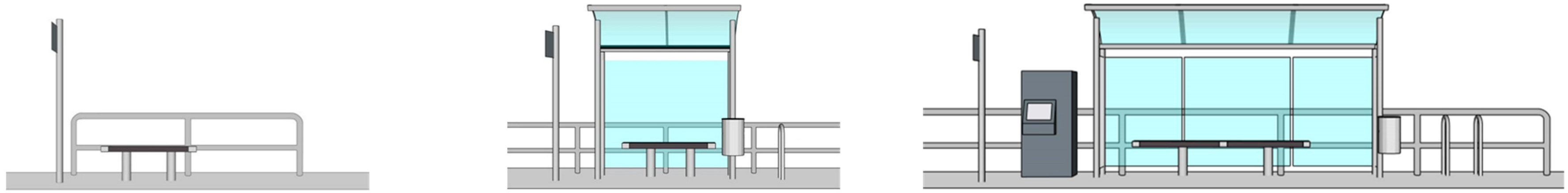
Park & Ride Station [7,10,11]

- Station Width (overall)—20’ max. to 10’ min.
- Clear Platform Width—12’ desirable, 10’ min.

All Station Types [7,10,11]

- Station Height—14.5”-15.5”
- Station Length—140’
- Approach Taper Length—1.5x Bus Length
- Departure Taper Length—1x Bus Length

Figure 5.2.2 | Example Station Dimensions and Components by Station Scale



Width		
10’	10’-12’	10’-12’
Length		
50’	50’-100’	100’
Components		
• ADA accessibility/pad • Shelter option • Sign and paper schedule • Bench • Lighting • Emergency phone • Limited micro-mobility services • Pole	• ADA accessibility/pad • Shelter or partial enclosure • System map (wayfinding) • Seating • Lighting and security • Fare collection system • Emergency phone • Provide micro-mobility capacity if not already in close proximity	• ADA accessibility/pad • Partial or full enclosure • Real-time passenger message boards/LCD • Seating • Lighting and security • Fare collection system • Landscaping • Focus on rideshare; provide micro-mobility capacity if not already in close proximity • Art installations

Source: Analysis of 2022 HART BRT Arterial Study data.

Shelter Design

Branding is a key feature of BRT applications; station design should be consistent with a BRT system’s brand and design. In addition, the following also should be taken into consideration.

Design Considerations:[1]

- Provide consistency among all stations; be unique enough to distinguish them from other system bus stops and/or services and reflect the BRT brand; use shelter design to enhance visibility of the service.
- Explore concepts for integrating existing shelters, facilities, and public amenities along each corridor while creating an overall design that can be read as an integrated whole.
- Provide consistency (in materials, colors, and design) with other site elements, including lighting, railings, signage, litter receptacles, bike racks, etc.
- Materials and components must be easy to maintain, repair, and refurbish; be vandal-resistant; be transportable; and have a proven and dependable performance history.
- Benches or leaning rails should be considered inside all shelters.
- Hardwired internal shelter lighting is preferred; a minimum of 4 footcandles (43 lux) illumination average within the shelter is recommended.
- One seating or leaning position for every five waiting passengers is desirable.
- Design must discourage the use of seating for sleeping; maximum bench length is 4 feet and dividers along the length of the bench are recommended.

- Seating requirements may need to be minimized where passenger volumes are very high or where there is a high level of pedestrian activity.

Off-Board Fare Collection

This practice enables riders to purchase their bus fares before entering the vehicle and allows for them to simply enter the bus upon its arrival. Various fare collection options are available for BRT systems; however, "smart purchasing" options are becoming widely used. Smart purchasing allows riders to buy fares using their smart phones. Other options utilize ticket vending machines or prepaid cards that can be reloaded with funds. BRT vehicles are then equipped with card readers at each door that allow passengers to simply tap their card against the device and enter the bus. Encouraging the use of smart payments decreases the need for physical ticketing devices, saves space within the BRT station, and requires less overall maintenance. In instances where card readers are not used, visual fare validation by operators may be utilized.

Lighting

At BRT stations, lighting can play a bigger role than at a regular traditional bus stop due to the nature of the service and the branding-related enhancements. Proper illumination can help locate and identify the station. In addition to improving safety and security, as for any bus stop, lighting at a BRT station also can help enhance the investment the transit agency makes in architectural and design elements.

Information Displays

A key amenity recommended for BRT stations is real-time bus information displays, showing information on bus arrivals and other service information/updates. When placing these displays at BRT stations, necessary federal and state guidelines on signage should be followed so the visibility or safety of the users of those facilities will not be hindered.

While numerous transit agencies have begun offering real time information through smart phone applications, these physical passenger displays still are recommended.

Table 5.2.1
BRT Station Components by Investment Type

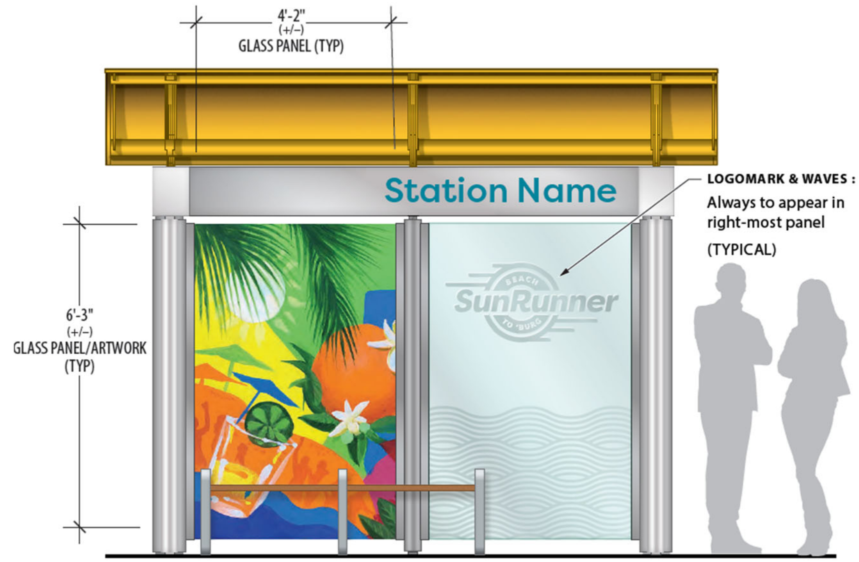
Investment	Shelter Type	Security Cameras	Outdoor Rated Display Monitor	Ticket Vending Machine	Bench	Trash Receptables	Bike Rack	Artwork
High	Large Shelter with Totem	Two	Yes	Yes	Multiple	Yes	Yes	Should consider depending on the location
Medium	Small Shelter with Totem	One	Yes	Yes	One	Yes	Yes	Should consider depending on the location
Low	Totem only	None	Yes	Yes	Leaning Rail	Yes	Yes	As applicable

Source: Proposed PSTA BRT service and industry data.

Station Branding

Branding is one of the most important features of BRT, and station design should be consistent with a BRT system's brand and design. Figure 5.2.3 shows an example of a BRT station branding concept.

While there are no standard requirements on the materials for and dimensions of branding-related components at stations, all designs and materials should comply with the guidance presented in this handbook to ensure that stations are safe and accessible to all.



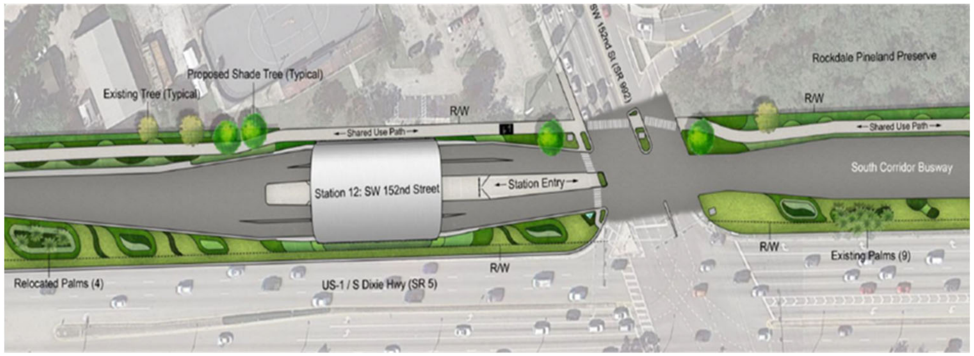
Source: PSTA

Figure 5.2.3 | Branding at a BRT station in St. Peterburg, Florida.

Bike and Shared Mobility Parking

When planning BRT stations, it is important to consider the potential parking demand for bikes and shared mobility modes, such as e-scooters, or even cars. Bicycle and e-scooter parking is a typical need while some larger BRT stations may provide park-and -ride facilities, as well, if they are expected to be heavily used by commuters.

Enclosed bike storage is becoming popular, but riders, especially commuters, may prefer secure facilities. Whether open or enclosed, bike and e-scooter parking and storage facilities at BRT stations should follow all necessary guidelines included in this handbook and should not impede access to and from the station. Regardless of the nature of the parking and/or storage arrangement, compliant and adequate signage and wayfinding also should be provided to ensure that patrons are able to safely access these amenities during day and night times.



Source: MDTA

Figure 5.2.4 | Proposed landscaping plan for BRT station in Miami, Florida.

Landscaping

Similar to the case for traditional bus stops, landscaping also can enhance the overall experience at a BRT station and help increase the appeal of the service available there to existing riders, potential new users, and even the surrounding development community. Although BRT stations typically are located in more populated areas where space may be limited for landscaping elements, it still is a worthwhile amenity to consider—even at a limited scale. When space is available in BRT station applications, landscaping should be included and should follow the necessary guidelines included in this handbook. Figure 5.2.4 illustrates a sample landscaping plan concept for a BRT station in Miami.

BRT IN FLORIDA

First Coast Flyer – Jacksonville

Source: JTA

Jacksonville North Corridor (Green Line) – Opened in 2014, with 5.5 miles of dedicated lanes. Serves an economically distressed area within Jacksonville.

Jacksonville Southeast Corridor (Blue Line) – Opened in 2016, connecting Downtown Jacksonville to Southshore I-295. An 11-mile service route with access to a park-and-ride lot.

Jacksonville West Corridor (Red Line) – Opened in 2018 and offered the first BRT route in the state to connect beaches to the community.

Jacksonville Southwest Corridor BRT Project (First Coast Flyer Orange Line) – Opened for service in 2021, connecting downtown Jacksonville, Florida State College Campus, and Orange Park Mall.

LYMMO – Orlando

Source: LYNX

LYMMO Lime Line – LYMMO BRT service began in Orlando in 1997. The Lime Line was a development that began operation in 2016 and added over 2 miles of service, connecting the Parramore and Callahan neighborhoods to the central business district, SunRail access, Amway Center, and the Creative Village.

LYMMO Grapefruit Line – Opened in 2018, this route circulates from Parramore neighborhood to South Eola and Thornton Park.

LYMMO Expansions – In February 2022, LYNX received a grant that will be used to implement 9 new LYMMO BRT stations to create a new 6-mile transit corridor along SR 436.

BRT – Miami-Dade


Source: Miami-Dade County

South Dade Transitway Corridor – This BRT service is scheduled to begin operation by January 2023. The South Corridor runs approximately 20 miles from the Dadeland South Metrorail Station along the existing Transitway to the SW 344th Street Park-and-Ride/ Transit Terminal Facility.

MetroRapid – Tampa


Source: HART

HART's first mixed-traffic BRT, opened in 2013, connects the USF area to downtown Tampa at HART's Marion Transit Center.

HART currently is conducting an Arterial BRT study to examine the potential application of a new, enhanced BRT service with dedicated guideways and BAT lanes.

SunRunner – St. Petersburg

Source: PSTA

Designed to operate on a 10.3-mile route from downtown St. Petersburg to St. Pete Beach via the Central Avenue corridor, SunRunner BRT construction began in 2020 and is scheduled to open for service in late 2022. The first BRT service for PSTA and Pinellas County, Florida, SunRunner would utilize BAT lanes, dedicated bus lanes, raised platforms, and TSP technology to provides its services.

5.3 STATION PLATFORMS

The design of BRT stations, especially the platform area, requires thoughtful consideration for the passenger and desired infrastructure. A carefully planned and designed platform will ensure a smoother and safer boarding and alighting process, as well as a more comfortable wait for the bus. For example, many BRT systems implement raised platforms at stations to increase the accessibility of the buses and reduce dwell times at the station. In addition to choosing the best placement for the station, consideration for how a site can accommodate the desired platform configuration is necessary to effectively choosing an ideal location for a BRT station.

AREA

The BRT station platform provides an area for patrons to wait and the BRT vehicles to interface with them once there. The actual extent of this area depends on expected ridership activity, the type(s) of vehicles to serve the station, and the placement of various station components.

Design Considerations:

Some of the factors that should be considered while designing a platform area include the following.[1]

- Efficient flow of pedestrians
- Passenger amenities, including benches, weather protection, etc.
- Compatibility with BRT vehicle door configuration
- Accessibility for persons with disabilities

REQUIREMENTS

- *Minimum width for a BRT station platform is 8 feet.*[1]
- *A portion of the main counter at ticketing counters must be at least 36 inches long with a maximum height of 36 inches.*[2]
- *The space in front of the counter must provide for a parallel approach or, if the counter is not at least 36 inches long, then it must be at least 30 inches long and provide knee and toe space under the counter for a forward approach.*[2]
- *Ticket counters providing a front approach must satisfy knee and toe clearance requirements. The assessment must ensure that a forward approach with a clearance depth of 17 to 19 inches is provided to permit a person in a wheelchair to pull up far enough under the counter to utilize it as a work surface.*[2]
- *If public address systems are provided to convey information to the public, there also must be a means of conveying the same or equivalent information to persons with hearing impairments.*[2]
- *Lighting plans for BRT station platforms, boarding and alighting areas, and other areas of the station must meet bus stop lighting guidelines.*[6,9]
- *Where clocks are provided for use by the public, the clock face shall be uncluttered so that its elements are clearly visible. Hands, numerals, and digits shall contrast with the background, either light-on-dark or dark-on-light. Where clocks are installed overhead, numerals and digits shall comply with ADA requirements for the visual character heights previously identified in this handbook.*[2]

- Station name visible from inside the vehicle
- Clear and simple wayfinding signs
- Fare collection and control systems
- Safety and security
- Emergency evacuation procedures

LENGTH

BRT station platform length is generally easier to accommodate than the width, and even more so when a station/stop is in the median. Additionally, the length also should accommodate sufficient total bus stop length to allow vehicles to merge into the traffic lane safely and efficiently. Longer platforms also help to reduce dwell times by providing space for multiple vehicles to load and unload passengers concurrently.

Platform length should meet the needs of the transit agency providing the station. Figures 5.3.1 and 5.3.2 show a BRT station with a near-level boarding area.

Figure 5.3.1 | Example of a median platform BRT station with near-level boarding.

DESIGN TIP

- At least one covered seating position is required.[1]
- Ample area under cover must be provided for at least one person using a wheelchair or other mobility device without obstructing other seating.[1]

Design Dimensions

Length

- 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.[1]
- Space also must be provided for infrastructure and the transition area.[1]
- Station saturation should be used as a driver when determining the additional length needed. Saturation refers to the percentage of time that BRT buses are occupying the station, opening doors, boarding and alighting passengers, and finally undocking and leaving the station.[5]
- If vehicles are utilizing the same platform, the vehicle waiting in queue behind a BRT bus currently at the station should be able to wait behind the first vehicle without blocking the station on either side. To achieve this, minimum spacing between bays should remain at least 1.7 times the length of the longest vehicle utilized at the station. Given the use of a 60' articulated bus, the necessary distance for this scenario would be approximately 100'.[5]

WIDTH

Width generally is 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 it 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 medians.

While ADA regulations require a minimum width of 8 feet for a BRT station platform, when there are no right-of-way constraints, width is generally a function of the anticipated passenger load and the station operational design.

HEIGHT

Platform height refers to the vertical height of the station platform above the roadway or transitway. 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.

Source: Blair Lorenzo

Figure 5.3.2 | Example of a near-level boarding BRT platform.

Design Dimensions

Width

- According to ADA regulations, a minimum width for a BRT station a platform is 8 feet.[2]
- Center platforms should be as wide as 20' to 25' because they are serving buses on both sides of the platform.[7]
- Platform width should be sufficient to accommodate station infrastructure (ramps, garbage receptacles, ticket vending machines, signage, bicycle racks, stairs, elevators, etc.), passenger waiting areas, entry/exit and circulation within the station, and access and safety for all passengers, including mobility-aid users.[1]
- If right-of-way is limited, consider reducing width requirements by offsetting vehicle berths on either side of the station, thereby reducing the depth needed to accommodate passenger waiting areas for those traveling in opposite directions.[1]

Height

- Platform height needs to be coordinated with fare collection and vehicle design.[7]
- Standard curb platforms are typically 6" above street level, leaving about 8" to the base of the vehicle.[7]
- Raised curbs are typically 9" to 11" above the street level, leaving about 5" to the base of the vehicle. Level platforms are typically 14" to 15" high.[1]

5.4 STATION PLACEMENT

Placement of BRT stations depends on the runningway type proposed for the service, including general purpose lanes 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.

Figure 5.4.1 | BRT station in Jacksonville, Florida.

Unlike traditional bus stops that require relatively less investment and typically can be relocated easily, placing a BRT station requires significant investment and, therefore, warrants additional planning for agencies. Figure 5.4.1 shows an example of a BRT station.

For example, local zoning ordinances should be reviewed to ensure that existing regulations allow for such 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 also should consider the availability of additional space to include park-and-ride lots, if applicable.

Collaboration 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 collaboration, see Chapter 2 of this handbook.

The rest of this section presents and discusses the six primary placement locations for BRT stations. The first three location options are primarily related to the placement of the runningway (curb or median) being applied for the BRT service, while the latter three are associated with station position in relation to the proximate intersection (near-side, far-side, mid-block).

RUNNINGWAY-BASED STATION PLACEMENT

As indicated previously, placement of BRT stations depends on the runningway type. The following guidance is provided specifically for the two main runningway-based placement options, including the curbside station application and the median station application (with its three key functional variations due to platform type applied based on need, design, and local site conditions).

Curbside Station

A curbside station is located adjacent to the curb or parking lane of a street and often is integrated into the existing sidewalk area. Curbside stations can be located far-side, near-side, or mid-block. The curbside option generally requires two platforms (one in each direction) and may conflict with other uses of the sidewalk area, particularly in dense urban corridors. In these instances, coordination with adjacent property owners may be required. Figure 5.4.2 shows an example curbside station application.

If near-level or level boarding is desired at a curbside station, the design should ensure that there are no grading issues, as typical platform heights in these cases are 12 to 15 inches, which is higher than the standard curb height of 6 inches.

Source: HART

Figure 5.4.2 | Curbside BRT station in Tampa, Florida.

PLACEMENT TIP

When Placing BRT Stations on Curbside

Pros

- Space is more likely to be available, and it is possible to avoid taking street space by using existing sidewalk area.
- Can be integrated with buildings and may complement other uses of the sidewalk.
- Possible to use a standard bus and share the facility with traditional bus service.
- Eliminates the need for some pedestrian street crossings.

Cons

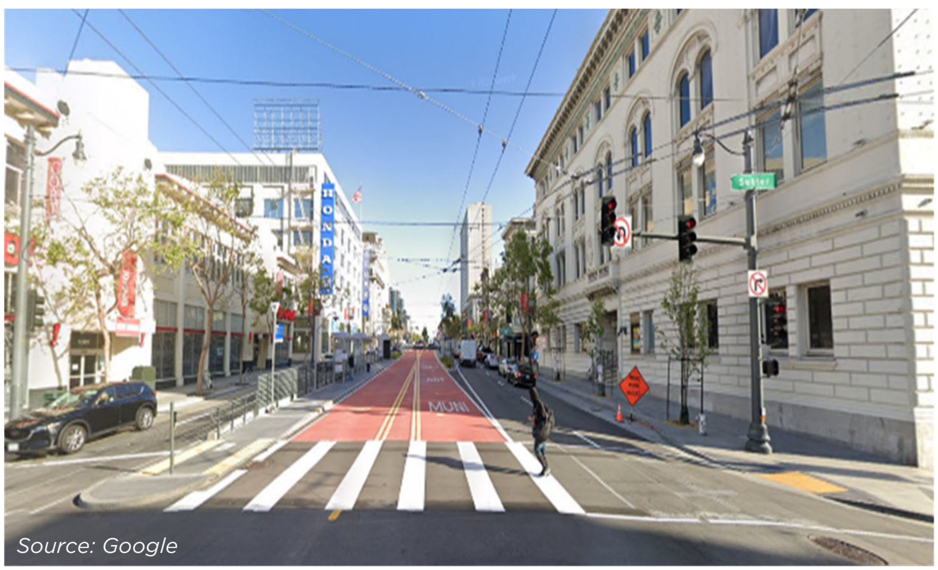
- Curbside real estate is quite valuable, particularly in dense urban locations.
- Buses must use the curbside lane to serve the station, potentially creating conflicts with right -turning vehicles, parked cars, bicycles, etc. (Use of a curb extension helps to mitigate this issue.)
- In heavily commercialized areas, it may be difficult to distinguish station signs on the curbside from other signage.

Median Station

Median stations are located within the median right-of-way of a divided street or roadway. They are associated with median runningways or bus lanes. In many instances, the application of a median station may be difficult or infeasible due to the existing roadway configuration and/or available right-of-way.

Center Platform

Located on the center island of the median runningway, this median station type has a platform that allows shared passenger facilities serving both directions of service and, thus, has 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. However, to accommodate this configuration, it is necessary to have vehicles with left-side doors. It also may complicate left turns for automobiles across the runningway. Figure 5.4.3 shows an example of a median BRT station with a center platform.



Source: Google

Figure 5.4.3 | Median BRT station with a center platform, San Francisco, California.

PLACEMENT TIP

When Placing BRT Stations on a Roadway Median

Pros

- Can serve both directions simultaneously and provides more similarity to rail service.
- Can maximize speed by minimizing car conflicts and make TSP easier with unique signals and signal phasing.
- Can take advantage of unused medians and may enable curbside parking.
- Easy to distinguish, enhancing system identity and visibility.
- Does not create a visual obstruction for businesses.

Cons

- May require taking of more right-of-way than curbside stations.
- May conflict with other uses of the road, including left turn lanes.
- May require unique signal timings.
- Requires passengers to cross some traffic lanes to get to the stations, creating the need for a longer walk than for curbside stations.
- Median space may be limited.
- Relatively more difficult to maintain than a curbside station.

These types of stations also can be used when there is limited right-of-way to accommodate ramps for side platforms. Compared with offset center platforms, center platforms have lower construction costs due to requiring only one set of station amenities and access routes (e.g., stairways, etc.), require less linear space along the runningway, and provide a simpler customer experience with a single platform.[1]

Side Platform

Side platform stations can be implemented as an alternative to center-running stations if necessitated by the nature of and space available for the runningway in the center of a roadway. These stations also are beneficial when right-side shoulders or runningways are deployed. The stations do not require crossover operations since right-side vehicle door boarding and alighting is accommodated.[1] Station pairs with this type of platform can be located far-side, side-by-side, near-side, or mid-block, with each platform located on opposite sides of the median to serve both directions of bus travel. However, since this platform type does require two separate station areas, it also requires more design, space, and infrastructure considerations. Figure 5.4.4 shows an example median BRT station with a side platform.

Offset Center Platform

An offset center platform station functions similarly to a standard center platform application. However, instead of a single shared platform, buses access two separate platforms offset in a way that allows for conventional, right-side boarding without the need for crossover operations. Compared to center platforms, offset center platforms often have higher construction costs due to the need for expanded infrastructure and two sets of station amenities. They also require more linear space along the runningway, and may provide a more complex customer experience as customers must select the correct platform when entering the station.

Figure 5.4.4 | Median BRT station with a side platform.

INTERSECTION-BASED STATION PLACEMENT

Similar to traditional bus stops, BRT station placement also can be categorized based on its location in relation to an intersection. The following guidance is provided for the three primary intersection-based placement options available. In addition, Table 5.4.1 lists the pros and cons for the placement of BRT stations at each of these intersection-related locations.

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-turn lane for buses only.

Mid-Block Station

A mid-block station is located at some point between consecutive intersections. It is typically unique to mid-block locations that have large trip generators located nearby. Mid-block stations also may be useful in situations where an agency wishes to implement TSP because they provide enough distance to the upcoming intersection to be able to trigger signal adjustments after the vehicles stop. Figure 5.4.5 shows an example of a mid-block station.

Far-Side Station

A far-side station 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 station on the far side of the intersection reduces the potential 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.

Figure 5.4.5 | Mid-block BRT station in Jacksonville, Florida.

<table>
<tr><th colspan="2">Table 5.4.1
BRT Station Placement at an Intersection</th></tr>
<tr><th>Pros</th><th>Cons</th></tr>
<tr><td colspan="2">Near-Side</td></tr>
<tr><td>• Can be used where limited property is available at a far-side location.
• For curbside 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 curbside 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).</td><td>• 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.</td></tr>
<tr><td colspan="2">Mid-Block</td></tr>
<tr><td>• Both arrival and departure at platform are independent of traffic signal timing and, for curbside 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).</td><td>• 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.</td></tr>
<tr><td colspan="2">Far-Side</td></tr>
<tr><td>• 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.</td><td>• 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 station designed to serve multiple buses stopping at the same time, station needs to be moved two or more vehicle lengths beyond intersection to accommodate multiple vehicles.</td></tr>
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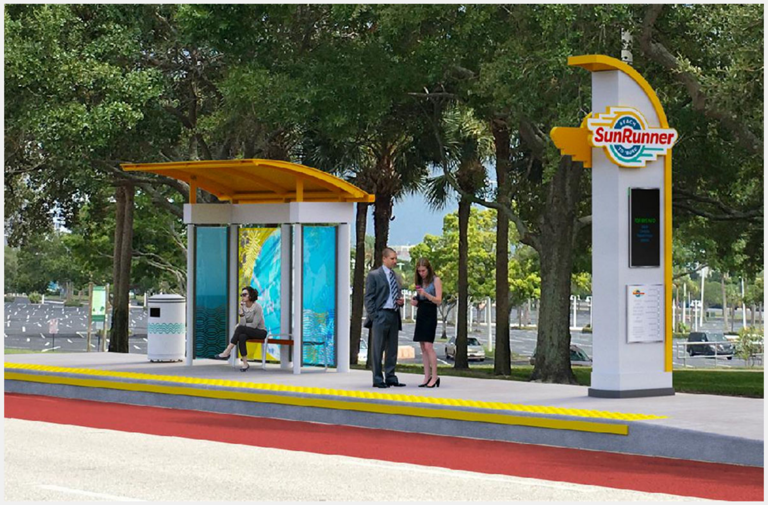
CASE STUDY

Tying BRT Design to Community Design

Pinellas County, FL



Source: PSTA

Through several funding contributions, including a federal Capital Investment Grant, PSTA recently has constructed its first BRT system, with its grand opening occurring in October 2022. The "SunRunner" BRT system connects the City of St. Petersburg's downtown region to the nearby beaches through shared traffic lanes and 32 stations utilizing level boarding platforms. In recent decades, the area of St. Petersburg has seen incredible amounts of development and regional growth, and the addition of BRT is anticipated to contribute even further to ongoing development efforts in the area.

In conjunction with the advancements of the SunRunner BRT system, PSTA also has initiated a regional Transit–Oriented Design (TOD) study that the agency has named "SunRunner Rising." The study aims to incorporate public comments and opinion into the enhancement of TOD in the areas associated with the BRT system. PSTA has received both positive and negative input from the community in St. Petersburg, through which the SunRunner will operate. Many of the concerns presented by community residents are related to the major development projects and not without reason.

PSTA heard the voices of residents who oppose as well as support attempts being made to restructure zoning laws to allow for increased TOD, a measure that would allow for higher density housing along the corridor that would support SunRunner's goals. Early conversations regarding zoning changes have suggested that these laws should take effect within a quarter-mile boundary from SunRunner stations, a range that some community members have indicated may not be far enough to foster the true impacts that TOD could create in the area. In addition to these types of concerns, other TOD-related opinions being focused on by residents include rents being raised, reduced parking, and traffic being congested by implementing the shared-use BRT lanes.

PSTA has been actively involved in acknowledging the concerns of the community and putting the minds of residents at ease. Providing multiple avenues for public comments to be made, engaging with community stakeholders, and providing transparent anticipations are some of the key ways that PSTA has used to create a more positive community perspective regarding the advancement of BRT and the TOD that will follow in its path. Another way this is being done is by analyzing the effects that TOD will have on fulfilling St. Petersburg's long-range goals outlined in the *StPete2050 Vision Plan*, which aim to support "sustainable, resilient, and equitable growth over the next 30 years." PSTA is making strides in providing the community with valuable transit development while also accommodating the needs of the community and responding to its concerns constructively.

5.5 PLANNING FOR BRT FACILITIES

Careful evaluation of all applicable factors are important for decision-making during the planning, design, and placement of BRT stations so that they become effective investments that reach desired ridership and community goals. For example, such considerations may involve types of adjacent land uses, area density/intensity, resulting ridership potential on the corridor, access to surrounding development, and other typical bus facility design and engineering factors. Figure 5.5.1 illustrates some of the planning considerations that were used when placing stops for the South Corridor BRT in Miami.

Table 5.5.1 presents planning and design factors that can support or hinder successful implementation of BRT services.

Furthermore, planning for BRT facilities also should consider the input of riders and community stakeholders, especially when the capital investment for station implementation is significant. Including community stakeholders in station design and placement conversations may lead to better understanding of the community, local needs, and other necessary implementation considerations.

The rest of this section provides considerations, guidance, and best practices for planning BRT facilities. These recommendations are based on the report, Bus Rapid Transit: Current State of Practice, a 2022 TCRP study that analyzed input from various BRT systems already operating in the U.S.

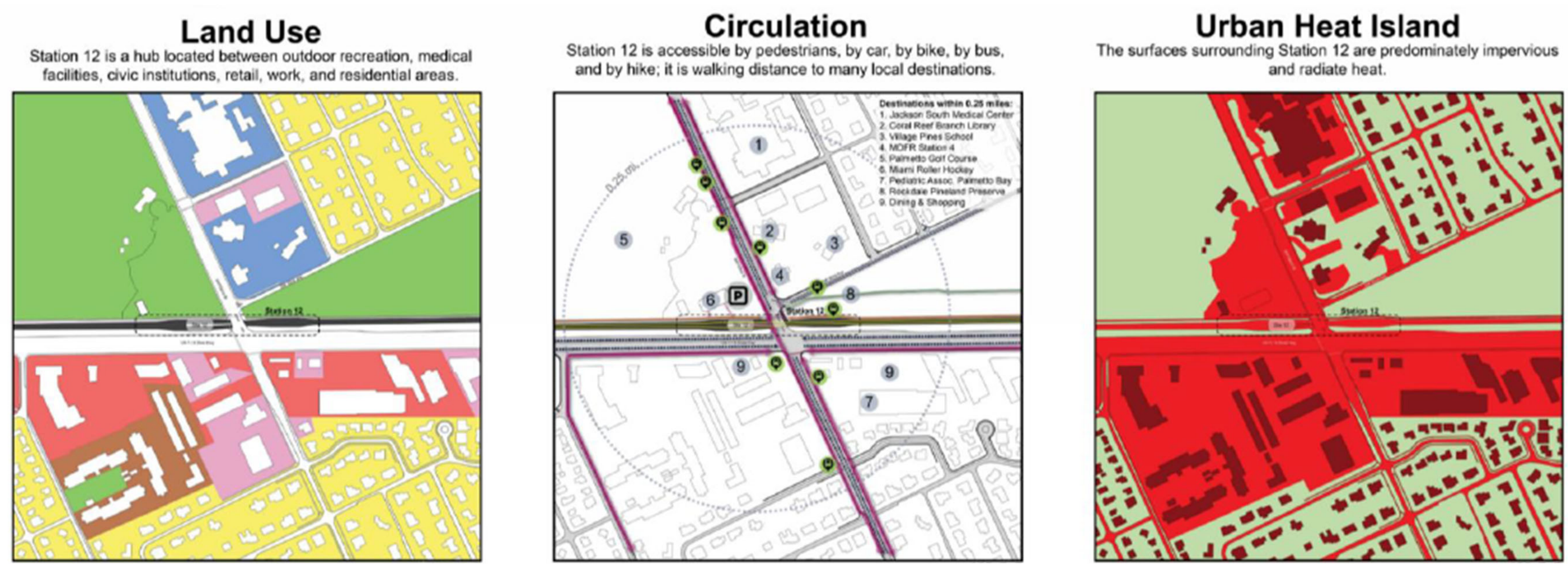


Figure 5.5.1 | BRT Station Context Analysis for South Corridor BRT in Miami, Florida.

Source: Miami-Dade County

Considerations, Guidance, and Best Practices

Get what is needed to make BRT service effective. Decisions made to save costs during design and implementation might reduce service effectiveness after implementation and/or lead to a more expensive project later. Agencies can consider the life cycle of BRT components when making such decisions. Agencies also can obtain exclusive runningway wherever possible.

Figure out the details early on. Agencies can figure out early in the development process how the BRT service will be operated and maintained, both under normal conditions and in circumstances where adverse weather or unavailable vehicles impact service delivery. This might influence staffing and technology investments.

Make decisions effectively and clearly. Although agencies can figure out BRT service and infrastructure details in advance, at some point, an agency may need to consider available time, staffing, and funding and make a decision and move forward. Implementing a "perfect" BRT service might not be possible.

Learn from experience. When developing the first BRT service or facility in the service area, an agency can work with highly experienced project managers. When developing subsequent BRT services or facilities, an agency can learn from the BRT services and facilities that are already in place.

DESIGN TIP

- When thinking about implementing BRT service, imagine as if you are tasked with implementing rail.
- Plan to implement BRT in concurrence with other supportive strategies, such as additional pedestrian infrastructure and road diets/lane repurposing.
- Consider the best way to provide adequate resources for development of a reliable service.
- Consider climate and other sustainability aspects.

Recognize that introducing BRT or prioritized bus infrastructure may require educating the local community. Although identifying and understanding community needs is a factor in planning and designing a successful BRT project, educating the community about BRT can continue after project implementation. Some agencies noted that it took time for drivers to learn how to use its business access and transit (BAT) lanes and for riders to learn how to use off-board fare payment systems.

Table 5.5.1[4]
Planning and Design Factors Impacting Successful BRT Operations and Maintenance

Factors That Support Successful BRT	Factors That Hinder Successful BRT
• Making decisions based on service effectiveness (e.g., maximizing service productivity), not on saving money during construction or shortening implementation time • Taking the time to do things right during planning, design, and implementation • Investing in service connections • Using pilot projects • Involving operations and maintenance staff in planning and design	• Funding that requires BRT service levels that are higher than necessary • Insufficient funding/budget to implement BRT as needed • Inadequate commitment to making sure BRT is supported with enough vehicles, operators, mechanics, etc. • Lack of involvement of operations and maintenance staff in planning and design

Choose carefully which corridor will be the first BRT corridor in the service area. It might be easier to implement BRT in corridors where existing ridership is high, the existing roadway geometry or ROW can accommodate BRT, and local jurisdictions strongly support the BRT project. A successful first BRT project can be used to show the community how BRT works, demonstrate its benefits, and build support for future BRT investments.

Consider whether to implement a BRT service in phases or all at once. Some agencies noted that showing positive impacts quickly can positively affect perceptions of the BRT investment and build support for further BRT investments.

Balance the advantages and disadvantages of having a dedicated BRT fleet. The agencies uniformly acknowledged the branding advantage of having a dedicated BRT fleet, but some observed that using a dedicated BRT fleet can create operations and maintenance challenges. Some agencies noted that the challenges of operating and maintaining a new fleet of specialized vehicles for a future BRT corridor will be offset by the positive travel time and safety impacts made possible by the specialized vehicles.

Establish and maintain healthy relationships with partners. Such agreements and relationships can facilitate runningway acquisition, maintenance, and a continued high level of operations (e.g., by managing future signal timing changes). Interlocal agreements can be helpful. It also can be important to understand the needs of local communities and to look for opportunities to address those needs. Some agencies have indicated that it is helpful when agency partners have a stake in BRT success and share in the “ownership” of BRT. It can take several years to build strong relationships with local entities.

Use branding effectively. Agencies can take advantage of opportunities to reinforce branding and not shy away from bold branding initiatives. Agencies can recognize that BRT branding might evolve over time in response to factors such as maintenance needs, operation needs, and evolving technology.

Keep improving the BRT service or facility. Agencies can continue to invest in the service or facility, including making sure that service components are always in good condition and adequately sized to meet demand and that frequent service is sustained. It also can include looking for opportunities to streamline or otherwise improve BRT service and implementing large -scale BRT investments (e.g., adding exclusive bus lanes).

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Guidelines for Bus Transit Stops in Highway Construction Work Zones
https://rosap.ntl.bts.gov/view/dot/28632

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Appendix A: Quick Reference Guide

Bus Stop B&A Areas

- A B&A area must have a firm, stable, and slip-resistant surface with a minimum clear length of 8 feet (measured perpendicular to the curb or roadway edge), and a minimum clear width of 5 feet (measured parallel to the roadway).[2]
- Firm, stable, and slip-resistant B&A areas are required if amenities such as benches or shelters are added to a bus stop.[2]
- An accessible path to a bus stop B&A area must be provided and designed to maintain a minimum clear width of 60 inches and vertical clearance of 84 inches, unless approved design variation by the District Design Engineer.[2]
- On flush shoulder roadways, B&A areas should be constructed at the shoulder break (or edge of shoulder pavement on roadways with a posted speed of 45 mph or less) to create an accessible bus stop.[2]
- The B&A area on flush shoulder roadways shall use a Type E curb and gutter (5” curb height) and be connected to the sidewalk along the roadway, or to the roadway when no sidewalk is present.[2]
- Except for the area adjacent to the 5-inch curb, the areas surrounding the B&A area on flush shoulder roadways shall be flush with the adjacent shoulder and side slopes and designed to be traversable by errant vehicles.[2] On the upstream side of the B&A area’s landing, a maximum slope of 1:12 should be provided, and may be grass or a hardened surface.[2]
- A sidewalk and/or ramp provided with a B&A area shall be a minimum of 60 inches (5 feet) in width, and the ramp shall not exceed a slope of 1:12 (8.33%).[2]
- Bus stop B&A areas shall be connected to streets, sidewalks, or pedestrian paths by an accessible route.[1]
- A detectable warning surface is required where a sidewalk associated with a B&A area connects to the roadway at grade.[2]
- 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 1:50 (2%).[2]
- The B&A area can be located either within or outside the shelter, and shall be connected to streets, sidewalks, or pedestrian circulation paths by an accessible route.[7]
- If a concrete B&A area (and ramp and level landing, if needed) are to be constructed, requirements include 6-inch-thick concrete.[2]
- The design of vehicles shall be coordinated with the boarding platform design such that the horizontal gap between each vehicle door at rest and the platform shall be no greater than 3 inches and the height of the vehicle floor shall be within plus or minus 5⁄8-inch of the platform height under all normal passenger load conditions. Vertical alignment may be accomplished by vehicle air suspension or other suitable means of meeting the requirement.[11]
- For drainage purposes, a maximum slope of 1:50 (2%) measured perpendicular to the roadway is allowed.[2]

Bus Stop Signs

- For curb and gutter roadway sections in business or residential areas, a minimum 2-foot distance from the face of the curb to the nearest edge of the sign is required.[10]
- 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.[10]
- All signs must comply with the requirements set forth in the Manual on Uniform Traffic Control Devices (MUTCD).[5]
- The minimum height, measured vertically from the bottom of the sign to the top of the curb, or in the absence of curb, measured vertically from the bottom of the sign to the elevation of the near edge of the traveled way, of signs installed at the side of the road in business, commercial, or residential areas where parking or pedestrian movements are likely to occur, or where the view of the sign might be obstructed, shall be 7 feet.[5]
- Provide a minimum 7-foot vertical clearance over the entire walking surface. If the vertical clearance is less than 7 feet and is placed along an accessible route, a barrier to warn people with visual impairment must be provided.[2]
- Objects with leading edges more than 27 inches and not more than 80 inches above the finish floor or ground shall protrude 4 inches maximum horizontally into the circulation path.[1]
- All sign supports, except overhead cantilever, truss type or bridge, or barrier wall-mounted, shall be breakaway as defined in AASHTO's Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, and the AASHTO Roadside Design Guide.10 Signs shielded by a barrier wall or guardrail do not require breakaway support.[10]
- Sign supports shall be of an acceptable and crashworthy design as described in the FDOT Standard Plans.[2] Signs and poles must be located in accordance with FDOT Standard Plans.[2]
- Signs shall not be installed where such signing interferes with the functions or visibility of existing traffic control devices.[4]
- Non-discrimination requirements of ADA pertaining to visual signage requirements specify that route indicators must be present on bus stop signs.[1]
- Characters and their background shall have a non-glare finish. Characters shall contrast with their background with either light characters on a dark background or dark characters on a light background.[1]
- Visual characters on the sign must comply with the following:[1]
    - 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 other unusual forms.
    - 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".
    - Stroke thickness of the uppercase letter "I" shall be 10% minimum and 30% maximum of the height of the character.
    - Character spacing shall be measured between the two closest points of adjacent characters, excluding word spaces. Spacing between individual characters shall be 10% minimum and 35% maximum of character height.

Bus Stop Signs (continued)

- To the maximum extent practicable, minimum character height shall comply with Table 3.2.1 in the Handbook.
- 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."[1]
- Bus schedules, timetables, and maps that are posted at the bus stop or bus bay shall not be required to comply with bus stop sign requirements.[1]

Bus Stop Benches

- 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 at the end of the bench seat and parallel to the short axis of the bench.[1]
- Benches must be able to support 250 pounds of force applied at any point on the seat, fastener, mounting device, or supporting structure.[1]
- 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.[1]
- Benches shall be placed only at agency-authorized transit stops. Convenience or comfort benches, if located at a transit bus stop, are not limited to a minimum number of benches to accommodate the comfort and convenience of the general public.[4]
- Commercial advertising shall be displayed upon a bench only on either the front or rear surface of the backrest area.[4]
- 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.[4]
- Any bench placed on any part of a sidewalk shall leave a clear, unobstructed width of five feet standard (four feet minimum) for pedestrian traffic wholly within the improved walking surface (measured between the edges of the improved surface, not including the top of any roadway curbs). [4]
- Benches shall not be placed in the median of any divided highway, except when maintained by bus rapid transit providers utilizing an inside lane for passenger transport.[4]
- Bench location must meet the setback and minimum clear recovery zone requirements as established in the FDM. 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 60 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.[4]
- Benches must not obstruct the full 5-foot-by-8-foot B&A area or passenger access to loading and unloading.[1]

Bus Stop Shelters

- 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.[1]
- 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.[1]
- Shelter access entry and exit points shall provide a minimum clear width of 4 feet to meet State requirements (ADA requirement is 3 feet).[8]
- Changes in level greater than ½-inch must be ramped in compliance with Sections 405 (Ramps) and 406 (Curb Ramps) of the ADA Standards.[1]
- In shelters, 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.[4]
- No advertising shall be of a reflectorized material or otherwise cause a glare. 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.[4]
- Per FAC 14-20.003, a shelter may be erected only at bus stops designated by a public transit agency and identified as having service a minimum number of 10 times in a 5-day period, excluding weekends and holidays.[4]
- Shelters are prohibited in medians, except when maintained by bus rapid transit providers utilizing an inside lane for passenger transport, and on limited access roads.[4]
- 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.[4]
- Shelter locations must meet setback and minimum clear recovery zone requirements as established in the FDM.[2]
- A shelter shall not obstruct any sidewalk, bike path, pedestrian path, driveway, drainage structure, or ditch, and shall provide a clear, unobstructed width of five feet standard for pedestrian traffic between the edges of the improved surface, not including the top of any roadway curbs.[4]
- 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.[1]
- Shelters shall not be located within 15 feet of a disabled parking space.[8]
- Prior to the installation of a shelter, the impacted utility companies must be notified to determine the location of utilities and prevent conflicts.[4]

Bus Stop Shelters (continued)

- Shelters also 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.[4]
- New or replaced bus shelters shall be installed or positioned to provide an accessible route from the public way (sidewalk or roadway) to
- Shelters shall be connected by an accessible route to a B&A area.[1]
- Lights are not permitted for the sole purpose of illuminating advertising, per Rule 14-20.003, FAC. All lights within a shelter must be placed or shielded so they do not interfere with motorists on roadways. Flashing lights on shelters are prohibited.[4]
- 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.[4]
- 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.[3]
- Transit agencies must refer to the Florida Building Code for any minimum requirements to ensure that bus shelters in hurricane-prone areas can withstand high winds and the impacts of wind-borne debris.[3]
- In addition, transit stops, if identified in an emergency evacuation plan, must be provided with signage indicating the same.[12]
- Shelters and any appurtenant totem signs shall not be located within 15 feet of any fire hydrant.[4]
- 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.[4]
- 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.[10]
- Lighting design for bus stops should meet the same criteria for minimum illumination levels, uniformity ratios, and max-to-min ratios that are being applied to the adjoining roadway.[7]

Bicycle Parking & Shared Mobility

- Bicycle racks must not be placed on the B&A area.[1]
- 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.[1]
- Bicycle racks must not interfere with pedestrian facilities and meet lateral offset requirements.[2]
- 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 the FDM.[2]

Trash Receptacles

- Waste disposal receptacles are prohibited on limited access facilities and where provided, shall be no greater than 110 gallons in capacity and no taller than 4 feet.[4]
- Trash receptacles shall not obstruct any sidewalk, bike path, pedestrian path, driveway, drainage structure, or ditch. [4]
- Trash receptacles must be securely attached to their foundations or another permanent fixture.[4]
- Advertising on a waste disposal receptacle must be affixed to the side of the receptacle and may not extend beyond the receptacle. No advertising shall be of a reflectorized material or otherwise cause a glare.[4]
- Trash receptacles are required to be properly maintained as to aesthetics, function, and safety, and their responsible agencies must maintain regularly scheduled garbage pick-up to preclude the accumulation of debris surrounding the receptacle.[4]
- Transit agencies or city or county governments must refer to 14-20.008 FAC for additional guidance on placement, construction, repair, improvement, maintenance, safe and efficient operation, alteration, or relocation of all, or any portion of a state road.[4]
- 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.[1]
- To maintain accessibility, trash receptacles shall not be placed on bus stop B&A areas.[1]
- Trash and recycling receptacles must meet clear zone requirements as put forth in the FDM.[2]

Landscaping

- Landscape design must preserve required sight distance, lateral offset, and clear zone.[2]
- Select ground cover plants (i.e., naturally low-growing plants) with maximum mature height of 18 inches within clear sight triangles, do not select plants that will require routine maintenance to preserve sight distance, and select trees with clear trunk(s) or limbed up to 5 feet minimum above the sight line datum.[2]
- The line of sight datum between roadways is 3.5 feet above both pavements.[2]
- The canopies of trees and trunked plants must be at least 5 feet above the sight line datum.[2]
- All landscaping along FDOT rights-of-way must comply with standards in the 2022 FDM section 228.2.[2]

Other Components

- Handrails 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.[1]
- Signs must be installed in a manner that eliminates any protruding objects hazards.[1]
- Where public address systems convey audible information to the public, the same or equivalent information shall be provided in visual format.[3]
- Text should be large and easy-to-read and must comply with all ADA requirements for text and pictogram size, placement, and contrast.[1]
- Bollards are not to be located in the road right-of-way.[8]
- Security bollards shall not obstruct a required accessible route or accessible means of egress.[1]
- Shopping cart locations must meet the setback and minimum clear recovery zone requirements established in 2022 FDM section 215.2.3 and 215.2.4.[2]
- The length of the telephone handset cord shall be a minimum of 29 inches. Phones shall be hearing-aid compatible and volume-control equipped.[1]
- 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.[1]

Other Components (continued)

- Where a parallel approach is provided, the distance from the edge of the telephone enclosure to the face of the telephone unit shall be 10 inches maximum. Where a forward approach is provided, the distance from the front edge of a counter within the telephone enclosure to the face of the telephone unit shall be 20 inches maximum.[1]
- Public telephones also must be located according to ADA Standards for protruding objects and operable parts. The ADA Standards for protruding objects state 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 state that operable parts of a telephone shall comply with clear floor space, height, and operation requirements.[1]
- A call box must not obstruct access to the stop.[9]
- A call box must be accessible to those that are deaf, hard of hearing, or people who use wheelchairs.[9]
- A call box also must be located according to ADA Standards for protruding objects and operable parts. The ADA Standards for protruding objects state 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.[1]
- 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 48 inches by 30 inches minimum.[1]
- The object's highest point must not be greater in elevation than 25 feet above the nearest point of the traveled way.[2]
- The location must be outside the appropriate lateral offset or clear zone as defined in FDM and should be as close to the right of way line as practical.[1]
- As public art at bus stops can vary by purpose, place, and the population it serves. Refer to all applicable ADA and FDM requirements.[1,2]
- Vending machine locations must meet the setback and minimum clear recovery zone requirements established in the FDM.[2]
- 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. ADA guidelines also state that any operable parts shall comply with clear floor space, height, and operation requirements.[1]

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Placement Considerations

- 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]
- 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]
- F.A.C. Section 14-20.003 requires that a minimum 15-foot distance be maintained between a bus shelter and a fire hydrant or an accessible parking space.[1]
- The shelter for a stop must not obstruct a driveway.[1]
- All bus stops in urban areas (curb & gutter and sidewalk) shall be situated so that passengers board and alight at a location where full height curb and gutter is present and not a driveway.[2]
- All bus stops in urban areas (curb & gutter and sidewalk) shall be situated to be 20’ or more away from the edge of a drainage structure.[2]

Spatial Location

- Locate guardrail no closer than 6 feet from the canal front slope.[3]
- Locate High Tension Cable Barrier no closer than 15 feet from the canal front slope.[3]
- Near-side bus stops shall be located so that railroad warning signs are not obstructed by a stopped bus.[2]
- For near-side or far-side bus bays, provide a minimum of 50 feet to the nearest rail line (per Florida Statute 316.1945 (1).[2]

Geometric Placement

- Drainage structures are not to be located within the bus bay.[2]
- All concrete joints shall be as per the latest version of the FDOT roadway and design standards.[2]
- Construction procedures related to TSP applications along state roads must comply with FDOT requirements.
- A queue jump bus bay requires an open bus bay on the far side of the intersection where the bus stop is located.[5]

Bus Vehicle Characteristics & Access

- Turning radii requirements for a standard transit bus are:[5]
    - minimum inside radius = 24.5 feet
    - minimum design turning radius = 41.6 feet
- Turning radii requirements for an articulated transit bus are:[5]
    - minimum inside radius = 21.3 feet
    - minimum design turning radius = 39.4 feet
- Pavement markings shall be in compliance with maintaining agency regulations and standards in the MUTCD.[7]
- The preferential lane-use marking for a bus-only lane shall consist of the word marking BUS ONLY.[7]
- Pavement markings shall be used to guide traffic away from fixed obstructions within a paved roadway.[7]

Bicycle & Pedestrian Access

- Newly constructed or altered streets, roads, and highways must contain curb ramps or other sloped areas at any intersection having curbs or other barriers to entry from a street level pedestrian walkway.[9]
- Curb ramps must be located to ensure a person with a mobility disability can travel from a sidewalk on one side of the street, over or through any curbs or traffic islands, to the sidewalk on the other side of the street.[10]

Bicycle & Pedestrian Access (continued)

- Detectable warnings are required at curb ramps and blended transitions at pedestrian street crossings, pedestrian refuge islands, pedestrian at-grade rail crossings not located within a street or highway, boarding platforms at transit stops for buses and rail vehicles where the edges of the boarding platform are not protected by screens or guards, and B&A areas at sidewalk or street level transit stops for rail vehicles where the side of the B&A areas facing the rail vehicles is not protected by screens or guards.[11]
- Detectable warning surfaces at platform boarding edges shall be 24 inches wide and shall extend the full length of the public use areas of
- Pavement markings used for separated bicycle facilities must conform to the MUTCD.[3,7]
- When green-colored pavement is used in conjunction with white dotted lines, such as when extending a bicycle lane across a right-turn lane or access to a bus bay, the transverse-colored marking must match the 2'- 4' white dotted line pattern of the bicycle lane extension.[3]
- Bicycle lanes shall not be provided on the circular roadway of a roundabout.[7]

Accessing Transit During Construction

- Where transit stops are affected or relocated because of work activity, both pedestrian and vehicular access to the affected or relocated transit stops shall be provided.[5]
- When existing pedestrian facilities are disrupted, closed, or relocated in a TTC zone, the temporary facilities shall be detectable and include accessibility features consistent with the features present in the existing pedestrian facility. Where pedestrians with visual disabilities normally use the closed sidewalk, a barrier that is detectable by a person with a visual disability traveling with the aid of a long cane shall be placed across the full width of the closed sidewalk.[5]
- While designing detours, ADA requirements must be considered.[9]
- 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.[8]
- According to FDOT Design Standards, Index 660, any temporary sidewalk must be a minimum of 4 feet wide with a maximum of 2% cross-slope.[8]
- 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.[9]
- Temporary ramps must meet the requirements for curb ramps specified in FDOT Design Standards, Index 304.[8]
- 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.[9]

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BRT Stations

- BRT is designated as bus service. Therefore, design and placement guidance applicable to bus stops, as included in this handbook and in any reference documentation, also is applicable to BRT stations. [2,4]
- Per APTA's Standards Development Program, Recommended Practices (December 11, 2020), BRT stations shall, at a minimum, incorporate the following characteristics and amenities:[8]
  - Provide passengers with basic premium amenities such as waste and recycling receptacles, seating, basic covered shelter, and bicycle parking.
  - Provide a safe waiting environment through lighting, runningway barriers, and CPTED standards.
  - Provide relevant passenger information including system maps, area destinations, and real-time information.
  - Facilitate multi-door boarding.
  - Enable near-level boarding.
  - Facilitate improved route speeds.
  - Accommodate Universal Accessibility.
  - Be welcoming and inviting, promoting visibility and facilitating the identified brand of the system.
  - Coordinate with design features and identity of the surrounding neighborhood/community.
  - Ensure ease of transfer to other transit modes such as rail, bike share, TNCs, and e-scooters through signage.

Station Design

- BRT stations must meet vertical and side clearance of the vehicle, turning radius of the intersection, curb lane width, parking clear zone, and presence of driveways, among other criteria.[1]

Station Platforms

- Minimum width for a BRT station platform is 8 feet.[1]
- A portion of the main counter at ticketing counters must be at least 36 inches long with a maximum height of 36 inches.[2]
- The space in front of the counter must provide for a parallel approach or, if the counter is not at least 36 inches long, then it must be at least 30 inches long and provide knee and toe space under the counter for a forward approach.[2]
- Ticket counters providing a front approach must satisfy knee and toe clearance requirements. The assessment must ensure that a forward approach with a clearance depth of 17 to 19 inches is provided to permit a person in a wheelchair to pull up far enough under the counter to utilize it as a work surface.[2]
- If public address systems are provided to convey information to the public, there also must be a means of conveying the same or equivalent information to persons with hearing impairments.[2]
- Lighting plans for BRT station platforms, boarding and alighting areas, and for other areas of the station must meet bus stop lighting guidelines. [6,9]
- Where clocks are provided for use by the public, the clock face shall be uncluttered so that its elements are clearly visible. Hands, numerals, and digits shall contrast with the background, either light-on-dark or dark-on-light. Where clocks are installed overhead, numerals and digits shall comply with ADA requirements for the visual character heights previously identified in this handbook.[2]

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Appendix B: Glossary

A

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; by 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/mi^2 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 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 probable conflict between the traffic flows.

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 often are combined with a computer-aided dispatch system.

Autonomous vehicle (AV) – the full-time performance by an automated driving system of all aspects of the dynamic driving task under all roadway and environmental conditions that can be managed by a human driver.

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 agencies require that passengers obtain a permit to use them.

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.*

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 exits. 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.

FDOT

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 a 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

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.

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.

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.

Curbside factors – factors that are located off the roadway that affect patron comfort, convenience, and safety.

Curbside stop — a bus stop in the travel lane immediately adjacent to the curb.

Curbside platform – a raised boarding platform at a curbside location; typically in conjunction with level bus boarding or BRT.

D

Deceleration, retardation, braking rate – decrease in velocity per unit of time; in transit practice, often measured in ft/s^2 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.

Downstream – in the direction of traffic.

E

EMS Access – Emergency Medical Services Access.

F

Far-side stop – see *Stop, far-side.*

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 Title 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 USC 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 also is known as a motorway.

G

Grade or **gradient** – a rise in elevation within a specified distance; for example, a 1% grade is a 1' rise in elevation in 100' 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, chlorofluorocarbons, hydrochlorofluorocarbons, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.

H

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.

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.

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.

LOS – level of service.

Lane, bicycle – a portion of roadway that has been designated for preferential or exclusive use by bicyclists via pavement markings and, if used, signs.

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).

Lane, managed – highway facilities or a set of lanes where operational strategies are proactively implemented and managed in response to changing conditions.

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 pedestrians with sight disabilities 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.

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.

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 know 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*.

M

MUTCD – *Manual on Uniform Traffic Control Devices.*

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.

Micromobility - any small, low-speed, human-, or electric-powered transportation device, including bicycles, scooters, electric-assist bicycles, electric scooters (e-scooters), and other small, lightweight, wheeled conveyances.

Mid-block stop – see *Stop, mid-block.*

Mixed traffic operations – the operation of transit vehicles on non-exclusive 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.

Mobility-on-Demand (MOD) - MOD is an innovative, user-focused approach that leverages emerging mobility services, integrated transit networks and operations, real-time data, connected travelers, and cooperative ITS to allow for a more traveler-centric, transportation system-of-systems approach, providing improved mobility options to all travelers and users of the system in an efficient and safe manner.

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, bus rapid transit, express bus service, light rail transit, rail rapid transit, and commuter rail.

N

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 lane, also known as a bus bulb or curb extension.

O

Operations, mixed traffic – see *Mixed traffic operations.*

P

PD&E Manual – Project Development and Environment Manual.

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 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 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 carpool 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 stormwater infiltration while serving as a structural surface.

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, average peak speed is used in the delay equation. Similarly, average daily speed is used to determine 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 queued 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.

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 to 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.

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 mobility – transportation services and resources that are shared among users, either concurrently or one after another. Includes public transit, micromobility, automobile-based modes, and commute-based modes or ridesharing.

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 often are 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

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 a *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 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 priority treatment – a system of traffic controls in which buses are given special treatment over general vehicular traffic (e.g., bus priority lanes, prioritization of traffic signals, bus on shoulder, or adjustment of green times for buses).

Transit signal priority (TSP) – a set of operational improvements that use technology to reduce dwell time at traffic signals for transit units (vehicles or trains) by extending the green signal phase or truncating the red signal phase. TSP may be implemented at individual intersections, along corridors, or throughout entire street networks.

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.

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).*

Appendix C: Bus Stop Checklist

Bus Stop Checklist

Part A: Identification/Location

Route Name:	Location:	Weather Conditions:	Stop No.:

	PART A: IDENTIFICATION/LOCATION		
A1	Is there a bus shelter?		Yes ☐ No ☐ N/A ☐
	Is 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 ☐
A2	Street Name:		
A3	Nearest Cross Street (street name or landmark if mid-block):		
A4	Bus Route Direction:		
	North Bound ☐ South Bound ☐ More than one direction ☐		
	East Bound ☐ West Bound ☐		
A5	What is the purpose of the stop?		
	Park and Ride ☐ Boarding ☐ Both Boarding and Alighting ☐		Other (Specify) ☐
	Kiss and Ride ☐ Alighting ☐ Transfer ☐		
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 bus crosses intersection) ☐ Far-side (After the bus crosses intersection) ☐		
	Mid Block ☐ Not Near Intersection ☐ Freeway bus pad ☐ N/A ☐		
A8	Distance from bus stop pole to curb of cross street (in Feet):		
A9	Adjacent property address or name of business (only if readily available):		
A10	Adjacent Property Description		
	Apartment Building ☐ Industrial Site/Bldg. ☐	Park ☐	School ☐
	Daycare ☐ Library ☐	Park and Ride ☐	Supermarket ☐
	Govt. Bldg. ☐ Mall/Shopping Center ☐	Place of Worship ☐	Transit Station/Center ☐
	Hospital ☐ Nursing Home ☐	Resident Townhouse ☐	Vacant Lot ☐
	Human Service Agency ☐ Office Building ☐	Residence Detached ☐	Retail Store ☐
	Other (Specify) ☐		
A11	Distance from previous bus stop (in feet):		

Date:	Time:	Surveyor:

Bus Stop Checklist

Part B: Pedestrian Access Features

Route Name:	Location:	Weather Conditions:	Stop No.:

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 ☐
B2	Where is the landing area positioned in relation to the curb/street?			
	Below street level ☐	Sidewalk ☐	Shoulder ☐	Other (Specify) ☐
	Bus Bulb ☐	Off-Road/No sidewalk ☐	Adjacent ☐	
B3	What is the material of the landing area?			
	Asphalt ☐	Dirt ☐	Gravel ☐	Other (Specify) ☐
	Concrete ☐	Grass ☐	Pavers ☐	
B4	Are there problems with the landing area surface?			Yes ☐ No ☐
	Rank 1-3 based on accessibility potential if YES (1 - Not Accessible, 2 - Minimally Accessible, 3 - Accessible)			
	Uneven - Rank:	Slopes up from the street - Rank:	Slopes down from the street - Rank:	
	Requires stepping over drain inlet - Rank:	Other (specify) - Rank:		
B5	Are there any obstacles that would limit the mobility of a wheelchair? If YES, describe obstruction:			Yes ☐ No ☐
B6	Additional landing area comments:			
B7	Landing area recommendations:			
	Widen sidewalk to expand landing area to 5 feet wide and 8 feet deep			☐
	Install curb bulb or remove on street parking			☐
	Move object to improve accessibility (specify where):			
	Make the following repairs (specify):			
	Other (specify)			

Date:	Time:	Surveyor:

Bus Stop Checklist

Part B: Pedestrian Access Features

Route Name:	Location:	Weather Conditions:	Stop No.:

PART B: PEDESTRIAN ACCESS FEATURES

Section B-2: Connections (Trip Generators)

B8	What are the primary trip generators for passengers at this stop? (Check all that apply)					
	Apartment Building (large)	☐	Human Service Agency (specify)	☐	School - Elementary/Middle	☐
	Apartment Building (small)	☐	Library	☐	School - High	☐
	Townhomes	☐	Major Shopping Center	☐	School - College/University/Technical School	☐
	Detached Homes	☐	Neighborhood Shopping	☐	Senior Center	☐
	Daycare/Pre-School	☐	Nursing Home/Assisted Living	☐	Transfer to Other Bus Routes	☐
	Gas Station	☐	Office Building/Employment	☐	Transit Station/Center	☐
	Government Building	☐	Park and Ride lot	☐	Hospital/Major Clinic	☐
	Place of worship	☐	Restaurant	☐	Hotel	☐
	Other (Specify): ☐					
B9	How wide is the sidewalk?					
	No Sidewalk ☐	Less than 3′ ☐	3′-5′ ☐	5′ or greater ☐	N/A ☐	
B10	Are there physical barriers that constrict the width of the sidewalk within the block on which the bus stop is located? If YES, what is the narrowest useable width:				Yes ☐ No ☐	
	Less than 3′ ☐		3′ or greater ☐			
B11	Rank the condition of the sidewalk: 1 = hazardous - large breaks, cracks, root uplifting, someone could get hurt from normal use or use of a wheelchair would be difficult 2 = in poor shape though not hazardous - very rough, some root uplifting, cracks, breaks 3 = fair - minor roof uplifting, minor cracks or breaks 4 = good - not perfect but no immediate repair 5 = cosmetically excellent; new					
	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	

Date:	Time:	Surveyor:

Bus Stop Checklist

Part B: Pedestrian Access Features

Route Name:	Location:	Weather Conditions:	Stop No.:

B12	Does the landing pad connect to the sidewalk? If YES, what does the sidewalk connect to:		Yes ☐ No ☐
	One of the trip generators listed in Question B8 ☐	The nearest intersection ☐	
B13	Where is the nearest street crossing opportunity?		
	The nearest intersection ☐	Mid-block crosswalk ☐	
B14	What pedestrian amenities are at the nearest intersection (or other crossing opportunity)?		
	Curb cuts all corners/both sides ☐	Pedestrian crossing signal ☐	Traffic Light ☐
	Visible crosswalk ☐	Audible crosswalk signal ☐	Crossing guard assistance ☐
	Curb cuts some corners/one side ☐	Accessible Pedestrian Signal (APS) ☐	Tactile warning strip on curb cut ☐
B15	Is there a companion bus stop across the street?		Yes ☐ No ☐ N/A ☐
B16	Are there connections to other transportation services at this bus stop? If YES, check all that apply:		Yes ☐ No ☐ N/A ☐
	Bus services, same or other agency ☐	Local Rail ☐	Commuter Rail ☐
	Greyhound ☐	Other (specify): ☐	
B17	Pedestrian connection recommendations:		
	Construct Sidewalk ☐	Widen Sidewalk ☐	Improve landing area connections to sidewalk ☐
	Install curb cut(s) at:		
	Move object to improve accessibility (specify where):		
	Make the following repairs (specify):		
	Other (specify):		
B18	Additional pedestrian connection comments:		

Date:	Time:	Surveyor:

Bus Stop Checklist

Part C: Passenger Comfort Amenities

Route Name:	Location:	Weather Conditions:	Stop No.:

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 ☐	Facings on-coming traffic ☐	Facing away from the street ☐			
C2	What kind of shelter is it? Insert shelter relevant to your system.					
	Own transit agency ☐	Another transit agency (shared stop) ☐	Other (specify): ☐			
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 ☐
	If YES, what are the dimensions of the opening?					
C5	Could a person using a wheelchair maneuver into the shelter?				Yes ☐	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 (760mm by 1200mm))?				Yes ☐	No ☐
	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′ ☐	2′ - 4′ ☐	4′ - 6′ ☐	6′ - 8′ ☐	8′ - 10′ ☐	> 10′ ☐
C8	Are there damages to the bus shelter? If YES, check all that apply:				Yes ☐	No ☐
	Broken panels ☐	Graffiti ☐	Holes in the roof ☐			
	Missing panels ☐	Needs repainting ☐	Other (specify): ☐			
C9	What is the approximate age of the shelter?					
C10	Rank the condition of the sidewalk: 1 = hazardous - broken glass, unstable 2 = in poor shape though not hazardous 3 = fair - needs repainting, glass panels need thorough cleaning, protruding but not hazardous bolts 4 = good - not perfect but no immediate repair 5 = cosmetically excellent; new					
	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	

Date:	Time:	Surveyor:

Bus Stop Checklist

Part C: Passenger Comfort Amenities

Route Name:	Location:	Weather Conditions:	Stop No.:

C11	Additional shelter comments:					
C12	Shelter recommendations:					
	Remove center panel					☐
	Make the following repair(s) (specify):					☐
	Move object to improve accessibility (specify where):					
	Move shelter to improve accessibility (specify where):					
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 (skip to question C15) ☐			Freestanding bench ☐		
	Fold down bench ☐			Leaning bench ☐		
	Other (specify) ☐					
C14	if not inside shelter, what is the distance of the seating from the curb in feet?					
	0 - 2′ ☐	2′ - 4′ ☐	4′ - 6′ ☐	6′ - 8′ ☐	8′ - 10′ ☐	> 10′ ☐
C15	Are there problems with the seating? if YES, check all that apply:				Yes ☐	No ☐
	Broken pieces ☐		Needs painting ☐		Graffiti ☐	
	Not securely installed ☐		Other (specify) ☐			
C16	Rank the condition of the seating: 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 5 = cosmetically excellent; new					
	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	

Date:	Time:	Surveyor:

Bus Stop Checklist

Part C: Passenger Comfort Amenities

Route Name:	Location:	Weather Conditions:	Stop No.:

C17	Additional seating comments:			
C18	Seating recommendations:			
	Move seating to improve accessibility (specify where):			
	Make the following repairs (specify):			
	Other (specify):			
Section C-3: Trash Assessment (move to Section C-4 if there is no trash receptacle)				
C19	What is the type of trash installation for the trash receptable?			
	Attached to shelter ☐	Free standing ☐	Garbage bag ☐	Bolted to sidewalk ☐
	Other (specify): ☐			
C20	Are there problems with the trash receptacle and surrounding area? If YES, check all that apply:		Yes ☐	No ☐
	Trash can very full ☐	Graffiti at bus stop ☐	Bus stop littered ☐	
	Grocery carts left at stop ☐	Trash can not secured properly ☐	Adjacent property littered ☐	
	Other (specify):			
C21	Additional comments:			
C22	Trash recommendations:			
	Install trash can due to litter problem	☐		
	Make the following repairs (specify):			
	Move trash can to improve accessibility (specify):			
	Other (specify):			

Date:	Time:	Surveyor:

FDOT

Bus Stop Checklist

Part C: Passenger Comfort Amenities

Route Name:	Location:	Weather Conditions:	Stop No.:

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 ☐
C24	Are the newspaper boxes a barrier to bus access/egress?	Yes ☐ No ☐
C25	Are they chained to the bus stop pole, shelter, or bench?	Yes ☐ No ☐
C26	Are they blocking access to posted bus schedule info?	Yes ☐ No ☐
C27	Additional newspaper box comments:	
C28	Newspaper box recommendations:	
	Move newspaper box to improve accessibility (specify where):	
	Other (specify):	

PART D: Safety and Security Features

Section D-1: Traffic and Pedestrian Issues		
D1	Where is the bus stop area located?	
	In travel lane ☐ Bus lane/pull off area ☐ Paved shoulder ☐ In right turn only lane ☐	
	Unpaved shoulder ☐ Off-street ☐ "No Parking" portion of street parking lane ☐	
	Other (specify): ☐	
D2	Is the bus stop zone designated as a no parking zone? If YES, indicated by:	Yes ☐ No ☐
	One "No Parking" sign ☐ 2 or more "No Parking" signs ☐ "Bus Only" sign ☐	
	Painted curb ☐ Painted street ☐	
D3	Are cars parked between the landing area and the bus stopping area?	Yes ☐ No ☐
D4	What is the posted speed limit sign in MPH?	Not posted ☐

Date:	Time:	Surveyor:

Bus Stop Checklist

Part D: Safety and Security Features

Route Name:	Location:	Weather Conditions:	Stop No.:

D5	What are the traffic controls at the nearest intersection for the street?				
	Traffic signals ☐	Flashing lights ☐	Stop/Yield sign ☐	None ☐	
	Other (specify): ☐				
D6	How many total lanes are on both sides of the road?				
	1 ☐	2 ☐	3 ☐	4 ☐	Other (specify) ☐ N/A ☐
D7	Is there on street parking permitted just before or after the bus stop zone?				Yes ☐ No ☐
	If YES, what is the length of the "No Parking" area in feet:				
D8	Are there potential traffic hazards? If YES, check all that apply:				Yes ☐ No ☐
	The bus stop is just over the crest of a hill ☐		The bus stop is just after a curve in the road ☐		
	The bus stop is near an at-grade railroad crossing ☐		A stopped bus straddles the crosswalk ☐		
	Waiting passengers are hidden from view of approaching bus ☐		Bus stop just before crosswalk ☐		
	High speed traffic ☐		No crosswalk ☐		
	Other (specify): ☐				
D9	Additional traffic safety comments / recommendations:				
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 street lightning is available?				
	Street light ☐	Shelter lighting ☐	Outside light on adjacent building ☐		
	Other (specify): ☐				
D11	Does the light produce glare?				Yes ☐ No ☐
D12	Is the light distributed evenly?				Yes ☐ No ☐
D13	Additional comments:				

Date:	Time:	Surveyor:

FDOT

Bus Stop Checklist

Part D: Safety and Security Features

Route Name:	Location:	Weather Conditions:	Stop No.:

	Section D-3: Pay Phone	
D14	Is there a pay phone within the immediate vicinity? If NO, skip to Question D16	Yes ☐ No ☐
D15	Is the pay phone within reach of a wheelchair user?	Yes ☐ No ☐
D16	If no pay phone is provided, is there a police call box?	Yes ☐ No ☐
D17	Additional comments:	
	Section D-4: Landscaping Assessment	
D18	Are there problems with the landscaping around the bus stop? If YES, check all that apply:	Yes ☐ No ☐
	Trees/bushes encroaching on landing area ☐ Trees/bushes encroaching on the sidewalk ☐	
	Tree branches that would hit the bus ☐ Other (specify): ☐	
D19	Additional comments:	
	Section D-5: Safety Recommendations	
D20	Improve pedestrian safety by:	☐
	Trim trees or branches	☐
	Move bus stop to:	
	Other (specify):	

Date:	Time:	Surveyor:

Bus Stop Checklist

Part E: Information Features

Route Name:	Location:	Weather Conditions:	Stop No.:

PART E: INFORMATION FEATURES

E1	Is there a bus stop sign? If NO, move to question E6		Yes ☐ No ☐
E2	What provider name is on the bus stop (list all providers utilizing stop)? Provider 1: Provider 2: Provider 3: Provider 4:		
E3	Are bus routes indicated on the bus stop sign? If YES, what routes?		Yes ☐ No ☐
E4	How is the sign installed?		
	On its own pole ☐	On a building ☐	On a utility pole ☐
	On a shelter ☐	Other (specify): ☐	
E5	Are there problems with the signage? If YES, check all that apply:		Yes ☐ No ☐
	Sign in poor condition ☐	Pole in poor condition ☐	Sign position hazardous to pedestrians ☐
	Sign not permanently mounted ☐	Lighting on sign is poor ☐	Other (specify): ☐
E6	Is there route/schedule/map (circle as appropriate) information posted? If NO, move to question E9		Yes ☐ No ☐
E7	Where is the route/schedule/map (circle as appropriate) information posted?		
	On pole under bus stop sign ☐	On its own pole ☐	On a utility pole ☐
	On a shelter ☐	In a shelter ☐	Other (specify): ☐
E8	Is the information at eye level of a wheelchair user?		Yes ☐ No ☐
E9	Is there a schedule rack?		Yes ☐ No ☐
	If YES, are repairs needed?		Yes ☐ No ☐
E10	Is there real time information display?		Yes ☐ No ☐
E11	Is the signage text ADA compliant (refer to the Toolkit for the Assessment of Bus Stop Accessibility and Safety for guidelines)?		Yes ☐ No ☐
E12	Is information provided in Braille or by a Talking Signs transmitter for people with visual impairments?		Yes ☐ No ☐
E13	Additional signage & information comments:		
E14	Signage & information recommendations:		
	Make the following repairs: ☐	Other (specify): ☐	

Date:	Time:	Surveyor:

FDOT

Bus Stop Checklist

Part F: Diagrammatic Sketch or Photograph

Route Name:	Location:	Weather Conditions:	Stop No.:

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 the location of:

Bus stop sign pole	☐	Newspaper boxes	☐	Traffic signal/stop sign	☐	Other poles	☐
Anything else installed	☐	Railroad tracks	☐	Landing pad	☐	Sidewalks	☐
Bus stop across the street	☐	Shelter	☐	Sidewalk barriers	☐	Bench	☐
Heating units in shelters	☐	Crosswalks	☐	Bike racks	☐	Trash can	☐
North/South/East/West	☐	Curb cuts	☐				

Date:	Time:	Surveyor:

Quick Bus Stop Checklist

Quick Bus Stop Checklist

Route Name:	Location:	Weather Conditions:	Stop No.:

	PART A: IDENTIFICATION/LOCATION			
A1	Street Name:			
A2	Nearest Cross Street (street name or landmark if mid-block):			
A3	Bus Route Direction:			
	North Bound ☐	South Bound ☐	More than one direction ☐	
	East Bound ☐	West Bound ☐		
A4	Where is bus stop positioned in relation to the nearest intersection?			
	Near-side (before bus crosses intersection) ☐	Far-side (After the bus crosses intersection) ☐		
	Mid-block or not near intersection ☐	Freeway bus stop boarding and alighting area ☐	N/A ☐	
A5	Distance from bus stop pole to curb of cross street (in feet)			
A6	Adjacent property address or name of business (only if readily available):			
	PART B: BOARDING AND ALIGHTING AREA ASSESSMENT			
B1	Is there a landing area at least 5 feet wide and 8 feet deep adjacent to the curb/street?			Yes ☐ No ☐
B2	Where is the landing area positioned in relation to the curb/street?			
	Below street level ☐	Sidewalk ☐	Shoulder ☐	Other (Specify) ☐
	Bus Bulb ☐	Off-Road/No sidewalk ☐	Adjacent ☐	
B3	What is the material of the landing area?			
	Asphalt ☐	Dirt ☐	Gravel ☐	Other (Specify) ☐
	Concrete ☐	Grass ☐	Pavers ☐	
B4	Are there problems with the landing area surface?			Yes ☐ No ☐
	Rank 1-3 based on accessibility potential if YES (1 - Not Accessible, 2 - Minimally Accessible, 3 - Accessible)			
	Uneven - Rank:	Slopes up from the street - Rank:	Slopes down from the street - Rank:	
	Requires stepping over drain inlet - Rank:	Other (specify) - Rank:		
B5	Are there any obstacles that would limit the mobility of a wheelchair? If YES, describe obstruction:			Yes ☐ No ☐
B6	Additional boarding and alighting area comments:			

Date:	Time:	Surveyor:

Quick Bus Stop Checklist

Route Name:	Location:	Weather Conditions:	Stop No.:

PART C: PEDESTRIAN COMFORT AMENITIES

Section C-1: Shelters (move to Section C-2 if there is no shelter)

C1	If non-standard shelter, what are the approximate dimensions (width, height, and depth in feet) of the interior standing area?	
	Width: Height: Depth:	
C2	Could a person using a wheelchair maneuver into the shelter?	Yes ☐ No ☐
C3	Could a person using a wheelchair fit completely under the shelter (minimum space of a common mobility device is 30” by 48”)?	Yes ☐ No ☐
C4	What is the distance of the front of the shelter from the curb in feet?	
	0 - 2′ ☐ 2′ - 4′ ☐ 4′ - 6′ ☐ 6′ - 8′ ☐ 8′ - 10′ ☐ > 10′ ☐	
C5	Additional shelter comments:	

Section C-2: Seating Assessment (move to part D if there is no seating)

C6	What is the type of seating available?
	Bench inside shelter (skip to question C8) ☐ Freestanding bench ☐
	Fold down bench ☐ Leaning bench ☐
	Other (specify) ☐
C7	If not inside shelter, what is the distance of the seating from the curb in feet?
	0 - 2′ ☐ 2′ - 4′ ☐ 4′ - 6′ ☐ 6′ - 8′ ☐ 8′ - 10′ ☐ > 10′ ☐
C8	Rank the condition of the seating: 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 5 = cosmetically excellent; new
	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
C9	Additional shelter comments:

Date:	Time:	Surveyor:

FDOT

Quick Bus Stop Checklist

Route Name:	Location:	Weather Conditions:	Stop No.:

PART D: INFORMATION FEATURES

D1	Is there a bus stop sign? If NO, move to question D5	Yes ☐ No ☐
D2	Are bus routes indicated on the bus stop sign? If YES, what routes?	Yes ☐ No ☐
D3	How is the sign installed?	
	On its own pole ☐ On a building ☐ On a utility pole ☐	
	On a shelter ☐ Other (specify): ☐	
D4	Are there problems with the signage? If YES, check all that apply:	Yes ☐ No ☐
	Sign in poor condition ☐ Pole in poor condition ☐ Sign position hazardous to pedestrians ☐	
	Sign not permanently mounted ☐ Lighting on sign is poor ☐ Other (specify): ☐	
D5	Is there route/schedule/map (circle as appropriate) information posted? If NO, move to question D8	Yes ☐ No ☐
D6	Where is the route/schedule/map (circle as appropriate) information posted?	
	On pole under bus stop sign ☐ On its own pole ☐ On a utility pole ☐ On a building ☐	
	On a shelter ☐ In a shelter ☐ Other (specify): ☐	
D7	Is the information at eye level of a person using a wheelchair and no lower than 40 inches above the finished floor ground surface?	Yes ☐ No ☐
D8	Additional signage & information comments:	

PART E: OTHER AMENITIES

E1	What other amenities are at the bus stop?	
	Trash receptacle ☐ Telephone or police call box ☐ Newspaper boxes ☐	
	No other amenities ☐ Other (specify): ☐	
E2	Do any of these amenities obstruct the access of a person using a wheelchair or other mobility device to the boarding and alighting area or other amenities within the site? If YES, specify what the amenity is blocking access to:	Yes ☐ No ☐
	Bus Shelter ☐ Seating area for people using wheelchairs or other mobility devices ☐	
	Bus ingress or egress ☐ Bus information ☐	
	Other (specify): ☐	

Date:	Time:	Surveyor:

Quick Bus Stop Checklist

Route Name:	Location:	Weather Conditions:	Stop No.:

PART F: TRAFFIC AND PEDESTRIAN SAFETY ISSUES					
Section F-1: Traffic and Pedestrian Issues					
F1	Where is the bus stop area located?				
	In travel lane ☐	Bus lane/pull off area ☐	Paved shoulder ☐	In right turn only lane ☐	
	Unpaved shoulder ☐	Off-street ☐	"No Parking" portion of street parking lane ☐		
	Other (specify): ☐				
F2	Is the bus stop zone designated as a no parking zone? If YES, indicated by:				Yes ☐ No ☐
	One "No Parking" sign ☐	2 or more "No Parking" signs ☐	"Bus Only" sign ☐		
	Painted curb ☐	Painted street ☐			
F3	Are cars parked between the landing area and the bus stopping area?				Yes ☐ No ☐
F4	What is the posted speed limit sign in MPH?				Not posted ☐
F5	What are the traffic controls at the nearest intersection for the street?				
	Traffic signals ☐	Flashing lights ☐	Stop/Yield sign ☐	None ☐	
	Other (specify): ☐				
F6	How many total lanes are on both sides of the road?				
	1 ☐	2 ☐	3 ☐	4 ☐	Other (specify) ☐ N/A ☐
F7	Are there potential traffic hazards? If YES, check all that apply:				Yes ☐ No ☐
	The bus stop is just over the crest of a hill ☐	The bus stop is just after a curve in the road ☐			
	The bus stop is near an at-grade railroad crossing ☐	A stopped bus straddles the crosswalk ☐			
	Waiting passengers are hidden from view of approaching bus ☐	Bus stop just before crosswalk ☐			
	High speed traffic ☐	No crosswalk ☐			
	Other (specify): ☐				
F8	Additional traffic safety comments / recommendations:				

Date:	Time:	Surveyor:

Quick Bus Stop Checklist

Route Name:	Location:	Weather Conditions:	Stop No.:

	Section F-2: Lightning Assessment (assessment preferably taken in the evening or at night; go to section G if no lighting)				
F9	What type of street lighting is available?				
	Street light ☐	Shelter lighting ☐	Outside light on adjacent building ☐		
	Other (specify): ☐				
F10	Additional comments:				
	PART G: GETTING TO THE BUS STOP				
G1	How wide is the sidewalk?				
	No Sidewalk ☐	Less than 3′ ☐	3′-5′ ☐	5′ or greater ☐	N/A ☐
G2	Rank the condition of the sidewalk: 1 = hazardous - large breaks, cracks, root uplifting, someone could get hurt from normal use or use of a wheelchair would be difficult 2 = in poor shape though not hazardous - very rough, some root uplifting, cracks, breaks 3 = fair - minor roof uplifting, minor cracks or breaks 4 = good - not perfect but no immediate repair 5 = cosmetically excellent; new				
	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
G3	Are there physical barriers that constrict the width of the sidewalk within the block on which the bus stop is located? If YES, what is the narrowest useable width:			Yes ☐	No ☐
	Less than 3′ ☐	3′ or greater ☐			
G4	Does the boarding and alighting area connect to the sidewalk?			Yes ☐	No ☐
G5	Where is the nearest street crossing opportunity?				
	The nearest intersection ☐	Mid-block crosswalk ☐			
G6	What pedestrian amenities are at the nearest intersection (or other crossing opportunity)?				
	Curb ramps at all points where a curb is encountered along the accessible route(s) ☐				
	Pedestrian crossing signal ☐	Traffic Light ☐			
	Visible crosswalk ☐	Audible crosswalk signal ☐	Crossing guard assistance ☐		
	Curb cuts at some corners/one side ☐	Accessible Pedestrian Signal (APS) ☐	Tactile warning strip on curb cut ☐		
	Other (specify): ☐				

Date:	Time:	Surveyor:

Tools and Technology Checklist

Tools
✓ Database
✓ Checklist
✓ Clipboard
✓ Camera (preferably digital to be able to download to a database)
✓ Measuring wheel
✓ Slope measuring level/device (e.g., Smartlevel)
Technology
✓ Handheld device, tablet, or laptop onto which the checklist can be downloaded
✓ Global Positioning System (GPS) device to triangulate the location of the bus stop
✓ Vehicle with GPS outfitted with computer equipment and sensors to transport the crew to the bus stop locations and gather data
✓ Bus stop inventory app for smartphone/tablet use

Note: The bus stop checklists are intended for use by transit and public works agencies in Florida. These checklists have been developed by Easter Seals Project ACTION, which is funded by USDOT and FTA. These checklists have been field-tested, but the user still is encouraged to customize the checklist according to local needs, issues, and concerns. The tools and technology checklist has been developed using data from Easter Seals Project ACTION as well as reviewing recent bus stop accessibility field data collection processes in Florida.

Appendix D: Transit Service Types & Facilities

OVERVIEW

This section 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 such transit services and bus stop facilities.

While some of the facilities incorporate 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 also are discussed for each applicable transit station design prototype. It also is 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 access state roadways, all applicable resources from FDOT and federal/local guidelines should be reviewed. Pertinent state and federal resources are listed throughout this handbook. 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 in the planning and development of transit facilities.

Types of Transit Services

Prior to a detailed review of transit facility types, it is helpful first to consider a review of the various types of transit modes. These service types represent the key modes that generally serve the hierarchy of transit facilities discussed throughout the rest of this chapter. For example, Florida has 30 urban agencies and 1 rural agency that provide fixed-route transit services. See the Florida Transit Handbook for more information on these agencies.

Local Bus

Local bus service is the most basic of fixed-route 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. These services are common to connect residents to local employment centers, recreational destinations, or other attractions. This service is useful for connecting to areas that are walkable and/or have limited parking available. Local bus services commonly use standard rubber-tired buses. Although, depending on demand and context, articulated buses can be used, as well. Figure A.1.1 shows an example of a standard rubber-tired bus typically used to provide local (or express) service.

Circulators are a type of local bus service that often is used for shorter trips and can be found in downtowns, town centers, or neighborhoods. Circulator routes start and end in the same place while connecting origins and destinations in a loop-like fashion. These routes are shorter than other local radial fixed-routes and have fixed stops. Frequencies will range depending on demand and destinations served. Circulators can serve riders in standard buses, smaller branded vehicles, or trolleys. This service can be used to connect downtown historic areas to the rest of the community and/or circulate within the downtown area.

FTA defines deviated/flex service as a transit service that operates along a fixed alignment or path at generally fixed times, but may deviate from the route alignment to collect or drop off passengers who have requested the deviation. The service can be delivered through point deviation or route deviation methods, as a feeder to fixed route transit, or as a circulator within a community, providing a many-to-many or many-to-few service. It also can provide circulator and feeder services with the same vehicle.[2] Typically, this service also is provided with standard rubber-tired buses.

Express Bus

Limited Express or 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 can slow during off-peak hours or cease service completely. Due to its purpose, buses operate efficiently in mixed traffic or on special/exclusive use lanes if demand warrants. The service is provided with standard rubber-tired or articulated buses depending on demand and/or operating context. Figure D.1.1 shows the typical vehicle for local or express bus service.

Bus Rapid Transit (BRT)

BRT service is a fast, frequent, rubber-tired bus service. It is an enhanced transit service with its own type of branding and station design, as well as a range of premium operational elements. Elements typically include off-board fare payment, real-time bus information displays, and comfortable/covered seating areas. BRT operates in more densely-populated urban areas and has greater station spacing than local bus. Currently, there are two primary types of BRT services: exclusive guideway and mixed-traffic arterial. Figure D.1.2 shows an BRT service using an exclusive guideway.

Figure D.1.1 | Local/express bus vehicle, Hernando County, Florida.

Figure D.1.2 | Exclusive guideway BRT service, Orlando, Florida.

FTA defines exclusive guideway BRT as a fixed-route bus system that operates at least 50 percent of the service on fixed guideway during peak periods. This often is a lower-cost alternative to light rail. However, 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. APTA describes mixed-traffic arterial BRT, sometimes called "BRT Lite," as a service that operates in lanes used by both transit and general traffic. Intersection treatments such as roadway widening and added auxiliary lanes provide buses with the ability to "jump the queue" at such locations and help provide some level of improved service times and reliability. Figure D.1.3 shows a stop for mixed-traffic BRT service. Examples of both BRT types in Florida include the JTA First Coast Flyer, LYNX LYMMO, HART MetroRapid, PSTA SunRunner, and South Miami-Dade Busway. See Chapter 5 for more information on BRT facilities.

Figure D.1.3 | Mixed-traffic BRT, Hillsborough County, Florida.

Mobility on Demand

MOD is a curb-to-curb service without fixed stops or set frequencies that is available by request, typically through a mobile app or by phone. Although on-demand service is not regularly scheduled, it can support fixed-route services. This newer service type is supplied by smaller transit vehicles or vans. On-demand service typically serves areas with lower transit demand and lower densities of population and employment. These areas, usually located in more suburban and rural settings, have been difficult for transit agencies to serve with fixed route services that tend to carry too few passengers to meet the standards of ridership performance service.[2] On-demand service also offers support for areas with high-demand for first-mile or last-mile service. Generally, the service is driven by demand and supported by technology, with some agencies utilizing the Software as a

Figure D.1.5 | MOD, Volusia County, Florida.

Service (SaaS) or Mobility as a Service (MaaS) model. The SaaS model is utilized by agencies that would like to use the technology, typically in a subscription format. This model typically allows riders to request a ride close to the time of departure and an algorithm will assign a vehicle to the rider. The location of the passengers is communicated to the driver and origins and destinations are usually constrained to a defined zone. The MaaS model allows agencies to include transit, carpooling, and other micromobility options in a one-stop shop application. The user can pay for all forms of transportation either by subscription or on a trip-by-trip basis. This model typically is contracted out to a private provider by the agency. Figure D.1.5 shows the typical style of vehicle that provides MOD service.

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 also may 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 the TECO Line Streetcar in Tampa (as shown in Figure D.1.6), Metromover in Miami (as shown in Figure D.1.7), and Jacksonville's Automated Skyway Express.

Figure D.1.6 | TECO Line Streetcar, Tampa, Florida.

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 Central Florida (as shown in Figure D.1.8) 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 increases the expense of installing the infrastructure. Heavy rail stations also require specific rail platforms/station configurations. Similar to commuter rail, heavy rail also realizes operational efficiency through larger passenger volumes. Examples of heavy rail in Florida include Metrorail in Miami and the private Brightline rail system. Brightline services currently operate between Miami and West Palm Beach, with a planned extension to Orlando (Figure D.1.9).

Figure D.1.7 | Metromover in Miami, Florida.

Figure D.1.8 | SunRail train operating in Central Florida.

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. 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. Because of its nature and extent, this handbook does not address the complex process of design, architectural programming, and transit planning necessary for construction of such facilities.

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. The rest of this appendix includes information for basic local bus stops, enhanced bus stops, transit malls, transfer centers, BRT stations, Park-and-Ride lots, and intermodal transfer centers. Information on each prototypical facility includes a description of the facility and its use, the required site area, a description of pedestrian connections and connections to other modes of transportation, and an inventory of the individual design elements.

Figure D.1.9 | Brightline train.

D.1 Basic Bus Stop

Basic 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 location, size, and design of bus stops have far-reaching impacts on safety, accessibility, convenience, and attractiveness.[2]

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. A comparison of perceived and real wait time at transit stops with benches and shelters found that as wait time increases, stops with even basic shelters or seating can significantly reduce wait-time perception, especially when wait time approaches 10 minutes.[3]

Any such amenities at basic bus stops should comply with all accessibility guidelines and must comply with the most stringent standards. Most improvement programs at transit agencies are driven by the motivation to increase ridership and customer satisfaction, with studies indicating that improved bus stops and pedestrian pathways are related to higher transit use.[4]

Table D.1.1 lists characteristics associated with a typical on-line bus stop. Figures D.1.1 shows an example of a basic bus stops.

Table D.1.1
Characteristics Associated with a Typical Basic 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.
Streetside Elements	Far-side or near-side curbside bus stop.
Curbside Elements	Sheltered stop with bench, bus B&A area, trash receptacle, bicycle rack, Wi-Fi, mobile device charging stations.
Shared Mobility/ 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.
Climate/ Sustainability Considerations	Shelters open at both back and front, including cantilevered shelters or post shelters, are easy to place and provide protection from sun and light rain. but little wind blockage.[3]

Figure D.1.1 | Basic bus stop.

D.2 Enhanced Bus Stop

Enhanced bus stops are off-lane bus stops with a special zone, typically a closed bus bay, on the side of the main roadway to allow buses to stop and load/unload passengers.

Enhanced 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. Areas for docked and/or dockless micromobility should be considered for stops with high ridership. Docked and dockless micromobility includes bicycle sharing and other options, such as scooters.

Table D.2.1 shows typical characteristics of an enhanced bus stop. Figures D.2.1 and D.2.2 show examples of an enhanced stop.

Figure D.2.1 | Enhanced bus stop in Manatee County.

Table D.2.1
Characteristics Associated with a Typical Enhanced Bus Stop

Adjacent Land Use	Office park employment center, central business district, major shopping mall, or high density commercial zone. If significant trip generators are within a quarter-mile, high-amenity shelters are desired.[3]
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.
Streetside Elements	Bus bay, bike lanes.
Curbside Elements	Sheltered stop with bench and trash receptacle, bus B&A area, bicycle parking facility, fare-vending machines, real-time bus information display, Wi-Fi, and mobile device charging ports.
Shared Mobility/ 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, and docked/dockless shared/micromobility parking,
Climate/ Sustainability Considerations	Consider climate in both design and materials selection; metals should be covered in a hot climate. In cold or harsh climates, enclosed shelters provide additional weather protection.[3]

Figure D.2.2 | Enhanced bus stop.

D.3 Transit Mall

Transit malls are created by removing automobile and truck access on sections of existing streets, usually on principal urban networks; only buses, vehicles providing mobility services, 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.

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 also may serve as the first element in a BRT mode of service provision.

Furthermore, connections to a variety of mobility options should be considered. Areas for docked and/or dockless micromobility options should be considered in addition to standard bicycling parking. MOD or TNC pick-up and drop-off areas should be considered and implemented as they continue to increase in popularity.

Table D.3.1 shows characteristics associated with a typical transit mall. Figure D.3.1 shows an example of a transit mall.

Table D.3.1
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.
Streetside Elements	Curbside stops in a dedicated busway, bike lanes or bike access.
Curbside Elements	Sheltered stop with benches and trash receptacles, bus B&A areas, bicycle parking facilities, real-time passenger information displays, solar panels, Wi-Fi, information kiosks, wayfinding, and mobile device charging stations.
Shared Mobility/ Bicycle/ Pedestrian Connections	Accessible routes connecting bus B&A areas and other bus loading areas along the transit mall with building entrances via crosswalks or pedestrian refuges, bicycle and micromobity parking areas, access to bicycle lanes/shared use paths. Pick-up/ drop-off areas for shared mobility.
Climate/ Sustainability Considerations	Appropriate green infrastructure to sequester carbon, solar panels to power lighting and other amenities, and constructed by local/recycled materials.

Figure D.3.1 | Transit mall.

D.4 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 also may work as MOD or TNC 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 bathrooms, mobile device charging stations, Wi-Fi for accessing route information, larger vending areas, and/or public restrooms. These additional amenities also must follow ADA standards.

Table D.4.1 lists the characteristics of a typical transfer center. Figure D.4.1 shows a typical transfer center layout.

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, often is

Table D.4.1
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.
Streetside Elements	Off-lane center with dedicated bus travel lanes/ half-sawtooth bus bays, and bicycle/micromobility access.
Curbside Elements	Sheltered stop with benches and trash receptacles, bus B&A areas, bathrooms, bicycle parking and storage facilities, docked and/or dockless micromobility parking facilities, public art, ticket counter/information kiosk, air-conditioned passenger waiting area, Wi-Fi, real time passenger information/wayfinding, and mobile device charging stations.
Shared Mobility/ Bicycle/ Pedestrian Connections	Accessible routes connected to bus B&A areas and surrounding infrastructure including bicycle/ micromobility parking areas, access to bicycle lanes/shared use paths, pick-up/drop-off areas for shared mobility users.
Climate/ Sustainability Considerations	Electric vehicle charging stations, appropriate green infrastructure to sequester carbon, solar panels to power lighting and other amenities, and constructed with local/recycled materials.

preferred. This arrangement frequently requires multi-agency coordination. Table D.4.2 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, micromobility parking and 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 also is 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 them.

Due to 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 also should follow the bus stop hierarchy presented in this appendix.

Table D.4.2
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-lane bus stop, follow prototypes 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 pullout bays; bike lanes; pick-up/drop-off areas.
Streetside 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.
Curbside Elements	Sheltered stop with bench and trash receptacle, bus B&A area, bicycle parking and storage facilities, ticket counter/information kiosk, Wi-Fi, real time passenger information/wayfinding, mobile device charging stations, and docked/dockless micromobility parking.
Shared Mobility/ 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, micromobility access, particularly in areas near high numbers of potential passengers.
Climate/ Sustainability Considerations	Appropriate green infrastructure to sequester carbon, solar panels to power lighting and other amenities, and constructed with local/recycled materials.

Figure D.4.1 | Transfer center.

D.5 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 often is 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/or impractical.

Table D.5.1 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

Table D.5.1
Characteristics Associated with a Typical BRT Station

Adjacent Land Use	High-density business corridors and residential areas; densely-populated developments.
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.
Streetside Elements	Along or parallel to major arterial roadways that have a high density of residential or commercial development.
Curbside Elements	Sheltered stop with bench and garbage receptacle, bus B&A area, bicycle parking facilities; landscaping (as feasible); off-board fare collection; raised platform or curb for level boarding; distinctive branding; passenger information, lighting, and security for a premium or enhanced station; bike sharing facilities.
Shared Mobility/ 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, and docked/dockless micromobility parking. Available parking and drop off available from MOD or TNCs.
Climate/ Sustainability Considerations	Appropriate green infrastructure to sequester carbon, solar panels to power lighting and other amenities, and constructed with local/recycled materials.

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 (e.g., people who do not have automobiles and/or people who may not want to pay for parking) and by reducing the parking requirements for new development.

Enhanced BRT stations may attract economic investments more than basic bus stops due to their unique appeal and their more permanent nature. Pedestrians also may be willing to walk farther for BRT service compared to more conventional transit because of its higher-order service components. For an example of a BRT station concept, see Figure D.5.1.

Figure D.5.1 | BRT station.

D.6 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 in suburban settings, 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 generally are not used during the workday. Table D.6.1 shows the typical characteristics of a park-and-ride facility.

Park-and-ride facilities that serve local transit routes are typically 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

Table D.6.1
Characteristics Associated with a Typical Park-and-Ride Facility

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.
Streetside/ Bus-Side Elements	Bus idling area, off-lane bus stop, bus bay, half-sawtooth bay, vehicle access points, and bike lanes.
Curbside Elements	Sheltered stop with benches and trash receptacles, transit B&A areas, trash receptacles, real-time bus information displays, passenger information/wayfinding information, Wi-Fi, mobile device charging stations, and docked/dock-less micromobility parking.
Shared Mobility Bicycle/Pedestrian Connections	Access for all-day vehicle parking; access to bicycle and pedestrian pathways and transit B&A areas. Available micromobility parking and sharing, pick-up/drop off available from MOD or TNCs.
Climate/ Sustainability Considerations	Electric vehicle charging stations, solar panels to power lighting and other amenities, and appropriate green infrastructure to sequester carbon

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.

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. Figure D.6.1 provides an example of a park-and-ride facility.

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 recently has been updated by FDOT; agencies should use this updated version of the document when planning park-and-ride facilities.

Figure D.6.1 | Park-and-ride facility.

D.7 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.

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.

BUS-RAIL INTERMODAL FACILITY

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 destinations. 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 be located in more densely-urbanized areas to maximize ridership. The station types vary depending on land use, architectural character, and natural amenities. Table D.7.1 shows the typical characteristics of a rail-bus intermodal transfer center.

Table D.7.1
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.
Streetside Elements	Local bus services, express services, possible connections to light rail, commuter rail, or BRT.
Curbside Elements	Air-conditioned waiting areas, seating, bathrooms, trash receptacles, real-time passenger information displays, passenger information/wayfinding, off-board fare collection, restaurant and retail options.
Shared Mobility/ 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; Wi-Fi, mobile device charging stations, and docked/dockless micromobility parking.
Climate/ Sustainability Considerations	Electric vehicle charging stations, solar panels to power lighting and other amenities, and appropriate green infrastructure to sequester carbon.

Figure D.7.1 | Bus-air intermodal facility in Tampa, Florida.

BUS-AIR INTERMODAL FACILITY

Bus transit systems that serve airports are an integral part of larger intermodal transportation networks. These facilities generally are housed in permanent facilities and provide a full set of passenger amenities.

Figures D.7.1 and D.7.2 show examples of air-bus intermodal facilities. 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, curbside 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 all are commonly used for enabling connections between air-bus intermodal centers and airport terminals. Intermediary movement that does not add additional traffic to curbside 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.

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 curbside

Figure D.7.2 | Bus-air intermodal facility in Miami, Florida.

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.

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D.8 Implementation & Maintenance

Bus stops are placed to provide transit customers with access to bus services. The primary entity responsible for choosing the locations where bus stops are placed is the transit agency. 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 2, Collaboration for Better Bus Facilities, goes into much more detail on the nature and types of entities that should coordinate on locating bus stops, but included below are some key aspects to consider when deciding on the development of new bus stops.

As mentioned, transit agencies have the primary responsibility for where bus stops should be located and whether they meet the ADA requirements for accessibility. 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-way 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 help improve safety and accessibility for 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 be placed and designed to meet the needs of bus patrons, as well as those of the nearby property or business owners.

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

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 may be instituted, but none of these should ever negate the need for or the practice of coordinating with the transit service provider. In such instances, 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 that will best serve the customers of the bus system as well as nearby interests. As mentioned previously, Chapter 2, Collaboration for Better Bus Facilities, provides much more detail on the subject of implementing and maintaining bus stops and many other issues where interagency coordination is required.

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