# TYPICAL SECTIONS FOR EXCLUSIVE TRANSIT RUNNING WAYS

**Prepared for:**

**Florida Department of Transportation**

**Freight, Logistics and Passenger Operations Office and Public Transit Office**

June 2013


STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION
FLP
Office of Freight, Logistics and Passenger Operations

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## Introduction

# 1.0 INTRODUCTION

## 1.1 PURPOSE OF THIS GUIDE

The purpose of this guide is to develop and present conceptual typical sections and design guidance for exclusive transit running ways that may see application in Florida. The typical sections and design guidance may be included or referenced in future versions of the *Plans Preparation Manual* (PPM) and the Florida Greenbook. The conceptual typical sections and design guidance may also be used to reinforce, revise, and/or inform Florida Department of Transportation (FDOT) policies related to transit facility design.

The conceptual typical sections and design guidance presented in this guide are based on data gathered from published research, interviews with transit agencies in North America that have implemented transit in exclusive running ways in the last 10 years or are in the late planning/design phase of such projects, and input from transit agencies in Florida who are currently operating or developing premium transit services that may or may not rely on exclusive transit running ways. Speaking to transit agency staff who have implemented exclusive transit running ways was particularly important in the development of this guide; such interviews tie geometric design decisions to operational experience and are a primary source of "lessons learned" when it comes to implementing exclusive transit running ways.

The intended audience for this guide includes:

- Planners who are conducting feasibility studies or alternatives analyses (AAs) and need information about exclusive transit running ways for right-of-way and cost estimates
- Designers and engineers who are commencing the development of typical section packages for a premium transit service project during preliminary engineering or project development
- FDOT and local government staff who are reviewing studies and plans for new transit services

## 1.2 AUTHORITY FOR THIS GUIDE

FDOT's authority to prepare guidance for the design of exclusive transit running ways comes from Florida Statutes Section 335.02, which allows exclusive lanes on the State Highway System and allows FDOT to "establish standards for lanes on the State Highway System." In doing so, FDOT is directed to "seek to achieve the highest degree of efficient mobility for corridor users," and FDOT "must give consideration to ... multimodal alternatives [and] addition of special use lanes [and] the most effective use of existing rights-of-way." Thus, FDOT is authorized to explore and implement multimodal alternatives as a means of maximizing mobility in State roadway corridors.

## 1.3 SCOPE OF THIS GUIDE

The transit services studied for this project focused on the exclusive transit running way applications that are most likely to be developed in Florida. Such applications comprise:

- Concurrent flow curb bus lanes
- Concurrent flow median bus lanes
- Contraflow bus lane on a one-way street
- Contraflow bus lane on a two-way street
- At-grade two-way busway on a two-way street
- At-grade reversible one-lane median busway on a two-way street
- At-grade exclusive busway in roadway right-of-way
- At-grade exclusive busway in separate right-of-way
- Exclusive bus street
- Shoulder-running bus lanes on a limited-access roadway

These scenarios are described in more detail in Section 3.0. High-occupancy vehicle (HOV) applications and grade-separated busways are not included in this guide.

For the purposes of this guide, "premium transit services" consist of bus rapid transit (BRT) and express bus services. Rail modes are considered premium transit services but rail modes require different design criteria and are not addressed in this guide.

## 1.4 USE OF THIS GUIDE

The conceptual typical sections and design guidance provided in this guide are for Florida applications of exclusive transit running ways. Use of the typical sections and design guidance presupposes that appropriate early planning has occurred. That is, this guide assumes that the need for an exclusive transit running way has been properly established, the alignment for that exclusive running way appropriately selected, and the need for a specific type of exclusive running way carefully determined. To assist with this early planning, Section 4.0 lists and describes several documents that provide relevant guidance.

This guide is intended to be a starting point for designing exclusive transit running ways. Case-by-case evaluation of sites and corridors is essential in producing design drawings that are feasible and effective. This guide provides references to various sources of design guidance and standards to aid in the development of design drawings.

The information in this guide is based on the PPM, the Florida Greenbook, and other Florida design documents. This guide is not a standard. If there is a conflict between this guide and any approved/adopted design criteria or standards, the designer is encouraged to seek variances and/or exceptions until such time as transit-specific design criteria and standards are adopted.

## 1.5 ACKNOWLEDGMENTS

This guide builds on the ***Bus Rapid Transit Functional Classification Study*** prepared by FDOT District Four's Office of Modal Development in 2003. This guide updates the typical sections and design guidance provided in the 2003 study to reflect operational experience, current FDOT design standards, and new applications of exclusive transit running ways. Several studies and reports published since 2003 were also used to prepare this guide.

In the course of guide development, the following agencies provided information about the details of their premium transit projects and the lessons they have learned in implementing and operating exclusive transit running ways:

- Central Florida Regional Transportation Authority (LYNX) in Orlando, FL
- City of Albuquerque in Albuquerque, NM
- Greater Cleveland Regional Transit Authority (GCRTA) in Cleveland, OH
- Hillsborough Area Regional Transit (HART) in Tampa, FL
- Jacksonville Transportation Authority (JTA) in Jacksonville, FL
- Lane Transit District (LTD) in Eugene, OR
- Miami-Dade Transit (MDT) in Miami, FL
- Regional Transportation Commission of Southern Nevada (RTC) in Las Vegas, NV

# SECTION 2.0
## Background

## 2.0 BACKGROUND

This section summarizes the literature review, case studies, and typical section reviews that were conducted for the purpose of obtaining state-of-the-practice information about the design and operation of exclusive transit running ways. This information guided development of the typical sections in Section 3.0. It should be noted that the findings and recommendations presented in Sections 2.1, 2.2, and 2.3 were developed independently of each other.

### 2.1 LITERATURE REVIEW

#### 2.1.1 Overview

The literature review that informed the development of the typical sections in Section 3.0 focused on key national and Florida technical manuals and reports that influence (or could influence) decision-making related to the development of typical sections for exclusive transit running ways. Particular attention was given to elements relevant to exclusive transit running ways in Florida contexts and on Florida roadways. A total of 15 documents were reviewed and are among those listed and described in Section 4.0. Appendix A includes typical sections obtained through the literature review.

#### 2.1.2 Findings

Many of the reports, guides, and manuals examined as part of this literature review effort did not provide specific geometric guidelines for the design of typical sections for exclusive transit running ways. These documents focused on qualitative, rather than quantitative, design considerations. However, several of the reviewed documents provided examples via case studies and suggested several topics for consideration in preparing typical sections for exclusive transit facilities in Florida. Key findings of the literature review are as follows:

- **Bus lane width.** Per Accessing Transit: *Design Handbook for Florida Bus Passenger Facilities*, Version 2 *(1)*, the desirable bus lane width is 12 feet. As reported in *Integrating Transit into Traditional Neighborhood Design Policies – The Influence of Lane Width of Bus Safety (2)*, the width of traffic lanes used by buses has safety impacts. The report recommends a minimum width of 12 feet wherever possible but notes that, on multilane roadways in traditional neighborhood design (TND) communities, at least the outside lane should be 12 feet wide. Transit Cooperative Research Program (TCRP) Report 90 *(3,4)* and TCRP Report 153 *(5)* indicate that concurrent flow bus lanes should be at least 11 feet wide.
- **Interaction with bicyclists.** *Integrating Transit into Traditional Neighborhood Design Policies – The Influence of Lane Width of Bus Safety (2)* notes that State law in Florida requires motorists to allow a minimum of 3 feet of clearance for bicyclists.
- **Vertical clearance.** TCRP Report 153 *(5)* recommends a minimum of 16 feet of vertical clearance for 40- and 45-foot buses.
- **Separators and delineators.** FTA's *Characteristics of Bus Rapid Transit for Decision Making (6)* states that running way markings are important for communicating the presence and purpose of the running way to motorists and pedestrians. Lane delineators and separators such as raised curbs, medians, and Jersey barriers affect the typical section.
- **Conversion to rail.** TCRP Report 90 *(3,4)* notes that BRT running ways can be shared with light rail transit (LRT). The running way must be designed to accommodate both modes in terms of typical section, grades, vertical clearance, and so forth.
- **Design speed.** Typical section dimensions must be sensitive to design speed of the transit facility.
- **Bus-on-shoulder (BOS) operations.** BOS operations are an option for providing an exclusive facility when bus volumes are low but the need for travel time and reliability improvements is high. Research indicates that a 12-foot shoulder is desirable for BOS operations; a 10-foot shoulder should be the minimum for BOS operations. Other geometric issues to be considered in implementing BOS projects are lateral clearance to roadside obstructions, visibility of the curb or edge of the road at night, drainage features, cross slope, superelevation, and increased horizontal curvature of the bus's travel path *(7,8)*.
- **Shared bicycle/bus lanes (SBBLs).** Operational experience indicates that implementing SBBLs requires a strong commitment to enforcing lane usage restrictions and a willingness to prohibit general traffic from making right turns from the SBBL or using it as a through lane. The researchers found that little formal research had been conducted on the safety and effectiveness of various designs. The researchers also found that agencies who had implemented SBBLs had minimal interest in implementing more SBBLs *(9)*.

Based on the above findings, the typical sections provided in Section 3.0 include the following:

- A lane width of 12 feet is preferred for exclusive transit lanes, but the lane could be narrowed to 11 feet if necessary. If premium transit operates on multilane roads in TND communities, general traffic lanes could be narrower still, but the lane that transit service operates in should be at least 11 feet wide. (Guided busways are not within the scope of this guide but could be considered where it is not possible to provide bus lanes that are at least 11 feet wide.) Bus lane width should consider bus turning requirements (e.g., at curves, at intersections, and on transitions near stations). All TND communities should provide for comprehensive pedestrian and bicyclist access to transit.

- Typical sections for BOS operations on both interrupted-flow and uninterrupted-flow facilities may be of value to transit agencies in Florida, although the limited extent to which urban-area interrupted-flow arterials in Florida have shoulders will limit opportunities for BOS operations on interrupted-flow facilities. BOS operations on interrupted-flow roadways appears to function similar to dedicated bus lanes with respect to bus stop access and interactions with general traffic turning movements. BOS operations appear to be implemented on interrupted-flow facilities when there is not enough bus volume to justify a dedicated lane.
- Typical sections for exclusive transit running ways should consider that State law requires motorists to give bicyclists at least 3 feet of clearance. If the transit lane is too narrow, bus operators might encroach into that buffer or encroach into other lanes.
- Given the influence of various propulsion technologies and features such as low-floor boarding on bus dimensions, typical sections for exclusive transit running ways should include vertical clearance requirements.
- Typical sections should account for a range of separators and delineators.
- If it is intended that an exclusive bus facility may one day be converted to a rail facility or shared with a rail mode, the typical section should reflect the design requirements of both.
- Typical sections for exclusive transit running ways should be sensitive to the effect of design speed on running way dimensions and features. For example, exclusive transit facilities with higher design speeds may require wider lanes than facilities with lower design speeds.

## 2.2 CASE STUDIES

### 2.2.1 Overview

To support the preparation of this guide, case studies of five BRT systems implemented within the last 10 years were conducted. Some of the agencies that operate these BRT systems are planning to implement new BRT services as well. The selected case study systems reflect a variety of transit running ways and BRT elements that are relevant to Florida transportation patterns, needs, and opportunities. Table 1 describes the case studies that were conducted. Appendix A includes typical sections obtained from the interviewed agencies.

**Table 1. Case Studies**

| System | Running Way Type(s) | Key Dates |
|---|---|---|
| South Miami-Dade Busway (Miami, FL) | Separate right-of-way (busway) | Phase I opened 1997<br>Phase II extended December 2007 |
| HealthLine (Cleveland, OH) | Median busway | Opened October 2008 |
| Emerald Express (Eugene, OR) | Dedicated lane, contraflow lane, median busway, and bi-directional single-lane | Opened 2007<br>Extended January 2011 |
| MAX, Strip & Downtown Express (SDX), and Boulder Highway (Las Vegas, NV) | Mixed traffic and dedicated lane | MAX - opened June 2004<br>SDX - opened 2010<br>Boulder Highway - opened September 2011 |
| Rapid Ride (Albuquerque, NM) | Mixed traffic | Full BRT design planned for 2013 |

As part of the case study effort, representatives of each of the selected BRT systems were interviewed to understand lessons learned with respect to intersection operations, pedestrian accessibility, and design trade-offs. The following questions were used to generally guide the interviews:

- What did the design process for choosing the running way type involve?
- Was there any reason for choosing the running way type that you ultimately implemented versus other alternatives?
- Can you comment on any design trade-offs related to the selected running way?
- Can you provide the typical section package for the BRT service?
- What guidelines/standards did you use to design the running way?
- What kinds of challenges did you face in developing typical sections and getting them approved?
- How did the selected running way perform after implementation?
- Can you provide copies of AA, engineering, and design studies for the BRT service?
- What design advice would you provide to an agency that is commencing a BRT AA now?

### 2.2.2 Findings

The case studies uncovered several considerations to take into account when deciding among running way alternatives and designing the selected running way. Key findings of the case studies follow:

- Running way design is strongly influenced by corridor constraints; availability of right-of-way is a common constraint. Other factors are traffic and pedestrian volumes and delays, pedestrian access, bicycle lane provision, turning volumes, deliveries, driveway access, parking, street network form, driver expectation, and aesthetics/image of the transit service.
- Station design and location affect the amount of right-of-way needed, particularly at intersections. Inbound and outbound platforms could be located at the same station, or they could be part of directional stations that straddle intersections. The latter can be used to accommodate left turn lanes where the exclusive transit facility takes the form of median-running dedicated lanes. Some station designs may require doors on the left side of the bus. Station design is site-specific; one station plan may not be appropriate for all stations along the route.
- BRT systems that have dedicated running ways report that dedicated running ways are essential to the success of their BRT service and should be provided whenever possible. They report that dedicated running ways contribute to significant travel time savings and improved reliability and that curbside transit lanes may be susceptible to delays due to the presence of delivery vehicles and double-parked automobiles in the curbside transit lane.
- More than one type of running way may be appropriate along a given bus route.
- The preferred bus lane width is 12 feet. Widths of 11 and 11.5 feet have been used in some cases, but the viability of narrower lanes depends on curvature, design speed, and operator training.
- The type of separation between exclusive transit lanes and general traffic lanes can serve to identify the exclusive transit lanes and keep general traffic out of them. One case study stated that rumble strips can deter automobiles from entering the exclusive transit lanes while still allowing automobiles and buses to pass disabled vehicles or construction. Mountable curbs have been used as a separation option as well, but one of the case studies indicated that a mountable curb can be problematic for motorcyclists who mistake it for a lane line. The selected type of separation should function in the dark and in the rain as well as during daylight and dry conditions.
- Bicyclists can be accommodated along a premium transit route in multiple ways, although right-of-way constraints may result in sub-optimal conditions. In Cleveland, for example, bicycle lanes were narrowed at some intersections.
- Jaywalking between median stations and streetside destinations can be a concern. Barriers, signage, countdown pedestrian signals, and education efforts have been reported to lessen jaywalking. One case study reported that curbside running ways on high-speed arterials help keep pedestrians on the sidewalk.
- Center running ways decrease pedestrian crossing time to and from stations.
- Most of the case study transit agencies reported that BRT-specific running way design standards did not exist when they designed their projects. They relied on a mix of city, county, and/or state standards—both local and non-local—and took advantage of design variances. Jurisdictional constraints may require different running ways along the BRT route.
- Exclusive transit facility design speed influences lane width and median requirements.
- Two case studies reported initial crashes associated with driver expectation at intersections with the dedicated BRT facility. Educational efforts and increased signage were used to address those crashes. In general, the case studies indicate that there is a period after BRT implementation in which drivers are adapting to the presence of BRT.

- Signal timings may require further adjustment after BRT begins operation.
- Exclusive transit facilities may require special pavement design to support bus loads.

Based on the above findings, the typical sections provided in Section 3.0 include the following:

- Allowing 11-foot exclusive transit lanes in a constrained environment but maintaining 12 feet as the desirable width
- Accounting for a range of separator and delineator types
- Accounting for a range of exclusive transit facility design speeds, as this affects lane width and median requirements
- Accounting for bicycle lanes and paths
- Providing references to detailed information on topics including station layout, shelter placement, transit preferential treatments, and pedestrian access to stations

## 2.3 EXISTING AND PLANNED FLORIDA PROJECTS

### 2.3.1 Overview

To support the preparation of this guide, typical sections prepared for existing and planned Florida BRT and exclusive transit facility projects were requested from Florida transit agencies and reviewed. Information was obtained for the following projects:

- Downtown BRT Enhancement Project (Jacksonville)
- North Corridor BRT (Jacksonville)
- Southeast Corridor BRT (Jacksonville)
- Parramore LYMMO BRT Extension (Orlando)
- East West LYMMO BRT Extension (Orlando)
- MetroRapid North-South BRT (Tampa)
- North-South BRT (Sarasota)
- I-Drive BRT (Orlando)
- Blanding Boulevard dedicated bus lane (Jacksonville)
- BOS system (Miami)

The South Miami-Dade Busway was reviewed as a case study, as described in Section 2.2.

The typical sections obtained through this effort are provided in Appendix A.

### 2.3.2 Findings

The review of typical sections prepared for existing and planned exclusive transit facilities in Florida uncovered several considerations that planners and designers of future exclusive transit facilities in Florida should take into account when deciding among running way alternatives and designing the selected running way. Key findings of the review of existing and planned Florida projects include:

- Right-of-way impacts, costs, and ridership are common criteria used to evaluate alignment and running way options. Other criteria include adjacent development, travel time impact, congestion impact, environmental impact, parking impact, mobility, connectivity, grade crossings, attractiveness/aesthetics, and funding eligibility.
- Most general traffic and transit lanes in the reviewed projects have been designed as 11- and 12-foot lanes.
- All of the reviewed BRT services for which typical sections are available are proposed to operate in concurrent flow, except for a portion of the East-West LYMMO BRT Extension, and all of the BRT vehicles will have doors only on the righthand side.
- Bicycle lanes in the reviewed projects are provided either curbside or between the transit lane and the general travel lanes. Bicycle lane widths vary from 3 to 8 feet.
- Currently, Florida Administrative Code Rule 14-20.003 limits bus shelters to a height of 10 feet and prohibits the placement of bus shelters in medians on State-owned roadways. Both conditions affect decision-making about exclusive transit running way projects on State roads in Florida because they potentially limit the running way alternatives that can be considered as well as station design options and amenities.
- BOS operations under congested traffic conditions can improve transit speed and reliability. Mainline traffic and bus operational requirements need to be identified, and signage should be provided to alert drivers in the general traffic lanes about BOS operations.

Based on the above findings, the typical sections provided in Section 3.0 include the following:

- Allowing 11-foot exclusive transit lanes in a constrained environment but maintaining 12 feet as the desirable width
- Accounting for multiple options for bicycle accommodation
- Retaining typical sections that include median shelters but citing the restrictions presented by Florida Administrative Code Rule 14-20.003
- Addressing vertical height requirements for premium transit service components
- Including typical sections for BOS operations

# SECTION 3.0

## TYPICAL SECTIONS FOR FLORIDA

## 3.0 TYPICAL SECTIONS FOR FLORIDA

This section, informed by the findings summarized in Section 2.0, describes scenarios for provision of exclusive transit running ways in Florida in terms of typical section elements, dimensions, analysis considerations, and intersection operations considerations. Typical section elements, general dimensions, analysis considerations, and intersection operations considerations have been identified for the following scenarios:

- Concurrent flow curb bus lanes
- Concurrent flow median bus lanes
- Contraflow bus lane on a one-way street
- Contraflow bus lane on a two-way street
- At-grade two-way busway on a two-way street
- At-grade reversible one-lane median busway on a two-way street
- At-grade exclusive busway in roadway right-of-way
- At-grade exclusive busway in separate right-of-way
- Exclusive bus street
- BOS operations on an uninterrupted flow highway

***Table 2*** describes the exclusive transit running way scenarios listed above. The table describes the scenarios with respect to the following characteristics:

- **Degree of exclusivity.** Some scenarios allow general traffic to share the transit running way under certain circumstances.
- **Environment.** Exclusive transit running ways can be developed on surface roads and limited-access roads. The running ways can be created by converting general traffic lanes, converting shoulders, narrowing existing general traffic lanes, converting on-street parking lanes, or widening the road.
- **Stations.** Some scenarios are better suited for providing access to/from transit stations than others. Station layouts can be highly variable. All stations must be accessible in accordance with the Americans with Disabilities Act (ADA).
- **Florida legal restrictions.** Some scenarios implemented in the U.S. have features that Florida law currently limits or prohibits. See Section 3.1 for more information.

Either standard-length buses or articulated buses could be utilized in all of the above scenarios.

Table 2. Exclusive Transit Facility Physical and Operating Scenarios

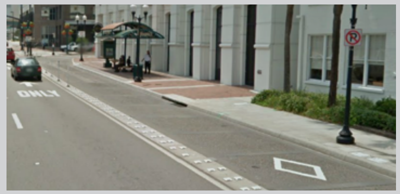
| Scenario | Example(s) | Degree of Exclusivity | Environment | Stations | Florida Legal Restrictions | Miscellaneous |
|---|---|---|---|---|---|---|
| Concurrent flow curb bus lane | <br>Curb bus lane in New York City, NY<br>Source: Kittelson & Associates, Inc.<br><br>Curb bus lane in Las Vegas, NV<br>Source: maps.google.com<br><br>Curb bus lane in Eugene, OR<br>Source: maps.google.com<br><br>Curb bus lane in Orlando, FL<br>Source: maps.google.com<br><br>Curb bus lane in Orlando, FL<br>Source: maps.google.com | Might be shared with right-turning vehicles, deliveries, taxis, bicycles, and/or other users<br>Might be in effect only during peak periods | Typically used where station access is needed<br>Might be created by converting a general-traffic lane, narrowing general-traffic lanes, converting on-street parking, or widening the road | Stations typically located outside the curb or in a curb extension (“bus bulb”)<br>Might feature a pull-out (“bus bay”) at stations to allow other buses to pass | None, but District-specific procedures for lane elimination analysis might apply | Transit signal priority may be appropriate |

**Table 2. (Cont.) Exclusive Transit Facility Physical and Operating Scenarios**

| Scenario | Example(s) | Degree of Exclusivity | Environment | Stations | Florida Legal Restrictions | Miscellaneous |
|---|---|---|---|---|---|---|
| Concurrent flow median bus lane | <br>Median bus lanes in Cleveland, OH<br>Source: maps.google.com<br><br>Median bus lanes in Cleveland, OH<br>Source: maps.google.com<br><br>Median bus lane in Eugene, OR<br>Source: Lane Transit District<br><br><br>Median bus lanes in Las Vegas, NV<br>Source: maps.google.com | Might be shared with left-turning vehicles<br>Might be in effect only during peak periods | Typically used where station access is needed<br>Might be created by converting a general-traffic lane, narrowing general-traffic lanes, converting a median, or widening the road | Stations typically located in the median<br>Median stations might use a central platform to serve both travel directions or separate platforms to serve each travel direction | Florida Administrative Code Rule 14-20.003(3) prohibits transit shelters in medians<br>District-specific procedures for lane elimination analysis might apply on State roads | Some median station configurations require doors on the left side of the bus<br>Left turn lanes for general traffic might be located inside or outside the bus lane; general traffic might be allowed to turn left from the bus lane<br>Bus movements may be controlled by dedicated signals at intersections with roadway network |

**Table 2. (Cont.) Exclusive Transit Facility Physical and Operating Scenarios**

| Scenario | Example(s) | | Degree of Exclusivity | Environment | Stations | Florida Legal Restrictions | Miscellaneous |
|---|---|---|---|---|---|---|---|
| Contraflow bus lane on a one-way street | <br>Contraflow bus lane in Orlando, FL<br>Source: maps.google.com | <br>Bi-directional bus lane in Eugene, OR [1]<br>Source: maps.google.com | Not shared with other users<br>May require substantial separator from general traffic and/or pedestrian fence to manage driver and pedestrian expectation issues, respectively<br>Separator should be flush with the pavement if bus lane is a part-time lane | Typically used where station access is needed<br>Takes advantage of available directional roadway capacity<br>Typically no more than 1-2 blocks long | Stations typically located outside the curb or in a curb extension ("bus bulb") but median stations are possible<br>Might feature a pull-out ("bus bay") at stations to allow other buses to pass | District-specific procedures for lane elimination analysis might apply<br>Florida Administrative Code Rule 14-20.003(3) prohibits transit shelters in medians on State roads | Some station configurations require doors on the left side of the bus<br>Bus movements may be controlled by dedicated signals at intersections with roadway network |
| Contraflow bus lane on a two-way street | | | Typically not shared with other users<br>Separator should be flush with the pavement if bus lane is a part-time lane shared with other users | Typically used where station access is needed<br>Takes advantage of available directional roadway capacity | Stations typically located outside the curb or in a curb extension ("bus bulb") but median stations are possible<br>Might feature a pull-out ("bus bay") at stations to allow other buses to pass | District-specific procedures for lane elimination analysis might apply<br>Florida Administrative Code Rule 14-20.003(3) prohibits transit shelters in medians | Some station configurations require doors on the left side of the bus<br>Bus movements may be controlled by dedicated signals at intersections with roadway network |

**Table 2. (Cont.) Exclusive Transit Facility Physical and Operating Scenarios**

| Scenario | Example(s) | | Degree of Exclusivity | Environment | Stations | Florida Legal Restrictions | Miscellaneous |
|---|---|---|---|---|---|---|---|
| At-grade two-way busway on a two-way street | <br>Median busway in Eugene, OR [2]<br>Source: Lane Transit District | <br>Median busway in Las Vegas, NV [2]<br>Source: maps.google.com | Not shared with other users<br>Higher degree of separation from general traffic in comparison to curb and median transit lanes | Typically used where station access is needed<br>Typically located in the median | Stations typically located in the median<br>Median stations might use a central platform to serve both travel directions or separate platforms to serve each travel direction | Florida Administrative Code Rule 14-20.003(3) prohibits transit shelters in medians | Some station configurations require doors on the left side of the bus<br>Bus movements may be controlled by dedicated signals at intersections with roadway network |
| At-grade reversible one-lane median busway on a two-way street | | | Not shared with other users | Typically used where station access is needed<br>Typically used where right-of-way constraints prevent implementation of a two-lane busway | Stations typically located in the median | Florida Administrative Code Rule 14-20.003(3) prohibits transit shelters in medians | |
| At-grade exclusive busway in roadway right-of-way | <br>Busway in Orlando, FL [2]<br>Source: maps.google.com | <br>Busway in Miami, FL [3]<br>Source: maps.google.com | Not shared with other users | Typically used where station access is needed | Station layout varies; platforms may be curbside and/or in transition area between bus lanes and general traffic lanes | Florida Administrative Code Rule 14-20.003(3) prohibits transit shelters in medians | Bus movements may be controlled by dedicated signals at intersections with roadway network |

**Table 2. (Cont.) Exclusive Transit Facility Physical and Operating Scenarios**

| Scenario | Example(s) | | Degree of Exclusivity | Environment | Stations | Florida Legal Restrictions | Miscellaneous |
|---|---|---|---|---|---|---|---|
| At-grade exclusive busway in separate right-of-way | <br>Busway in Los Angeles, CA<br>Source: Kittelson & Associates, Inc. | | Not shared with other users | Typically used where station access is needed | Stations typically located outside the curb | | Bus movements may be controlled by dedicated signals at intersections with roadway network |
| Exclusive bus street | <br>Transit street in Denver, CO<br>Source: maps.google.com | <br>Part-time transit street in Tampa, FL<br>Source: maps.google.com | Not shared with other users | Typically used where station access is needed | Stations typically located outside the curb | | Bus movements may be controlled by dedicated signals at intersections with roadway network |
| Shoulder-running bus lanes on an uninterrupted flow highway | <br>Bus-on-shoulder in St. Paul, MN<br>Source: University of Minnesota | | Buses travel on shoulder of limited-access facility under limited circumstances<br>Buses yield at entrance and exit ramps<br>Shoulder may be occupied by disabled vehicles | Used where station access is not needed<br>Can be implemented on righthand shoulder or lefthand shoulder depending on length of transit trip and location of entrances and exits | No stations | | May be challenging implement on bridge structures on State Highway System in Florida<br>FDOT phasing out lefthand entrances and exits on limited-access roadways as a policy |

1 This lane operates as a contraflow lane for eastbound buses.

2 Running way type varies along this route.

3 Busway built in abandoned railroad right-of-way adjacent to roadway

## 3.1 TYPICAL SECTIONS FOR FLORIDA

Section 3.1 presents conceptual typical sections for exclusive transit running way configurations, identifies conditions that should be analyzed when considering implementation of each configuration, and describes potential intersection operations issues associated with each configuration. The conditions and issues are summarized in Tables 3 through 14, with Table 3 providing guidelines that are relevant to all of the presented typical sections. The corresponding typical sections are presented in Figures 1 to 11 and depict different running way elements at midblock locations. Stations are depicted in some typical sections for illustrative purposes; it should be noted that stations are not required to be at midblock locations. Information about appropriate dimensions accompanies each typical section. The dimensions are provided for the following two conditions:

- **Preferred.** The preferred condition is where right-of-way, access management, roadside conditions, and other factors are such that desirable design controls and criteria can be achieved.
- **Constrained.** The constrained condition is where the impact (environmental, cost, construction, etc.) of providing desirable design controls and criteria is too great and minimum values may be used. Certain features of the constrained condition may require design variations and exceptions.

Preferred and constrained conditions are consistent with the criteria and standards of the PPM and the Florida Greenbook. The information obtained through the literature review, case studies, and review of Florida projects (which was summarized in Section 2.0) was used to refine the dimensions for each condition and address gaps in the PPM and Florida Greenbook. Application of engineering judgment may support alternative design parameters for specific projects and specific sites.

It is beyond the scope of this guide to determine whether or not it is appropriate to use constrained dimensions in a given scenario. It is stressed that close coordination with FDOT District staff is required in selecting the proper typical sections and proper dimensions to apply along certain roadways given current and projected traffic and development conditions in the corridor. This particularly relates to the use of any constrained dimensions, including any required design variance or design exception documentation.

Most of the conceptual typical sections in this guide reflect a six-lane roadway section. Adjustments in the typical section components and dimensions could be made for different through lane and/or intersection turn lane scenarios. The assumptions made in preparing the typical sections in this guide, as well as references to standards for specific design elements, are listed for each configuration in the Notes column of the dimensions table.

The following general **considerations and cautions** apply to the presented typical sections:

- The typical sections for Florida presented in this guide are examples. Other configurations are possible.
- The PPM *(10)*, the FDOT Design Standards *(11)*, and/or Florida Greenbook *(12)* should be reviewed carefully to ensure that the assumptions reflected in this guide are appropriate for a given site and that site-specific conditions not covered by the conceptual typical sections provided in this guide are addressed correctly.
- More than one type of running way may be appropriate along a given bus route.

Considerations and cautions for specific typical section features are provided in ***Table 3.***

**Table 3. Considerations and Cautions for Specific Typical Section Features**

| Typical Section Feature | Considerations and Cautions |
|---|---|
| Separation | The various types of separation included in the conceptual typical sections in this guide are not intended to buffer transit vehicles from general traffic but to clearly delineate the exclusive transit facility and discourage improper use of the exclusive transit facility. The minimum-width separation, based on practice, is a single conventional painted stripe. Wider painted striping, double-striping, rumble strips, striping with raised pavement markers, raised medians (with or without mountable curbs), jersey barriers, and/or pylons are alternative types of separation that may be appropriate given site-specific conditions and needs.<br>Contraflow separation should be more substantial than concurrent flow separation because the consequences of general traffic and other modes using the transit lane are potentially more acute for the former. Driver, pedestrian, and bicyclist expectation issues can be managed by reinforcing the identity of the contraflow lane through separation and delineation. Signage is needed to convey information to drivers.<br>Separation should be visible at night and in the rain as well as during daylight and dry conditions.<br>Decision-making regarding separation should consider bicycle movements, as raised separation could limit bicycle turning movements (e.g., the ability of bicyclists to leave a curbside bicycle lane to enter a left turn lane). |
| Station location, access, and layout | Station placement is influenced by geometry and operations. Chapter 2 of *(1)* provides detailed guidance for station placement.<br>Examples of station location and layout options are provided in Appendix B. Some station location and layout options require doors on the left side of the bus.<br>Stations must be accessible in accordance with the ADA.<br>Median stations may require a railing or fence to buffer passengers on the platform from adjacent general travel lanes.<br>See *(1)* for information about station elements, including benches, lighting, and bicycle racks. |
| Station width | Dimensions of station elements are available in *(1)*. Typical sections developed for existing BRT projects in the U.S. indicate that stations should have a minimum of 8 feet of width (10 feet desired) for the shelter and platform in median operations. Curbside operations should account for a sidewalk as well, though the orientation of the shelter can be more flexible within curbside stations. In all cases, stations must ultimately be sized to accommodate passenger demand and the number and type of buses using the station. Refer to *(1)* for additional guidance on stop and station design and requirements. |
| Shelters | Although Florida Administrative Code Rule 14-20.003(3) prohibits transit shelters in medians, conceptual typical sections for median running way configurations are included in this guide because transit operators outside of Florida who were interviewed for this guide report that median running way configurations offer significant transit travel time and reliability benefits and can be operated safely. Unless Rule 14-20.003(3) is amended, transit operators in Florida who desire to implement a median running way configuration should be prepared to seek a variance. |
| Bicycle lanes | For exclusive transit running ways located curbside, bicycle lanes could be placed to the inside of the transit lane (i.e., between the transit lane and the general traffic lanes), in which case additional separation between the transit lane and the general traffic lanes is not needed. |
| Emergency/service access | The transit running way should be accessible to emergency and service vehicles, so any separators or delineators used to define the transit running way should be navigable by emergency and service vehicles at periodic intervals at minimum. |
| Future conversion to rail facility | If it is intended that an exclusive bus facility may one day be converted to a rail facility or shared by a rail mode (e.g., a streetcar), the typical section should be modified to reflect the design requirements of both modes. |
| Higher-speed transit facilities | Minimum width requirements may need to be increased if the facility speed is 50 mph or greater or if the route is curved. See the PPM, the FDOT Design Standards, and/or Florida Greenbook as appropriate. |

**Table 4. Concurrent Flow Curb Bus Lanes**

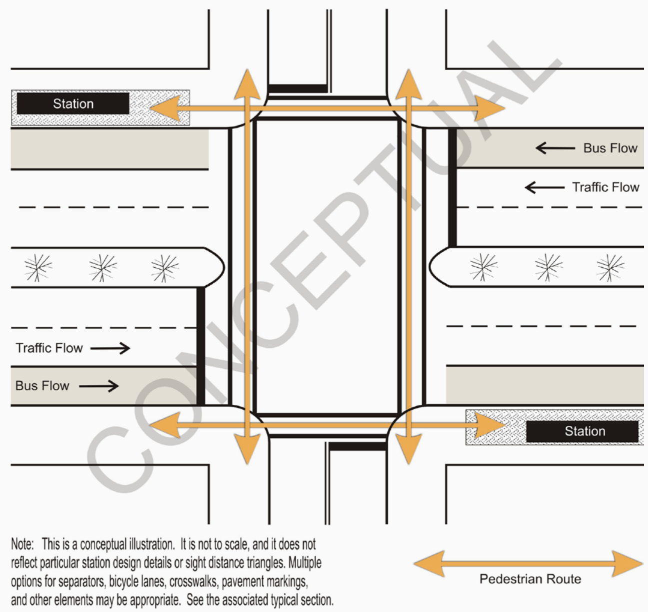
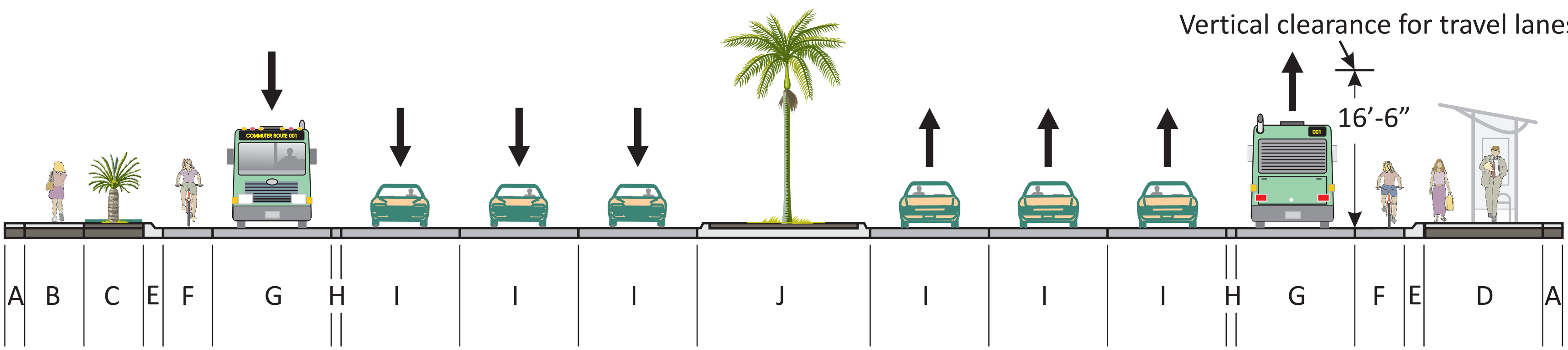
| Description | Typical Section |
|---|---|
| Concurrent flow curb bus lanes operate by limiting the use of the outside travel lanes closest to the curb to buses and, in some cases, to limited general traffic (e.g., traffic making right turns).<br>A concurrent flow lane could also be located in the lane adjacent to the curb lane. This is called an interior bus lane *(13)*. | ***Figure 1*** on the next page shows a conceptual typical section for a midblock location along with associated dimensions. |
| **Considerations** | **Intersection Operations** |
| The following conditions should be analyzed when considering implementation of concurrent flow curb bus lanes *(6,13-17)*:<br>1. On-street parking impacts<br>2. Business access impacts (e.g., deliveries and loading)<br>3. Impact on roadway capacity and level of service (LOS)<br>4. Driveway and intersection density<br>5. General traffic turning volumes<br>6. Volume of buses to be accommodated<br>7. Need to accommodate buses passing each other (e.g., by providing pull-outs at stations)<br>8. Station location (i.e., near-side, far-side, and midblock)<br>9. Pedestrian crossings and station access<br>10. Bicycle lane accommodation<br>11. Signalization<br>12. Enforcement<br>13. Full-time bus lanes vs. part-time bus lanes<br>More information about the above conditions can be found in *(13-17)*. | Because buses will occupy the outside curb lane, right turns from general traffic lanes need to be accommodated at intersections. In accommodating right-turning vehicles at intersections, the following treatments can be considered:<br>• **Right-turns from the bus lane.** At intersections with light to moderate right-turning volumes (under 100 vehicles per hour), general traffic is permitted to enter the curb bus lane approaching the intersection. It should be noted that intersection capacity gained by the use of right-turn overlap phasing and right-turn on red activity will be reduced due to the presence of through buses.<br>• **Exclusive right-turn lane.** At intersections with a high amount of right-turning volumes (more than 100 vehicles per hour), an exclusive right-turn lane for general traffic outside of the bus lane should be considered. Issues that need to be considered include the number of buses that are expected to use the curb lane in relation to the right-turning vehicle volume, the treatment of bicycle lanes, and pedestrian requirements at the intersection.<br>The quality of bus operations at intersections is sensitive to station location and use of transit signal priority. More information about these topics can be found in Chapter 4 of *(13)*, *(14)*, and *(15)*.<br>Conceptual plan view (for illustrative purposes only):<br> |

**Figure 1. Concurrent Flow Curb Bus Lanes: Typical Midblock Section, Two-Way Street**




| DESIGNATION | DESCRIPTION | DIMENSION | | NOTES |
|---|---|---|---|---|
| | | PREFERRED | CONSTRAINED | |
| A | BUFFER | 2' | 1' | 2' utility area should be accounted for behind sidewalk per all FDOT typical sections from PPM, Volume 2, Chapter 6, that show sidewalks. |
| B | SIDEWALK | 6' | 5' | Minimum 5' wide sidewalk shall be separated by 2' buffer strip. 6' wide sidewalk can be used when sidewalk constructed adjacent to curb [PPM, Volume 1, Chapter 8]. 5' minimum sidewalk with complies with ADA standards. |
| C | BUFFER/PLANTING STRIP | 6' | 0' to 6' | 0' wide strip permissible when sidewalk is minimum 6' wide. Minimum of 2' can be used when sidewalk is 5' wide. Buffer width tied to sidewalk width per PPM [PPM, Volume 1, Chapter 8]. Should be 6' wide where practical to eliminate need to narrow or re-route sidewalks around driveways. This wider strip places the sidewalk far enough back to not be affected by the driveway cross slope [Florida Greenbook, Chapter 8]. |
| D | STATION | 14' | 8' to 14' | 8' minimum width for station. Sidewalk of 5' or 6' is preferred with the station for total width of 14'. Note that typical section is showing station on right side of road. The typical section can be modified for a left-side station, two stations, or no stations. Total cross section width may vary depending on modification. |
| E | CURB AND GUTTER | 2' | 2' | Outside curb to be Type F curb and gutter [2' width - FDOT Design Standards, Index 300, and PPM, Volume 2, Chapter 6] on roadways with posted speed ≤45 mph. Type E curb can be used in special cases for roadways with a posted speed >45 mph. See PPM Volume 1, Chapter 2, for guidance on curb usage with roadways >45 mph. |
| F | BIKE LANE | 5' | 4' to 5' | 4' width minimum. 5' width minimum if adjacent to barrier or if the bike lane is between bus lane (G) and travel lanes (I) [PPM Volume 1, Chapter 8]. Note that the bike lane (F) can be placed between the bus lane (G) and general travel lane (I) instead, which would eliminate the need for the separator (H). Designers should consider safety, volumes, etc. when placing bike lane. |
| G | BUS LANE | 12' | 11' | Preferred and constrained widths reflect 2012 interviews with and case studies of bus rapid transit systems in the U.S. and *Integrating Transit into Traditional Neighborhood Design Policies - The Influence of Lane Width on Bus Safety*. |
| H | SEPARATION | 1' | 6" | 1' minimum preferred and 6" constrained based on case studies. Wider separation and/or concrete mountable separators may be warranted based on site-specific conditions and needs. If concrete separator is to be used, refer to FDOT Standard Index 302. These mountable separators can have widths of 4', 6', or 8'6". |
| I | TRAVEL LANE | 12' | 11' | From PPM, Volume 1, Chapter 2, lanes for arterials should be 12' wide but can be 11' wide if the facility is a SIS road and meets one of the conditions listed in the footnotes in Volume 1, Chapter 2, of the PPM. |
| J | MEDIAN | 22' | 15'6" | From PPM Volume 1, Chapter 2, median can be 10-12' wide if flush (painted) only on 5-lane sections where left turns need to be accommodated and speeds are <40 mph. If speeds are <45 mph and the median is raised, minimum width is 22'. This 22' median includes 2'3" Type E curb and gutter on both sides. Minimum width on Urban Streets with speed limit of 45 mph or less is 15'6" from Chapter 3 in Florida Greenbook. |

**Note:** All dimensions shown apply to roads with posted speed of 45 mph or less. If speed is 50 mph or higher, widths may need to be adjusted.

Dimensions reflect 2013 PPM and 2011 Florida Greenbook. Refer to updated versions as they are adopted.

**Concurrent Flow Curb Bus Lanes**
**Typical Midblock Section, Two-Way Street**

Figure
**1**

**Table 5. Concurrent Flow Median Bus Lanes**

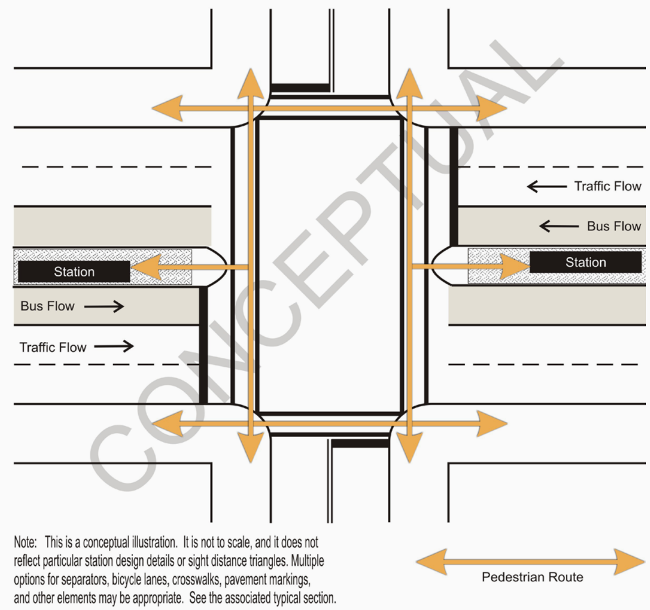
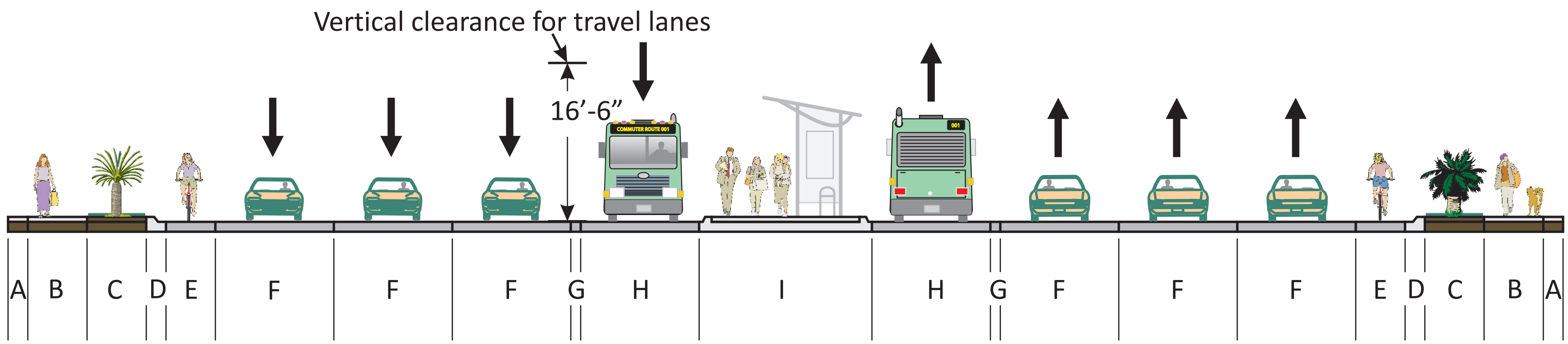
<table>
<tr><th>Description</th><th>Typical Section</th></tr>
<tr><td>Concurrent flow median bus lanes operate by removing buses from traffic conflicts associated with curb lanes and placing the buses in the lanes next to the center median of the roadway. Separation as discussed in Section 2.1 may be present between the bus lanes and the general travel lanes. This treatment works best when there is an extended raised median treatment with no midblock or only minor intersection left turn access.</td><td>Figure 2 shows a conceptual typical section for a midblock location along with associated dimensions.</td></tr>
<tr><th>Considerations</th><th>Intersection Operations</th></tr>
<tr><td>The following conditions should be analyzed when considering implementation of concurrent flow median bus lanes (6,13-17):<br>1. Presence of a suitably wide median or impact on roadway capacity and LOS if general traffic lanes along the median are converted to bus lanes<br>2. Right-of-way for median stations<br>3. Need to accommodate buses passing each other<br>4. Accommodation of general traffic left turns (e.g., by channeling them into lanes outside the median, by allowing them from the bus lane, or by prohibiting them)<br>5. Volume of buses to be accommodated<br>6. Pedestrian crossing and access<br>7. Signalization<br>8. Enforcement<br>9. Full-time bus lanes vs. part-time bus lanes<br>More information about the above conditions can be found in (13-17).</td><td>Because buses proceeding through an intersection may conflict with left-turning general traffic, left turns either are prohibited at intersections or special traffic signals are used to assign separate priority to bus through movements and left-turning vehicles. Median bus lanes do not impact right turns by general traffic.<br>The quality of bus operations at intersections is sensitive to station location and use of transit signal priority. More information about these topics can be found in Chapter 4 of (13), (14), and (15).<br>Conceptual plan view (for illustrative purposes only):<br>
</td></tr>
</table>

**Figure 2. Concurrent Flow Median Bus Lanes: Typical Midblock Section, Two-Way Street**




| DESIGNATION | DESCRIPTION | DIMENSION | | NOTES |
|---|---|---|---|---|
| | | PREFERRED | CONSTRAINED | |
| A | BUFFER | 2' | 1' | 2' utility area should be accounted for behind sidewalk per all FDOT typical sections from PPM, Volume 2, Chapter 6, that show sidewalks. |
| B | SIDEWALK | 6' | 5' | Minimum 5' wide sidewalk shall be separated by 2' buffer strip. 6' wide sidewalk can be used when sidewalk constructed adjacent to curb [PPM, Volume 1, Chapter 8]. 5' minimum sidewalk with complies with ADA standards. |
| C | BUFFER/PLANTING STRIP | 6' | 0' to 6' | 0' wide strip permissible when sidewalk is minimum 6' wide. Minimum of 2' can be used when sidewalk is 5' wide. Buffer width tied to sidewalk width per PPM [PPM, Volume 1, Chapter 8]. Should be 6' wide where practical to eliminate need to narrow or re-route sidewalks around driveways. This wider strip places the sidewalk far enough back to not be affected by the driveway cross slope [Florida Greenbook, Chapter 8]. |
| D | CURB AND GUTTER | 2' | 2' | Outside curb to be Type F curb and gutter [2' width - FDOT Design Standards, Index 300, and PPM, Volume 2, Chapter 6] on roadways with posted speed ≤45 mph. Type E curb can be used in special cases for roadways with a posted speed >45 mph. See PPM Volume 1, Chapter 2, for guidance on curb usage with roadways >45 mph. |
| E | BIKE LANE | 5' | 4' to 5' | 4' width minimum. 5' width minimum if adjacent to barrier [PPM Volume 1, Chapter 8]. |
| F | TRAVEL LANE | 12' | 11' | From PPM, Volume 1, Chapter 2, lanes for arterials should be 12' wide but can be 11' wide if the facility is a SIS road and meets one of the conditions listed in the footnotes in Volume 1, Chapter 2, of the PPM. |
| G | SEPARATION | 1' | 6" | 1' minimum preferred and 6" constrained based on case studies. Wider separation and/or concrete mountable separators may be warranted based on site-specific conditions and needs. If concrete separator is to be used, refer to FDOT Standard Index 302. These mountable separators can have widths of 4', 6', or 8'6". |
| H | BUS LANE | 12' | 11' | Preferred and constrained widths reflect 2012 interviews with and case studies of bus rapid transit systems in the U.S. and *Integrating Transit into Traditional Neighborhood Design Policies - The Influence of Lane Width on Bus Safety*. |
| I | MEDIAN/STATION | 22' | 15'6" | From PPM Volume 1, Chapter 2, median can be 10-12' wide if flush (painted) only on 5-lane sections where left turns need to be accommodated and speeds are <40 mph. If speeds are <45 mph and the median is raised, minimum width is 22'. This 22' median includes 2'3" Type E curb and gutter on both sides. Minimum width on Urban Streets with speed limit of 45 mph or less is 15'6" from Chapter 3 in Florida Greenbook. Note the typical section is showing the station oriented to the left side of the roadway but the station could also be oriented to the right side of the roadway. |

**Note:** All dimensions shown apply to roads with posted speed of 45 mph or less. If speed is 50 mph or higher, widths may need to be adjusted.

Dimensions reflect 2013 PPM and 2011 Florida Greenbook. Refer to updated versions as they are adopted.

**Concurrent Flow Median Bus Lanes**
**Typical Midblock Section, Two-Way Street**

Figure
**2**

**Table 6. Contraflow Bus Lane: One-Way Street**

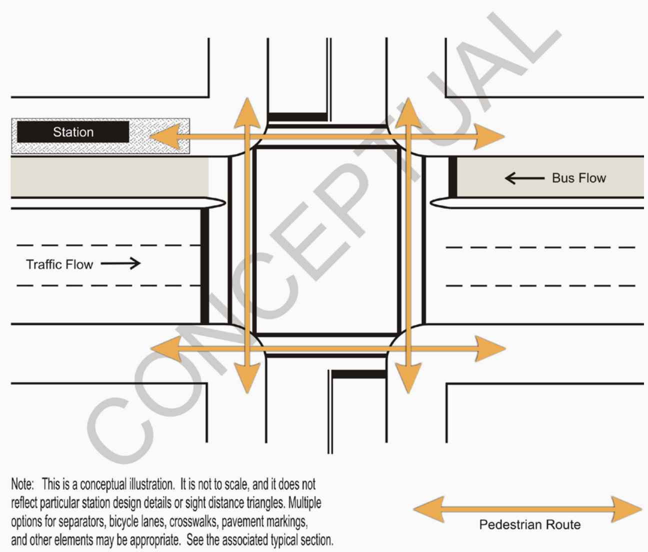
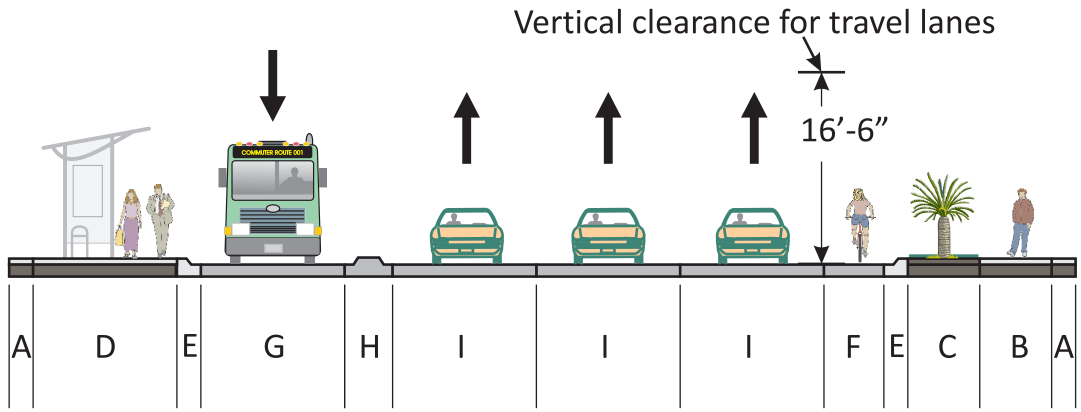
<table>
<tr><th>Description</th><th>Typical Section</th></tr>
<tr><td>Contraflow bus lanes on one-way streets operate by allowing a bus to travel in the opposite direction of the normal traffic flow so as to take advantage of available capacity in the other direction. Contraflow bus lanes on one-way streets are often no more than one to two blocks in length (15).</td><td>Figure 3 shows a conceptual section for a midblock location along with associated dimensions.</td></tr>
<tr><th>Considerations</th><th>Intersection Operations</th></tr>
<tr><td>The following conditions should be analyzed when considering contraflow bus lanes on one-way streets (6,13-17):<br>
1. On-street parking impacts (with consideration of time restrictions)<br>
2. Business access impacts (e.g., deliveries and loading)<br>
3. Impact on roadway capacity and LOS<br>
4. Driveway access<br>
5. Driveway and intersection density<br>
6. Volume of buses to be accommodated<br>
7. Need to accommodate buses passing each other (e.g., by providing pull-outs at stations)<br>
8. Station location (i.e., near-side, far-side, and midblock)<br>
9. Pedestrian crossings and access<br>
10. Bicycle lane accommodation<br>
11. Signalization<br>
12. Enforcement<br>
13. Full-time bus lanes vs. part-time bus lanes<br>
More information about the above conditions can be found in (13-17).</td><td>Contraflow bus lanes on one-way streets usually do not have a significant impact on intersection operations. Consideration may be given to the provision of an exclusive left-turn lane on the one-way street based on the number of conflicting buses. It should be noted that signal progression may be poor for buses due to the variable loading times of passengers and the progression requirements of the general traffic lanes.<br>
Conceptual plan view (for illustrative purposes only):<br>

</td></tr>
</table>

**Figure 3. Contraflow Bus Lane: Typical Midblock Section, One-Way Street**




| DESIGNATION | DESCRIPTION | DIMENSION | | NOTES |
|---|---|---|---|---|
| | | PREFERRED | CONSTRAINED | |
| A | BUFFER | 2' | 1' | 2' utility area should be accounted for behind sidewalk per all FDOT typical sections from PPM, Volume 2, Chapter 6, that show sidewalks. |
| B | SIDEWALK | 6' | 5' | Minimum 5' wide sidewalk shall be separated by 2' buffer strip. 6' wide sidewalk can be used when sidewalk constructed adjacent to curb [PPM, Volume 1, Chapter 8]. 5' minimum sidewalk with complies with ADA standards. |
| C | BUFFER/PLANTING STRIP | 6' | 0' to 6' | 0' wide strip permissible when sidewalk is minimum 6' wide. Minimum of 2' can be used when sidewalk is 5' wide. Buffer width tied to sidewalk width per PPM [PPM, Volume 1, Chapter 8]. Should be 6' wide where practical to eliminate need to narrow or re-route sidewalks around driveways. This wider strip places the sidewalk far enough back to not be affected by the driveway cross slope [Florida Greenbook, Chapter 8]. |
| D | STATION | 14' | 8' to 14' | 8' minimum width for station. Sidewalk of 5' or 6' is preferred with the station for total width of 14'. |
| E | CURB AND GUTTER | 2' | 2' | Outside curb to be Type F curb and gutter [2' width - FDOT Design Standards, Index 300, and PPM, Volume 2, Chapter 6] on roadways with posted speed ≤45 mph. Type E curb can be used in special cases for roadways with a posted speed >45 mph. See PPM Volume 1, Chapter 2, for guidance on curb usage with roadways >45 mph. |
| F | BIKE LANE | 5' | 4' to 5' | 4' width minimum. 5' width minimum if adjacent to barrier [PPM Volume 1, Chapter 8]. |
| G | BUS LANE | 12' | 11' | Preferred and constrained widths reflect 2012 interviews with and case studies of bus rapid transit systems in the U.S. and *Integrating Transit into Traditional Neighborhood Design Policies - The Influence of Lane Width on Bus Safety*. |
| H | SEPARATION | 4' | 2' | 4' minimum preferred and 2' constrained based on Figures 8-13 and 8-17 in the *HOV Systems Manual*, Chapter 8 - Design of Arterial Street HOV Facilities, Page 8-21. Figure 8-17 shows no separation between bus lanes but if speeds are at or near 45 mph, a separator is recommended. Wider separation and/or concrete mountable separator may be warranted based on site-specific conditions and needs. If concrete separator is to be used, refer to FDOT Standard Index 302, Type I or II Concrete Traffic Separator. These mountable separators can have widths of 4', 6', or 8'6". |
| I | TRAVEL LANE | 12' | 11' | From PPM, Volume 1, Chapter 2, lanes for arterials should be 12' wide but can be 11' wide if the facility is a SIS road and meets one of the conditions listed in the footnotes in Volume 1, Chapter 2, of the PPM. |

**Note:** All dimensions shown apply to roads with posted speed of 45 mph or less. If speed is 50 mph or higher, widths may need to be adjusted.

Dimensions reflect 2013 PPM and 2011 Florida Greenbook. Refer to updated versions as they are adopted.

**Contra-Flow Bus Lane**
**Typical Midblock Section, One-Way Street**

Figure
**3**

**Table 7. Contraflow Bus Lanes: Two-Way Street**

### Description

Contraflow bus lanes on two-way streets operate by designating a lane for buses to travel in the opposite direction of normal traffic flow. This lane is typically a different lane during the different peak periods. For example, on an east-west arterial during the a.m. peak hour with the peak direction being eastbound, a contraflow bus lane that flows eastbound could be established on the inside westbound lane. During the p.m. peak hour, when the peak direction is westbound, a contraflow bus lane that operates westbound could be established on the inside eastbound lane.

With this treatment, overhead lane use control signals and signing may be required to properly alert drivers that a lane on their side of the median is in use by buses traveling in the opposite direction. This configuration could be supplemented by the provision of a buffer zone between the contraflow bus lane and the adjacent general traffic lane, along with the placement of traffic cones or pylons between the contraflow lane and the adjacent traffic lane.

### Typical Section

***Figure 4*** shows a typical conceptual section for a midblock location along with associated dimensions.

### Considerations

The following conditions should be analyzed when considering contraflow bus lanes on two-way streets *(6,13-17)*:

1. Presence of a suitably wide median or impact on roadway capacity and LOS if general traffic lanes along the median are converted to bus lanes
2. Right-of-way for median stations
3. Need to accommodate buses passing each other
4. Accommodation of general traffic left turns (e.g., by channeling them into lanes outside the median or prohibiting them)
5. Volume of buses to be accommodated
6. Pedestrian crossings and access
7. Signalization
8. Enforcement
9. Full-time bus lanes vs. part-time bus lanes

More information about the above conditions can be found in *(13-17).*

### Intersection Operations

At signalized intersections, median contraflow bus lanes would be developed inside of the left turn lanes (next to the median), with buses traveling through the intersection on the same signal phase as through traffic and with left turns having a separate phase. At minor unsignalized side street intersections (and also at midblock driveways), left-in and left-out access may need to be prohibited during the hours of operation of the exclusive bus lane, as the lane may be physically separated from the adjacent general traffic lanes through pylons or movable concrete barrier, which would block left turn access. Contraflow bus lanes located along the median would not impact right turns by general traffic.

Conceptual plan view (for illustrative purposes only):

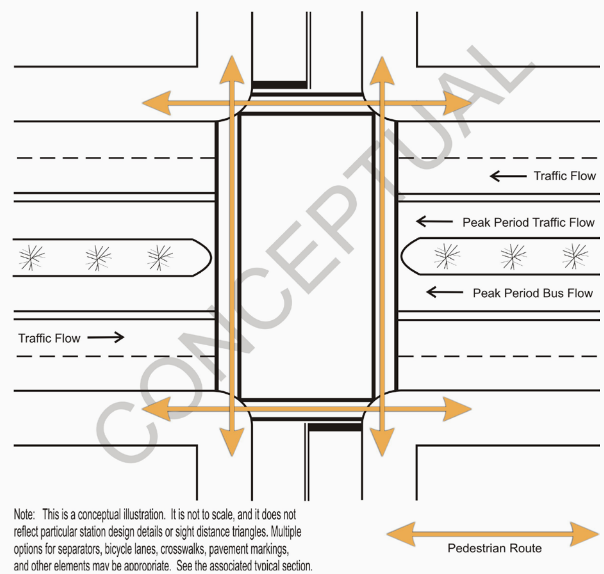
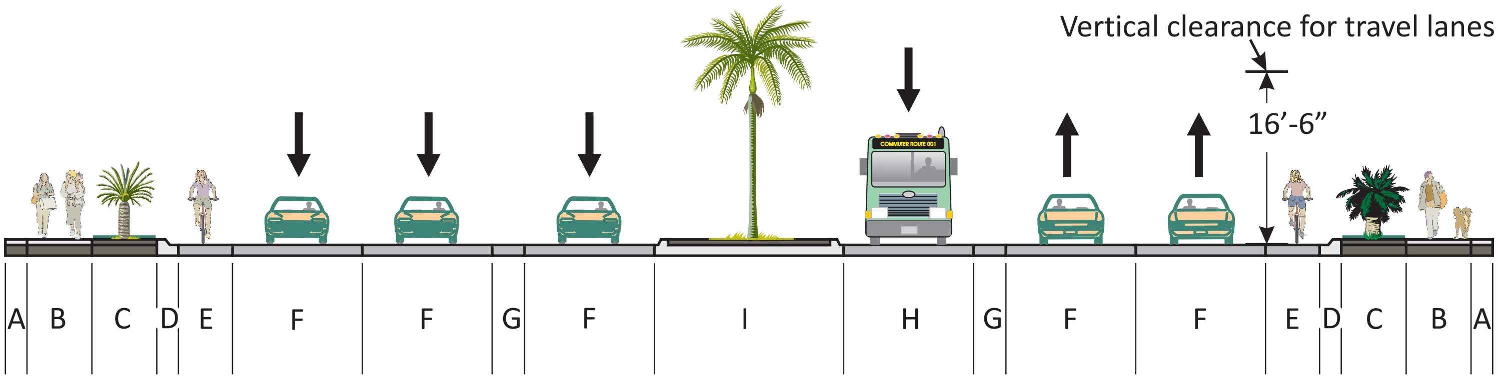


**Figure 4. Contraflow Bus Lanes: Typical Midblock Section, Two-Way Street**




**Note:** Bus lane H switches to inside travel on other side of road during opposite peak hour. The buses in this lane will be traveling opposite the passenger vehicles in the adjacent lanes.

| DESIGNATION | DESCRIPTION | DIMENSION | | NOTES |
|---|---|---|---|---|
| | | PREFERRED | CONSTRAINED | |
| A | BUFFER | 2' | 1' | 2' utility area should be accounted for behind sidewalk per all FDOT typical sections from PPM, Volume 2, Chapter 6, that show sidewalks. |
| B | SIDEWALK | 6' | 5' | Minimum 5' wide sidewalk shall be separated by 2' buffer strip. 6' wide sidewalk can be used when sidewalk constructed adjacent to curb [PPM, Volume 1, Chapter 8]. 5' minimum sidewalk with complies with ADA standards. |
| C | BUFFER/PLANTING STRIP | 6' | 0' to 6' | 0' wide strip permissible when sidewalk is minimum 6' wide. Minimum of 2' can be used when sidewalk is 5' wide. Buffer width tied to sidewalk width per PPM [PPM, Volume 1, Chapter 8]. Should be 6' wide where practical to eliminate need to narrow or re-route sidewalks around driveways. This wider strip places the sidewalk far enough back to not be affected by the driveway cross slope [Florida Greenbook, Chapter 8]. |
| D | CURB AND GUTTER | 2' | 2' | Outside curb to be Type F curb and gutter [2' width - FDOT Design Standards, Index 300, and PPM, Volume 2, Chapter 6] on roadways with posted speed ≤45 mph. Type E curb can be used in special cases for roadways with a posted speed >45 mph. See PPM Volume 1, Chapter 2, for guidance on curb usage with roadways >45 mph. |
| E | BIKE LANE | 5' | 4' to 5' | 4' width minimum. 5' width minimum if adjacent to barrier [PPM Volume 1, Chapter 8]. |
| F | TRAVEL LANE | 12' | 11' | From PPM, Volume 1, Chapter 2, lanes for arterials should be 12' wide but can be 11' wide if the facility is a SIS road and meets one of the conditions listed in the footnotes in Volume 1, Chapter 2, of the PPM. |
| G | SEPARATION | 4' | 2' | 4' minimum preferred and 2' constrained based on Figures 8-13 and 8-17 in the *HOV Systems Manual*, Chapter 8 - Design of Arterial Street HOV Facilities, Page 8-21. Figure 8-17 shows no separation between bus lanes but if speeds are at or near 45 mph, a separator is recommended. Wider separation and/or concrete mountable separator may be warranted based on site-specific conditions and needs. If concrete separator is to be used, refer to FDOT Standard Index 302, Type I or II Concrete Traffic Separator. These mountable separators can have widths of 4', 6', or 8'6". |
| H | BUS LANE | 12' | 11' | Preferred and constrained widths reflect 2012 interviews with and case studies of bus rapid transit systems in the U.S. and *Integrating Transit into Traditional Neighborhood Design Policies - The Influence of Lane Width on Bus Safety*. |
| I | MEDIAN | 22' | 15'6" | From PPM Volume 1, Chapter 2, median can be 10-12' if flush (painted) only on 5-lane sections where left turns need to be accommodated and speeds are <40 mph. If speeds are <45 mph and the median is raised, minimum width is 22'. This 22' median includes 2'3" Type E curb and gutter on both sides. Minimum width on Urban Streets with speed limit of 45 mph or less is 15'6" from Chapter 3 in Florida Greenbook. |

**Note:** All dimensions shown apply to roads with posted speed of 45 mph or less. If speed is 50 mph or higher, widths may need to be adjusted.

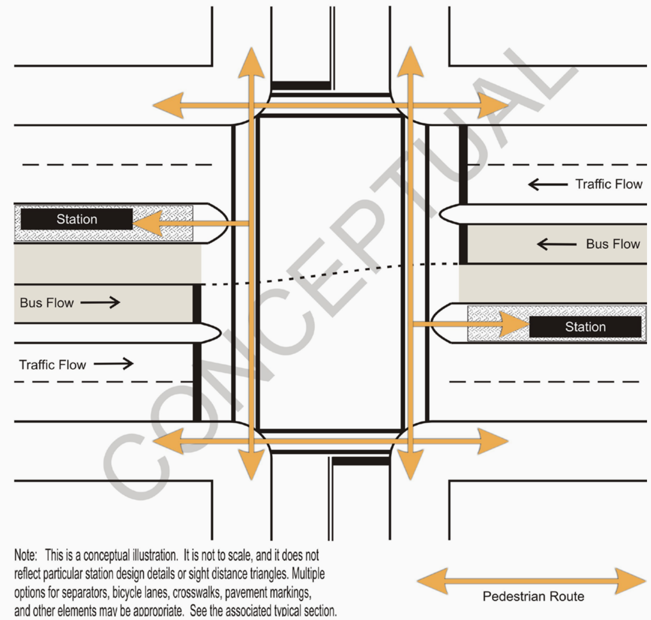
Dimensions reflect 2013 PPM and 2011 Florida Greenbook. Refer to updated versions as they are adopted.

**Contra-Flow Bus Lanes**
**Typical Midblock Section, Two-Way Street**

Figure
**4**

**Table 8. Two-Way Busway: Two-Way Street**

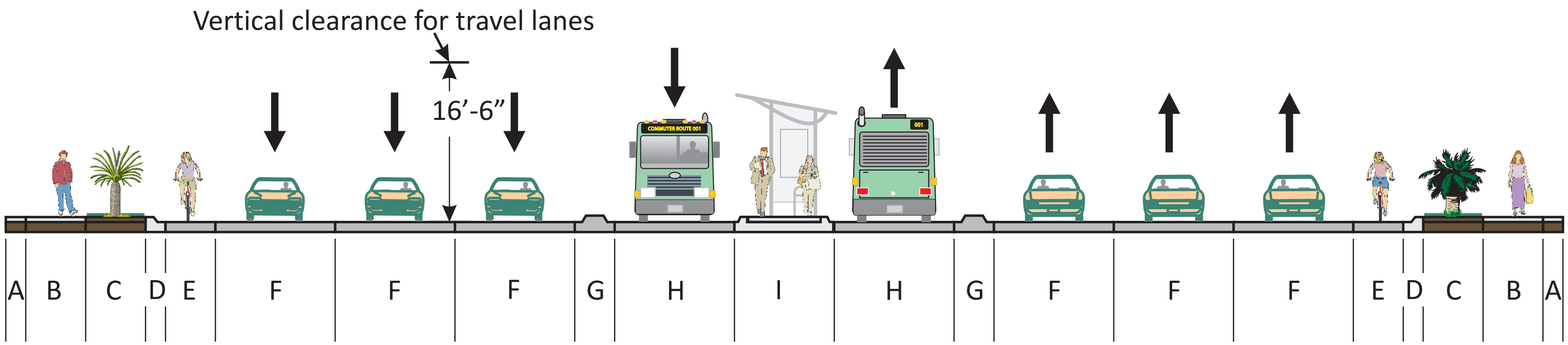
<table>
<tr><th>Description</th><th>Typical Section</th></tr>
<tr><td>A two-way (two-lane) busway in the median operates by removing buses from traffic conflicts associated with curb lanes and placing the buses in the center median of the roadway.</td><td>Figure 5 shows a conceptual typical section for a midblock location along with associated dimensions.</td></tr>
<tr><th>Considerations</th><th>Intersection Operations</th></tr>
<tr><td>The following conditions should be analyzed when considering implementation of a two-way busway (6,13-17):<br>1. Presence of a suitably wide median or impact on roadway capacity and LOS if the median is widened by absorbing the general traffic lanes along the median<br>2. Right-of-way for median stations<br>3. Need to accommodate buses passing each other<br>4. Accommodation of general traffic left turns (e.g., by channeling them into lanes outside the median or prohibiting them)<br>5. Volume of buses to be accommodated<br>6. Pedestrian crossings and access<br>7. Signalization<br>8. Enforcement<br>More information about the above conditions can be found in (13-17).</td><td>Because buses proceeding through an intersection may conflict with left-turning general traffic, left turns either are prohibited at intersections or special traffic signals are used to assign separate priority to bus through movements and left-turning vehicles. Median bus lanes do not impact right turns by general traffic.<br>Conceptual plan view (for illustrative purposes only):<br>





</td></tr>
</table>

**Figure 5. Two-Way Busway: Typical Midblock Section, Two-Way Street**




**Note:** This typical section does not include width for midblock stations.

| DESIGNATION | DESCRIPTION | DIMENSION | | NOTES |
|---|---|---|---|---|
| | | PREFERRED | CONSTRAINED | |
| A | BUFFER | 2' | 1' | 2' utility area should be accounted for behind sidewalk per all FDOT typical sections from PPM, Volume 2, Chapter 6, that show sidewalks. |
| B | SIDEWALK | 6' | 5' | Minimum 5' wide sidewalk shall be separated by 2' buffer strip. 6' wide sidewalk can be used when sidewalk constructed adjacent to curb [PPM, Volume 1, Chapter 8]. 5' minimum sidewalk with complies with ADA standards. |
| C | BUFFER/PLANTING STRIP | 6' | 0' to 6' | 0' wide strip permissible when sidewalk is minimum 6' wide. Minimum of 2' can be used when sidewalk is 5' wide. Buffer width tied to sidewalk width per PPM [PPM, Volume 1, Chapter 8]. Should be 6' wide where practical to eliminate need to narrow or re-route sidewalks around driveways. This wider strip places the sidewalk far enough back to not be affected by the driveway cross slope [Florida Greenbook, Chapter 8]. |
| D | CURB AND GUTTER | 2' | 2' | Outside curb to be Type F curb and gutter [2' width - FDOT Design Standards, Index 300, and PPM, Volume 2, Chapter 6] on roadways with posted speed ≤45 mph. Type E curb can be used in special cases for roadways with a posted speed >45 mph. See PPM Volume 1, Chapter 2, for guidance on curb usage with roadways >45 mph. |
| E | BIKE LANE | 5' | 4' to 5' | 4' width minimum. 5' width minimum if adjacent to barrier [PPM Volume 1, Chapter 8]. |
| F | TRAVEL LANE | 12' | 11' | From PPM, Volume 1, Chapter 2, lanes for arterials should be 12' wide but can be 11' wide if the facility is a SIS road and meets one of the conditions listed in the footnotes in Volume 1, Chapter 2, of the PPM. |
| G | SEPARATION | 6' (Concrete Traffic Separator) or 8' (Jersey Barrier) | 4' to 8' | If concrete separator is to be used, refer to FDOT Standard Index 302. These are mountable separators that can have widths of 4', 6', or 8'6". If Jersey barrier is to be used, refer to FDOT Standard Index 410, Full Wall concrete barrier wall. This wall has a width of 2' and a shoulder width of 6' should be included between the travel lane and placement of wall to account for shy distance at 45 mph. [AASHTO Roadside Design Guide, 4th Edition 2011, Chapter 5, Table 5-7]. Because concrete traffic separator is mountable, no shy distance is required. |
| H | BUS LANE | 12 | 11 | Preferred and constrained widths reflect 2012 interviews with and case studies of bus rapid transit systems in the U.S. and *Integrating Transit into Traditional Neighborhood Design Policies - The Influence of Lane Width on Bus Safety*. |
| I | MEDIAN/STATION | 4' (Median) or 14' (Station) | 2' (Median) or 8' (Station) | 4' minimum preferred and 2' constrained median based on Figures 8-13 and 8-17 in the *HOV Systems Manual*, Chapter 8 - Design of Arterial Street HOV Facilities, Page 8-21. Figure 8-17 shows no separation between bus lanes but if speeds are at or near 45 mph, a separator is recommended. Wider separation and/or concrete mountable separators between bus lanes may be warranted based on site-specific conditions and needs. If concrete separator is to be used, refer to FDOT Standard Index 302, Type I or II Concrete Traffic Separator. These mountable separators can have widths of 4', 6', or 8'6". Additional width required if stations are located between bus lanes, as shown in this typical section. Additional width required if stations are located between bus lanes as shown in typical section. Alternative station layouts and locations are possible. Consider pedestrian access, the need to relocate transit lanes, increased median width requirements, and other factors. |

**Note:** All dimensions shown apply to roads with posted speed of 45 mph or less. If speed is 50 mph or higher, widths may need to be adjusted.

Dimensions reflect 2013 PPM and 2011 Florida Greenbook. Refer to updated versions as they are adopted.

**Two-Way Busway**
**Typical Midblock Section, Two-Way Street**

Figure
**5**

**Table 9. Reversible One-Lane Median Busway: Two-Way Street**

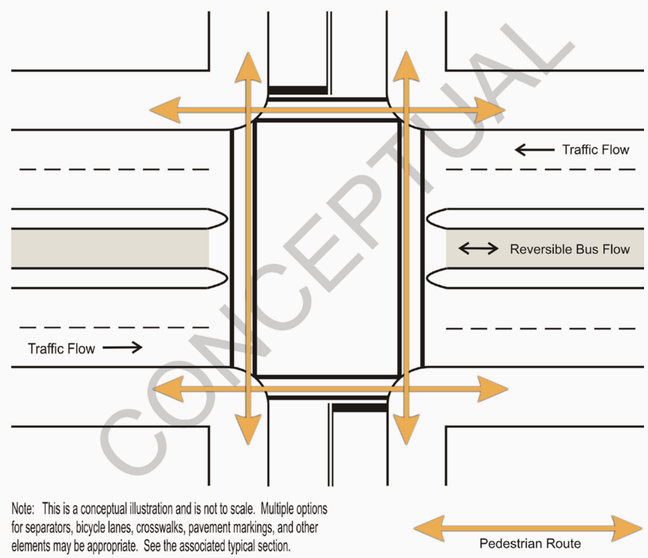
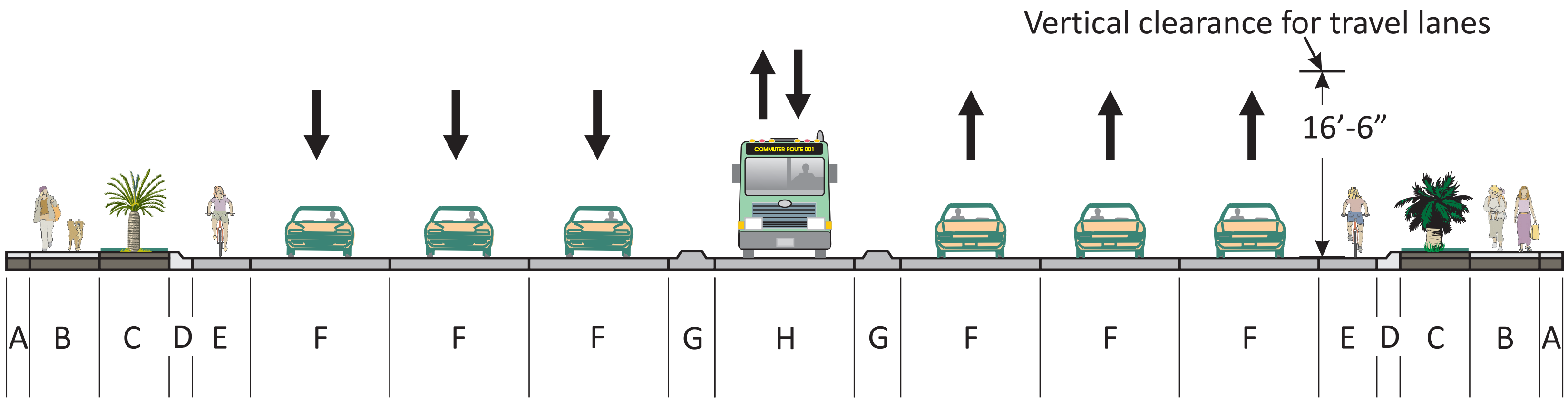
| Description | Typical Section |
|---|---|
| A reversible flow median one-lane busway operates by removing buses from traffic conflicts associated with curb lanes and placing the buses in the center lane of the roadway. The one-lane median busway would serve peak direction travel during each peak period, reversing its direction of operation between the peak periods. It is important that access to the one-lane busway be provided in the form of mountable separators or pylons so that service vehicles can reach disabled buses and emergency vehicles can access the busway. | ***Figure 6*** shows a conceptual typical section for a midblock location along with associated dimensions. |
| **Considerations** | **Intersection Operations** |
| The following conditions should be analyzed when considering implementation of a reversible one-lane median busway *(6,13-17)*:<br>1. Presence of a suitably wide median or impact on roadway capacity and LOS if a general travel lane is converted to the busway; the latter would require additional right-of-way for the separation between the busway and the remaining general travel lanes<br>2. Right-of-way for median stations<br>3. Need to accommodate buses passing each other<br>4. Accommodation of general traffic left turns (e.g., by channeling them into lanes outside the median, by allowing them from the bus lane, or by prohibiting them)<br>5. Volume of buses to be accommodated<br>6. Pedestrian crossings and access<br>7. Signalization<br>8. Enforcement<br>More information about the above conditions can be found in *(13-17)*. | Because buses proceeding through an intersection may conflict with left-turning general traffic, special traffic signals are used to assign separate priority to the bus through movement and left-turning vehicles. (Left-turning vehicles operate using protected phasing only.) A reversible median bus lane would not impact right turns by general traffic.<br>Conceptual plan view (for illustrative purposes only):<br><br> |

**Figure 6. Reversible One-Lane Median Busway: Typical Midblock Section, Two-Way Street**




**Note:** This typical section does not include width for midblock stations.

| DESIGNATION | DESCRIPTION | DIMENSION | | NOTES |
|---|---|---|---|---|
| | | PREFERRED | CONSTRAINED | |
| A | BUFFER | 2' | 1' | 2' utility area should be accounted for behind sidewalk per all FDOT typical sections from PPM, Volume 2, Chapter 6, that show sidewalks. |
| B | SIDEWALK | 6' | 5' | Minimum 5' wide sidewalk shall be separated by 2' buffer strip. 6' wide sidewalk can be used when sidewalk constructed adjacent to curb [PPM, Volume 1, Chapter 8]. 5' minimum sidewalk with complies with ADA standards. |
| C | BUFFER/PLANTING STRIP | 6' | 0' to 6' | 0' wide strip permissible when sidewalk is minimum 6' wide. Minimum of 2' can be used when sidewalk is 5' wide. Buffer width tied to sidewalk width per PPM [PPM, Volume 1, Chapter 8]. Should be 6' wide where practical to eliminate need to narrow or re-route sidewalks around driveways. This wider strip places the sidewalk far enough back to not be affected by the driveway cross slope [Florida Greenbook, Chapter 8]. |
| D | CURB AND GUTTER | 2' | 2' | Outside curb to be Type F curb and gutter [2' width - FDOT Design Standards, Index 300, and PPM, Volume 2, Chapter 6] on roadways with posted speed <u><</u>45 mph. Type E curb can be used in special cases for roadways with a posted speed >45 mph. See PPM Volume 1, Chapter 2, for guidance on curb usage with roadways >45 mph. |
| E | BIKE LANE | 5' | 4' to 5' | 4' width minimum. 5' width minimum if adjacent to barrier [PPM Volume 1, Chapter 8]. |
| F | TRAVEL LANE | 12' | 11' | From PPM, Volume 1, Chapter 2, lanes for arterials should be 12' wide but can be 11' wide if the facility is a SIS road and meets one of the conditions listed in the footnotes in Volume 1, Chapter 2, of the PPM. |
| G | SEPARATION | 4' | 2' | 4' minimum preferred and 2' constrained based on Figures 8-13 and 8-17 in the *HOV Systems Manual*, Chapter 8 - Design of Arterial Street HOV Facilities, Page 8-21. Wider separation and/or concrete mountable separator may be warranted based on site-specific conditions and needs. If concrete separator is to be used, refer to FDOT Standard Index 302, Type I or II Concrete Traffic Separator. These mountable separators can have widths of 4', 6', or 8'6". |
| H | BUS LANE | 12 | 11 | Preferred and constrained widths reflect 2012 interviews with and case studies of bus rapid transit systems in the U.S. and *Integrating Transit into Traditional Neighborhood Design Policies - The Influence of Lane Width on Bus Safety*. |

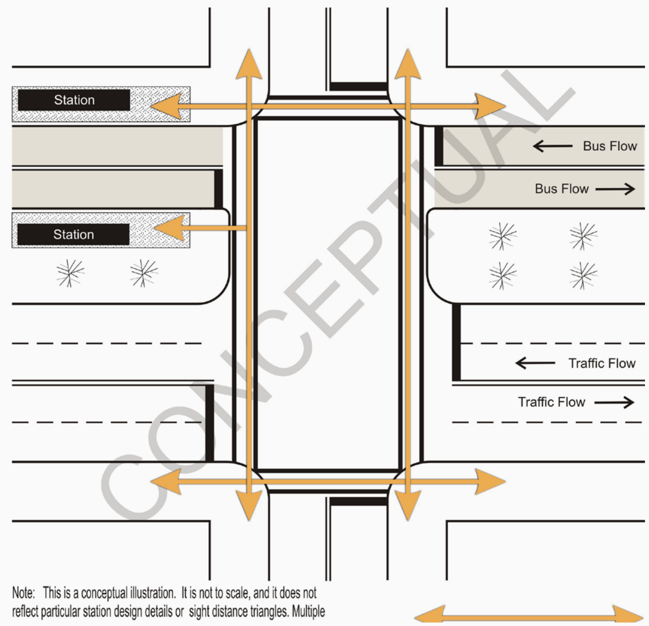
**Note:** All dimensions shown apply to roads with posted speed of 45 mph or less. If speed is 50 mph or higher, widths may need to be adjusted.

Dimensions reflect 2013 PPM and 2011 Florida Greenbook. Refer to updated versions as they are adopted.

**Reversible One-Lane Median Busway Typical Midblock Section, Two-Way Street**

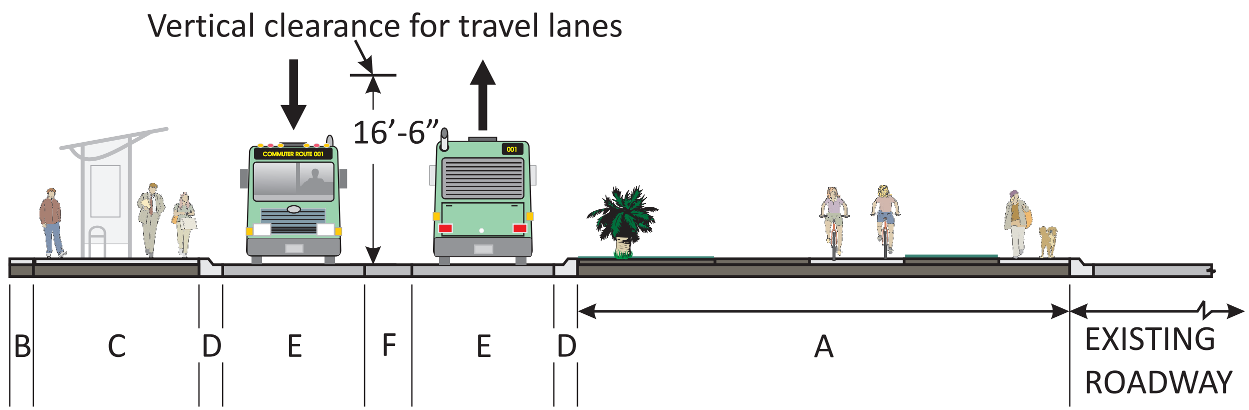
Figure **6**

**Table 11. Exclusive Busway in Roadway Right-of-Way**

<table>
<tr><th>Description</th><th>Typical Section</th></tr>
<tr><td>
Exclusive busways are special roadways designed for exclusive or predominant use by buses. These roadways are designed in accordance with the principles, guidelines, and standards used for traditional roadways. That is, the PPM, the FDOT Design Standards, and/or Florida Greenbook should be followed for geometric design standards and criteria.<br><br>
If the busway is built within roadway right-of-way, 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.
</td><td>
Figure 7 shows a conceptual typical section for a midblock location along with associated dimensions.
</td></tr>
<tr><th>Considerations</th><th>Intersection Operations</th></tr>
<tr><td>
The following conditions should be analyzed when considering implementation of an exclusive busway in roadway right-of-way (6,13-18):<br>
1. Available right-of-way<br>
2. Transition area components (e.g., station infrastructure and bicycle path)<br>
3. Need to accommodate buses passing each other<br>
4. Volume of buses to be accommodated<br>
5. Separation between opposing directions of bus travel<br>
6. Pedestrian crossings and access<br>
7. Signalization at intersections with the roadway network<br>
8. Distance between busway and adjacent roadway<br>
9. Signage at intersections with the roadway network<br>
10. Enforcement<br>
More information about the above conditions can be found in (13-18).<br><br>
Regarding Conditions 8 and 9 above, the early crash history of existing busways located adjacent to a roadway includes vehicles turning right on red from the roadway and crossing the busway without yielding to buses. Such crashes have been addressed through increased signage and slower bus speeds.
</td><td>
The location and design of intersections should follow the design principles, guidelines, and standards used for traditional intersections. For example, FDOT access management procedures (Rule 14-97) should be followed to obtain acceptable intersection spacing, and the PPM, the FDOT Design Standards, and/or the Florida Greenbook should be followed for geometric design standards and criteria.<br><br>
Conceptual plan view (for illustrative purposes only):<br>


</td></tr>
</table>

**Figure 7. Exclusive Busway in Roadway Right-of-Way: Typical Section**




| DESIGNATION | DESCRIPTION | DIMENSION | | NOTES |
|---|---|---|---|---|
| | | PREFERRED | CONSTRAINED | |
| A | TRANSITION AREA | Variable | Variable subject to minimums for cross section elements included. | The width of this area is dependent on multiple variables such as roadway speed, ROW width, and cross section elements that are within the transition zone such as sidewalks, bike paths/multiuse paths, stations, etc. The transition zone should be considered on a corridor specific basis. |
| B | BUFFER | 2' | 1' | 2' utility area should be accounted for behind sidewalk per all FDOT typical sections from PPM, Volume 2, Chapter 6, that show sidewalks. |
| C | STATION | 14' | 8' to 14' | 8' minimum width for station. Sidewalk of 5' or 6' is preferred with the station for total width of 14'. Note that typical section is showing the station on left side of road. The typical section can be modified for a right-side station, two stations, or no stations. Typical section could also allow for bus passing lanes. Total cross section width may vary depending on modifications. |
| D | CURB AND GUTTER | 2' | 2' | Outside curb to be Type F curb and gutter [2' width - FDOT Design Standards, Index 300, and PPM, Volume 2, Chapter 6] on roadways with posted speed ≤45 mph. Type E curb can be used in special cases for roadways with a posted speed >45 mph. See PPM Volume 1, Chapter 2, for guidance on curb usage with roadways >45 mph. |
| E | BUS LANE | 12 | 11 | Preferred and constrained widths reflect 2012 interviews with and case studies of bus rapid transit systems in the U.S. and *Integrating Transit into Traditional Neighborhood Design Policies - The Influence of Lane Width on Bus Safety*. |
| F | MEDIAN | 4' | 2' | 4' minimum preferred and 2' constrained based on Figures 8-13 and 8-17 in the *HOV Systems Manual*, Chapter 8 - Design of Arterial Street HOV Facilities, Page 8-21. Figure 8-17 shows no separation between bus lanes but if speeds are at or near 45 mph, a separator is recommended. Wider separation and/or concrete mountable separator may be warranted based on site-specific conditions and needs. If concrete separator is to be used, refer to FDOT Standard Index 302, Type I or II Concrete Traffic Separator. These mountable separators can have widths of 4', 6', or 8'6". |

**Note:** All dimensions shown apply to roads with posted speed of 45 mph or less. If speed is 50 mph or higher, widths may need to be adjusted.

Dimensions reflect 2013 PPM and 2011 Florida Greenbook. Refer to updated versions as they are adopted.

**Exclusive Busway in Roadway Right-of-Way**
**Typical Section**

Figure **7**

**Table 12. Exclusive Busway in Separate Right-of-Way**

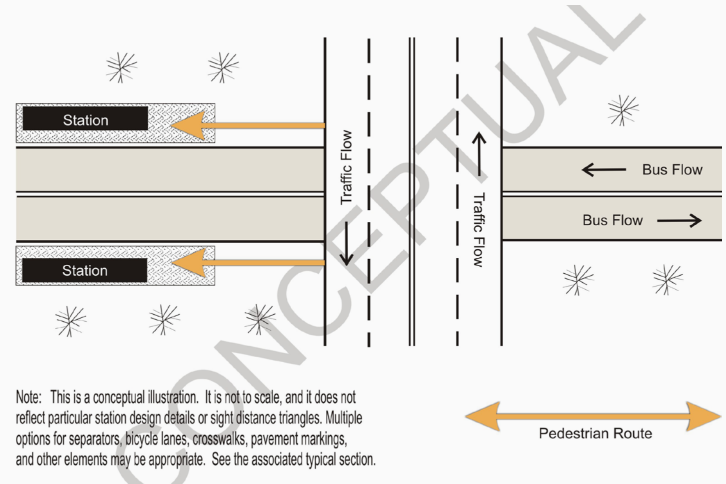
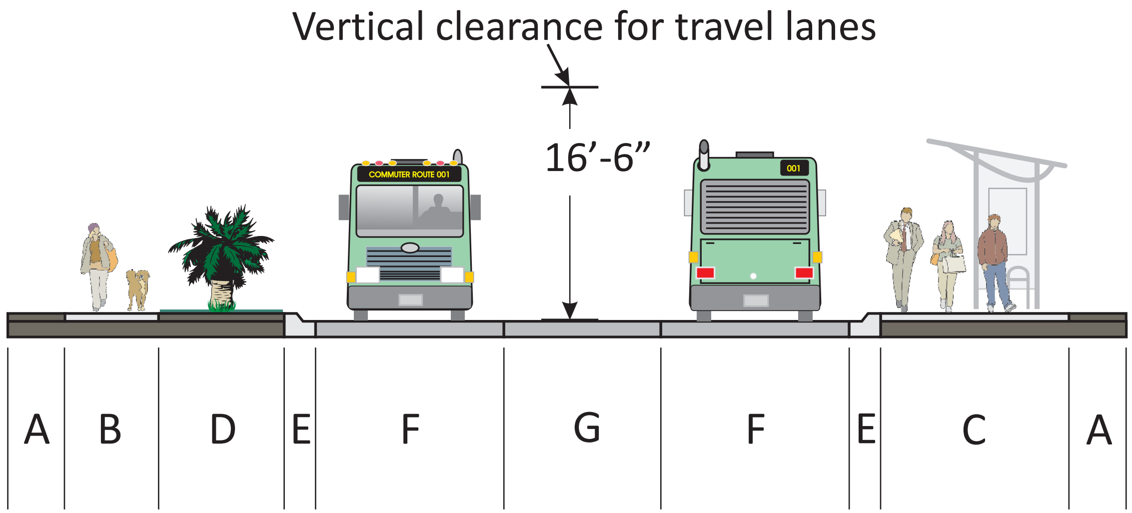
| Description | Typical Section |
|---|---|
| Exclusive busways are special roadways designed for exclusive or predominant use by buses. A two-way busway facility in separate right-of-way should be designed in accordance with the principles, guidelines, and standards used for traditional roadways (i.e., the PPM, the FDOT Design Standards, and/or the Florida Greenbook). | ***Figure 8*** shows a conceptual typical section for a midblock location along with associated dimensions. In this figure, the busway has curb and gutter. Open drainage sections may also be applicable for exclusive busways. |
| **Considerations** | **Intersection Operations** |
| The following conditions should be analyzed when considering implementation of an exclusive busway in separate right-of-way *(6,13-18)*:<br>1. Available right-of-way<br>2. Need to accommodate buses passing each other<br>3. Volume of buses to be accommodated<br>4. Separation between opposing directions of bus travel<br>5. Pedestrian crossings and access<br>6. Signalization at intersections with the roadway network<br>7. Distance between busway and adjacent roadway<br>8. Signage at intersections with the roadway network<br>9. Enforcement<br>More information about the above conditions can be found in *(13-18)*.<br>Regarding Conditions 7 and 8 above, the early crash history of existing busways located adjacent to a roadway includes vehicles turning right on red from the roadway and crossing the busway without yielding to buses. Such crashes have been addressed through increased signage and slower bus speeds. | The location and design of intersections should follow the design principles and guidelines used for traditional intersections. For example, FDOT access management procedures (Rule 14-97) should be followed to obtain acceptable intersection spacing, and the PPM, the FDOT Design Standards, and/or the Florida Greenbook should be followed for geometric design standards and criteria.<br>Conceptual plan view (for illustrative purposes only):<br><br> |

Figure 8. Exclusive Busway Typical Section




| DESIGNATION | DESCRIPTION | DIMENSION | | NOTES |
|---|---|---|---|---|
| | | PREFERRED | CONSTRAINED | |
| A | BUFFER | 2' | 1' | 2' utility area should be accounted for behind sidewalk per all FDOT typical sections from PPM, Volume 2, Chapter 6, that show sidewalks. |
| B | SIDEWALK | 6' | 5' | Minimum 5' wide sidewalk shall be separated by 2' buffer strip. 6' wide sidewalk can be used when sidewalk constructed adjacent to curb [PPM, Volume 1, Chapter 8]. 5' minimum sidewalk with complies with ADA standards. |
| C | STATION | 14' | 8' to 14' | 8' minimum width for station. Sidewalk of 5' or 6' is preferred with the station for total width of 14'. Note that typical section is showing station on right side of road. The typical section can be modified for a left-side station, two stations, or no stations. Typical section could also allow for bus passing lanes. Total cross section width may vary depending on modifications. |
| D | BUFFER/PLANTING STRIP | 6' | 0' to 6' | 0' wide strip permissible when sidewalk is minimum 6' wide. Minimum of 2' can be used when sidewalk is 5' wide. Buffer width tied to sidewalk width per PPM [PPM, Volume 1, Chapter 8]. Should be 6' wide where practical to eliminate need to narrow or re-route sidewalks around driveways. This wider strip places the sidewalk far enough back to not be affected by the driveway cross slope [Florida Greenbook, Chapter 8]. |
| E | CURB AND GUTTER | 2' | 2' | Outside curb to be Type F curb and gutter [2' width - FDOT Design Standards, Index 300, and PPM, Volume 2, Chapter 6] on roadways with posted speed ≤45 mph. Type E curb can be used in special cases for roadways with a posted speed >45 mph. See PPM Volume 1, Chapter 2, for guidance on curb usage with roadways >45 mph. |
| F | BUS LANE | 12 | 11 | Preferred and constrained widths reflect 2012 interviews with and case studies of bus rapid transit systems in the U.S. and *Integrating Transit into Traditional Neighborhood Design Policies - The Influence of Lane Width on Bus Safety*. |
| G | MEDIAN | 4' | 2' to 6' | 4' minimum preferred and 2' constrained based on Figures 8-13 and 8-17 in the *HOV Systems Manual*, Chapter 8 - Design of Arterial Street HOV Facilities, Page 8-21. Figure 8-17 shows no separation between bus lanes but if speeds are at or near 45 mph, a separator is recommended. Wider separation and/or concrete mountable separator may be warranted based on site-specific conditions and needs. If concrete separator is to be used, refer to FDOT Standard Index 302, Type I or II Concrete Traffic Separator. These mountable separators can have widths of 4', 6', or 8'6". |

**Note:** All dimensions shown apply to roads with posted speed of 45 mph or less. If speed is 50 mph or higher, widths may need to be adjusted.

Dimensions reflect 2013 PPM and 2011 Florida Greenbook. Refer to updated versions as they are adopted.

**Exclusive Busway Typical Section**

Figure **8**

**Table 13. Exclusive Bus Street**

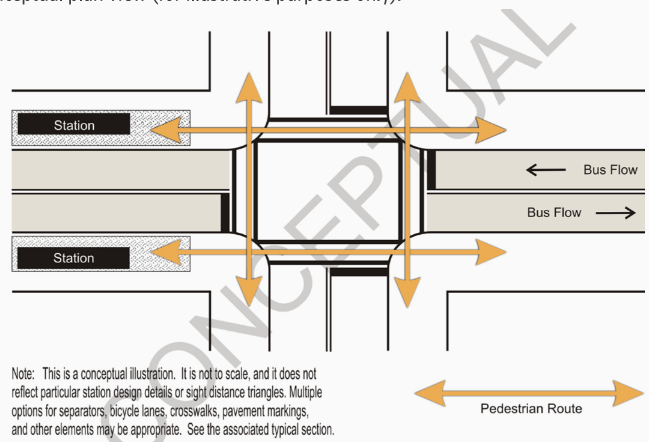
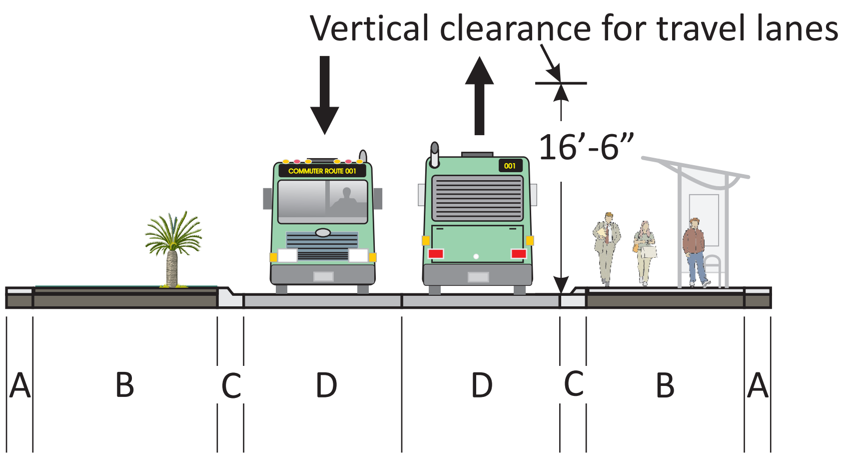
| Description | Typical Section |
|---|---|
| Exclusive bus streets are downtown streets that are restricted to transit use only. They may be called transit malls. Exclusive bus streets fully separate bus and car traffic. The roadways are designed in accordance with the principles, guidelines, and standards used for traditional roadways (i.e., the PPM, the FDOT Design Standards, and/or the Florida Greenbook). | ***Figure 9*** shows a conceptual typical section for a midblock location along with associated dimensions. |
| **Considerations** | **Intersection Operations** |
| The following conditions should be analyzed when considering implementation of an exclusive busway in separate right-of-way *(6,13-17)*:<br>1. Available right-of-way<br>2. Need to accommodate buses passing each other<br>3. Volume of buses to be accommodated<br>4. Pedestrian crossings and access<br>5. Signalization at intersections with the roadway network<br>6. Enforcement<br>More information about the above conditions can be found in *(13-17).* | The location and design of intersections should follow the design principles, guidelines, and standards used for traditional intersections. That is, the PPM, the FDOT Design Standards, and/or Florida Greenbook should be followed for geometric design standards and criteria.<br>Conceptual plan view (for illustrative purposes only):<br><br> |

Figure 9. Exclusive Bus Street Typical Section




| DESIGNATION | DESCRIPTION | DIMENSION PREFERRED | DIMENSION CONSTRAINED | NOTES |
|---|---|---|---|---|
| A | BUFFER | 2' | 1' | 2' utility area should be accounted for behind sidewalk per all FDOT typical sections from PPM, Volume 2, Chapter 6, that show sidewalks. |
| B | STATION | 14' | 8' to 14' | 8' minimum width for station. Sidewalk of 5' or 6' is preferred with the station for total width of 14'. Note that typical section is showing station on right side of road. The typical section can be modified for a left-side station, two stations, or no stations. Typical section could also allow for bus passing lanes. Total cross section width may vary depending on modifications. |
| C | CURB AND GUTTER | 2' | 2' | Outside curb to be Type F curb and gutter [2' width - FDOT Design Standards, Index 300, and PPM, Volume 2, Chapter 6] on roadways with posted speed ≤45 mph. Type E curb can be used in special cases for roadways with a posted speed >45 mph. See PPM Volume 1, Chapter 2, for guidance on curb usage with roadways >45 mph. |
| D | BUS LANE | 12 | 11 | Preferred and constrained widths reflect 2012 interviews with and case studies of bus rapid transit systems in the U.S. and *Integrating Transit into Traditional Neighborhood Design Policies - The Influence of Lane Width on Bus Safety*. |

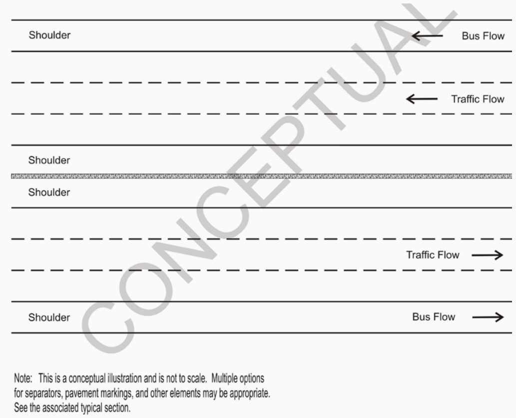
**Note:** All dimensions shown apply to roads with posted speed of 45 mph or less. If speed is 50 mph or higher, widths may need to be adjusted.

Dimensions reflect 2013 PPM and 2011 Florida Greenbook. Refer to updated versions as they are adopted.

**Exclusive Bus Street Typical Section**

Figure **9**

**Table 14. BOS Operations on Uninterrupted Flow Highway**

<table>
<tr><th>Description</th><th>Typical Section</th></tr>
<tr><td>BOS operations allows buses to travel on the shoulder when the general traffic lanes are congested (e.g., when speeds in the general traffic lanes are 35 mph or less). Buses in BOS operation on uninterrupted flow highways are typically not allowed to travel more than 15 mph faster than general traffic, they must yield at entrance and exit ramps, and they must merge with general traffic wherever the shoulder is not suitable for BOS operations (e.g., where a disabled vehicle is parked on the shoulder or where the shoulder is too narrow). BOS operations is typically accompanied by signage indicating that buses are allowed to travel on the shoulder. No special separation or delineation is required.<br><br>BOS operations has historically been a retrofit strategy, not something that has been explicitly designed for when the roadway is designed. However, the Minnesota DOT is making all shoulders on new and reconstructed uninterrupted flow highways 12 feet wide in case there is a need to run BOS operations on those facilities in the future.</td><td>Figure 10 and Figure 11 show conceptual typical sections for righthand and lefthand BOS operations on an uninterrupted flow highway, along with associated dimensions. Lefthand operations may be suitable where entrances and exits are on the left side, although FDOT is phasing such exit configurations out. Lefthand operations may also be suitable where entrances and exits are on the right side if transit trip lengths are long enough that it is worthwhile for the bus to maneuver across the roadway to travel on the lefthand shoulder, thus avoiding the delay of yielding at entrance and exit ramps.</td></tr>
<tr><th>Considerations</th><th>Operations</th></tr>
<tr><td>The following conditions should be analyzed when considering implementation of BOS operations on uninterrupted flow highways (7,8,14,16,17):<br>1. Available paved shoulder width<br>2. Clear zones<br>3. Adequacy of shoulder pavement to support bus loads<br>4. Volume of buses to be accommodated<br>5. Signage and markings<br>6. Enforcement<br>7. Off-line station access<br>More information about the above conditions can be found in (7), (8), (14), (16), and (17).</td><td>Conceptual plan views (for illustrative purposes only):<br>

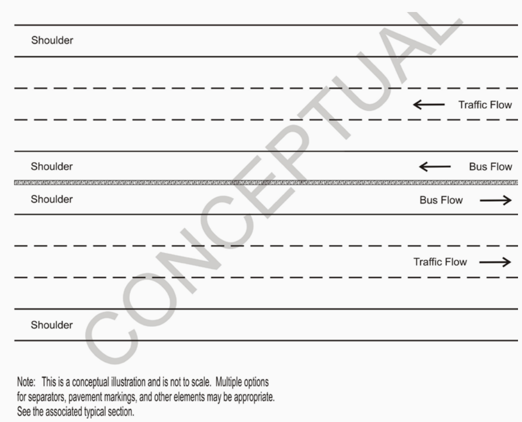
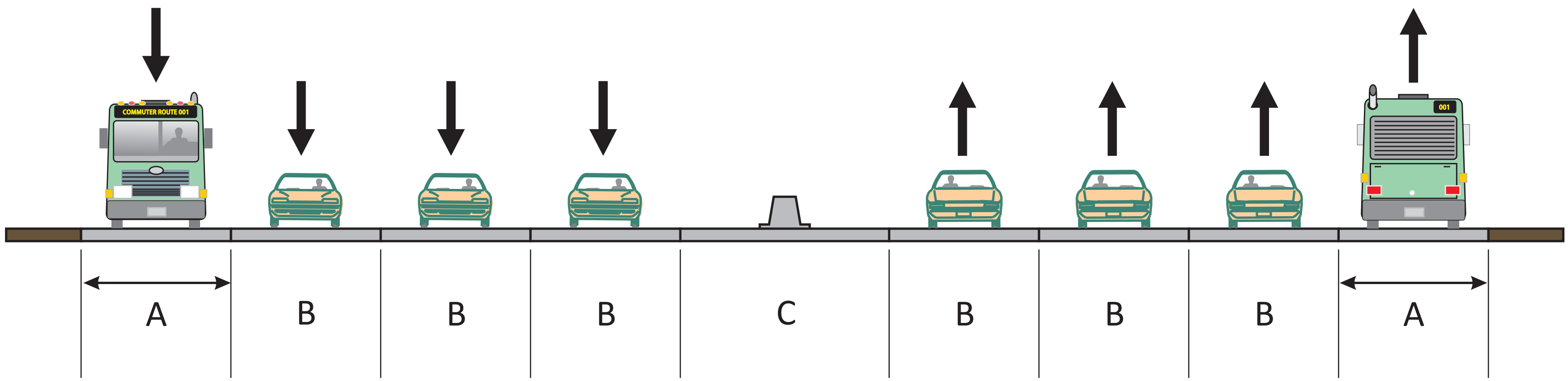

</td></tr>
</table>

Figure 10. Righthand BOS Operations Typical Section



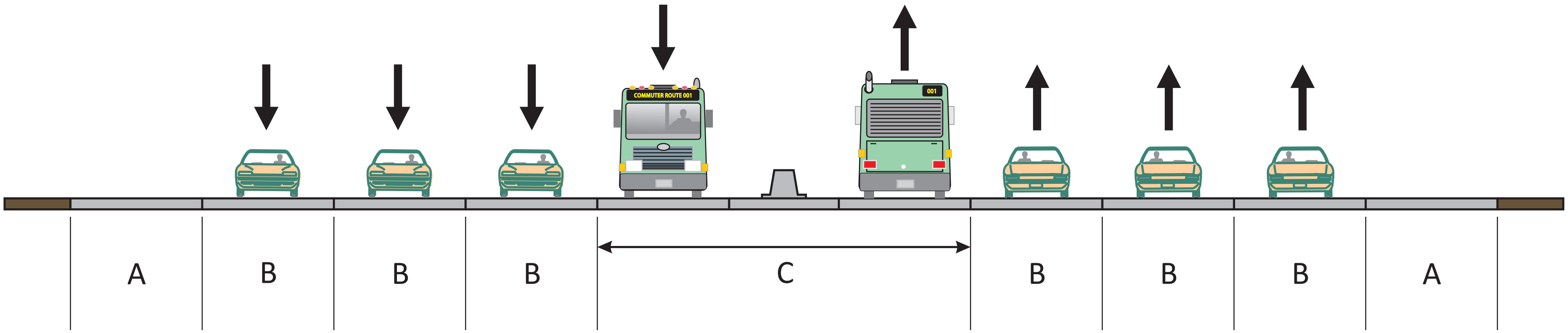

| DESIGNATION | DESCRIPTION | DIMENSION | | NOTES |
|---|---|---|---|---|
| | | PREFERRED | CONSTRAINED | |
| A | PAVED SHOULDER/BUS-ON-SHOULDER LANE | 12' | 11' | From PPM Table 2.3.1: Shoulder Widths and Slopes - Freeways, for a 3- or 4-lane freeway (in one direction) the minimum full width of the shoulder without gutter is 12', 10' of that being paved. It is recommended that the paved portion of the shoulder be 12' wide but, under constrained conditions, no less than 11'. See FDOT PPM Volume 1, Chapter 2, for guidance on unpaved shoulder width. |
| B | TRAVEL LANE | 12' | 12' | Lanes should be 12' wide for freeway operations [FDOT PPM, Volume 1, Chapter 2]. |
| C | MEDIAN | 26' | 24' | From Table 2.2.1: Median Widths, for a freeway with all design speeds. This includes a 2' barrier with 12' shoulders either side. For Interstates or other freeways without barriers, the median width could range from 40' to 64' depending on the speed of the facility [FDOT PPM, Volume 1, Chapter 2]. Note median width can be reduced to 11' shoulders on either side under constrained conditions. |

**Note:** Dimensions reflect 2013 PPM and 2011 Florida Greenbook. Refer to updated versions as they are adopted.

**Bus-on-Shoulder (BOS) Operations**
**Uninterrupted Flow Highway, Right Hand Shoulder**

Figure
**10**

**Figure 11. Lefthand BOS Operations Typical Section**




| DESIGNATION | DESCRIPTION | DIMENSION | | NOTES |
|---|---|---|---|---|
| | | PREFERRED | CONSTRAINED | |
| A | PAVED SHOULDER | 12' | 11' | From PPM Table 2.3.1: Shoulder Widths and Slopes - Freeways, for a 3- or 4-lane freeway (in one direction) the minimum full width of the shoulder without gutter is 12', 10' of that being paved. It is recommended that the paved portion of the shoulder be 12' wide but, under constrained conditions, no less than 11'. See FDOT PPM Volume 1, Chapter 2, for guidance on unpaved shoulder width. |
| B | TRAVEL LANE | 12' | 12' | Lanes should be 12' wide for freeway operations [FDOT PPM, Volume 1, Chapter 2]. |
| C | PAVED MEDIAN/BUS-ON-SHOULDER LANE | 26' | 24' | From Table 2.2.1: Median Widths, for a freeway with all design speeds. This includes a 2' barrier with 12' shoulders either side. For Interstates or other freeways without barriers, the median width could range from 40' to 64' depending on the speed of the facility [FDOT PPM, Volume 1, Chapter 2]. Note median width can be reduced to 11' shoulders on either side under constrained conditions. |

**Note:** Dimensions reflect 2013 PPM and 2011 Florida Greenbook. Refer to updated versions as they are adopted.

**Bus-on-Shoulder (BOS) Operations**
**Uninterrupted Flow Highway, Left Hand Shoulder**

Figure
**11**

## 3.2 OTHER TYPICAL SECTIONS

Appendix A contains typical sections of exclusive transit running ways implemented and/or designed throughout the U.S. These typical sections are provided as informational examples of practice only and may include elements that are not consistent with the PPM, the FDOT Design Standards, and the Florida Greenbook.

# SECTION 4.0

## REFERENCES

## 4.0 REFERENCES


1. Florida Planning and Development Lab at Florida State University. *Accessing Transit: Design Handbook for Florida Bus Passenger Facilities, Version 2.* Florida Department of Transportation, Tallahassee, FL, 2008.

This handbook provides design guidelines pertinent to Florida bus passenger facilities (e.g., bus stops, bus lanes, and bus pull-outs) and specifically addresses pedestrian access to transit stops and stations. Chapter 2 contains sections on special-use lanes (including exclusive bus lanes), vehicle characteristics, and pavement markings. Each section in Chapter 2 describes purpose, location factors, and design factors. Under vehicle characteristics, the handbook provides vehicle lengths, widths, heights, and operating characteristics in conjunction with roadway and facility designs. Chapter 3 of the handbook includes prototypes for different transit facilities. Version 3 of the handbook is currently in development and will reflect new federal and state access regulations. *(http://www.dot.state.fl.us/transit/Pages/2008_Transit_Handbook.pdf)*

2. University of North Florida and FAMU-FSU College of Engineering. *Integrating Transit into Traditional Neighborhood Design Policies – The Influence of Lane Width on Bus Safety.* Florida Department of Transportation, Tallahassee, FL, 2010.

This report investigates the relationship between lane width and bus safety. The report provides typical sections and recommended widths of vehicle and bicycle lanes for four roadway types. *(http://www.dot.state.fl.us/transit/Pages/LaneWidthonBusSafety.pdf)*

3. Levinson, Herbert, Samuel Zimmerman, Jennifer Clinger, Scott Rutherford, Rodney Smith, John Cracknell, and Richard Soberman. TCRP Report 90: *Bus Rapid Transit, Volume 1: Case Studies in Bus Rapid Transit.* Transportation Research Board, Washington, D.C., 2003.

This report draws from 26 BRT case studies in North America, Australia, Europe, and South America and provides guidelines for the design and implementation of BRT. It categorizes the 26 case studies based on six different running way characteristics: bus tunnel, busway (separate right-of-way), arterial median busway, bus lane, and mixed traffic. The guidelines provided in this report are generally qualitative. *(http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_90v1.pdf)*

4. Levinson, Herbert, Samuel Zimmerman, Jennifer Clinger, James Gast, Scott Rutherford, and Eric Bruhn. TCRP Report 90: *Bus Rapid Transit, Volume 2: Implementation Guidelines.* Transportation Research Board, Washington, D.C., 2003.

This report provides running way design guidelines for BRT in Chapter 3. The report classifies running ways as either on-street, off-street, or freeway. Within each running way classification, qualitative design considerations for each running way type are specified.

The report provides minimum and preferred lane widths for each running way type, provides design criteria for different types of running ways, and reproduces bus dimensions and design characteristics from the 2001 AASHTO Greenbook and other sources. Sample typical sections are provided. *(http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_90v2.pdf)*

5. Coffel, Kathryn, Jamie Parks, Conor Semler, Paul Ryus, David Sampson, Carol Kachadoorian, Herbert Levinson, and Joseph Schofer. TCRP Report 153: *Guidelines for Providing Access to Public Transportation Stations.* Transportation Research Board, Washington, D.C., 2012.

This report is station-focused and does not directly address running way elements. However, Chapter 9 provides design characteristics for 40- and 45-foot buses. The report also specifies 11 feet as the minimum lane width for buses and 16 feet as the minimum vertical clearance. *(http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_153.pdf)*

6. National Bus Rapid Transit Institute at the University of South Florida. *Characteristics of Bus Rapid Transit for Decision-Making.* Project No. FTA-FL-26-7109.2009.1. Federal Transit Administration, Washington, D.C., 2009.

This report describes three main characteristics of running ways: type, marking, and guidance. Generally, this report focuses on the qualitative, not quantitative, aspects of running way types, markings, and guidance. *(http://www.fta.dot.gov/documents/CBRT_2009_Update.pdf)*

7. Martin, Peter C. TCRP Synthesis 64: *Bus Use of Shoulders.* Transportation Research Board, Washington, D.C., 2006.

This report summarizes information about accommodation of transit buses on highway shoulders in the U.S. The report describes several BOS projects and identifies concerns that highway and transit agencies should address when considering implementation of BOS projects. Design-related concerns include sight distance adequacy, speed differentials, merge distances, clearances from roadside structures (e.g., bridge supports), and drainage. The report does not recommend lane widths or other design criteria. *(http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_syn_64.pdf)*

8. Martin, Peter, Herbert Levinson, and Texas Transportation Institute. TCRP Report 151: *A Guide for Implementing Bus on Shoulder (BOS) Systems.* Transportation Research Board, Washington, D.C., 2012.

This report provides guidelines for BOS implementation (i.e., a decision-making framework), operations, and design. These guidelines were developed from surveys of agency staff, passengers, and bus operators; a literature review; detailed case studies of seven existing BOS systems; and shorter case studies of seven other BOS systems. *(http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_151.pdf)*

9. Hillsman, Edward, Sara Hendricks, and JoAnne Fiebe. *A Summary of Design, Policies, and Operational Characteristics for Shared Bicycle/Bus Lanes.* Florida Department of Transportation, Tallahassee, FL, 2012.

This report summarizes research conducted on the design, operation, and usage of shared (SBBLs) in the U.S. and three other countries. The report describes planning considerations, describes SBBL studies conducted in Tallahassee and Panama City Beach, describes international SBBL practice, and identifies benefits and challenges of implementing SBBLs. *(http://www.dot.state.fl.us/research-center/Completed_Proj/Summary_RD/FDOT_BDK85_977-32_rpt.pdf)*

10. Roadway Design Office of the Florida Department of Transportation. *Plans Preparation Manual.* Volumes 1 and 2. Florida Department of Transportation, Tallahassee, FL, 2013.

This manual provides design criteria and procedures for FDOT projects. Chapter 8 contains design criteria for pedestrian, bicycle, and public transit facilities. Transit is addressed in the context of pedestrian and bicycle connectivity to transit stops, transit stop design, bus bays, and accommodation of bicycles on buses. The manual refers to *Accessing Transit: Design Handbook for Florida Bus Passenger Facilities*, Version 2, and other sources for more information. *(http://www.dot.state.fl.us/rddesign/PPMManual/2013PPM.shtm)*

11. Florida Department of Transportation. *Design Standards for Design, Construction, Maintenance, and Utility Operations on the State Highway System.* Florida Department of Transportation, Tallahassee, FL, 2013.

The FDOT Design Standards contain standard index drawings for a variety of roadway elements. These detailed drawings represent FDOT's accepted practice and standards for engineering and design. *(http://www.dot.state.fl.us/rddesign/DS/13/STDs.shtm)*

12. Florida Department of Transportation. *Manual of Uniform Minimum Standards for Design, Construction, and Maintenance for Streets and Highways* ("Florida Greenbook"). Florida Department of Transportation, Tallahassee, FL, 2011.

The Florida Greenbook provides minimum design standards and criteria for county and city street and highway engineering projects. Chapter 13 describes the components of transit systems, including shelters, concrete bus stop pads, and bus bays.

The Florida Greenbook refers to standard drawings for bus bays available from the FDOT Public Transportation Office. It also refers to *Accessing Transit: Design Handbook for Florida Bus Passenger Facilities*, Version 2, for more information. *(http://www.dot.state.fl.us/rddesign/FloridaGreenbook/FloridaGreenbook.pdf)*

13. Kittelson & Associates, Inc., Herbert S. Levinson Transportation Consultants, and DMJM+Harris. Transit Cooperative Research Program (TCRP) Report 118, *Bus Rapid Transit Practitioner's Guide.* Transportation Research Board, Washington, D.C., 2007.

This report provides information on the costs, impacts, and effectiveness of implementing selected BRT components, including different running way options. Chapter 4 includes discussion of running way components, costs, impacts, design, implementability, and operation. The chapter notes that running ways vary with respect to degree of separation from other traffic, type of markings (including delineators), and extent of lateral guidance. Lane dimensions and "envelope" widths are provided. *(http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_118.pdf)*

14. American Public Transportation Association (APTA). *Designing Bus Rapid Transit Running Ways.* Recommended Practice of the APTA Standards Development Program. American Public Transportation Association, Washington, D.C., 2010.

APTA has published a series of Recommended Practice guidance documents on various transit topics. Designing Bus Rapid Transit Running Ways addresses geometry, typical sections, and engineering and drainage considerations for a range of exclusive running ways.

The document provides guidance to planners in selecting the appropriate running way. It distinguishes corridors with constrained right-of-way and corridors with unconstrained right-of-way, it provides design criteria and typical sections, it discusses access to exclusive transit facilities, and it discusses intersection treatments. The document provides general guidance about pavement design, drainage, landscaping, lighting, signage, and pavement markings. *(http://www.apta.com/resources/standards/Documents/APTA-BTS-BRT-RP-003-10.pdf)*

15. Danaher, Alan. TCRP Synthesis 83: *Bus and Rail Transit Preferential Treatments in Mixed Traffic.* Transportation Research Board, Washington, D.C., 2010.

This report describes the state of the practice in using transit preferential treatments in mixed-traffic operations. The report considers median transitways and exclusive transit lanes (which can be applied on a segment basis as well as a corridor basis) to be transit preferential treatments. The research included surveys of 64 urban areas and four follow-up case studies. The report provides guidelines for operating bus service in exclusive transit lanes. *(http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_syn_83.pdf)*

16. Federal Highway Administration. *Manual on Uniform Traffic Control Devices*. 2009 Edition with Revision Numbers 1 and 2. Federal Highway Administration, Washington, D.C., 2012.

The *Manual on Uniform Traffic Control Devices* (MUTCD) provides minimum standards for design of traffic control devices including signs, pavement markings, and traffic signals in the United States. *(http://mutcd.fhwa.dot.gov/pdfs/2009r1r2/pdf_index.htm)*

17. Traffic Engineering and Operations Office of the Florida Department of Transportation. *Traffic Engineering Manual*. Florida Department of Transportation, Tallahassee, FL, 2012.

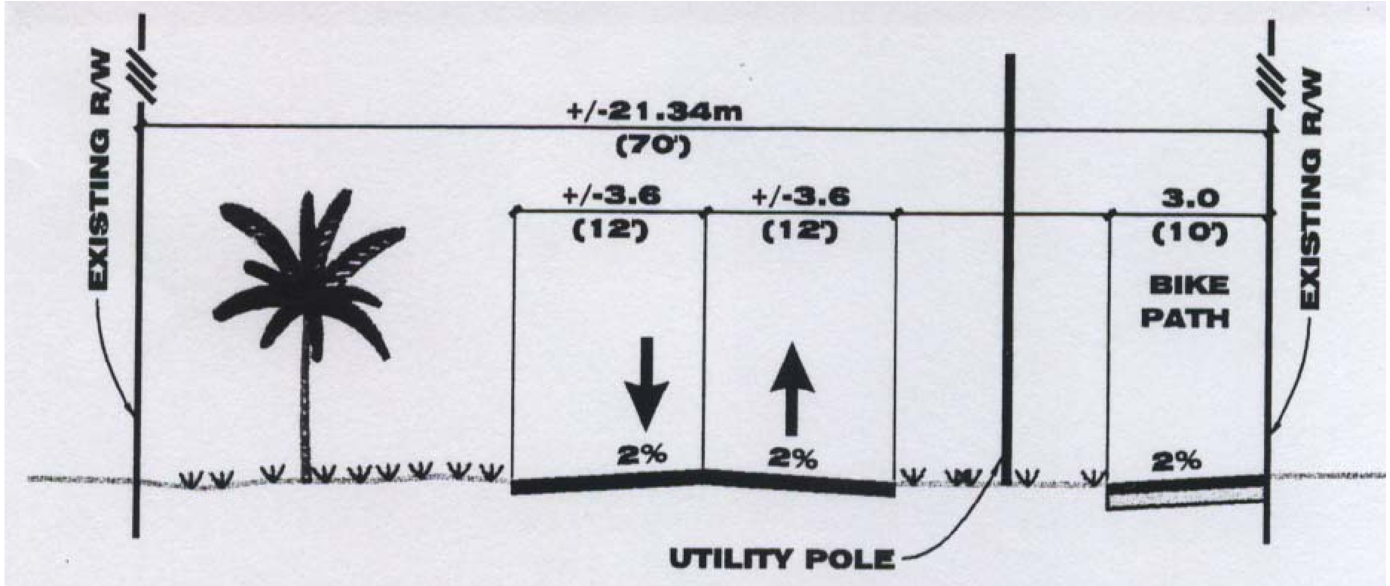
The *Traffic Engineering Manual* (TEM) provides standards and guidelines for signalization, signage, and markings on the State Highway System in Florida. Pedestrian crossings are included. *(http://www.dot.state.fl.us/TrafficOperations/Operations/Studies/TEM/FDOT_Traffic_Engineering_Manual_revised_November_2012.pdf)*

18. Pessaro, Brian, Marie-Elsie Dowell, Michelle Gonzales, and Alan Danaher. *BRT Applications, Phase 2.* Florida Department of Transportation District IV, Fort Lauderdale, FL, 2011.

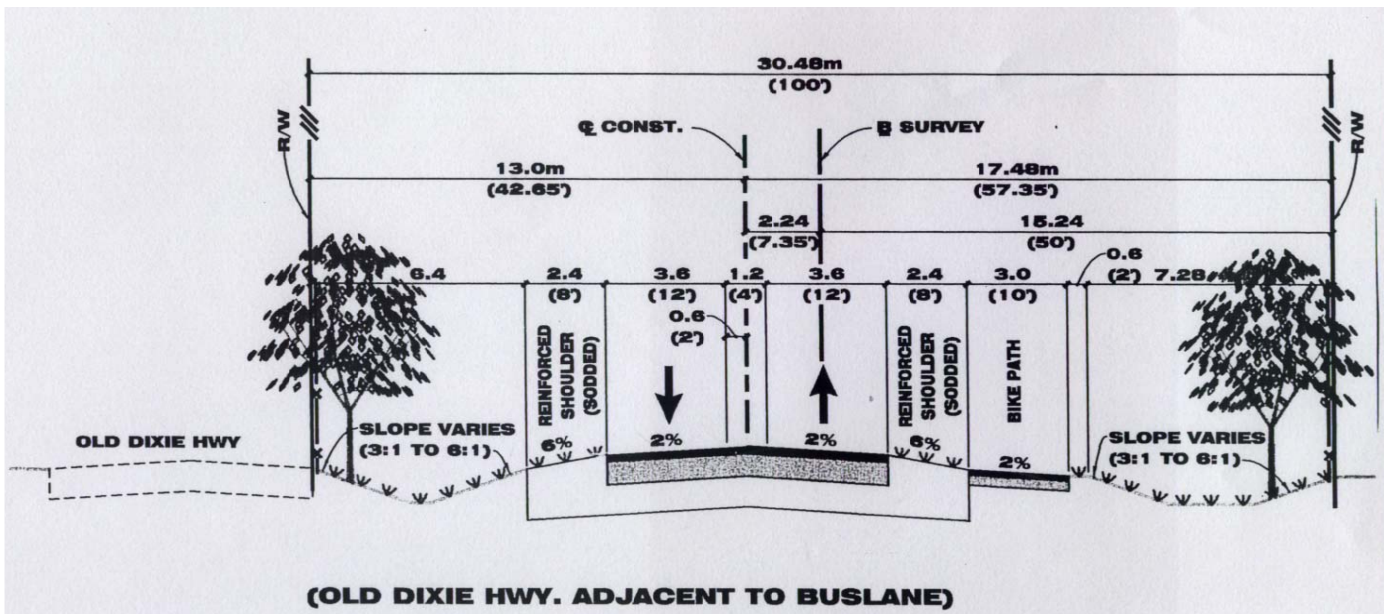
This report provides a summary of eight BRT systems in the United States. For each BRT system, the following six elements are described: project background, costs, before-and-after performance, system characteristics, lessons learned, and future plans. Under system characteristics, the report provides running way details related to length and type (e.g., mixed traffic and dedicated lane). *(http://www.nbrti.org/docs/pdf/BRT_Applications_PhaseII_Report_Final12-08-2011.pdf)*

# APPENDIX A

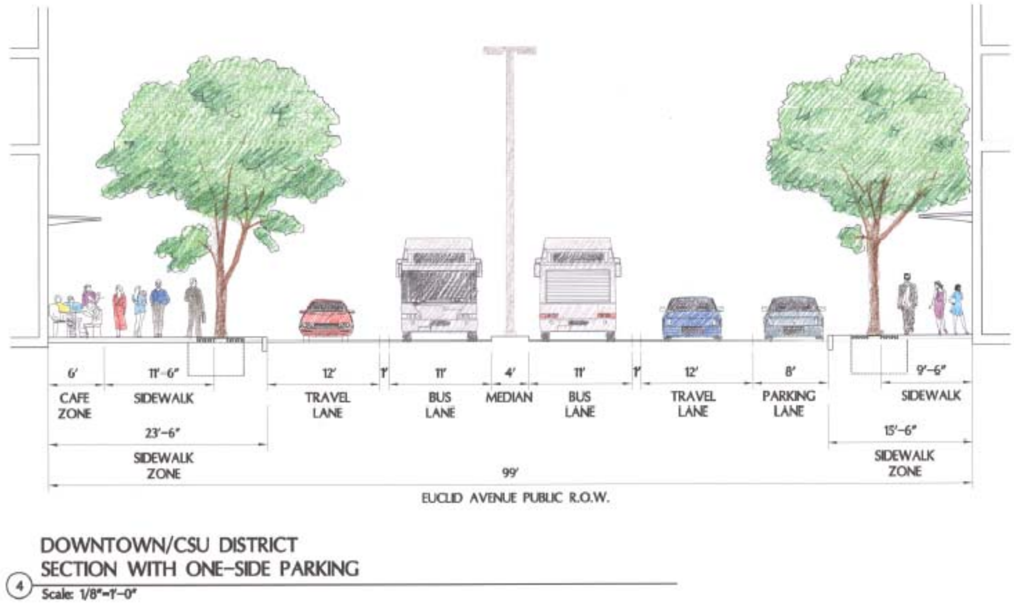
## EXAMPLE TYPICAL SECTIONS FOR INFORMATIONAL PURPOSES



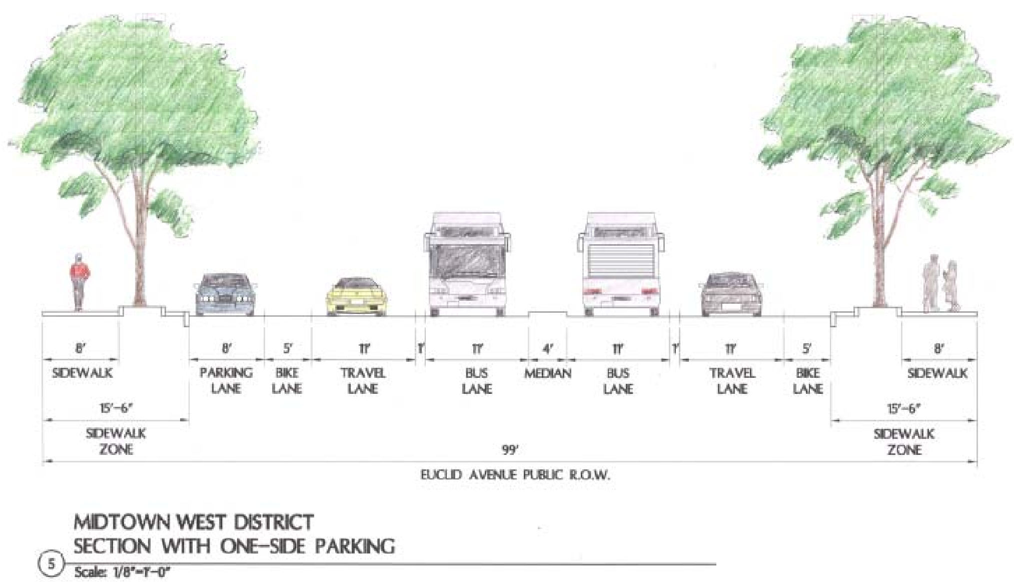

**South Miami-Dade Busway Phase II Typical Section** ***(South Miami-Dade Busway System Summary)***



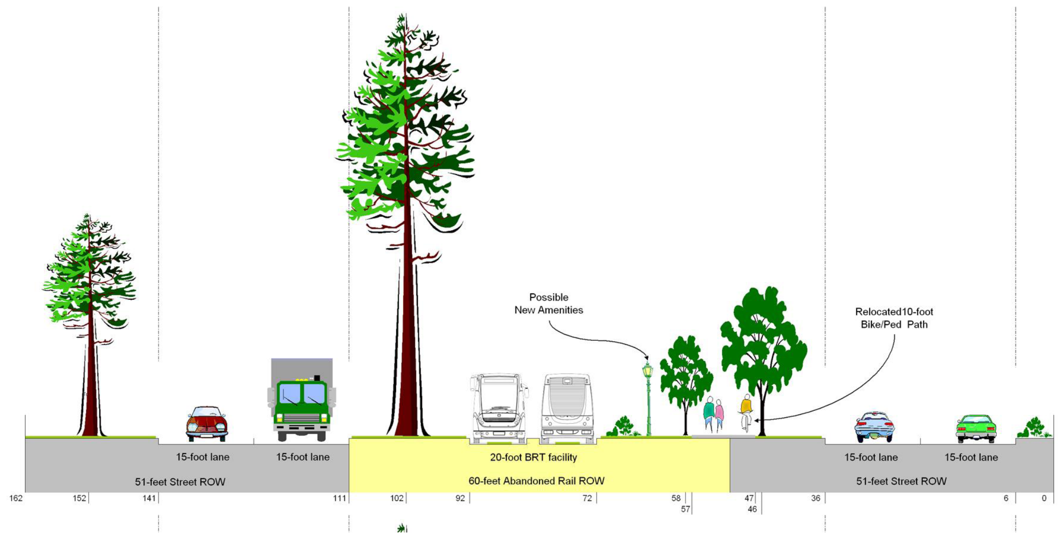

**South Miami-Dade Busway Phase II Typical Section** ***(South Miami-Dade Busway System Summary)***



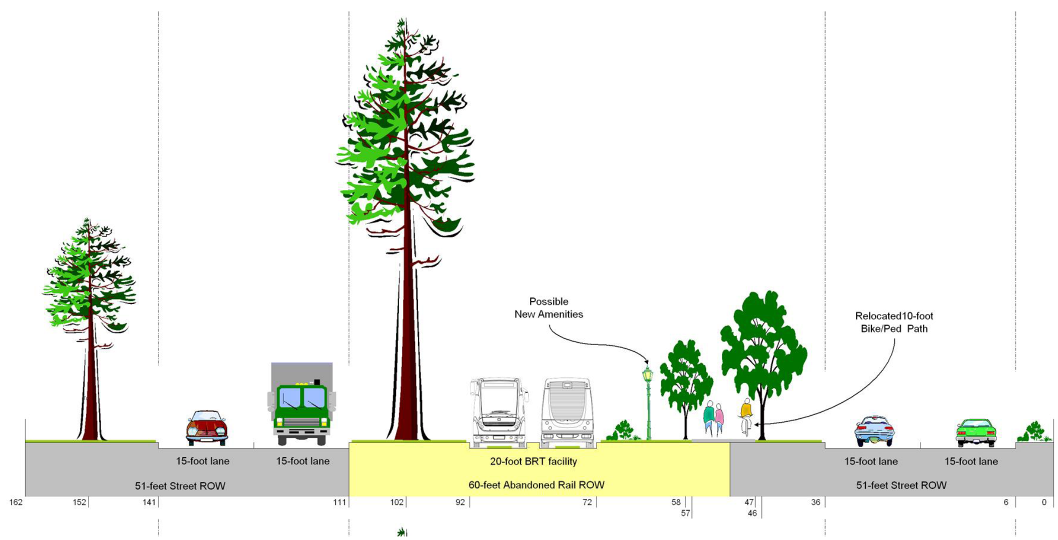

**HealthLine Typical Section - Lower Euclid (GCRTA "TOD in Practice" Presentation)**



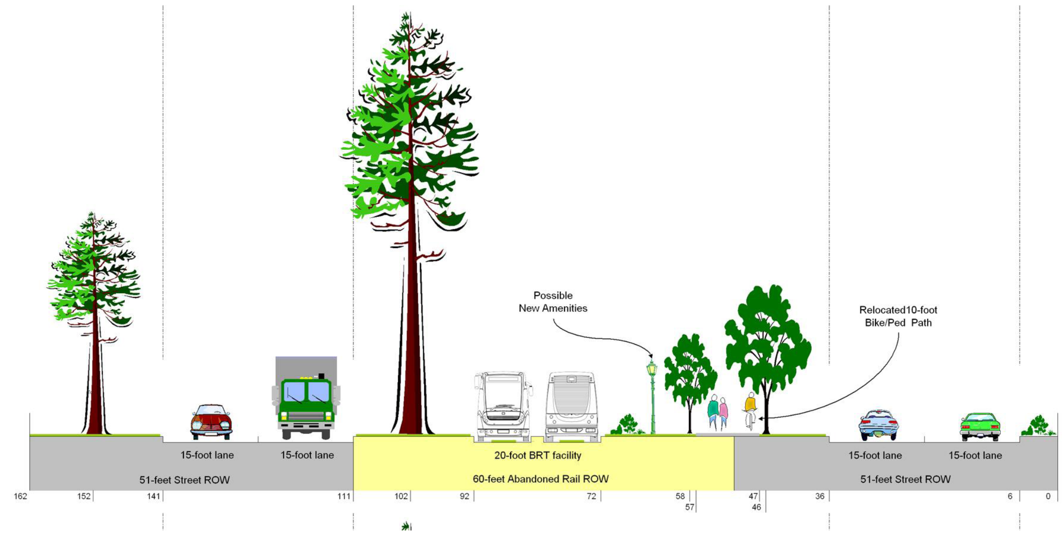

**HealthLine Typical Section - Midtown (GCRTA "TOD in Practice" Presentation)**



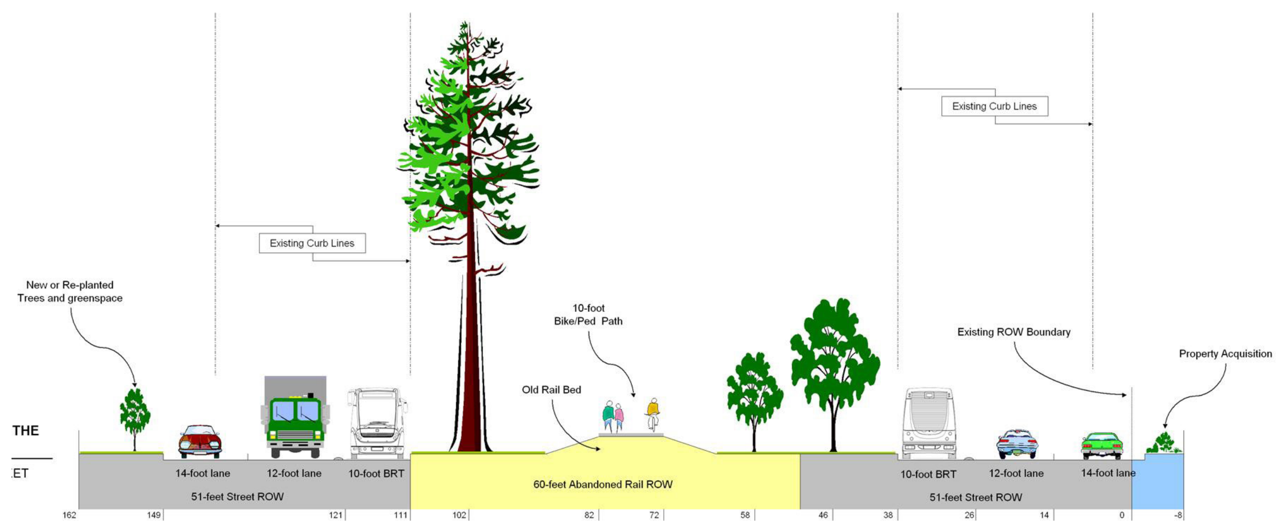

EmX Extension Typical Section - Pioneer Parkway Alternative 1 (from LTD)



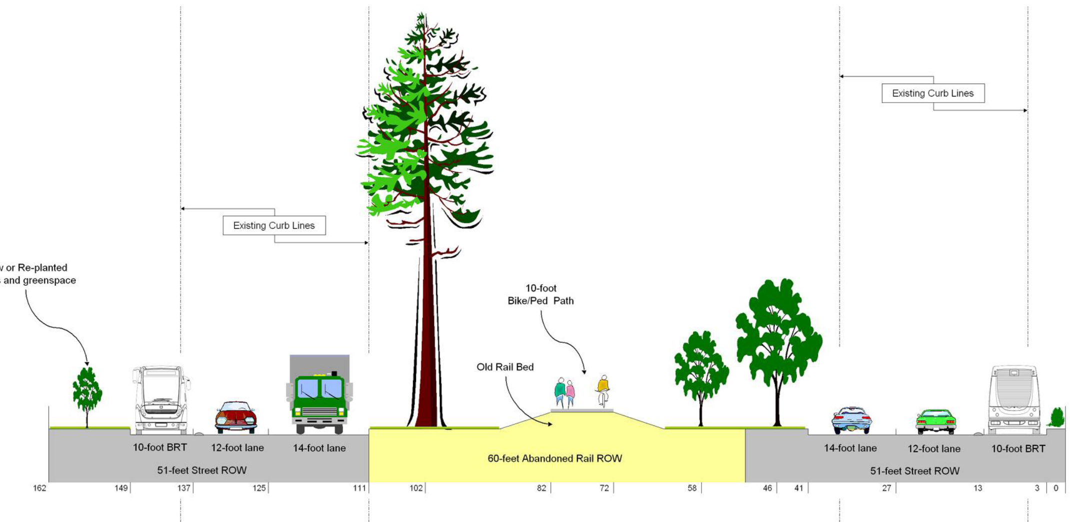

EmX Extension Typical Section - Pioneer Parkway Alternative 2 (from LTD)



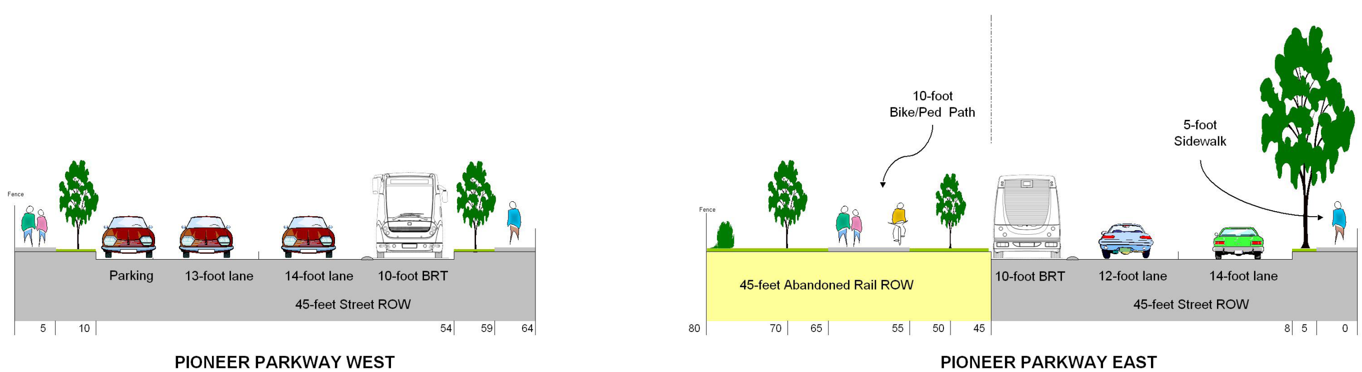

EmX Extension Typical Section - Pioneer Parkway Alternative 3 (from LTD)



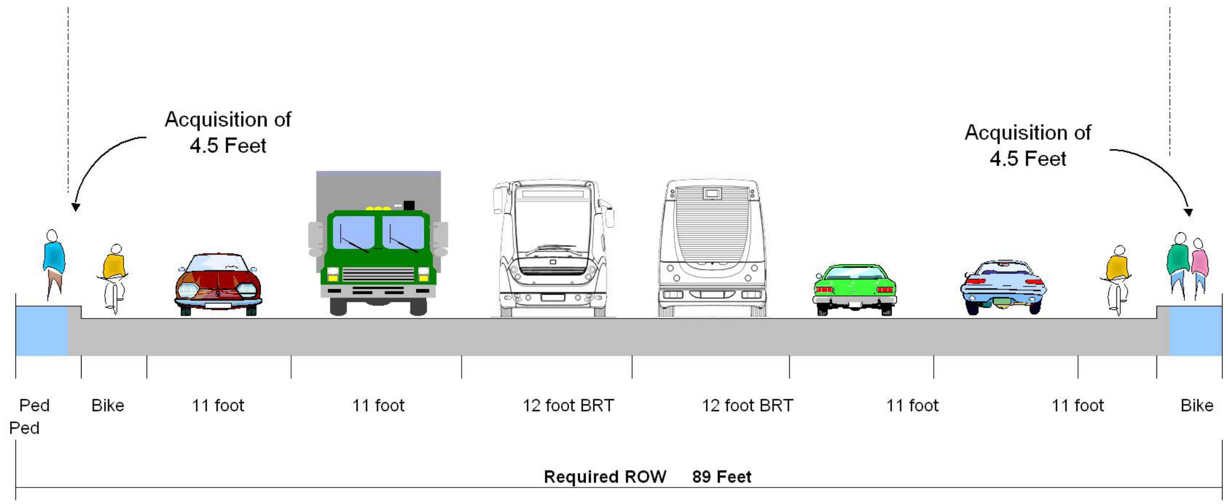

EmX Extension Typical Section - Pioneer Parkway Alternative 4 (from LTD)



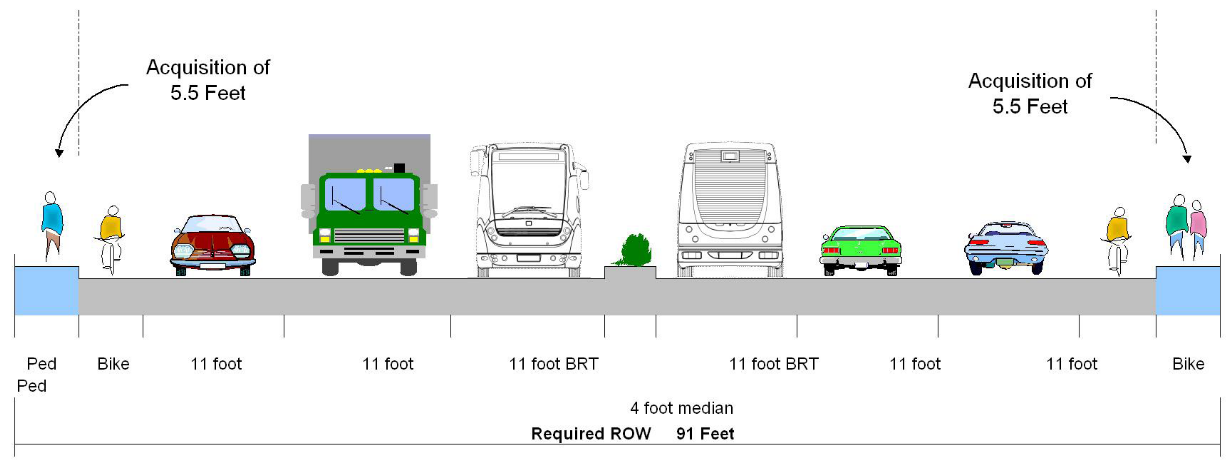

**EmX Extension Typical Section - Pioneer Parkway Alternative 5 (from LTD)**



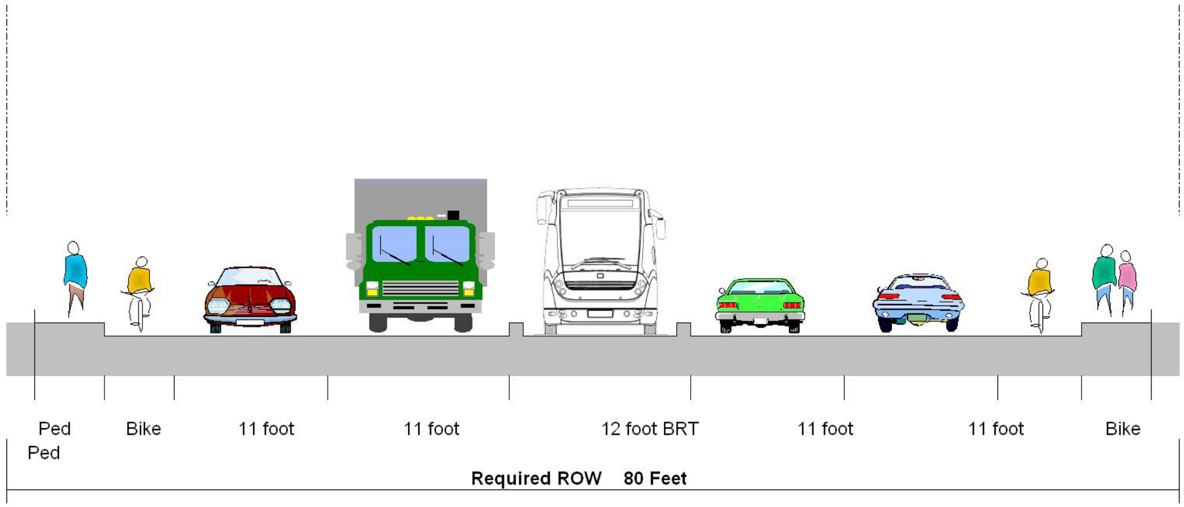

**EmX Extension Typical Section - Pioneer Parkway Couplet Alternative (from LTD)**



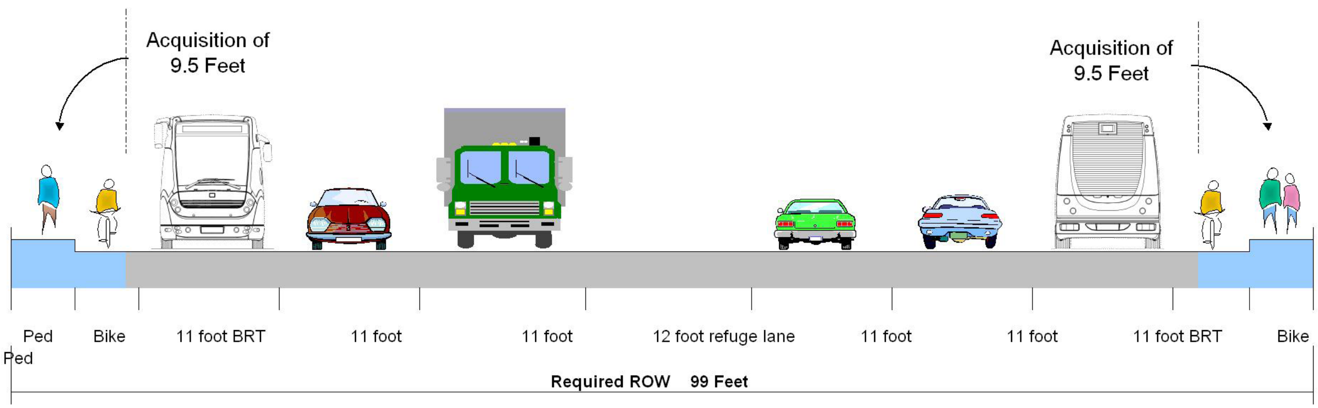

**EmX Extension Typical Section - International Way Alternative 1A (from LTD)**



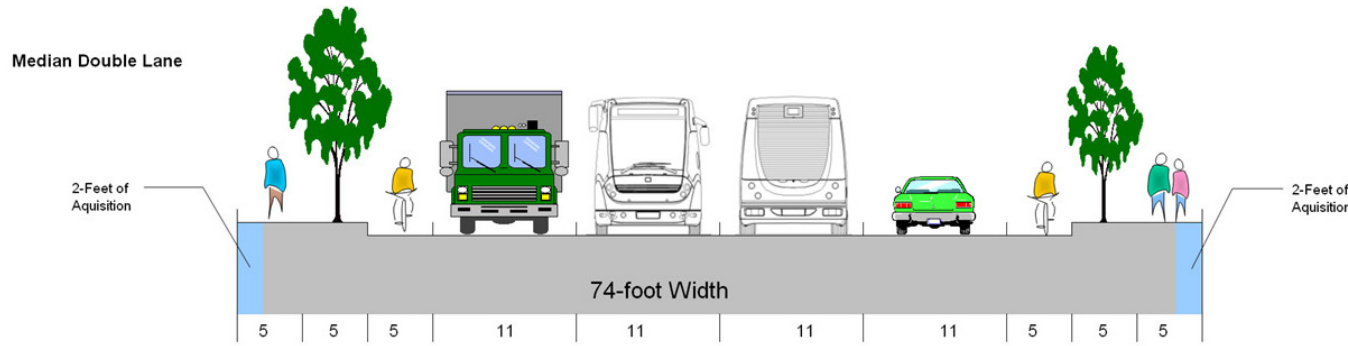

**EmX Extension Typical Section - International Way Alternative 2A (from LTD)**



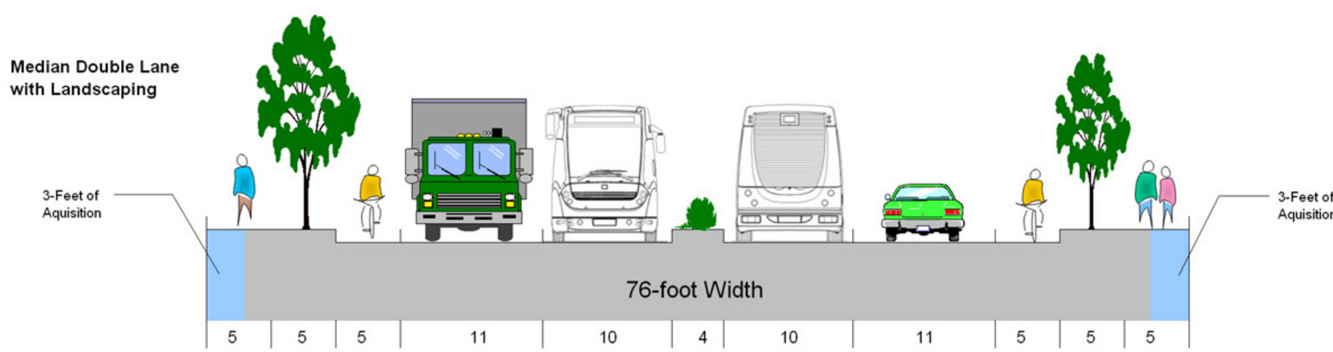

EmX Extension Typical Section - International Way Alternative 3A (from LTD)



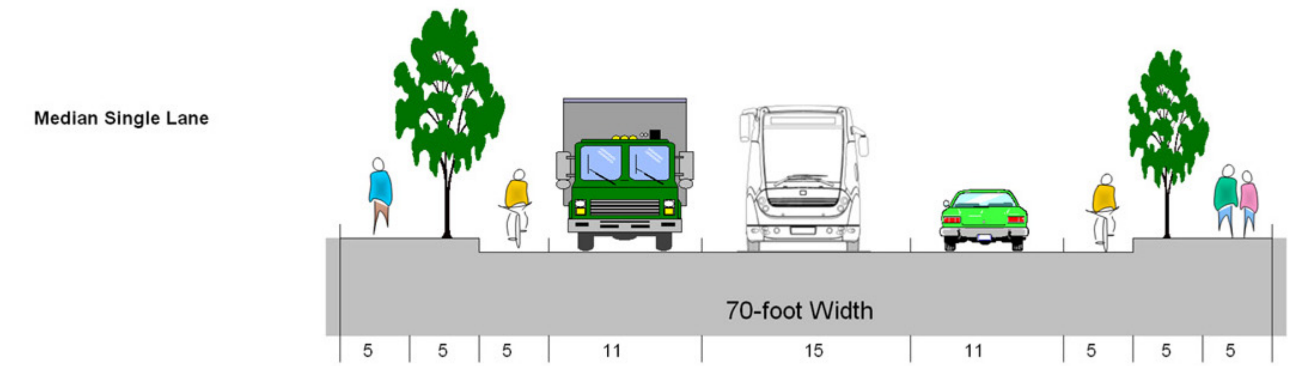

EmX Extension Typical Section - International Way Alternative 4A (from LTD)



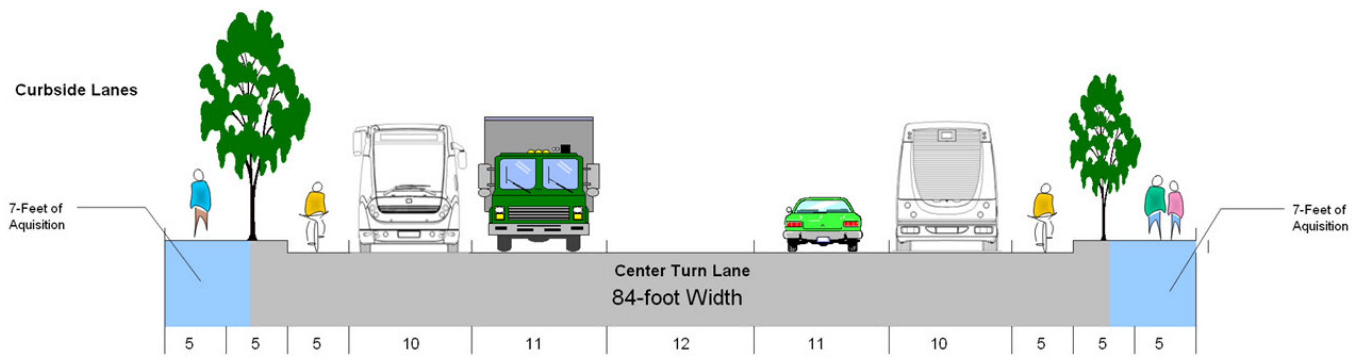

**EmX Extension Typical Section - International Way Alternative 1B (from LTD)**




**EmX Extension Typical Section - International Way Alternative 2B (from LTD)**

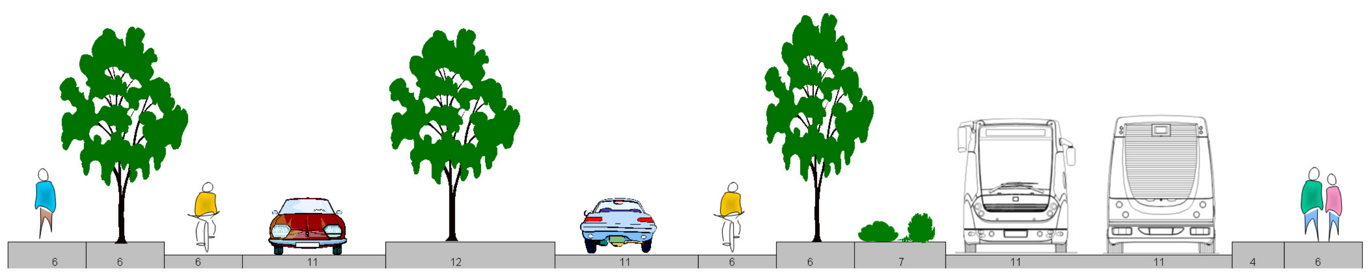



EmX Extension Typical Section - International Way Alternative 3B (from LTD)



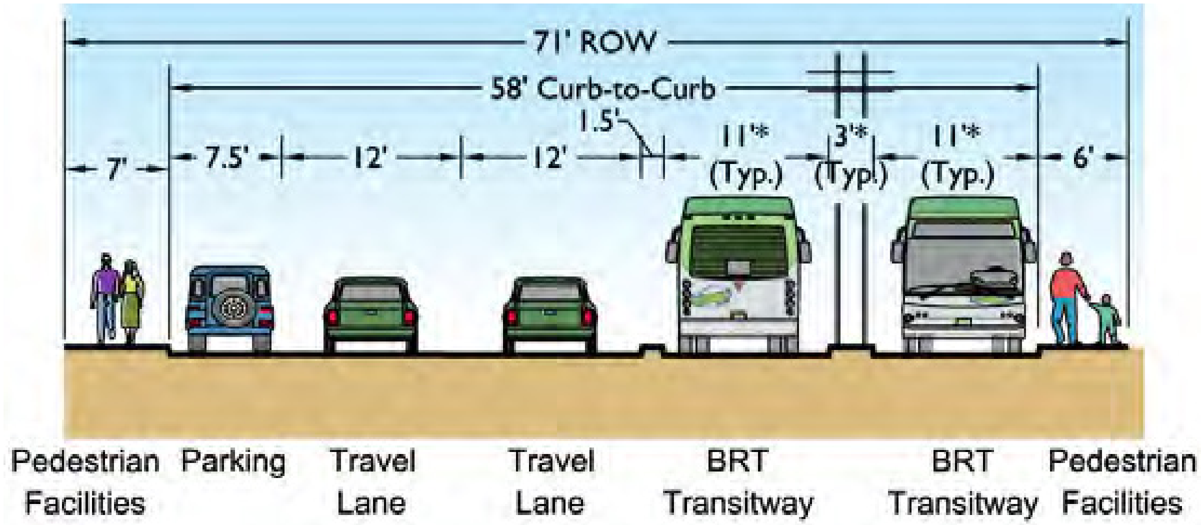

EmX Extension Typical Section - International Way Alternative 4B (from LTD)

River Bend Drive

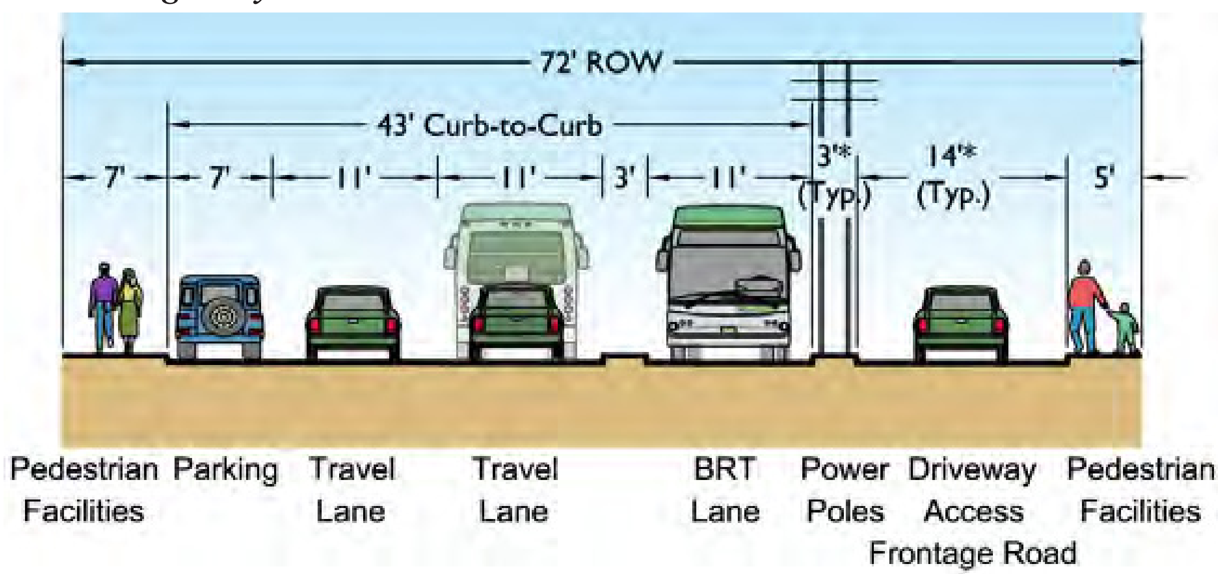



EmX Extension Typical Section - RiverBend Drive Alternative (from LTD)

*Two-Way Transitway DO*

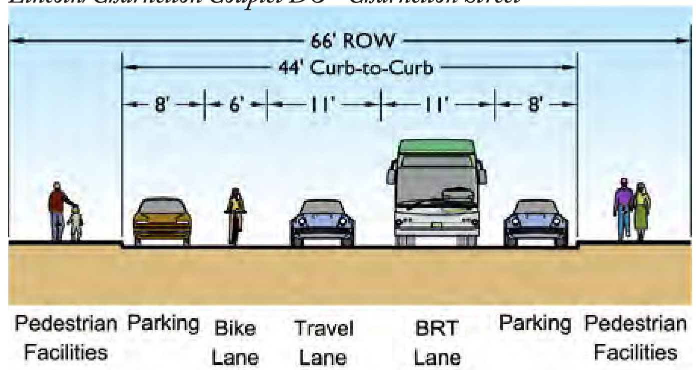



*Frontage Alley DO*

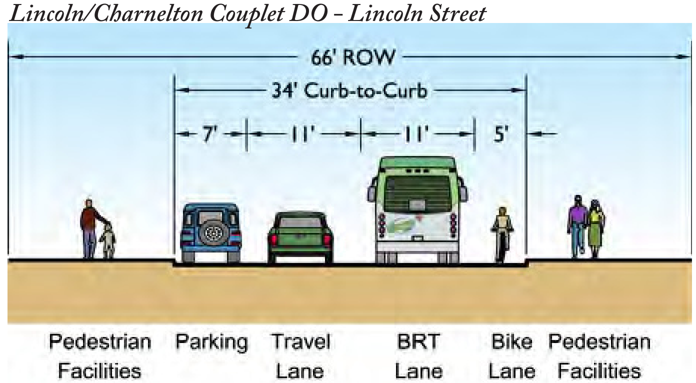



**EmX Extension Typical Sections - West 13th Avenue to West 11th Avenue Alternative**
***(West Eugene EmX Extension Project Alternatives Analysis Report)***

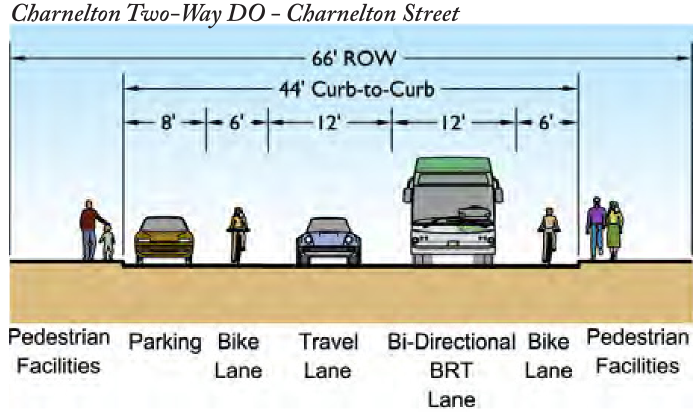
*Lincoln/Charnelton Couplet DO - Charnelton Street*




*Lincoln/Charnelton Couplet DO - Lincoln Street*

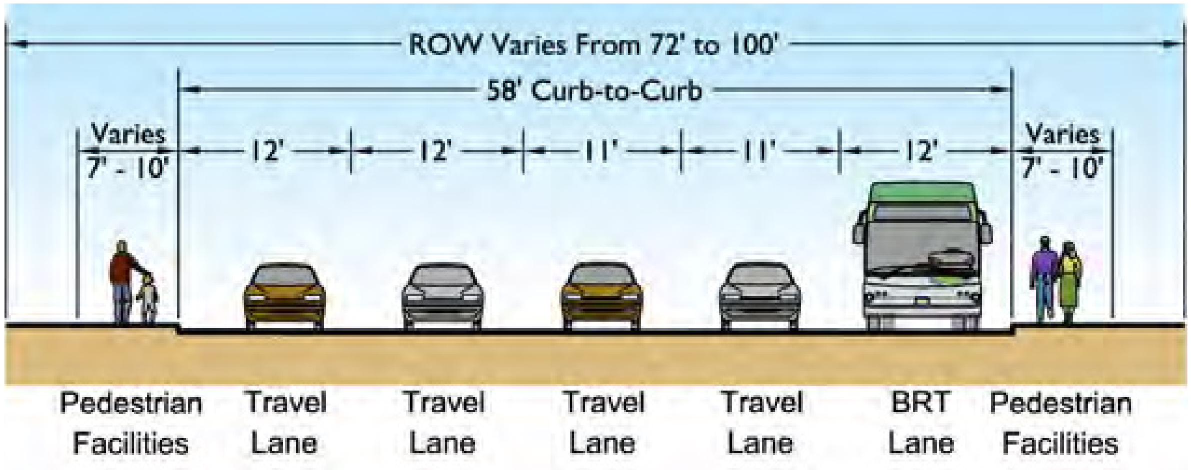



*Charnelton Two-Way DO - Charnelton Street*

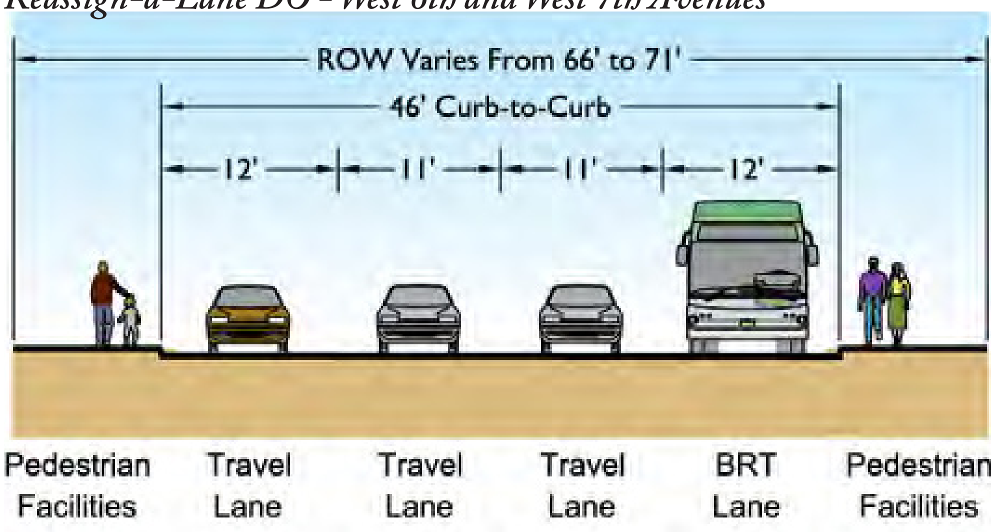



**EmX Extension Typical Sections - West 6th/7th Avenues to West 11th Avenue Alternative**
***(West Eugene EmX Extension Project Alternatives Analysis Report)***

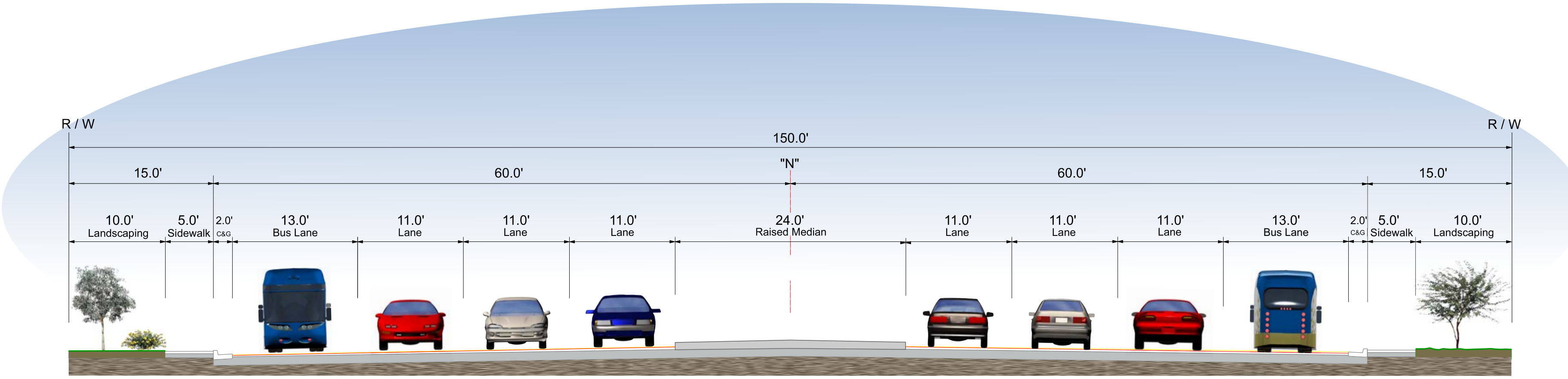
*Add-a-Lane DO - West 6th and West 7th Avenues*



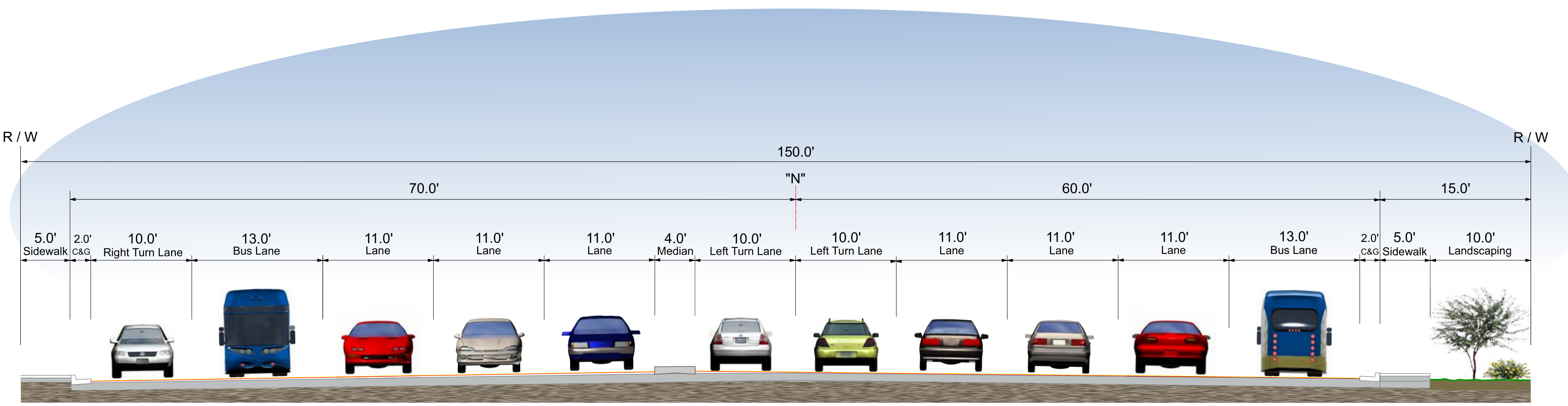

*Reassign-a-Lane DO - West 6th and West 7th Avenues*



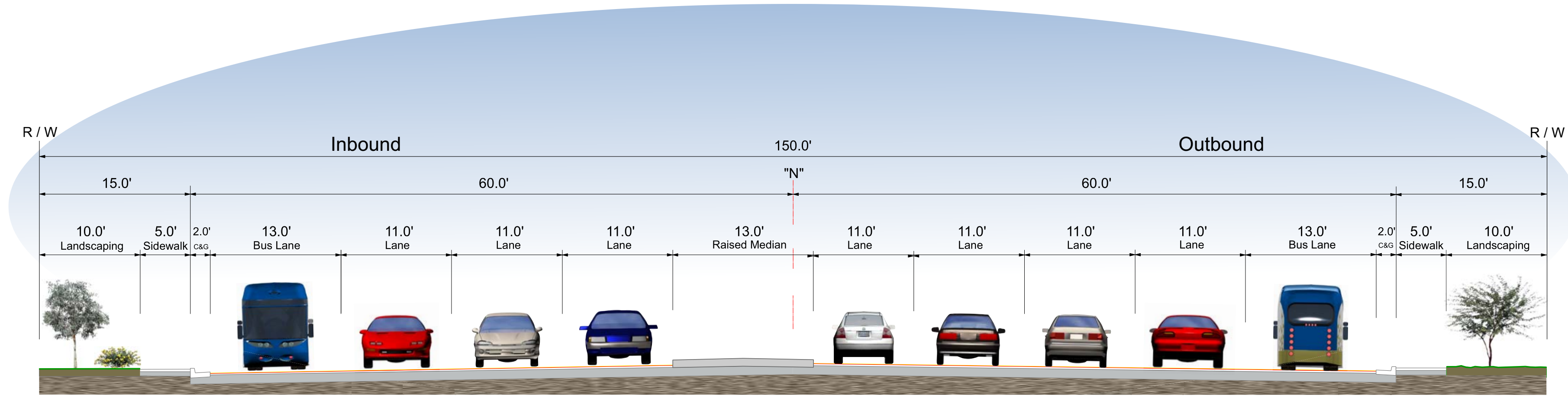

**EmX Extension Typical Sections - West 6th/7th Avenues to West 11th Avenue Alternative**
***(West Eugene EmX Extension Project Alternatives Analysis Report)***



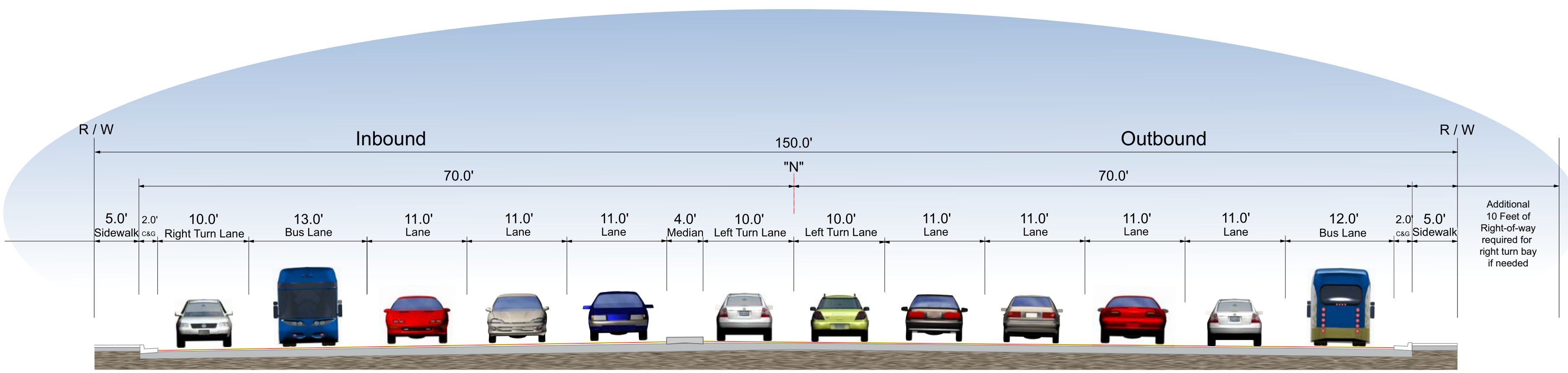

**Sahara Avenue BRT Typical Section - Alternative 1 - Mid-Block *(Sahara Avenue Corridor Rapid Transit Study)***



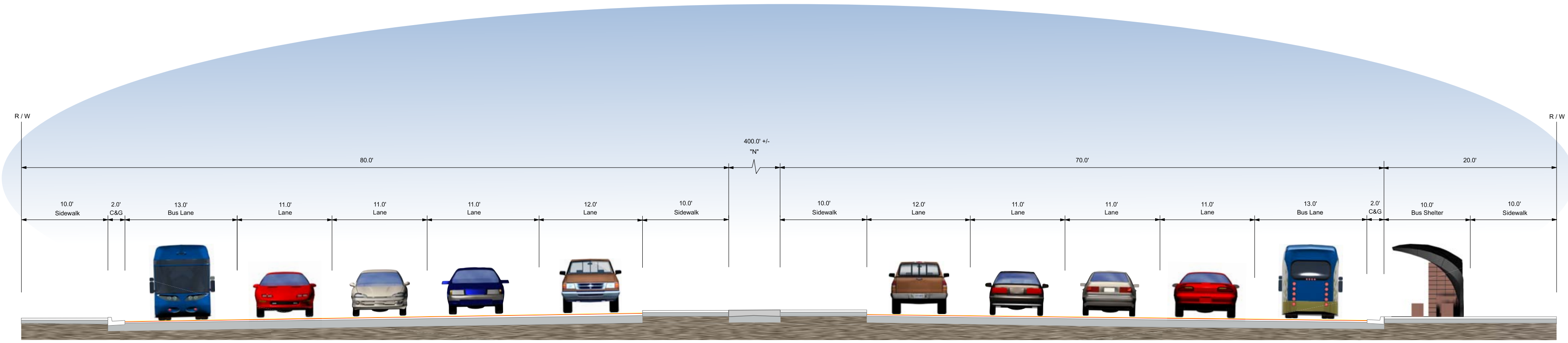

**Sahara Avenue BRT Typical Section - Alternative 1 - Intersection *(Sahara Avenue Corridor Rapid Transit Study)***




**Sahara Avenue BRT Typical Section - Alternative 2 - Mid-Block *(Sahara Avenue Corridor Rapid Transit Study)***




**Sahara Avenue BRT Typical Section - Alternative 2 - Intersection *(Sahara Avenue Corridor Rapid Transit Study)***

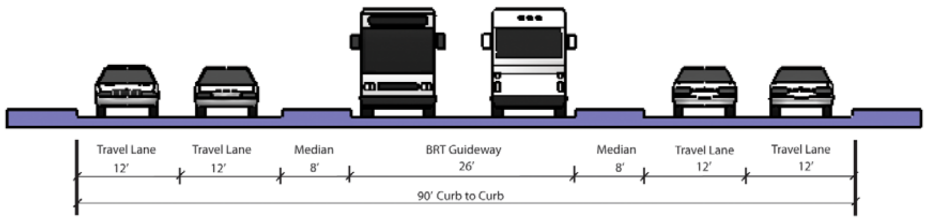



**Sahara Avenue BRT Typical Section - Couplet *(Sahara Avenue Corridor Rapid Transit Study)***

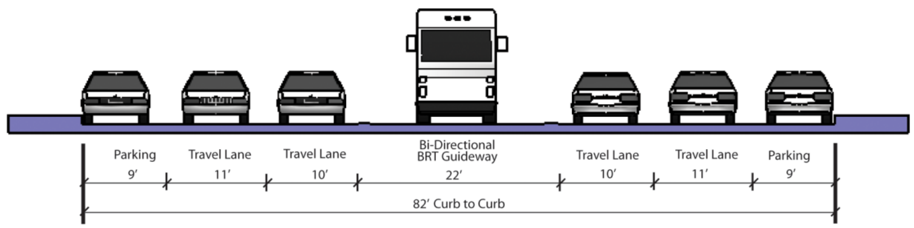

**Flamingo Road BRT Typical Section - Alternative 1**
***(Flamingo Road Corridor Study)***


**Flamingo Road BRT Typical Section - Alternative 2**
***(Flamingo Road Corridor Study)***

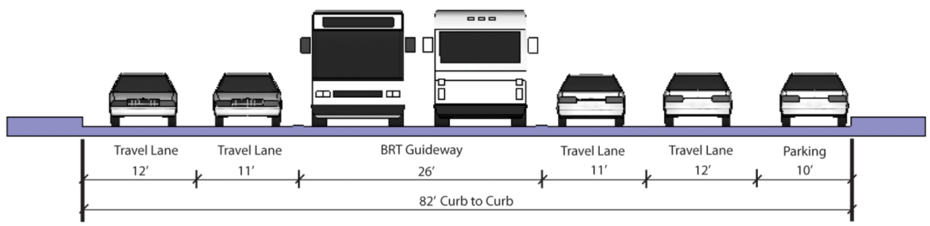
Recommended Section Louisiana to Carlisle



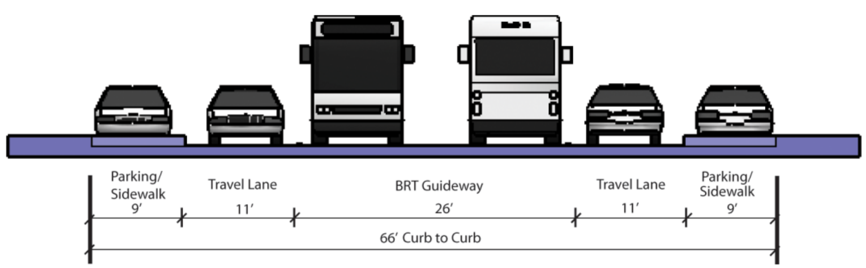

Recommended Section Carlisle to Girard




Recommended Section Girard to University

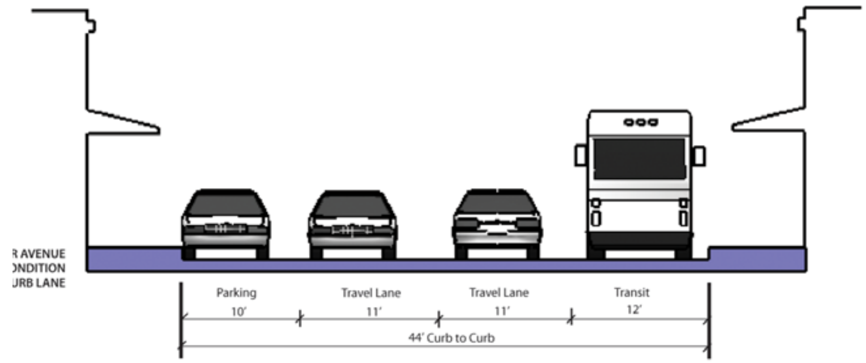



Recommended Sections University to 1st Street

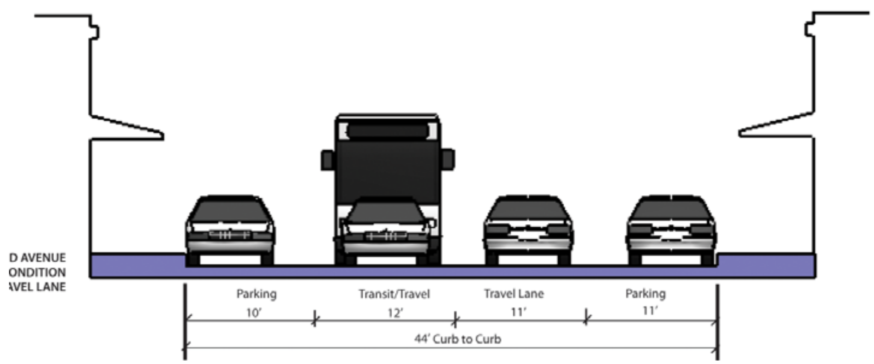



**Albuquerque Central Avenue BRT Cross Sections**
***(Central Avenue Corridor BRT Feasibility Assessment: Final Report)***

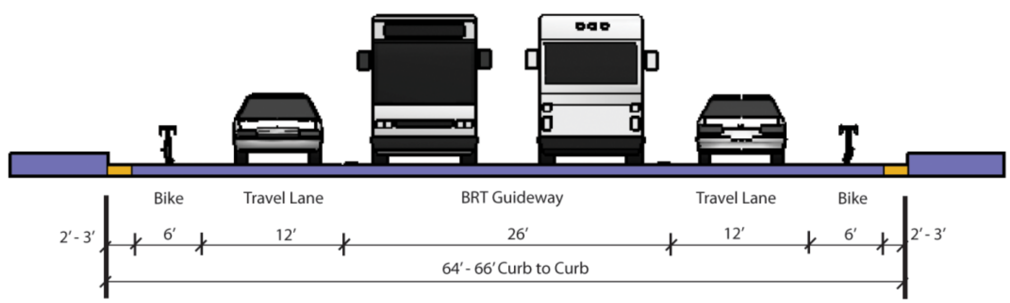
Recommended Section Copper




Recommended Section Gold



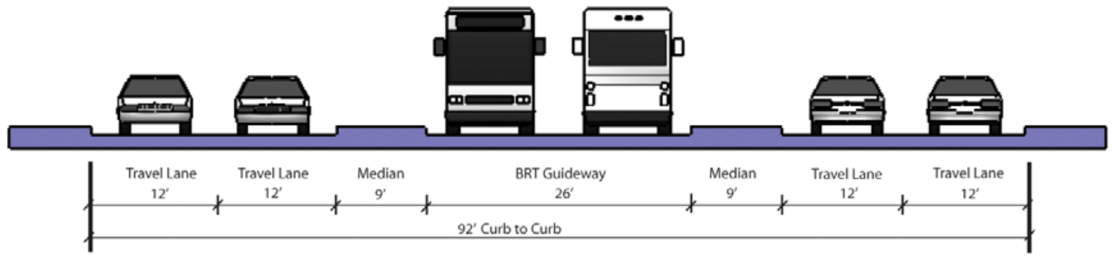

Recommended Section 8th Street to Lomas



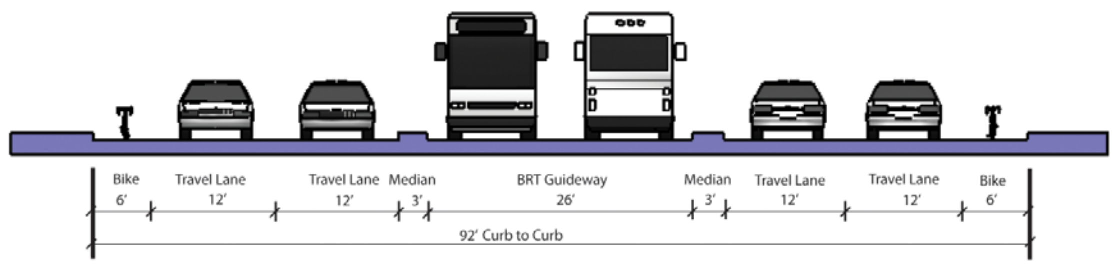

**Albuquerque Central Avenue BRT Cross Sections**

***(Central Avenue Corridor BRT Feasibility Assessment: Final Report)***

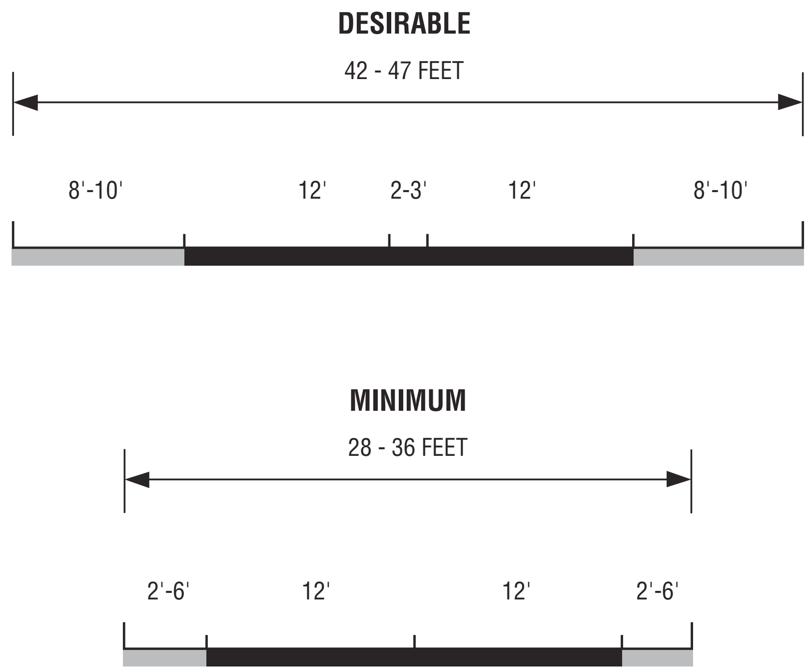
Recommended Section Lomas to Atrisco



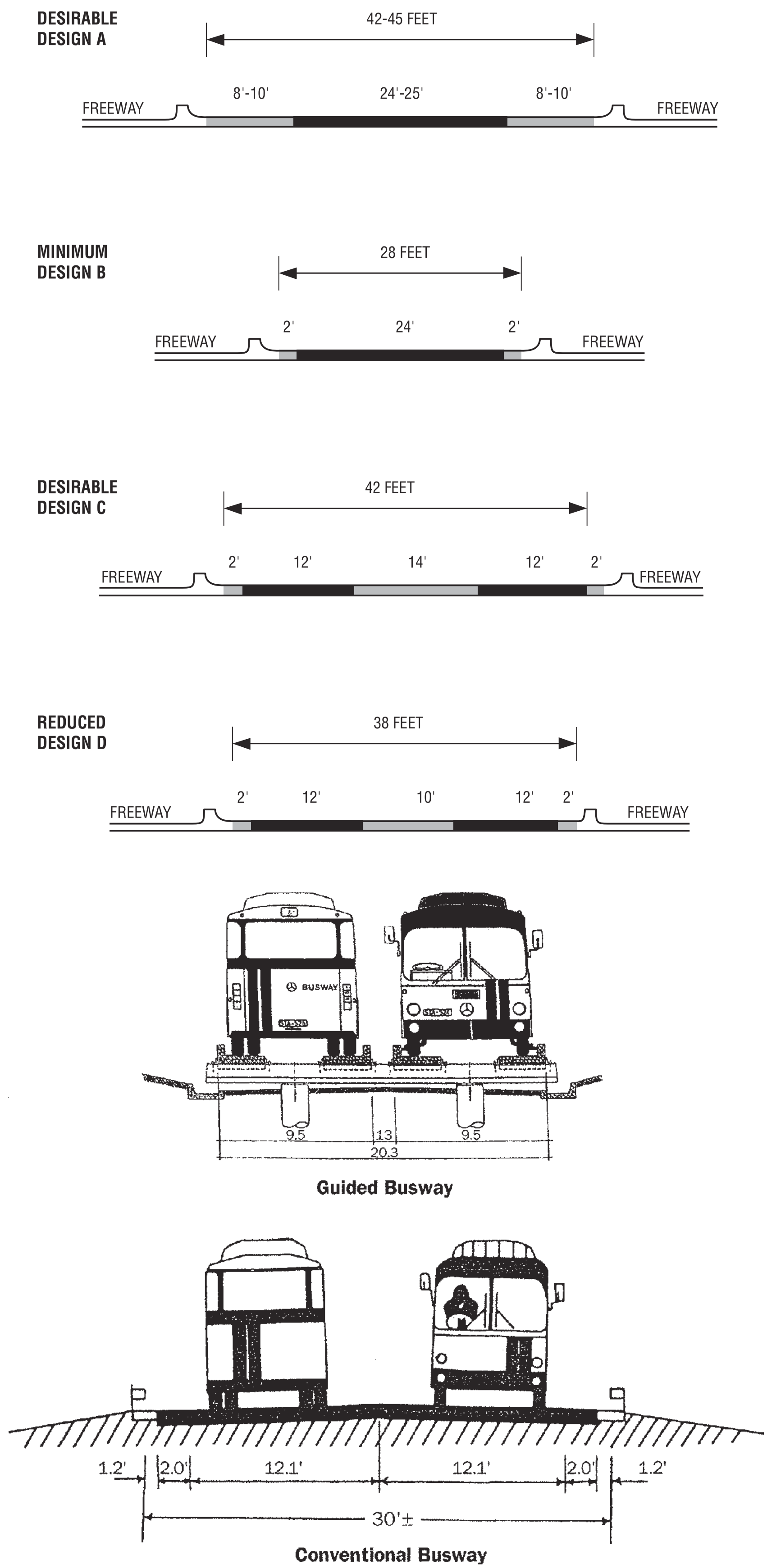

Recommended Section Atrisco to Unser Transit Center




**Albuquerque Central Avenue BRT Cross Sections**
***(Central Avenue Corridor BRT Feasibility Assessment: Final Report)***

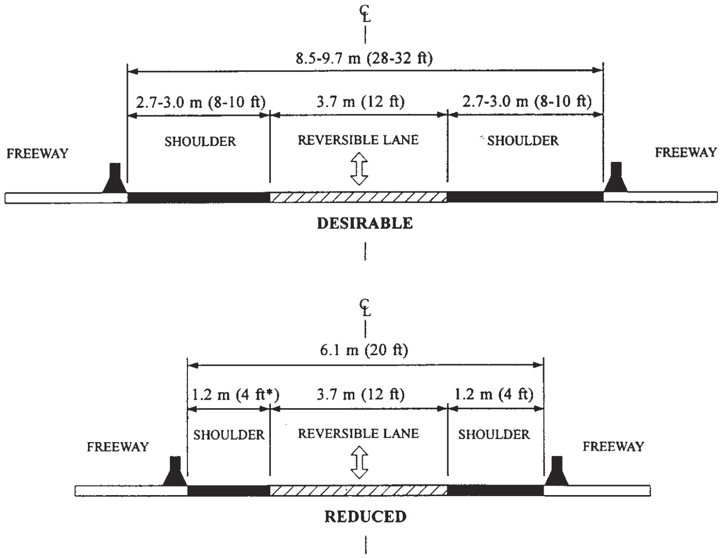



**Sample Cross Sections (TCRP Report 90, *Bus Rapid Transit, Volume 2: Implementation Guidelines*)**



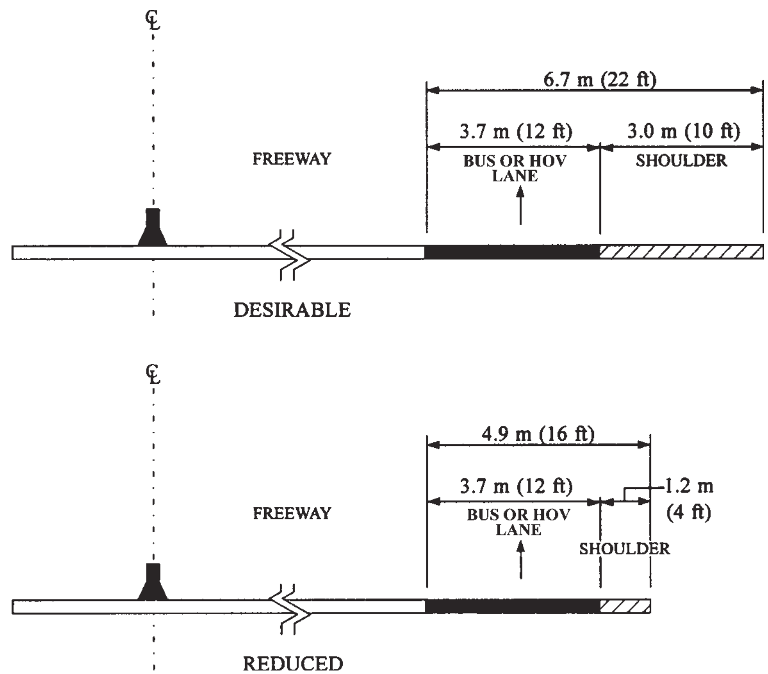

(Source: Richards, 1990)

**Sample Cross Sections (TCRP Report 90, *Bus Rapid Transit, Volume 2: Implementation Guidelines*)**



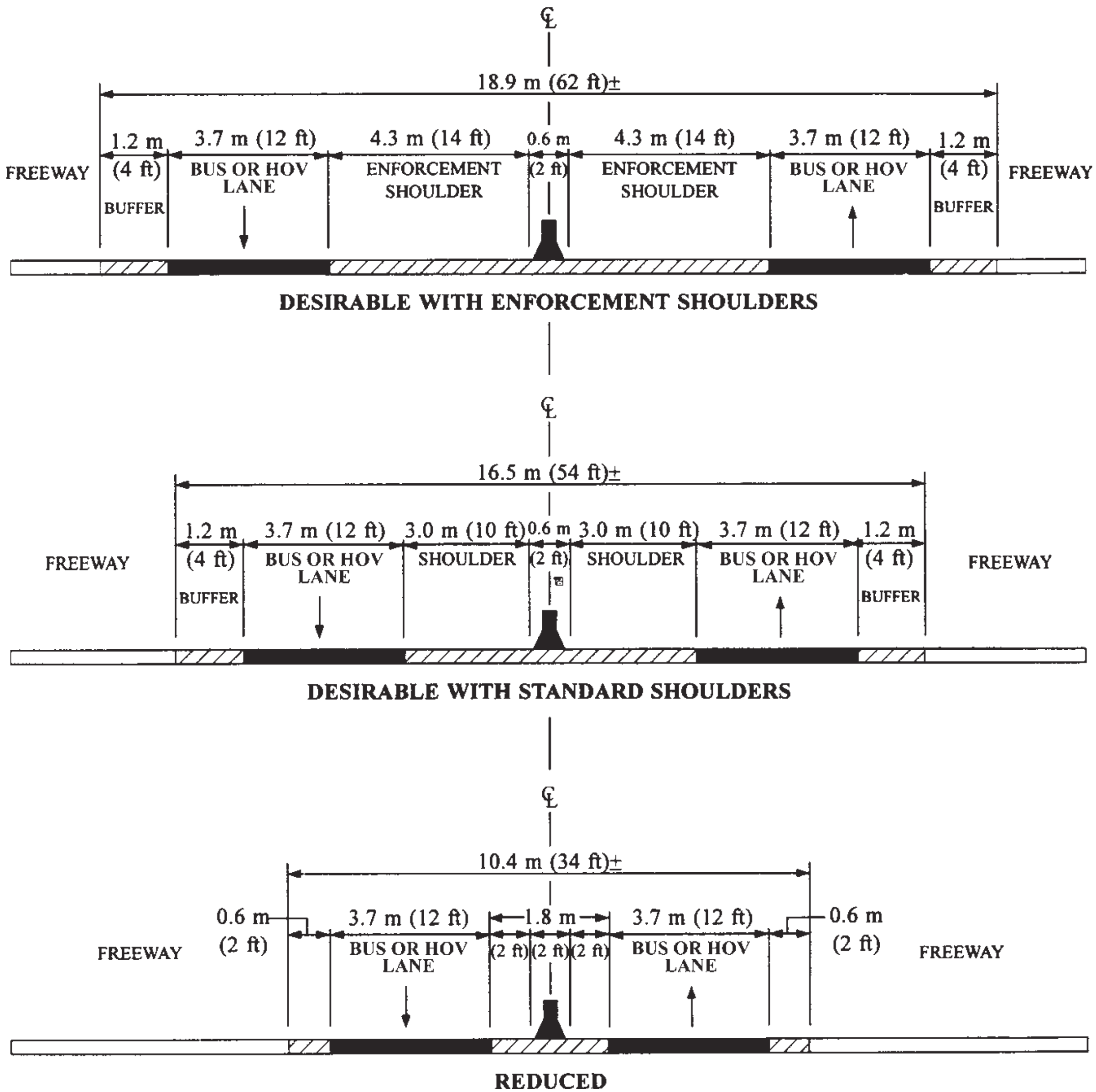

* Lateral clearances may be combined to provide a dedicated 2.4 m (8 ft) shoulder on one side or the other, or a 7.3 m (24 ft) envelope may be striped with two 3.7 m (12 ft) travel ways with traffic always operated to the right of the center stripe

(Source: Texas Transportation Institute et al., 1998)



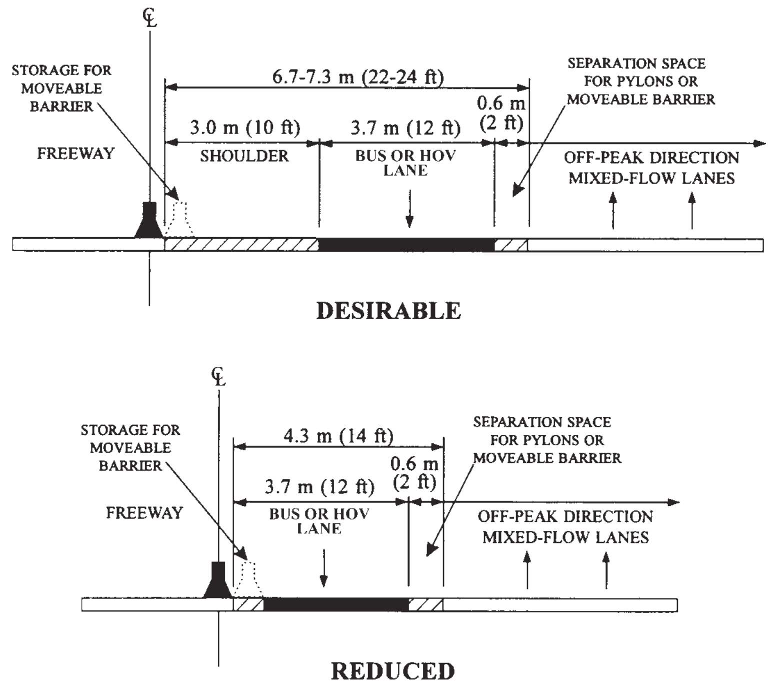

(Source: Texas Transportation Institute et al., 1998)

**Sample Cross Sections (TCRP Report 90, *Bus Rapid Transit, Volume 2: Implementation Guidelines*)**

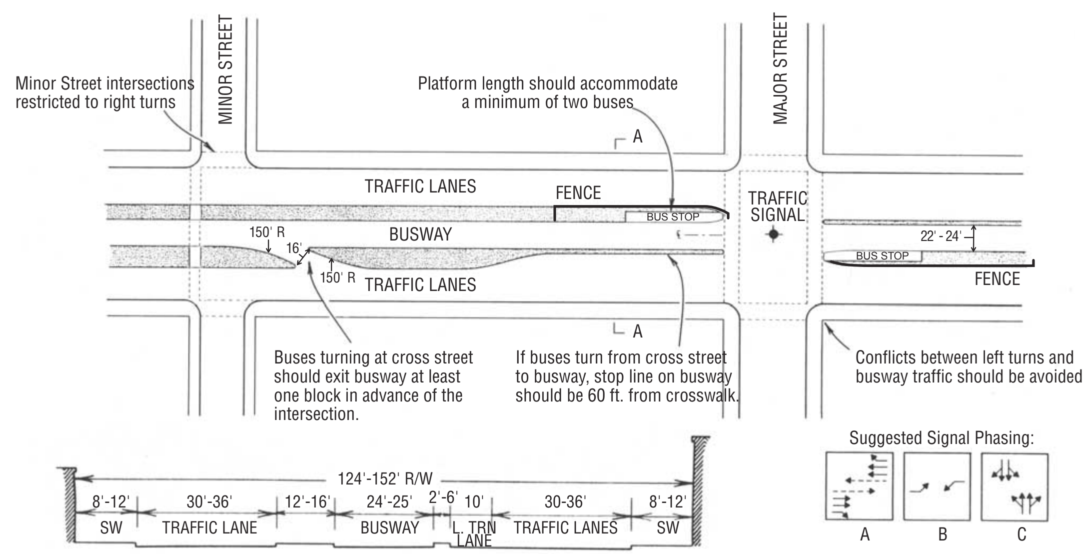



(SOURCE: Texas Transportation Institute et al., 1998)

**Sample Cross Sections (TCRP Report 90, *Bus Rapid Transit, Volume 2: Implementation Guidelines*)**

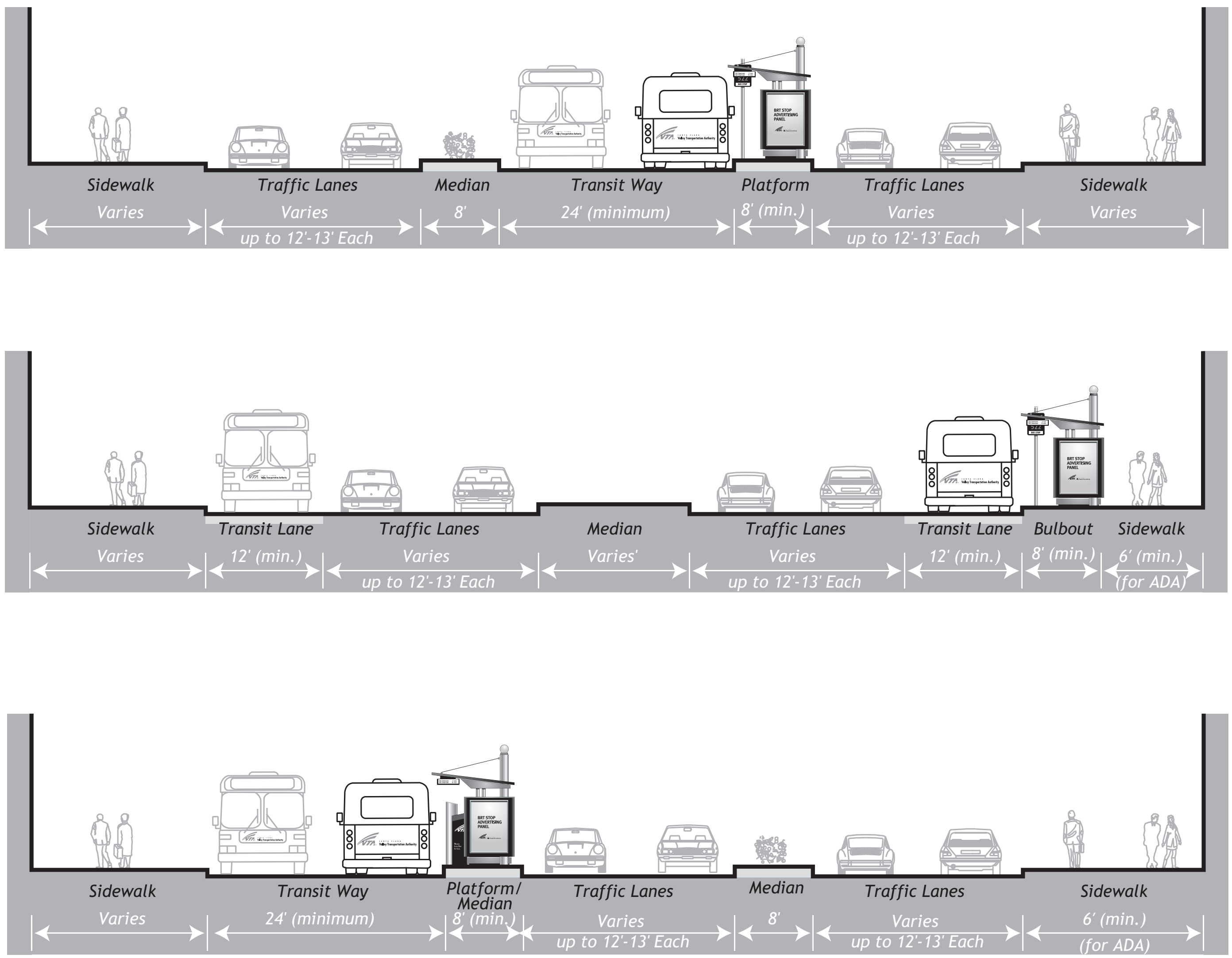



(SOURCE: Texas Transportation Institute et al., 1998)

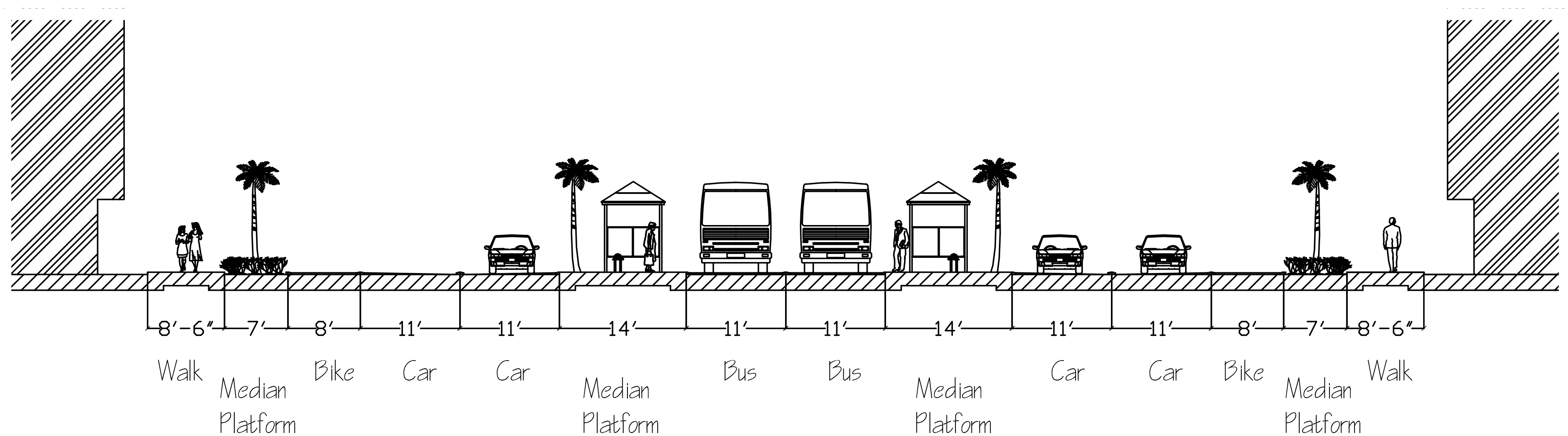



(SOURCE: Adapted from Levinson et al., 1975)

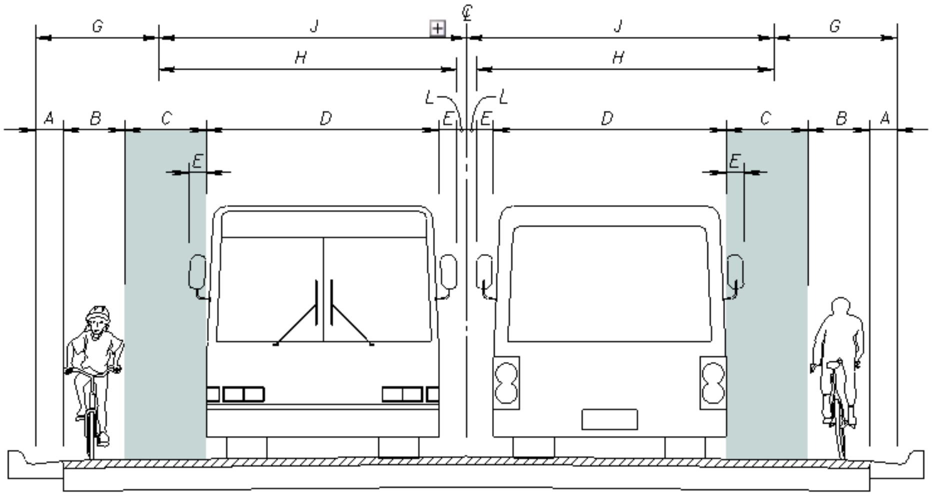
**Sample Cross Sections (TCRP Report 90, *Bus Rapid Transit, Volume 2: Implementation Guidelines*)**



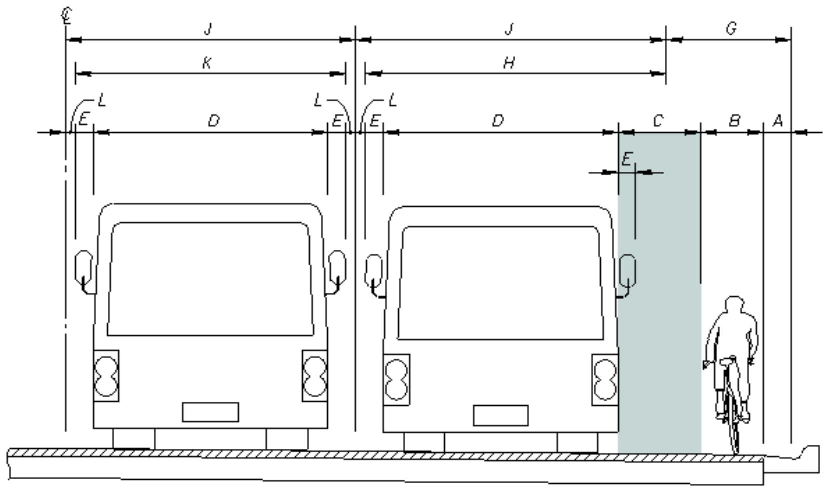

**Example Typical Sections (Santa Clara VTA *Bus Rapid Transit Service Design Guidelines*)**




**Cross Section of the Right of Way for a Transit Mall (*Accessing Transit: Design Handbook for Florida Bus Passenger Facilities*, Version 2 – Figure 3.9)**



(a) 2-Lane – 2-Way Curbed Roads



(b) 4-Lane – 2-Way Curbed Roads

All values in feet.

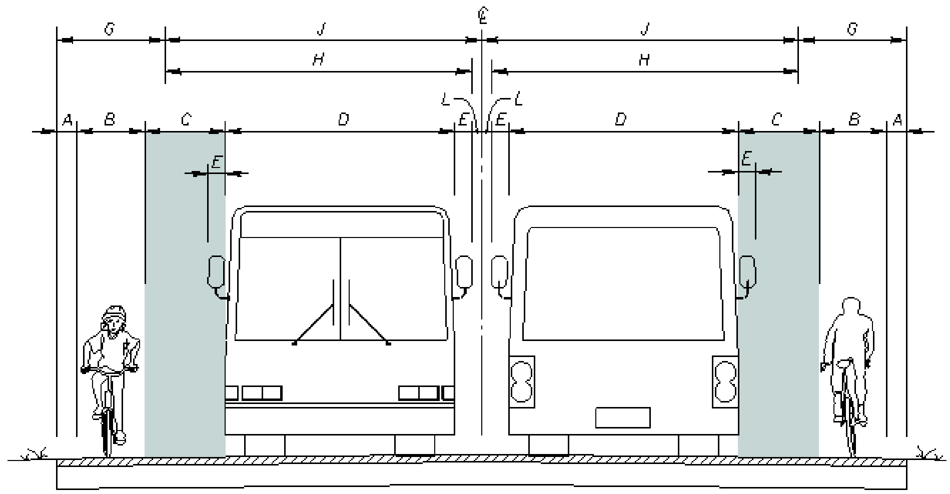
| Type | A | B | C | D | E | F | G | H | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2-Lane | 1.25 | 2.5 | 3.0 | 8.5 | 1.0 | 16.25 | 5.0 | 11.25 [2] | 12.0 | 0.0 | 0.75 |
| 4-Lane | 1.25 | 2.5 | 3.0 | 8.5 | 1.0 | 16.25 | 5.0 | 11.25 [2] | 12.0 [1] | 10.5 [1] | 0.75 |

1. For divided 4-Lane -2-Way roads with median, K = 9.5 ft, J = 11.0 ft.
2. Allowed only when right-of-way constraints prohibit recommended travel lane width.

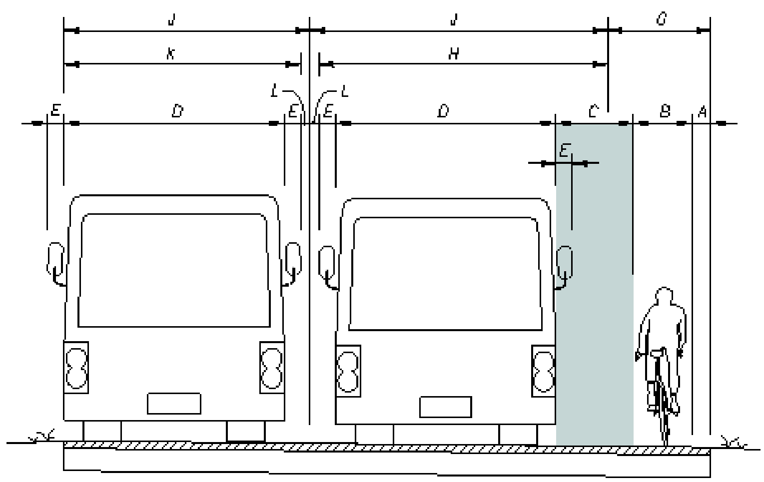
A = Distance from face of curb to edge of bicyclist
B = Required bicyclist area
C = Clearance required between bicyclist and bus
D = Width of bus
E = Width of mirror
F = Distance from face of curb to outside left bus mirror

G = Width of bike lane
H = Minimum travel lane width
J = Recommended travel lane width
K = Minimum inside travel lane width
L = Minimum clearance

**Recommended Lane Width for Curbed Roads (*Integrating Transit into Traditional Neighborhood Design Policies – The Influence of Lane Width on Bus Safety* – Figure 8.3)**




(a) 2-lane -2-way Suburban roads




(b) 4-lane -2-way Suburban roads

All values in feet.

| Type | A | B | C | D | E | F | G | H | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2-Lane | 0.75 | 2.5 | 3.0 | 8.5 | 1.0 | 15.75 | 4.0 | 11.75 | 12.0 | 0.0 | 0.25 |
| 4-Lane | 0.75 | 2.5 | 3.0 | 8.5 | 1.0 | 15.75 | 4.0 | 11.75 | 11.0 [1] | 9.5 [1] | 0.25 |

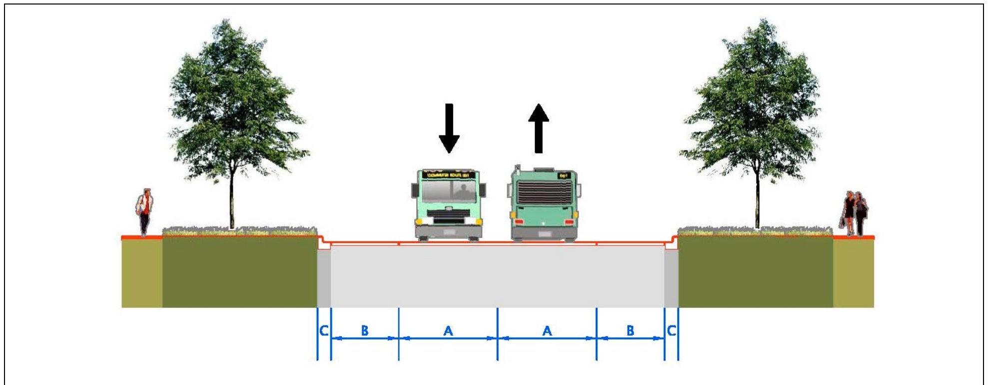
1. For undivided 4-Lane -2-Way roads with median, K = 10.5 ft, J = 12.0 ft.

A = Distance from face of curb to edge of bicyclist
B = Required bicyclist area
C = Clearance required between bicyclist and bus
D = Width of bus
E = Width of mirror
F = Distance from face of curb to outside left bus mirror

G = Width of bike lane
H = Minimum travel lane width
J = Recommended travel lane width
K = Minimum inside travel lane width
L = Minimum clearance

**Recommended Lane Width for Curbed Roads (*Integrating Transit into Traditional Neighborhood Design Policies – The Influence of Lane Width on Bus Safety* – Figure 8.4)**

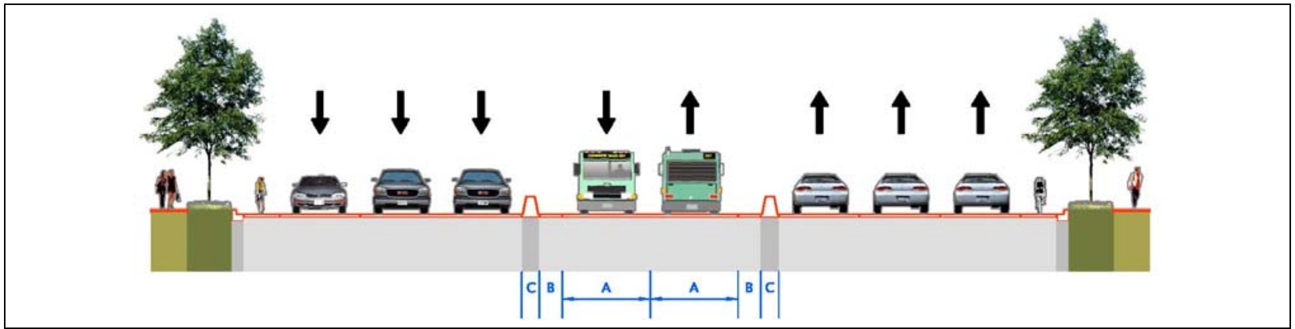
Separate Busway Typical Section




| Designation | Description | Dimension (feet) | | Notes |
|---|---|---|---|---|
| | | Preferred | Constrained | |
| A | BRT/bus lane | 12 | 11 | |
| B | Shoulder | 4 | 2 | Wider shoulders suggested for snow storage. |
| C | Barrier/curb and gutter | 2 | 2 | |

**Typical Section for Separate Busway *(Designing Bus Rapid Transit Running Ways)***

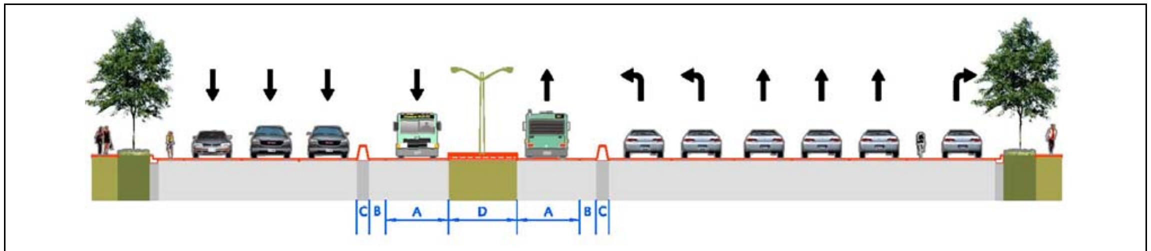
Two-Way Median Busway, Typical Cross-Section




| Designation | Description | Dimension (feet) | | Notes |
|---|---|---|---|---|
| | | Preferred | Constrained | |
| A | BRT/bus lane | 12 | 11 | |
| B | Shy distance | 4 | 1 | No shoulder with guided busway. |
| C | Curb separator | 2 | 2 | Possible to replace with 8-inch ripple paint stripe. |

**Typical Section for Two-Way Arterial Median Busway *(Designing Bus Rapid Transit Running Ways)***

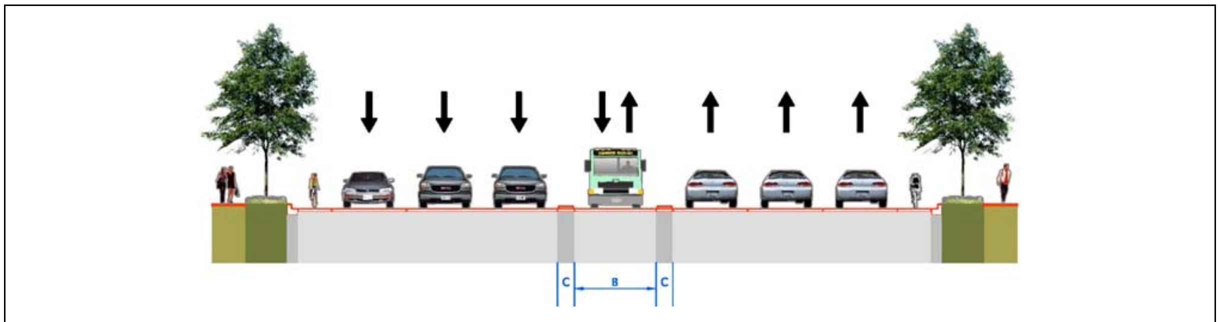
Two-Way Median Busway, Typical Cross-Section




| Designation | Description | Dimension (feet) | | Notes |
|---|---|---|---|---|
| | | Preferred | Constrained | |
| A | BRT/bus lane | 12 | 11 | |
| B | Shy distance | 4 | 1 | No shoulder with guided busway. |
| C | Barrier/curb separator | 2 | 2 | 10-inch shoulder added; 4-inch shoulder added |
| D | Station platform | 14 | 12 | If narrower than 12 feet, must meet ADA requirements. |

**Typical Section for Two-Way Arterial Median Busway *(Designing Bus Rapid Transit Running Ways)***

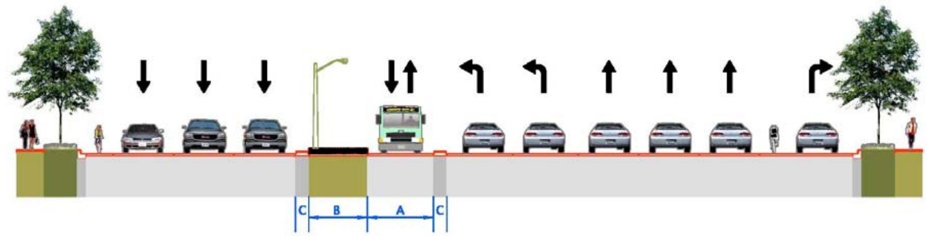
Two-Way Median Busway, Typical At-Station Section




| Designation | Description | Dimension (feet) | | Notes |
|---|---|---|---|---|
| | | Preferred | Constrained | |
| B | BRT/bus lane | 12 | 11 | |
| C | Curb separator | 2 | 1.5 | Separator should be mountable to allow access and egress to the lane (pass and service disabled vehicles). May be 8-inch ripple paint stripe. |

**Typical Section for Two-Way Arterial Median Busway *(Designing Bus Rapid Transit Running Ways)***

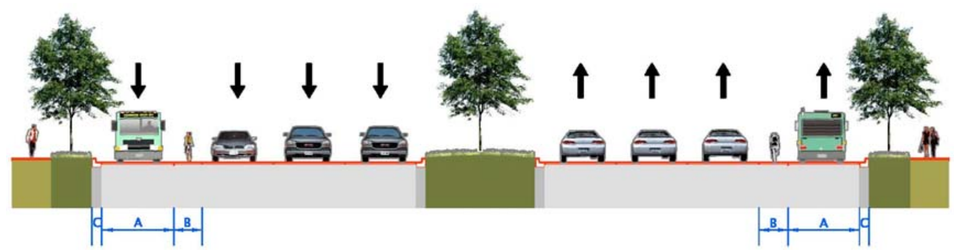
Bidirectional, One-Lane Median Busway, Typical Midblock Cross-Section




| Designation | Description | Dimension (feet) | | Notes |
|---|---|---|---|---|
| | | Preferred | Constrained | |
| A | BRT/bus lane | 12 | 10 | |
| B | Center station | 12 | 10 | |
| C | Curb separator | 2 | 2 | 4-in. separator should be mountable to allow access and egress to the lane (pass and service disabled vehicles). Tubular markers (pylons) with width of 2 to 6 in. may be used. May be ripple paint stripe. |

**Typical Section for Two-Way Arterial Median Busway *(Designing Bus Rapid Transit Running Ways)***

Concurrent Flow Curbside Bus Lanes on a Two-Way Street, Typical Midblock Section

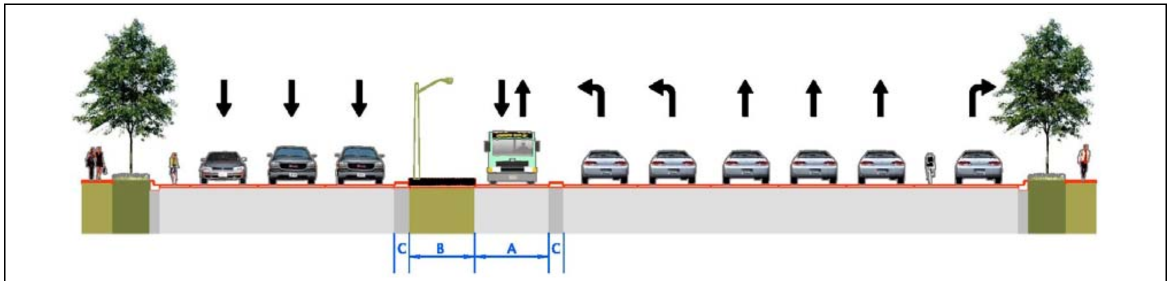



| Designation | Description | Dimension (feet) | | Notes |
|---|---|---|---|---|
| | | Preferred | Constrained | |
| A | BRT/bus lane | 12 | 10.5 | |
| B | Bicycle lane | As required | As required | |
| C | Curb and gutter | 2 | 2 | |

**FIGURE 14**
Contraflow Curbside Bus Lanes on a One-Way Street, Typical Section

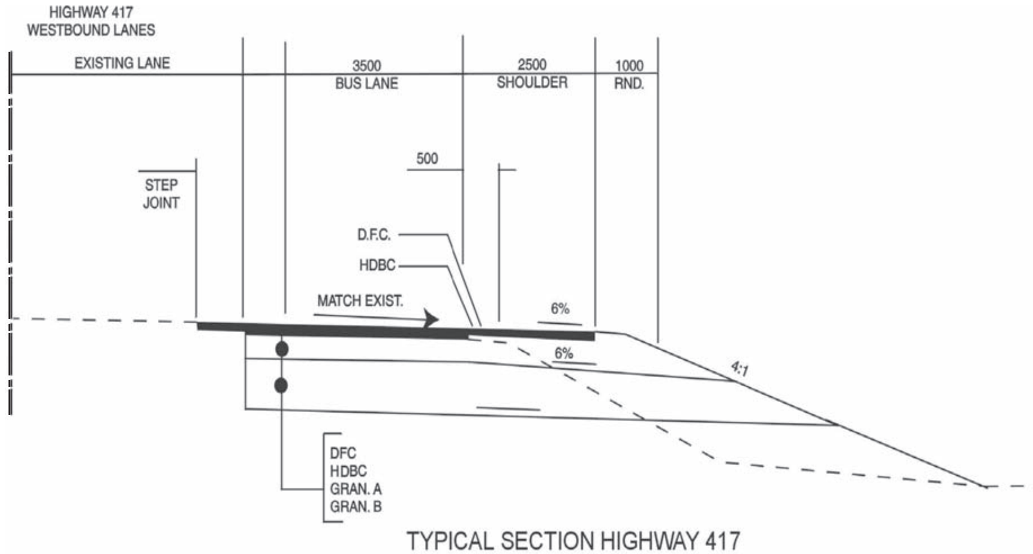
**Concurrent Flow Curbside Bus Lane on Two-Way Arterial *(Designing Bus Rapid Transit Running Ways)***

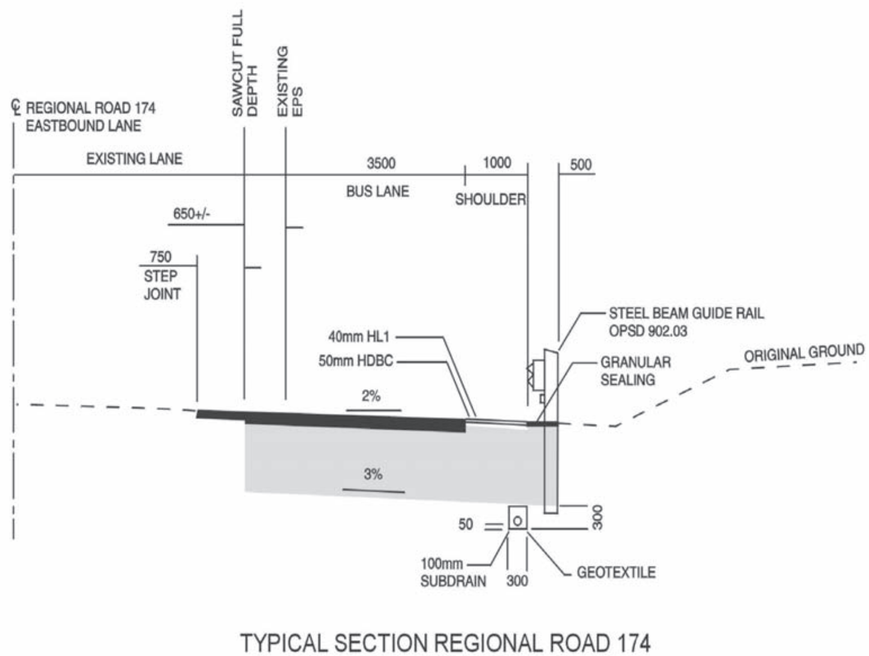
Bidirectional, One-Lane Median Busway, Typical Midblock Cross-Section




| Designation | Description | Dimension (feet) | | Notes |
|---|---|---|---|---|
| | | Preferred | Constrained | |
| A | BRT/bus lane | 12 | 10 | |
| B | Center station | 12 | 10 | |
| C | Curb separator | 2 | 2 | 4-in. separator should be mountable to allow access and egress to the lane (pass and service disabled vehicles). Tubular markers (pylons) with width of 2 to 6 in. may be used. May be ripple paint stripe. |

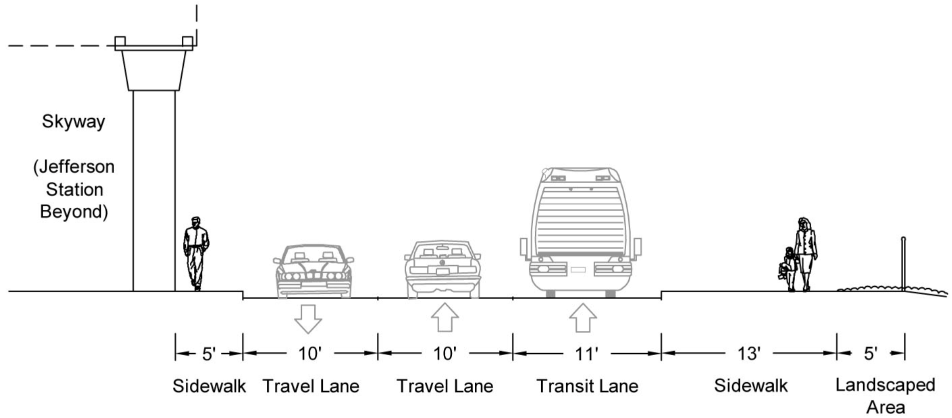
**Contraflow Curbside Bus Lane on One-Way Arterial** ***(Designing Bus Rapid Transit Running Ways)***



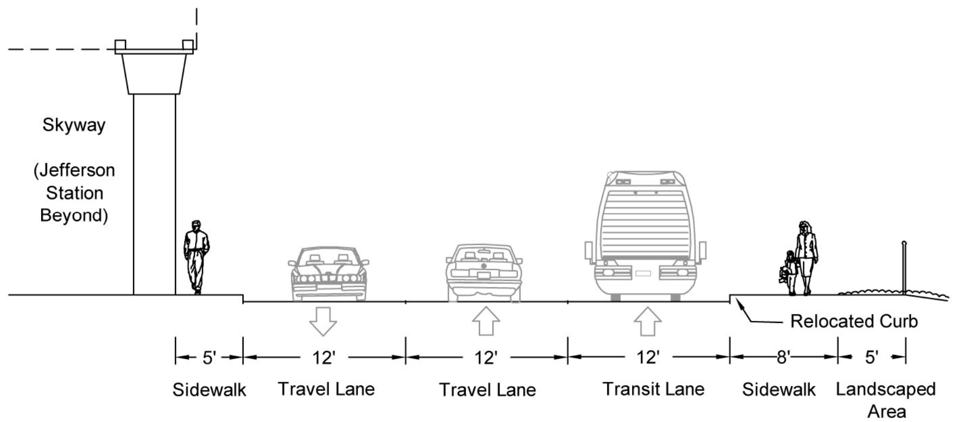




**BOS Typical Sections - Ottawa (TCRP Synthesis 64 – Figure 12)**

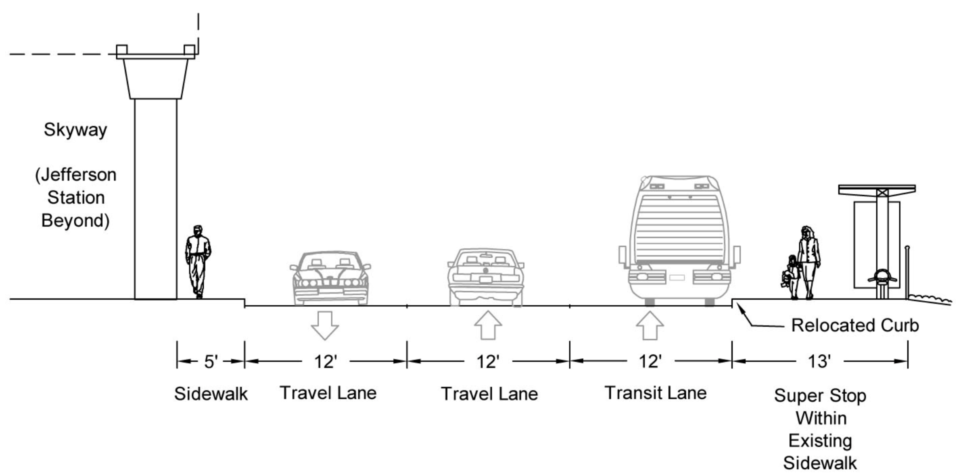
Looking west along Bay Street between Jefferson Street and Madison Street




**Existing Conditions (Peak Period)**



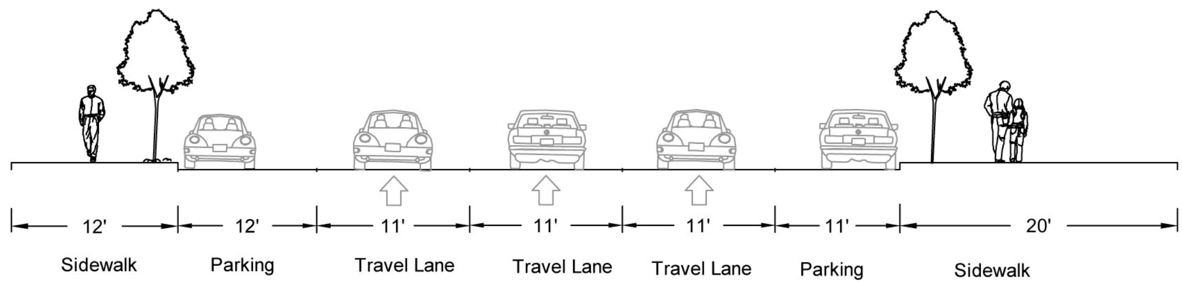

**Proposed Conditions at Mid-block (Peak Period)**



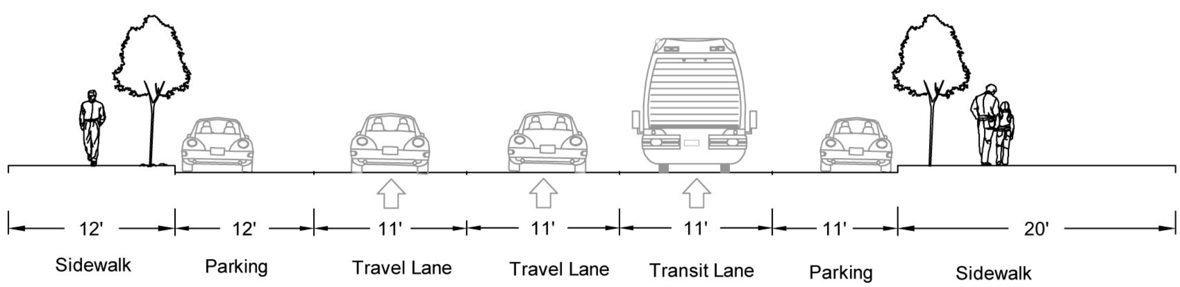

**Proposed Conditions at Super Stop (Peak Period)**

**Downtown BRT Enhancement Project - Jacksonville**
***(Jacksonville Rapid Transit System Phase One: Environmental Assessment)***

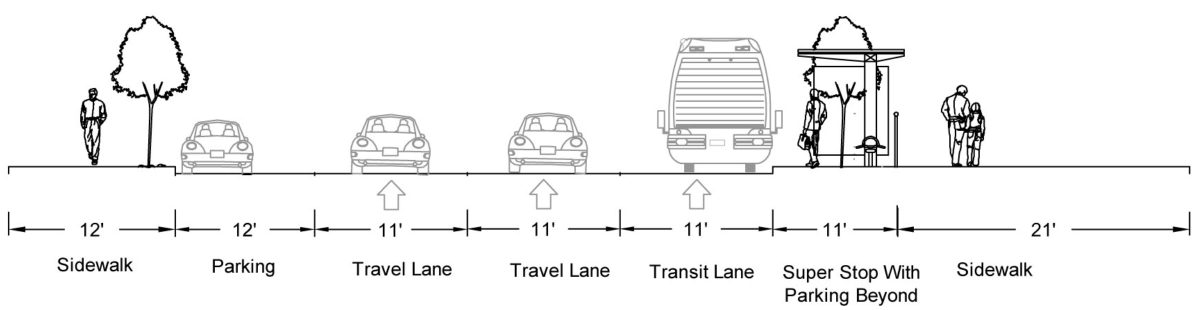
Looking west along Bay Street between Laura Street and Hogan Street




**Existing Conditions (Peak Period)**



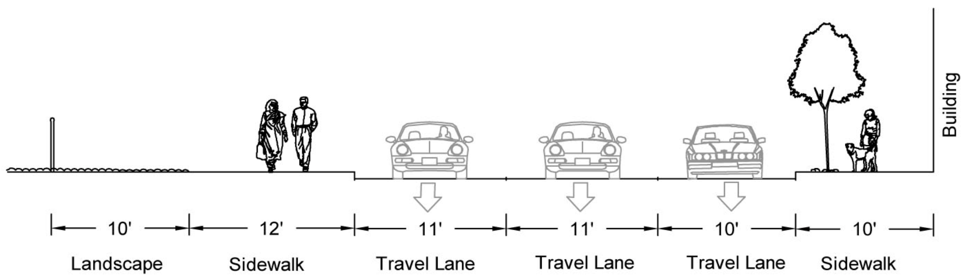

**Proposed Conditions at Mid-block (Peak Period)**



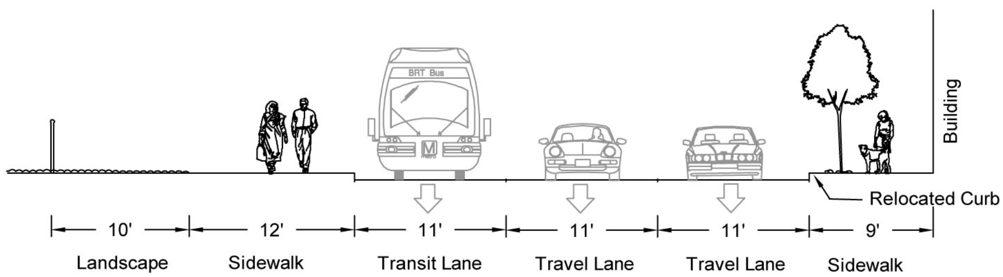

**Proposed Conditions at Super Stop (Peak Period)**

**Downtown BRT Enhancement Project - Jacksonville**
***(Jacksonville Rapid Transit System Phase One: Environmental Assessment)***

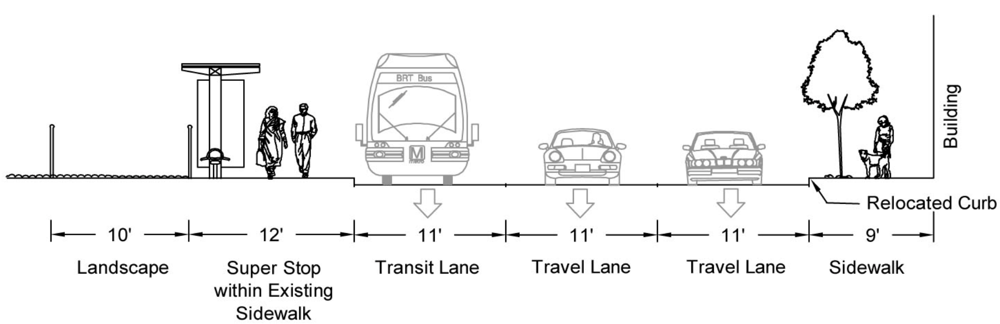
Looking west along Forsyth Street between Madison Street and Jefferson Street




**Existing Conditions (Peak Period)**

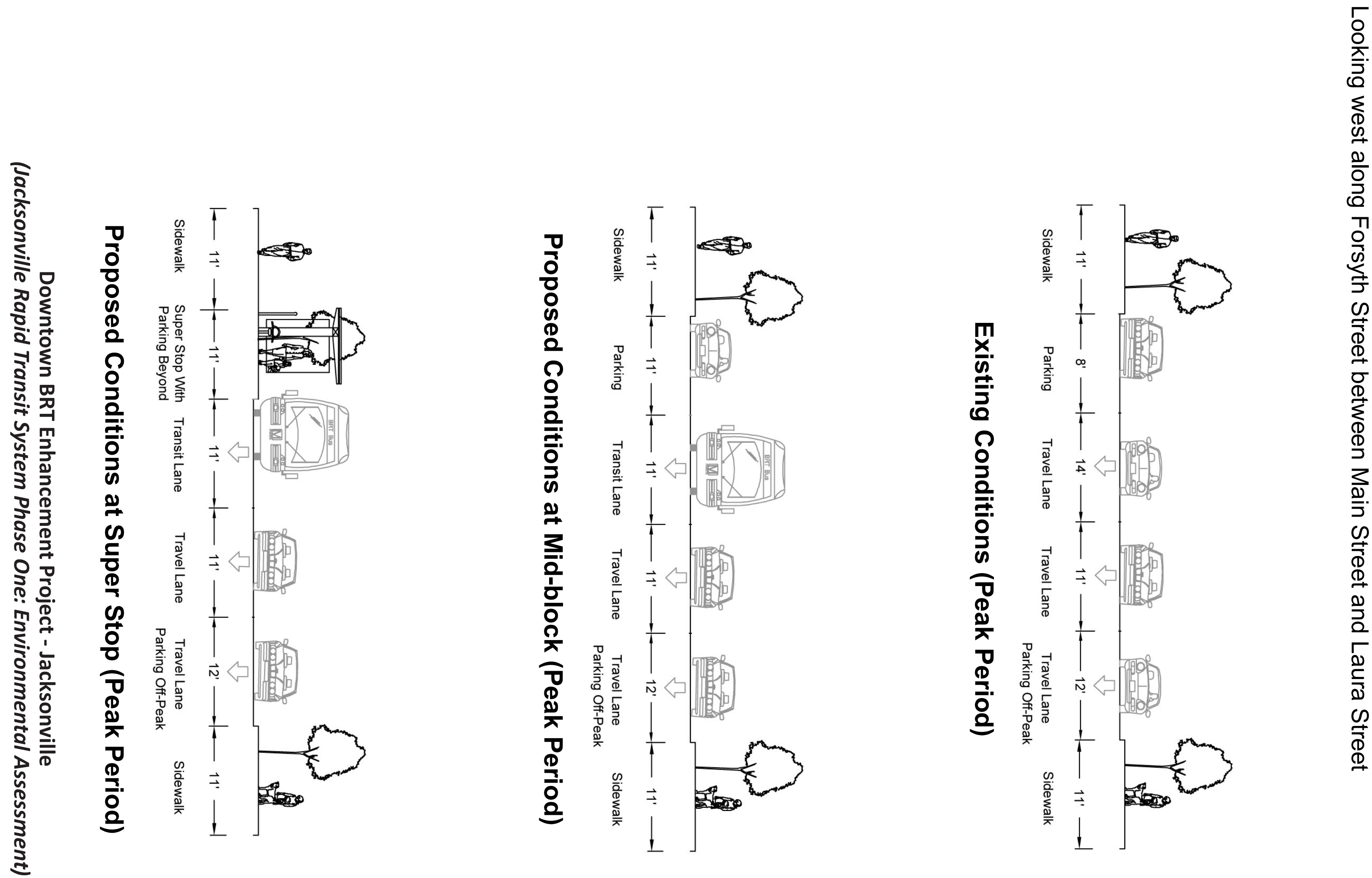



**Proposed Conditions at Mid-block (Peak Period)**

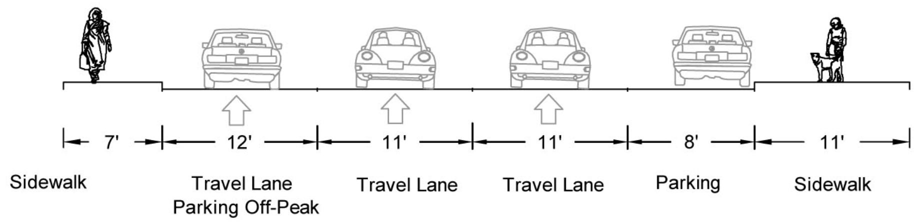



**Proposed Conditions at Super Stop (Peak Period)**

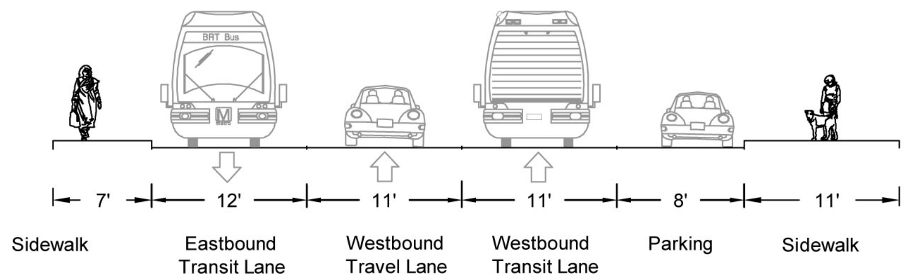
**Downtown BRT Enhancement Project - Jacksonville**
***(Jacksonville Rapid Transit System Phase One: Environmental Assessment)***


Looking west along Forsyth Street between Main Street and Laura Street
Existing Conditions (Peak Period)
11'
8'
14'
11'
12'
11'
Sidewalk
Parking
Travel Lane
Travel Lane
Travel Lane
Parking Off-Peak
Sidewalk
Proposed Conditions at Mid-block (Peak Period)
11'
11'
11'
11'
12'
11'
Sidewalk
Parking
Transit Lane
Travel Lane
Travel Lane
Parking Off-Peak
Sidewalk
Proposed Conditions at Super Stop (Peak Period)
11'
11'
11'
11'
12'
11'
Sidewalk
Super Stop With
Parking Beyond
Transit Lane
Travel Lane
Travel Lane
Parking Off-Peak
Sidewalk
Downtown BRT Enhancement Project - Jacksonville
*(Jacksonville Rapid Transit System Phase One: Environmental Assessment)*

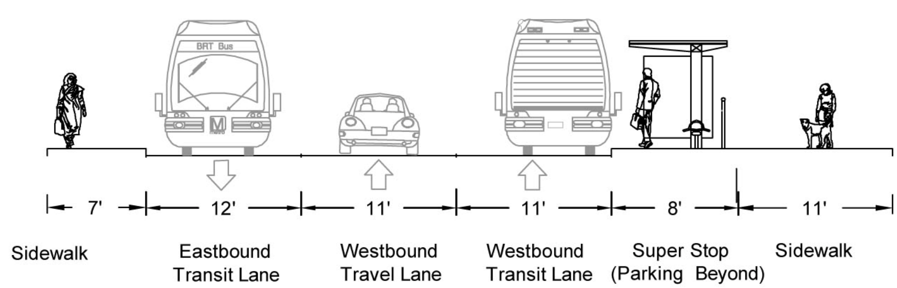
Looking west along Adams Street between Laura Street and Hogan Street




**Existing Conditions (Peak Period)**

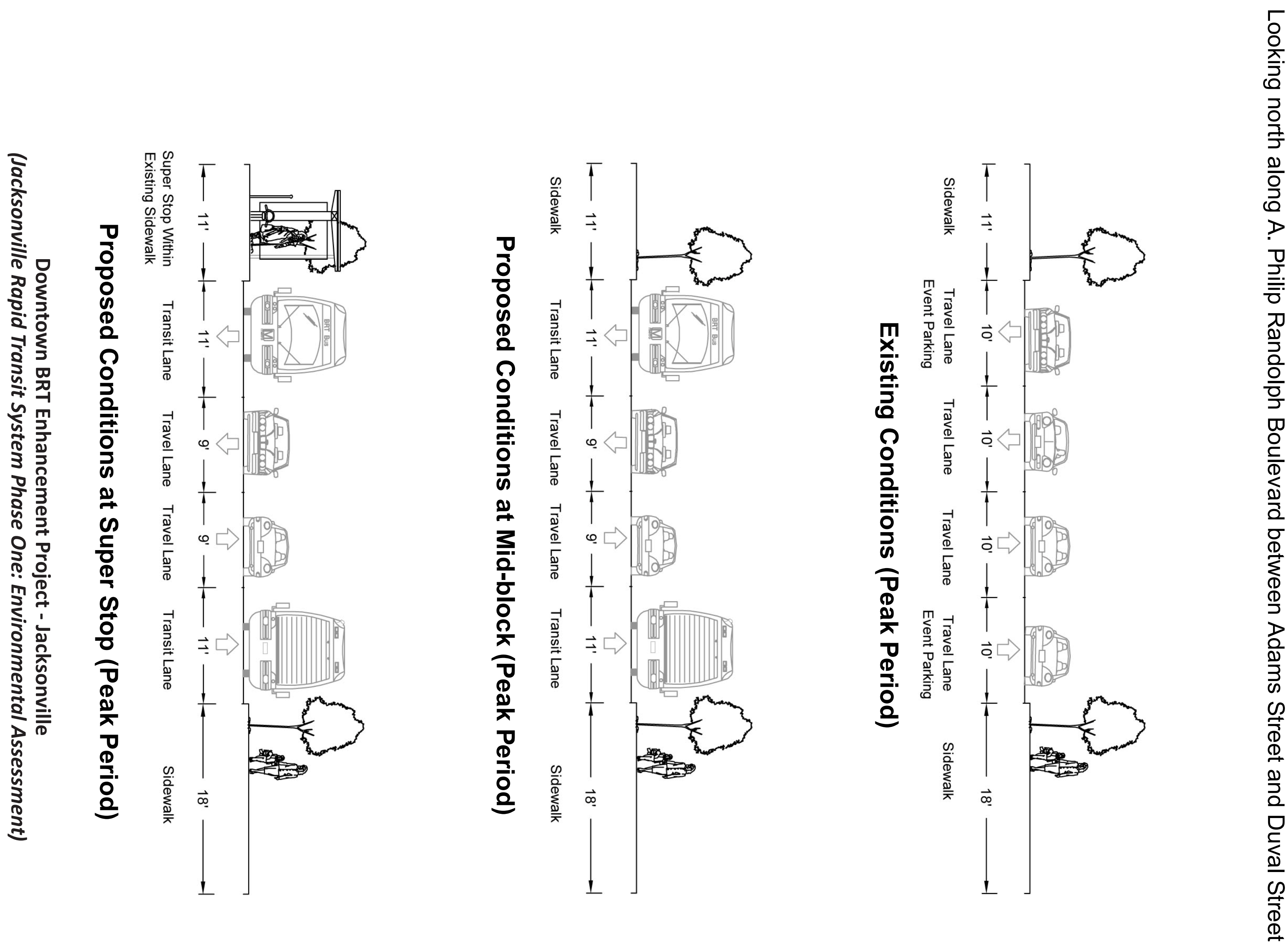



**Proposed Conditions at Mid-block (Peak Period)**

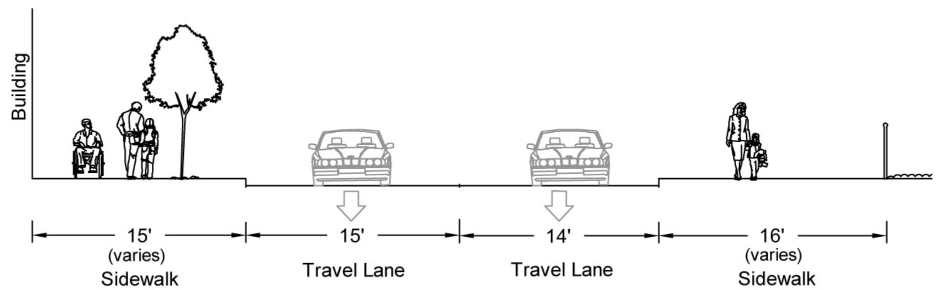



**Proposed Conditions at Super Stop (Peak Period)**

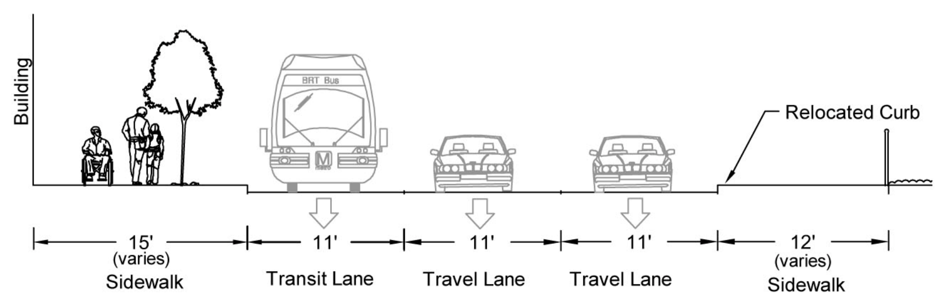
**Downtown BRT Enhancement Project - Jacksonville**
***(Jacksonville Rapid Transit System Phase One: Environmental Assessment)***


Looking north along A. Philip Randolph Boulevard between Adams Street and Duval Street
11'
10'
10'
10'
10'
18'
Sidewalk
Travel Lane
Event Parking
Travel Lane
Travel Lane
Travel Lane
Event Parking
Sidewalk
Existing Conditions (Peak Period)
11'
11'
9'
9'
11'
18'
Sidewalk
Transit Lane
Travel Lane
Travel Lane
Transit Lane
Sidewalk
Proposed Conditions at Mid-block (Peak Period)
11'
11'
9'
9'
11'
18'
Super Stop Within
Existing Sidewalk
Transit Lane
Travel Lane
Travel Lane
Transit Lane
Sidewalk
Proposed Conditions at Super Stop (Peak Period)
Downtown BRT Enhancement Project - Jacksonville
(Jacksonville Rapid Transit System Phase One: Environmental Assessment)

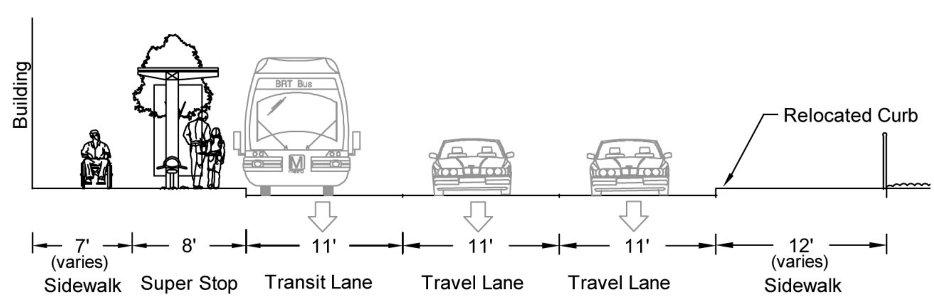
Looking north along Jefferson Street between Forsyth Street and Union Street




**Existing Conditions (Peak Period)**

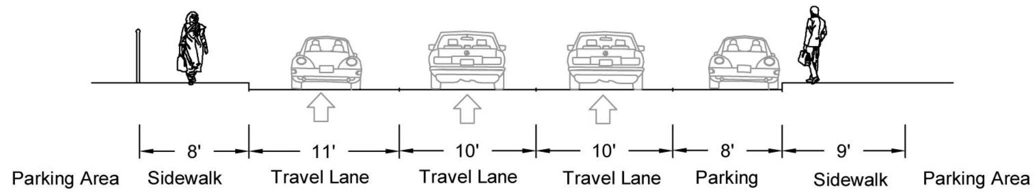



**Proposed Conditions at Mid-block (Peak Period)**

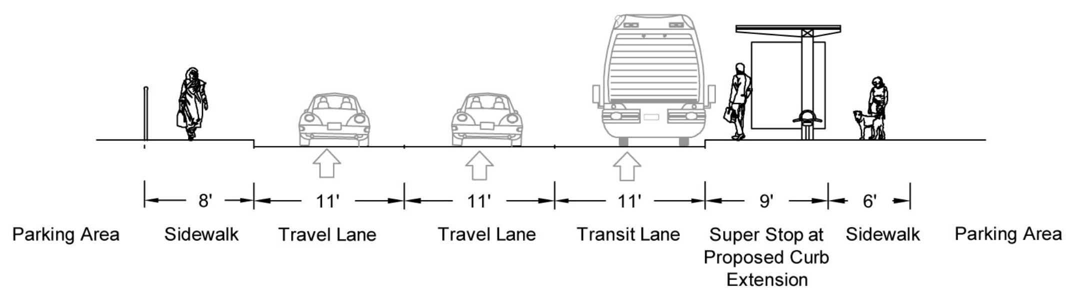



**Proposed Conditions at Super Stop (Peak Period)**

Looking north along Broad Street, this section applies to the segment between Forsyth Street and Adams Street.



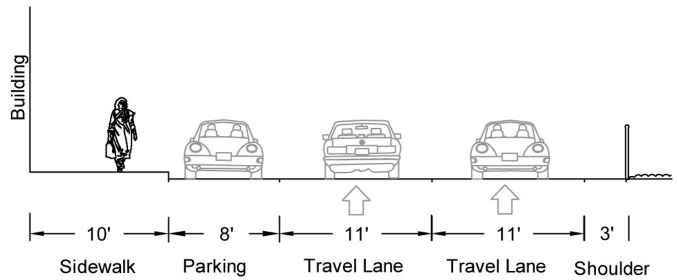

**Existing Conditions (Peak Period)**



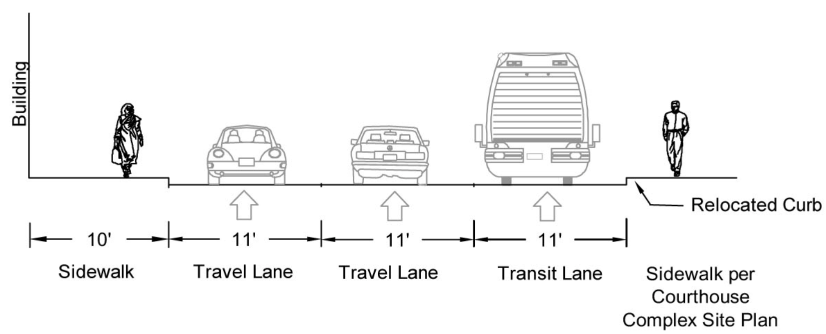

**Proposed Conditions at Super Stop (Peak Period)**

**Downtown BRT Enhancement Project - Jacksonville**
***(Jacksonville Rapid Transit System Phase One: Environmental Assessment)***

Looking north along Broad Street, this section applies to the segment between Adams Street and Duval Street, adjacent to the proposed Courthouse complex.



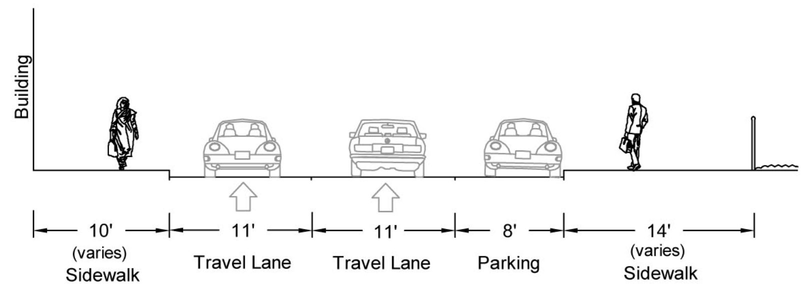

**Existing Conditions (Peak Period)**



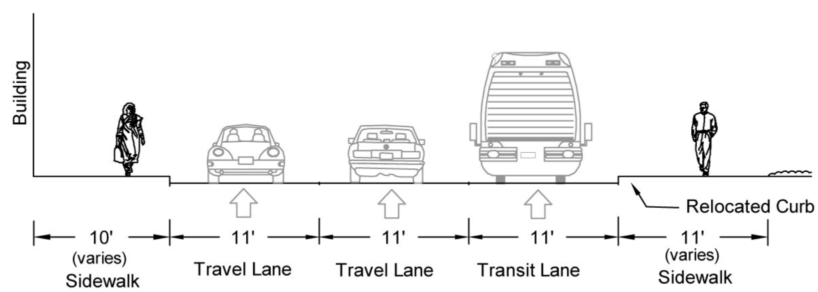

**Proposed Conditions at Super Stop (Peak Period)**

**Downtown BRT Enhancement Project - Jacksonville**
***(Jacksonville Rapid Transit System Phase One: Environmental Assessment)***

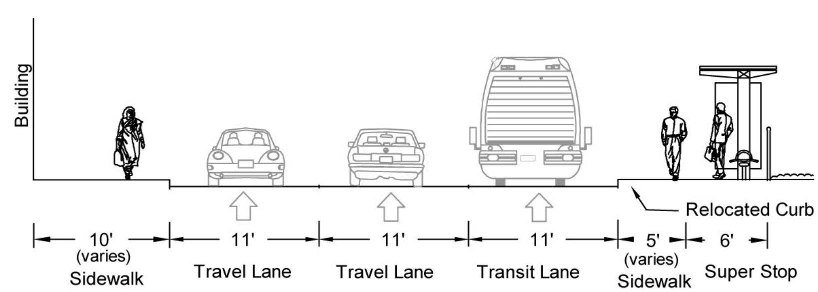
Looking north along Broad Street, this section applies between Duval Street and Union Street.




**Existing Conditions (Peak Period)**



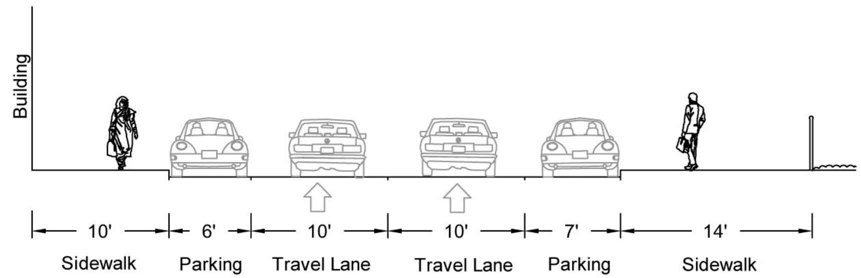

**Proposed Conditions at Mid-block (Peak Period)**



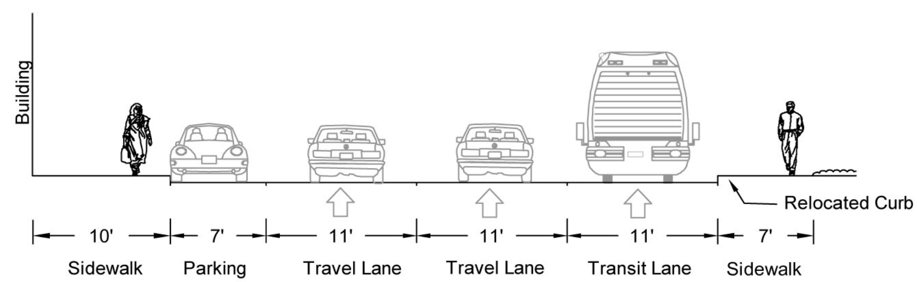

**Proposed Conditions at Super Stop between Ashley and Beaver Streets(Peak Period)**

**Downtown BRT Enhancement Project - Jacksonville**
***(Jacksonville Rapid Transit System Phase One: Environmental Assessment)***

Looking north along Broad Street, this section applies along the north end of the block between Duval Street and Church Street.



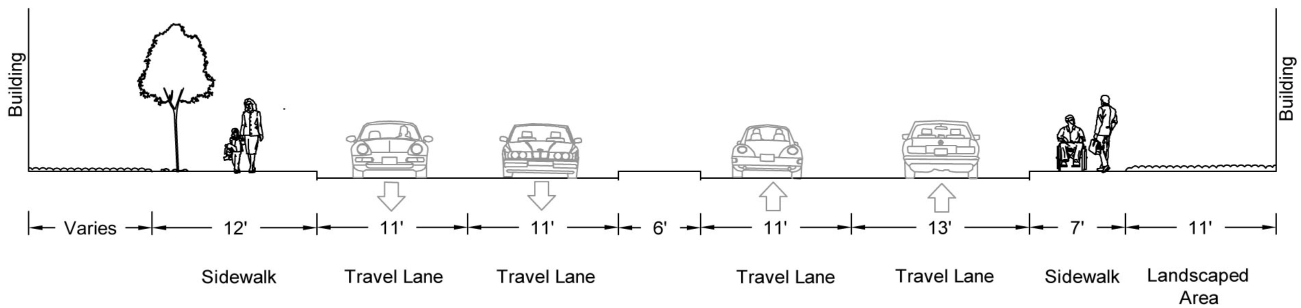

**Existing Conditions (Peak Period)**



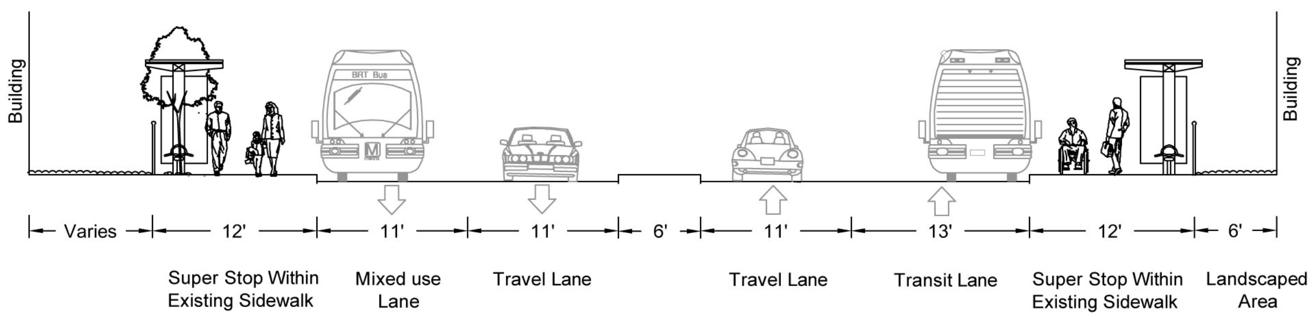

**Proposed Conditions at Mid-block (Peak Period)**

**Downtown BRT Enhancement Project - Jacksonville**
***(Jacksonville Rapid Transit System Phase One: Environmental Assessment)***

Looking west along Riverplace Boulevard between Main Street and Museum Circle



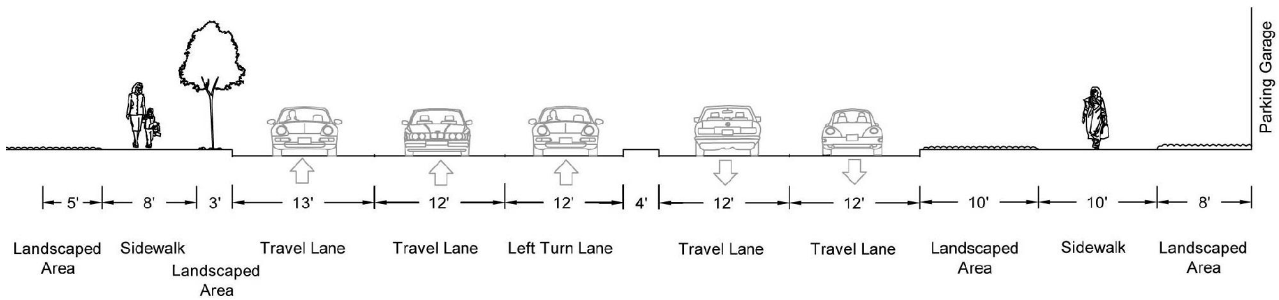

**Existing Conditions (Peak Period)**



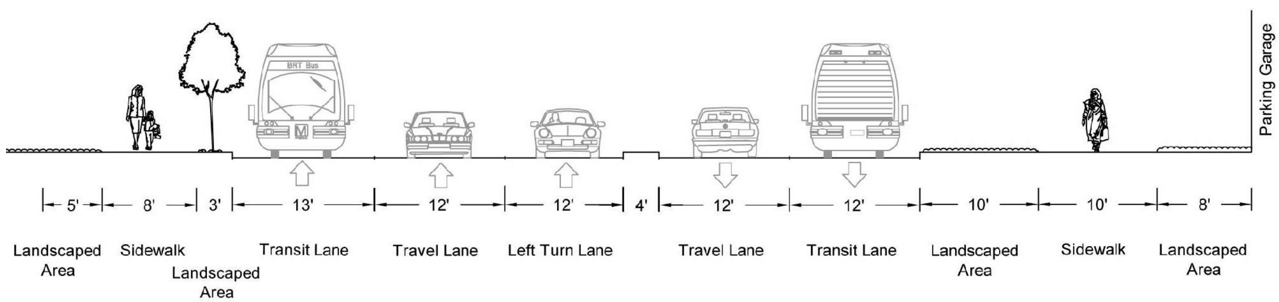

**Proposed Conditions at Super Stop (Peak Period)**

**Downtown BRT Enhancement Project - Jacksonville**
***(Jacksonville Rapid Transit System Phase One: Environmental Assessment)***

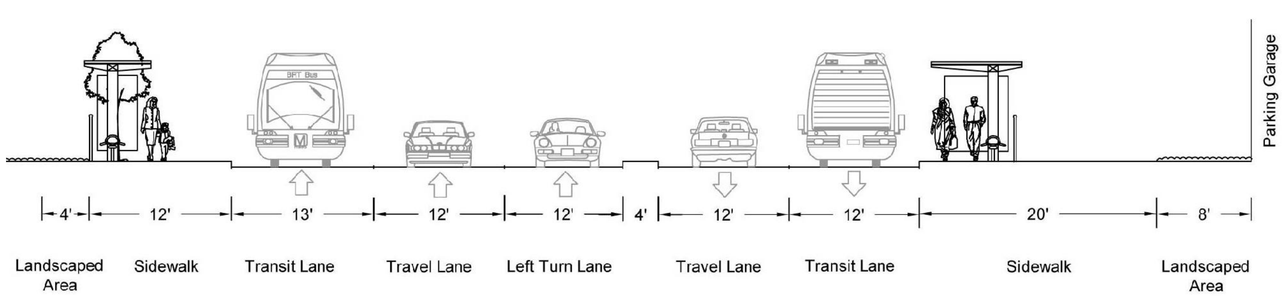
Looking west along Riverplace Boulevard between Flagler Avenue and Wharfside Way




**Existing Conditions (Peak Period)**

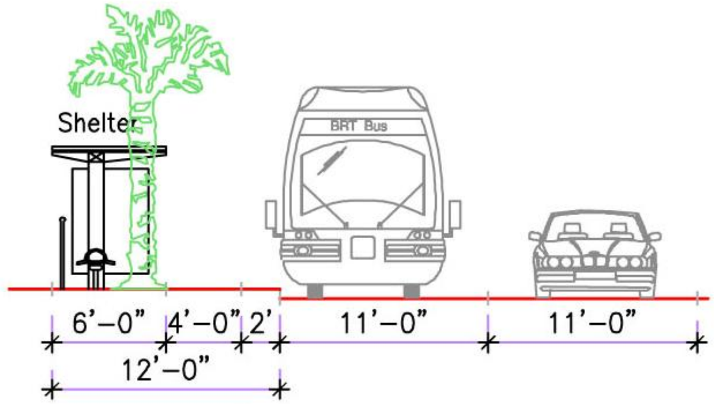



**Proposed Conditions at Mid-block (Peak Period)**

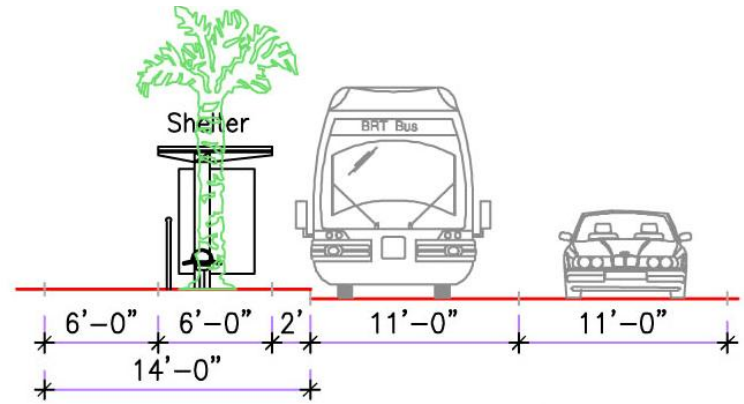



**Proposed Conditions at Super Stop (Peak Period)**

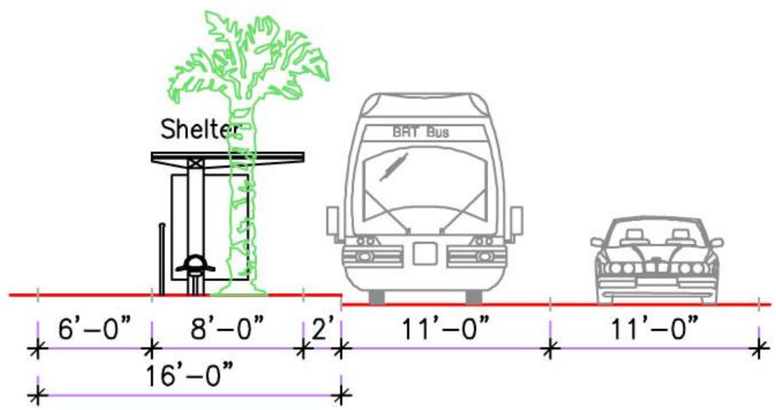
**Downtown BRT Enhancement Project - Jacksonville**
***(Jacksonville Rapid Transit System Phase One: Environmental Assessment)***




Typical Section at Super Stop
Existing Sidewalk 12' to 14'

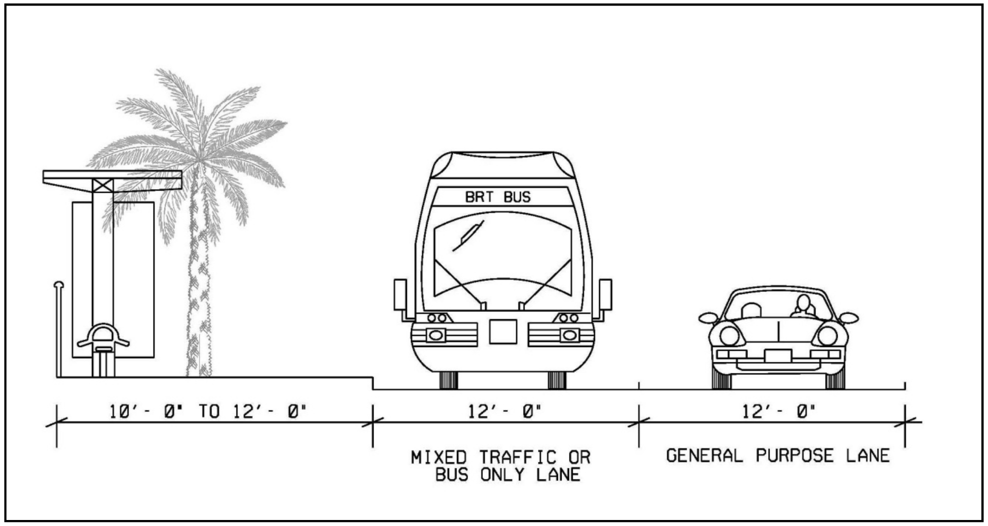



Typical Section at Super Stop
Existing Sidewalk 14' to 16'

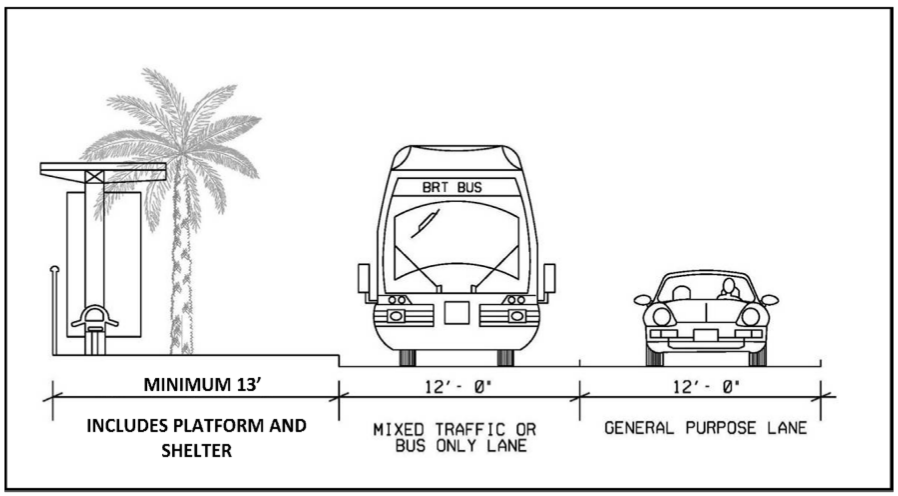



Typical Section at Super Stop
Existing Sidewalk 16' and Greater

**Downtown BRT Enhancement Project - Jacksonville**
***(Jacksonville Rapid Transit System Phase One: Environmental Assessment)***

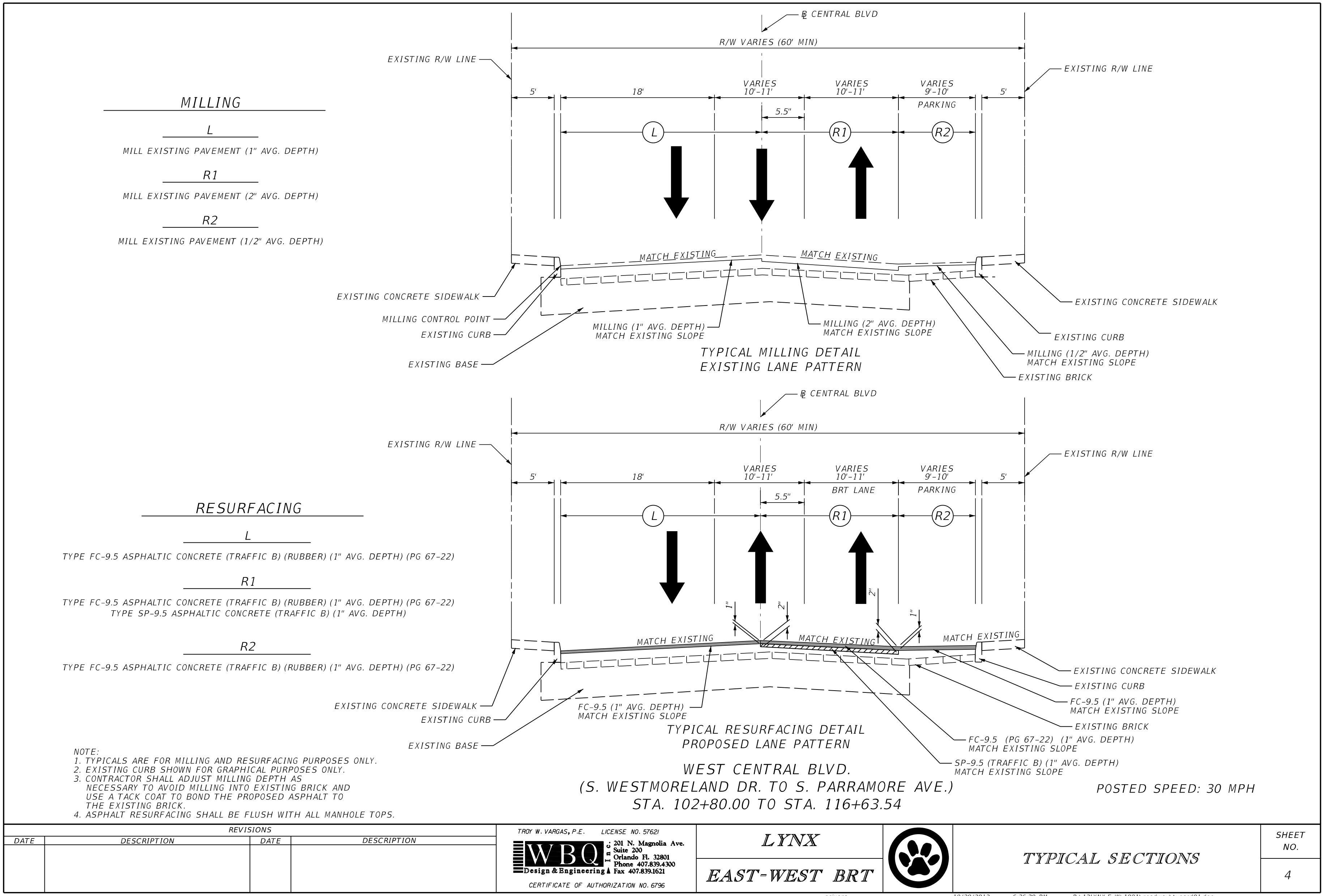



**North Corridor BRT - Jacksonville *(Bus Rapid Transit North Corridor Final Environmental Assessment)***

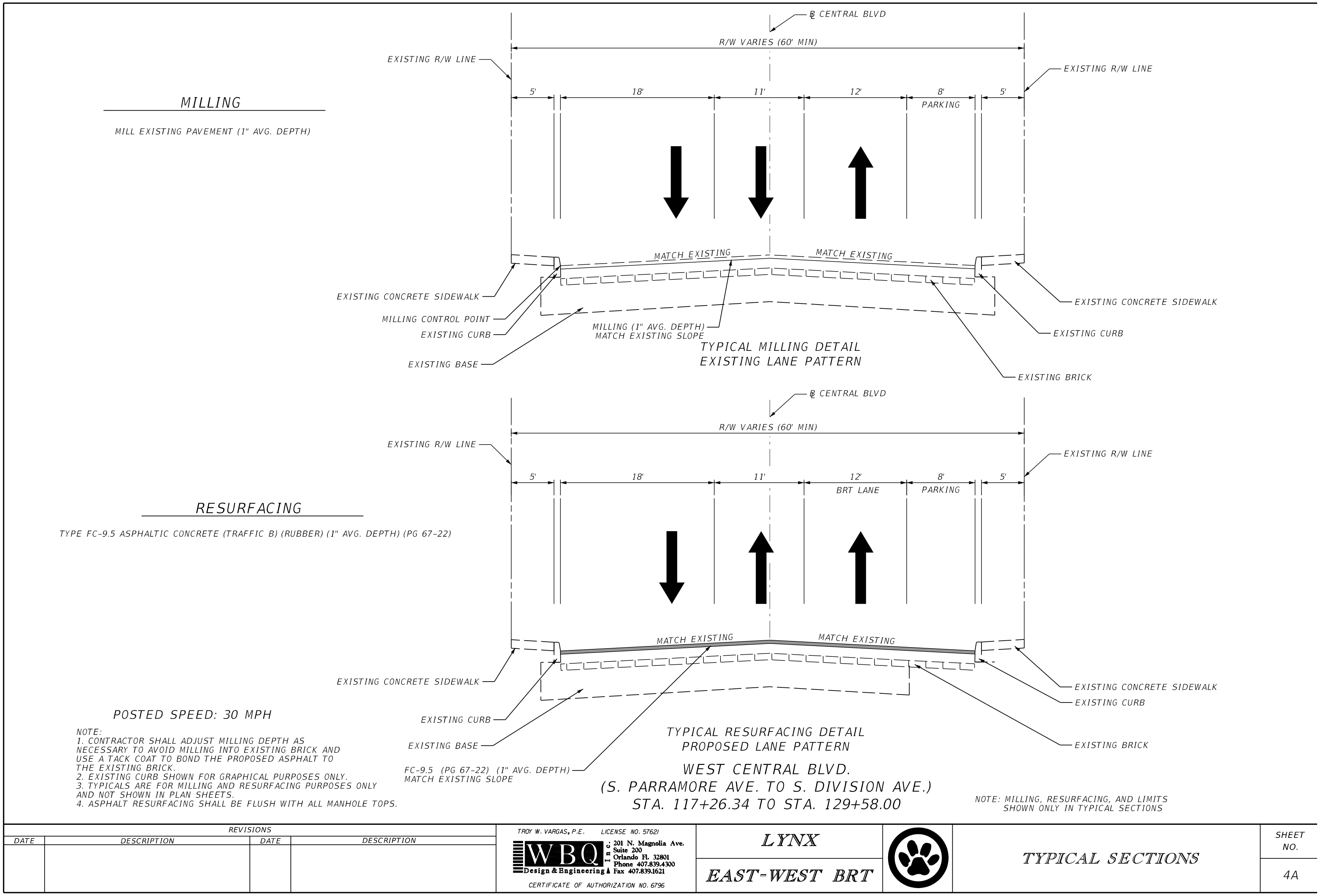



Park-n-ride or kiss-n-ride locations are proposed at Station 3 (J. Turner Butler Boulevard), Station 5 (Avenues Walk), and Avenues Mall (Station 6). Further examination of park-n-ride/kiss-n-ride locations are discussed in Section 3.3.

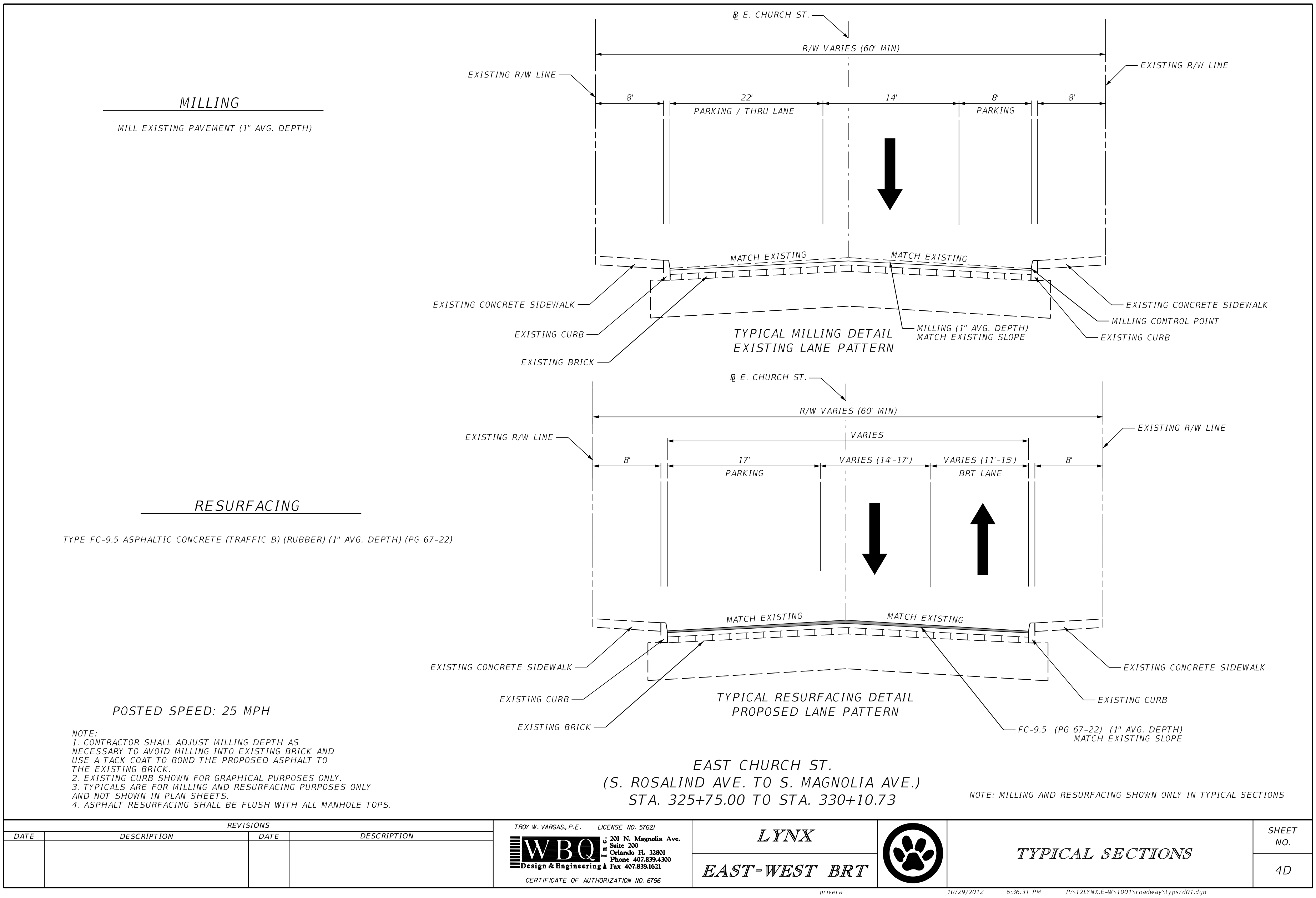
**Southeast Corridor BRT - Jacksonville *(Bus Rapid Transit North Corridor Final Environmental Assessment)***



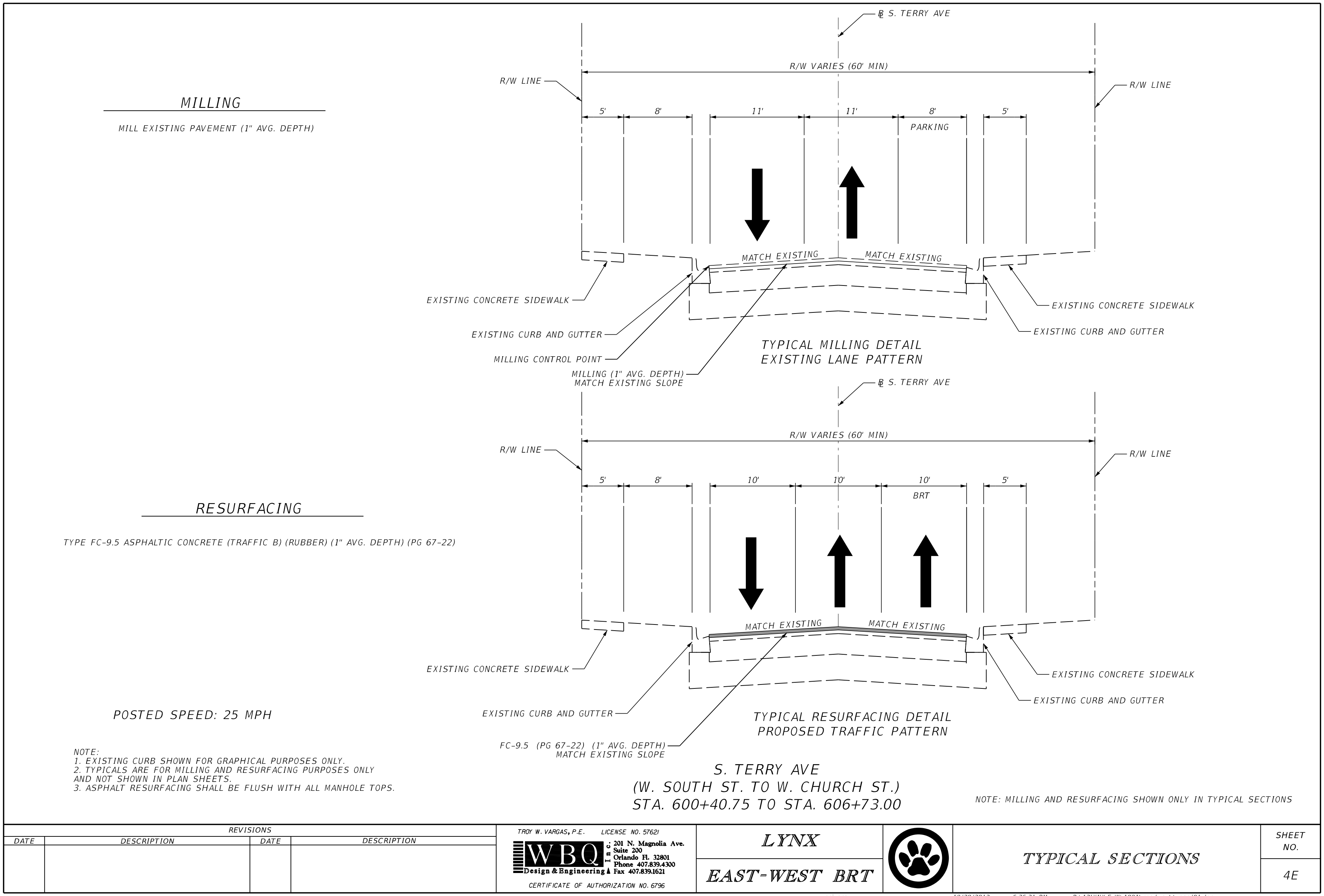

**Lymmo East-West - Orlando**




**Lymmo East-West - Orlando**




**Lymmo East-West - Orlando**

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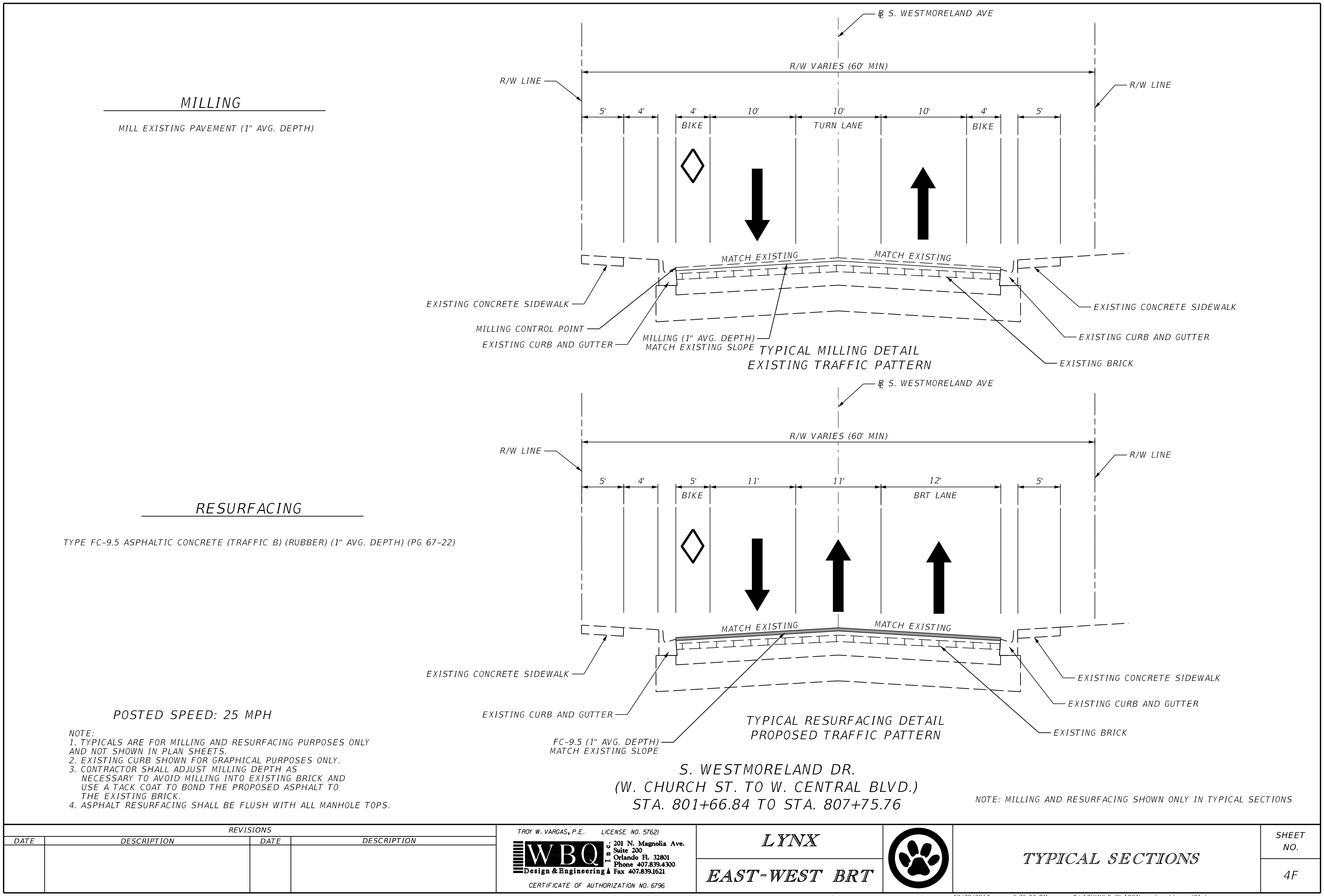
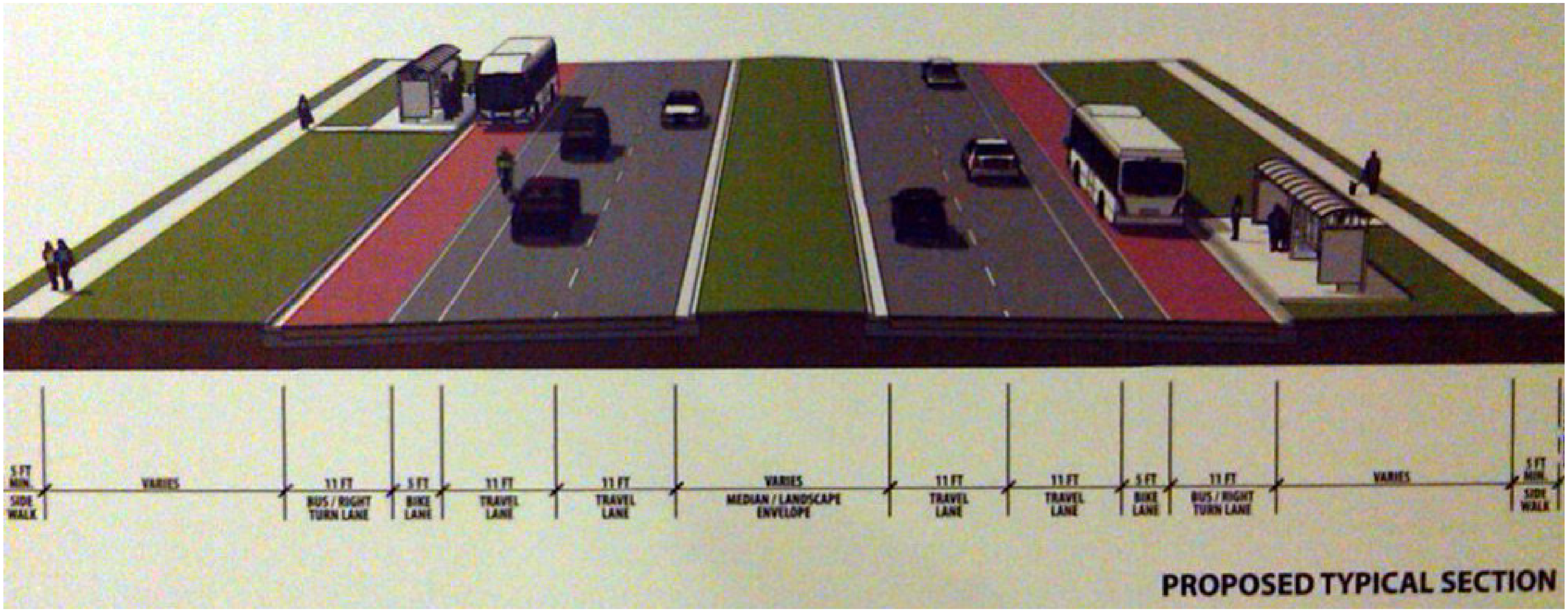
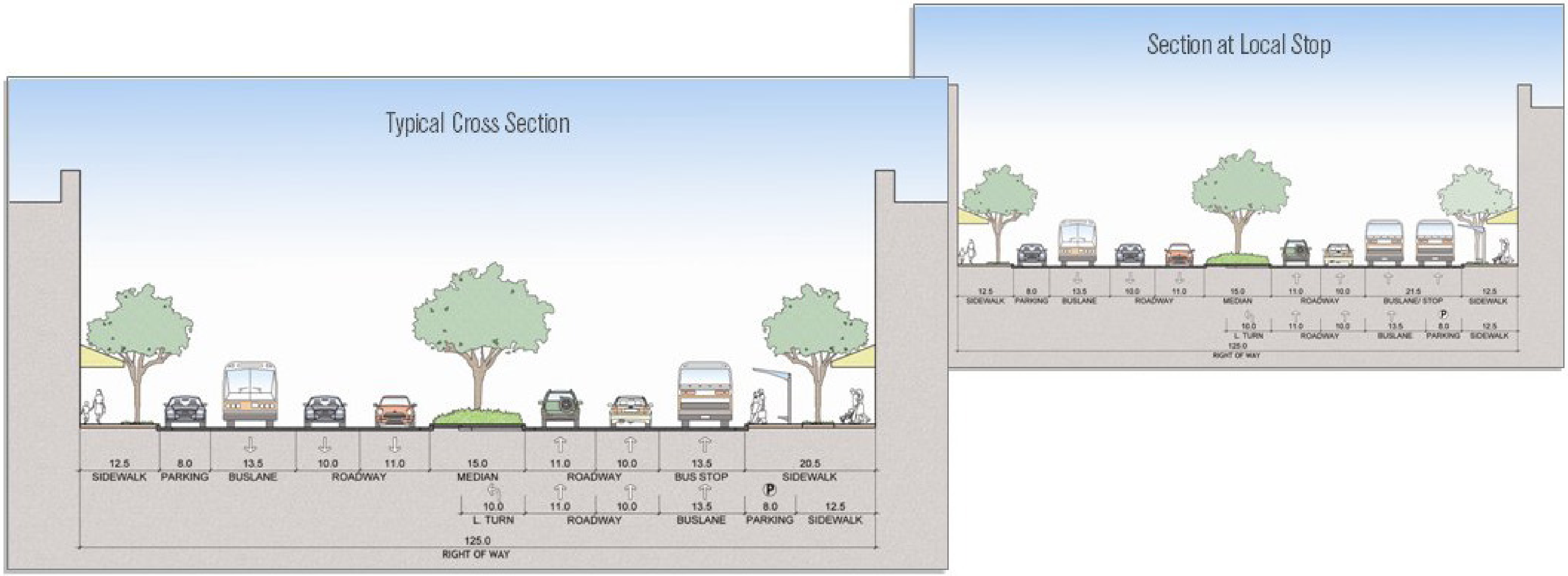


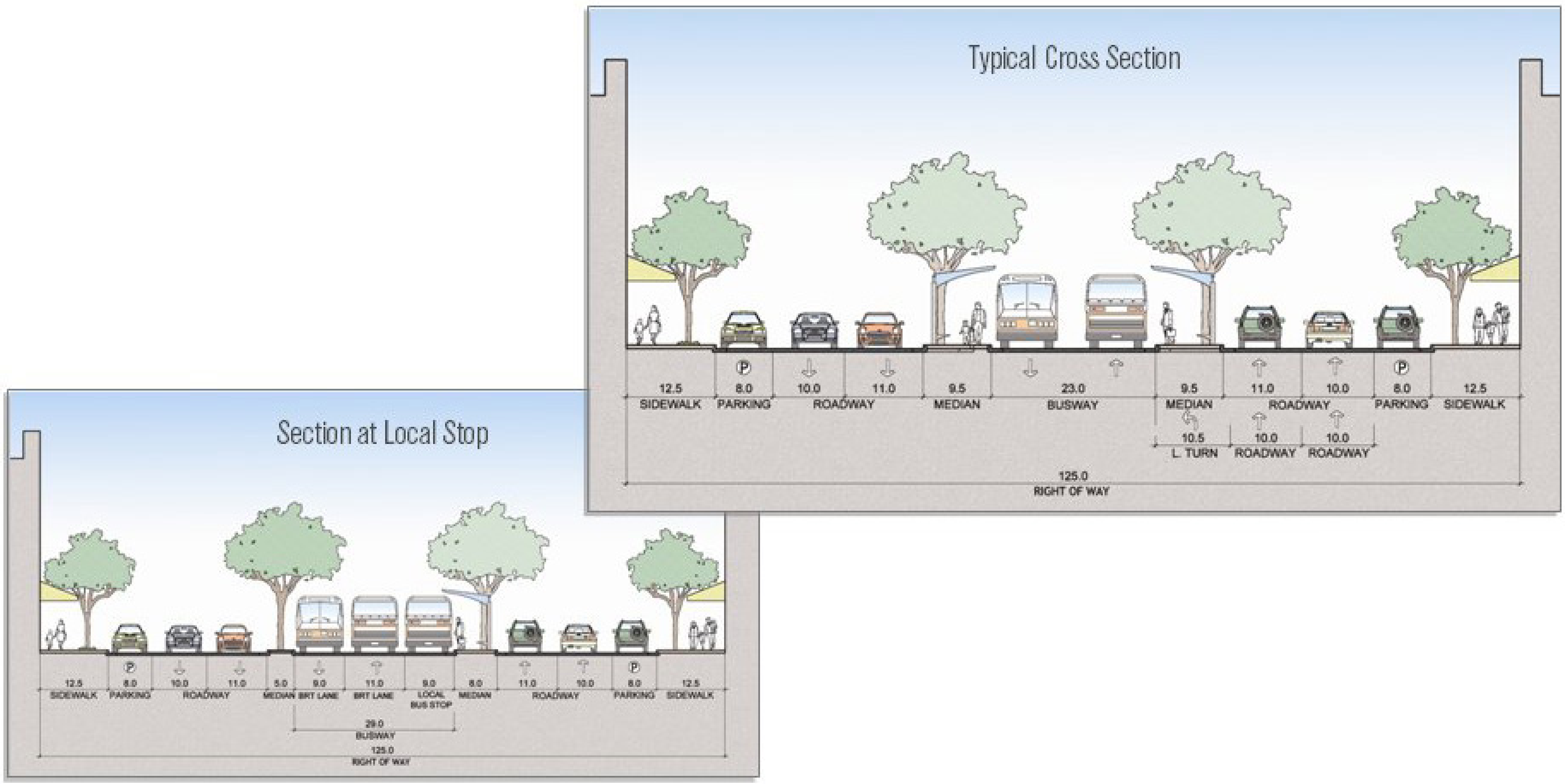

**Lymmo East-West - Orlando**



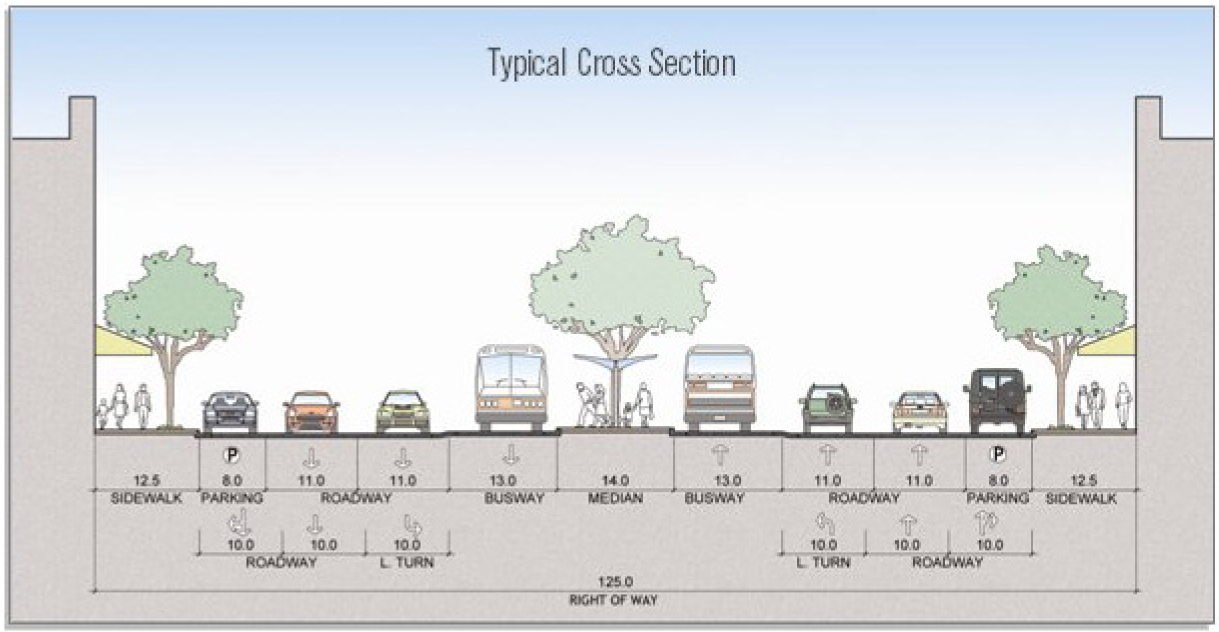

**International Drive - Orlando**




**Example BRT Concept *(Geary Corridor BRT Study)***



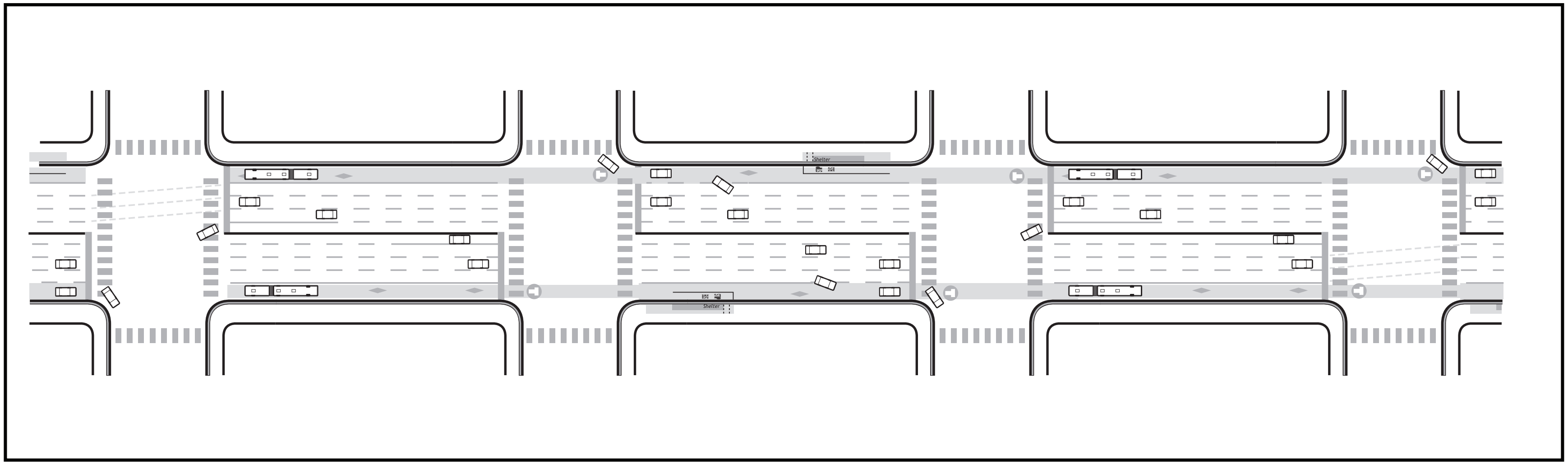

**Example BRT Concept** ***(Geary Corridor BRT Study)***



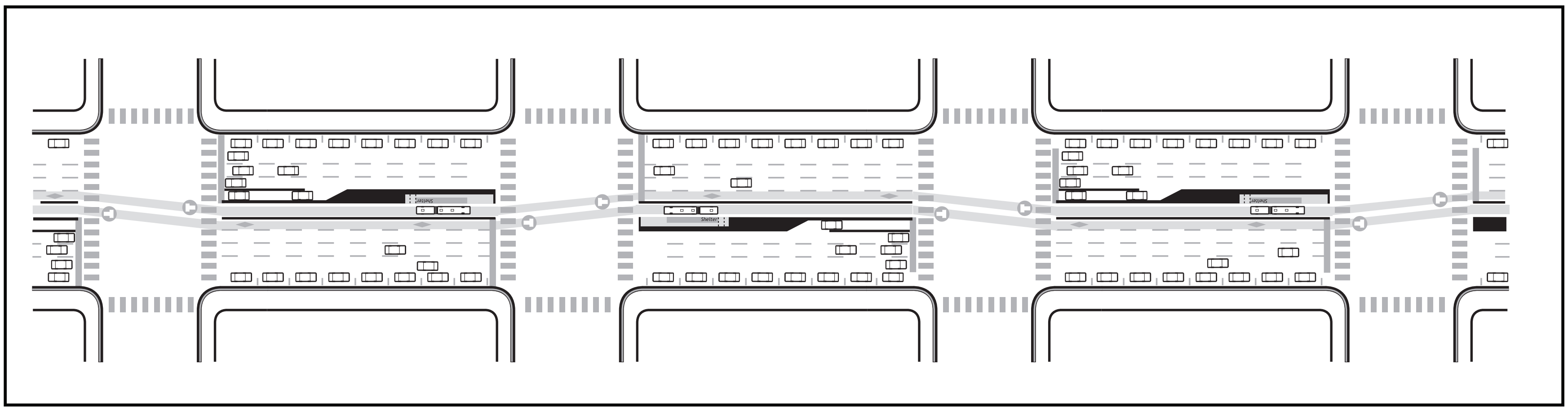

**Example BRT Concept *(Geary Corridor BRT Study)***

# APPENDIX B

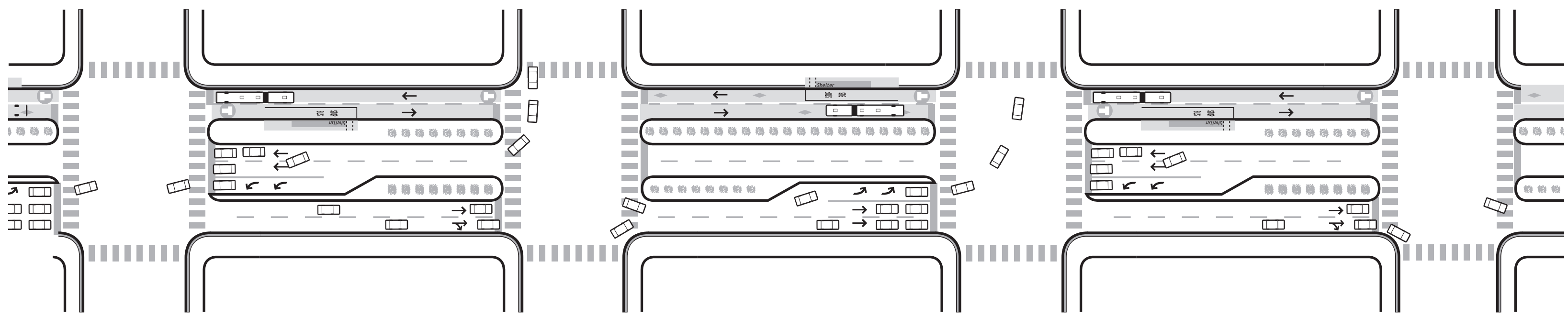
## STATION LOCATION/LAYOUT AND INTERSECTION EXAMPLES



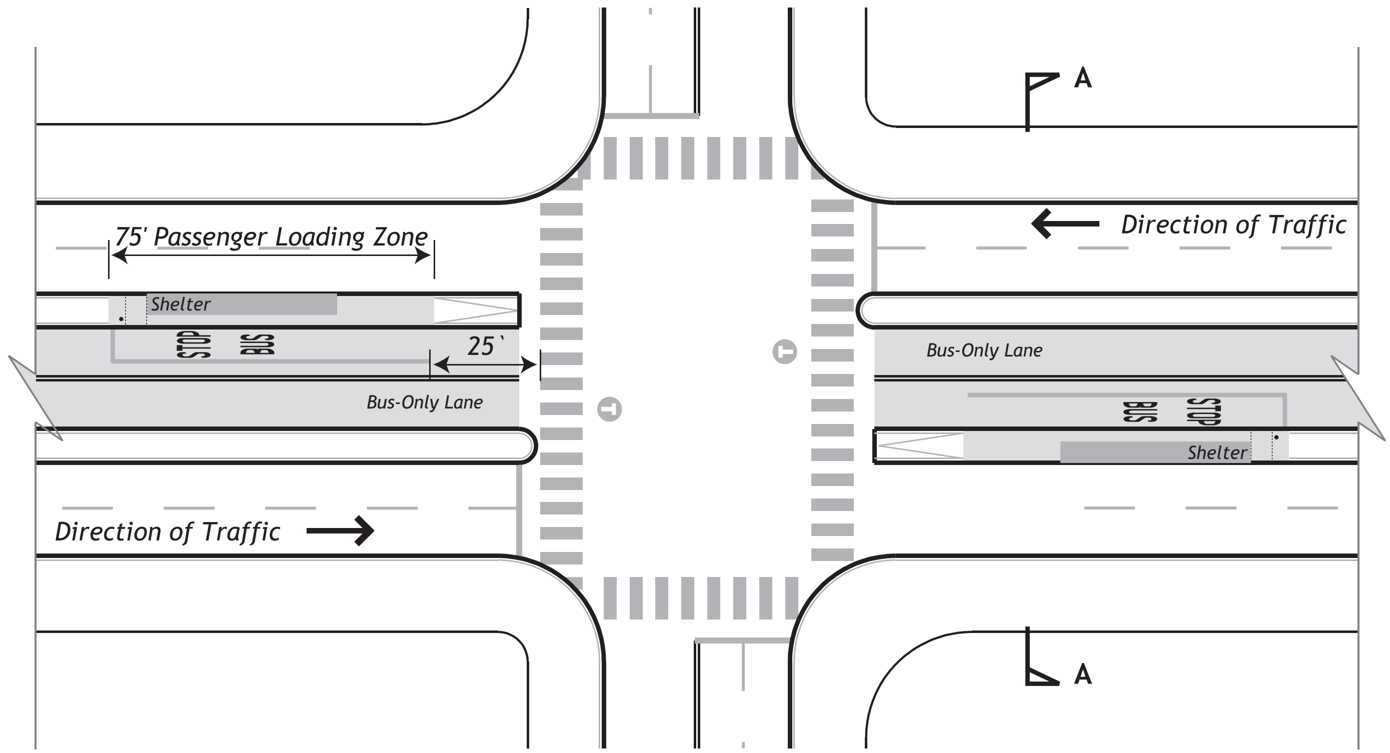
**Corridor Bus Lane Concept (Santa Clara VTA *Bus Rapid Transit Service Design Guidelines*)**



**Corridor Bus Lane Concept (Santa Clara VTA *Bus Rapid Transit Service Design Guidelines*)**

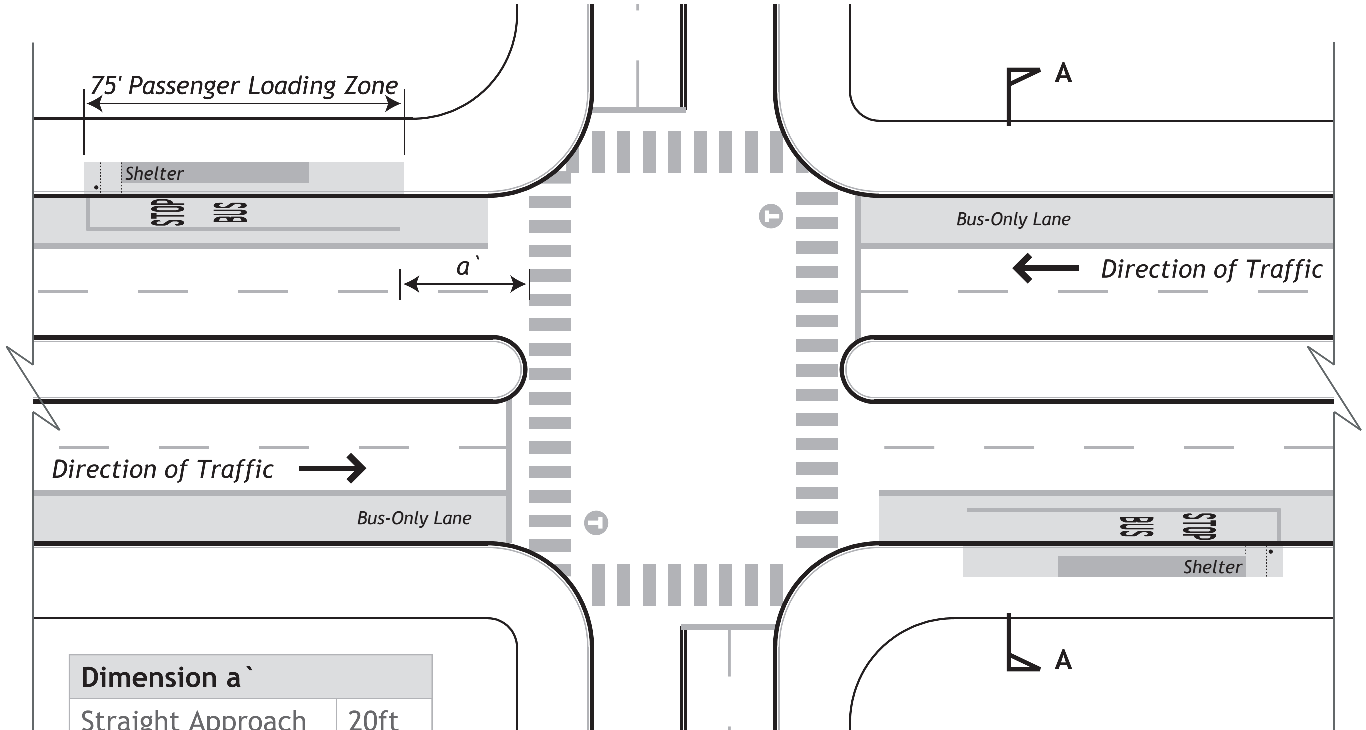


**Corridor Bus Lane Concept (Santa Clara VTA *Bus Rapid Transit Service Design Guidelines*)**




*Notes:*
*1.) For the layout and details of the passenger loading zone, refer to Figure X.*
*2.) A 75′ loading zone is sufficient for a standard (40′) or an articulated (60′) bus.*
*3.) A 55’ loading zone is sufficient for a standard (40′) bus.*
*4.) A 120’ loading zone is sufficient for serving two standard buses simultaneously.*
*5.) A 140’ loading zone is sufficient for serving a standard and an articulated bus simultaneously.*

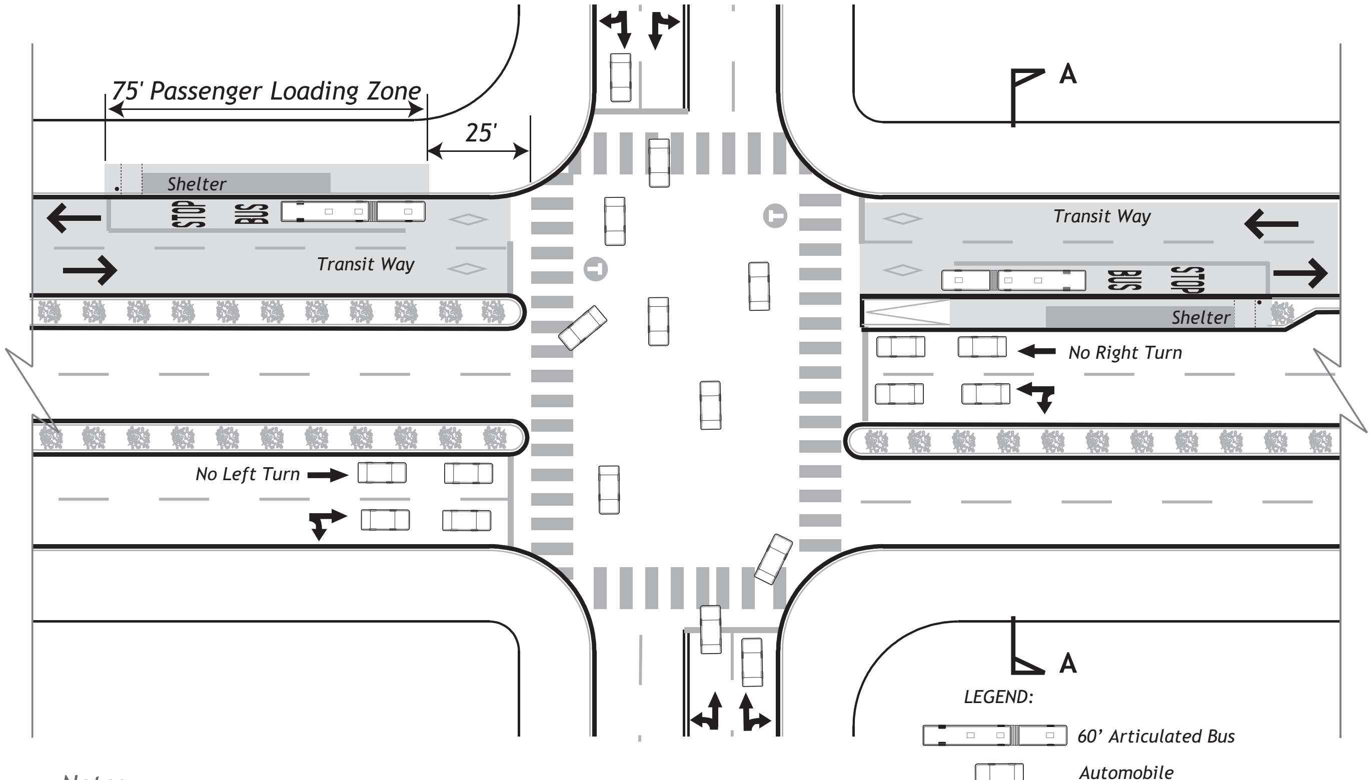
**Example BRT Station (Santa Clara VTA *Bus Rapid Transit Service Design Guidelines*)**




| Dimension a` | |
|---|---|
| Straight Approach | 20ft |
| After Right Turn | 75ft |
| After Left Turn | 50ft |

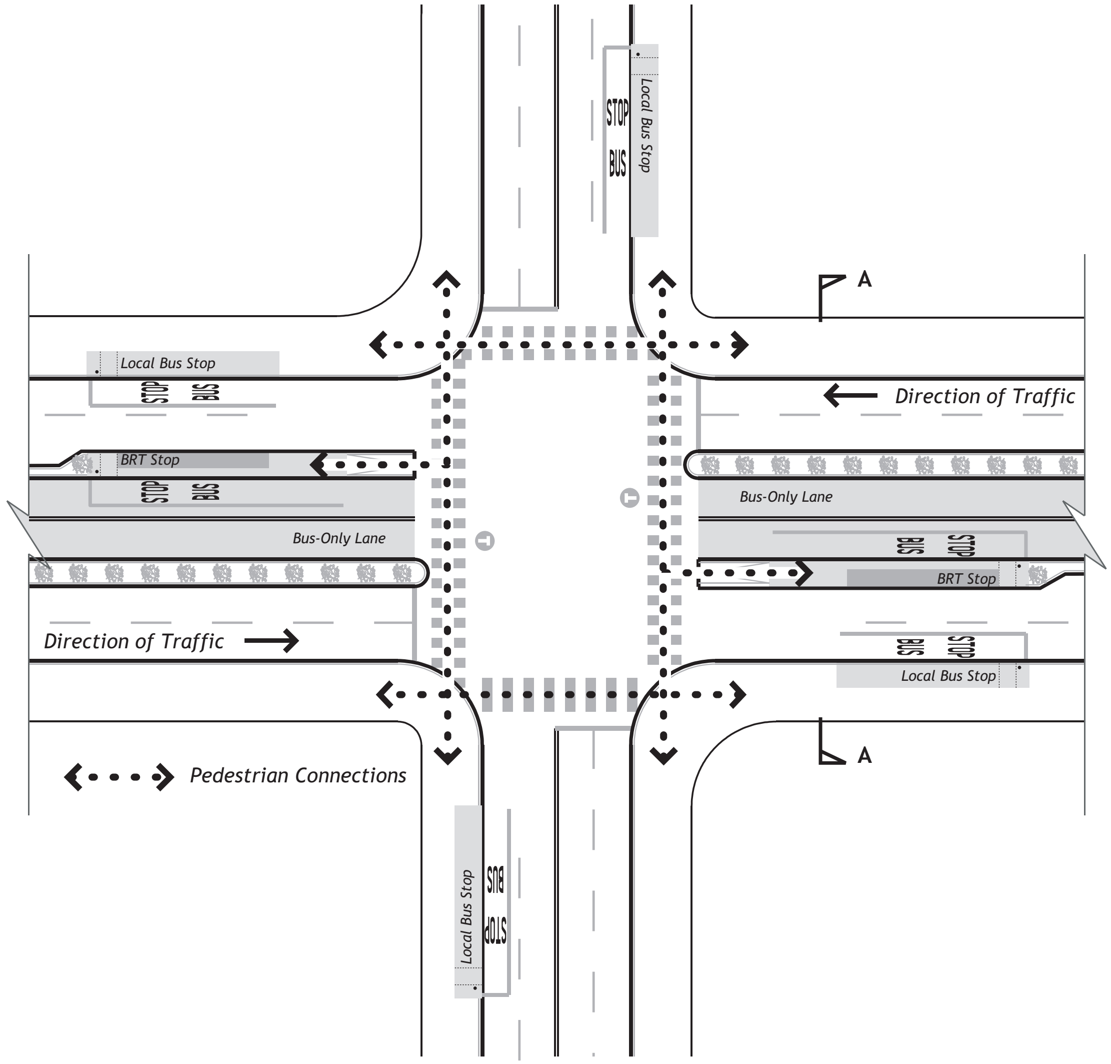
*Notes:*
*1.) For the layout and details of the passenger loading zone, refer to Figure 8.*
*2.) A 75′ loading zone is sufficient for a standard (40′) or an articulated (60′) bus.*
*3.) A 55’ loading zone is sufficient for a standard (40′) bus.*
*4.) A 120’ loading zone is sufficient for serving two standard buses simultaneously.*
*5.) A 140’ loading zone is sufficient for serving a standard and an articulated bus simultaneously.*
*6.) If a BRT station is on a bulbout, the minimum taper length is 50’ after the station.*

**Example BRT Station (Santa Clara VTA *Bus Rapid Transit Service Design Guidelines*)**

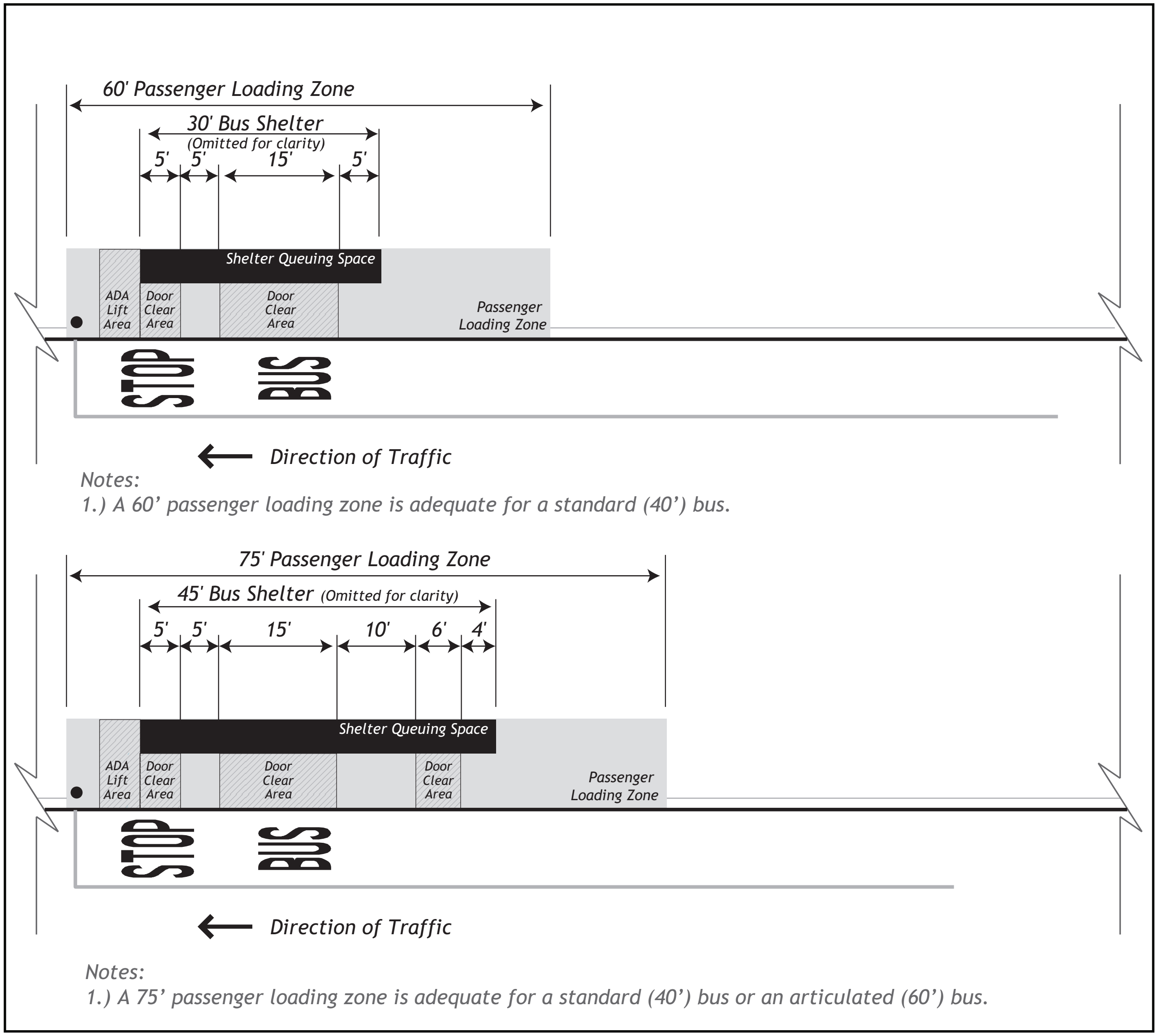



*Notes:*
*1.) At-grade transitways are fully segregated from mixed traffic flows except at intersections and the entrance/exit to the transitway.*
*2.) In this scenario, only north-south traffic movements are permitted to cross the transitway to shorten delay. Prohibited turning movements in this scenario can also be permitted, although this will further delay buses.*
*3.) For the layout and details of the passenger loading zone, refer to Figure 8.*
*4.) A 75' loading zone is sufficient for a standard (40') or an articulated (60') bus.*
*5.) A 55' loading zone is sufficient for a standard (40') bus.*
*6.) A 120' loading zone is sufficient for serving two standard buses simultaneously.*
*7.) A 140' loading zone is sufficient for serving a standard and an articulated bus simultaneously.*

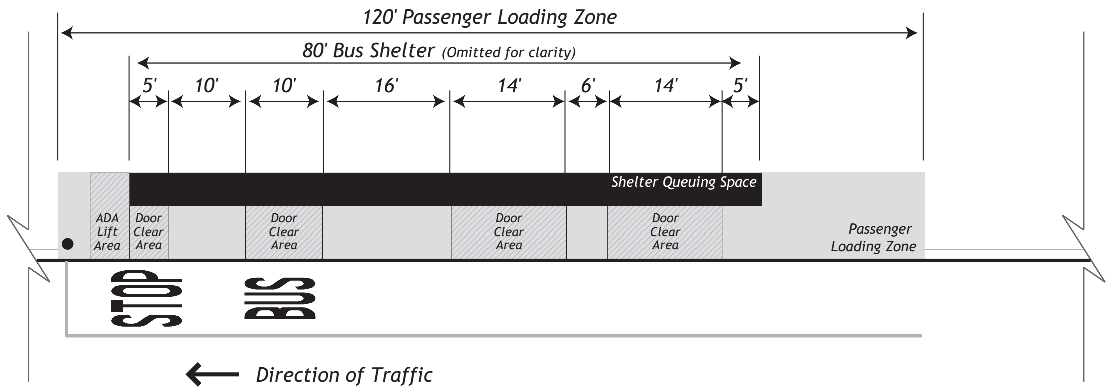
**Example BRT Station (Santa Clara VTA *Bus Rapid Transit Service Design Guidelines*)**



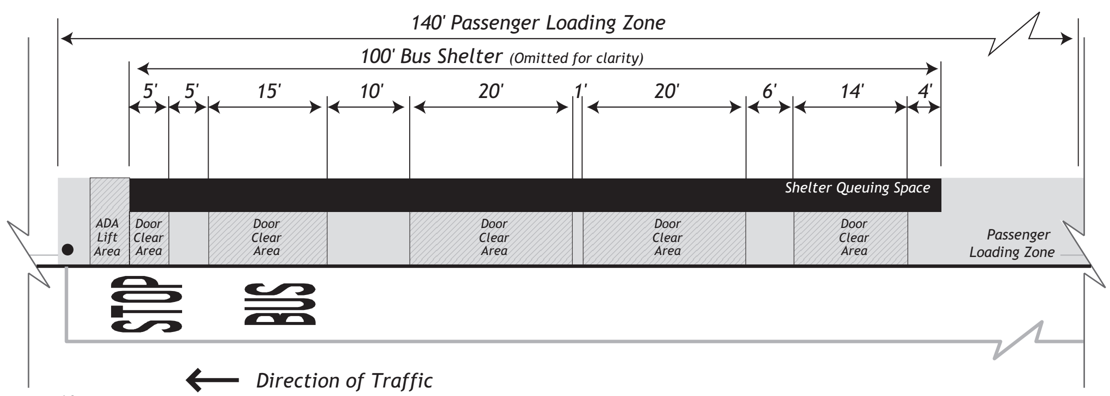

**Example BRT Station (Santa Clara VTA *Bus Rapid Transit Service Design Guidelines*)**




**Example Station Concept (Santa Clara VTA *Bus Rapid Transit Service Design Guidelines*)**

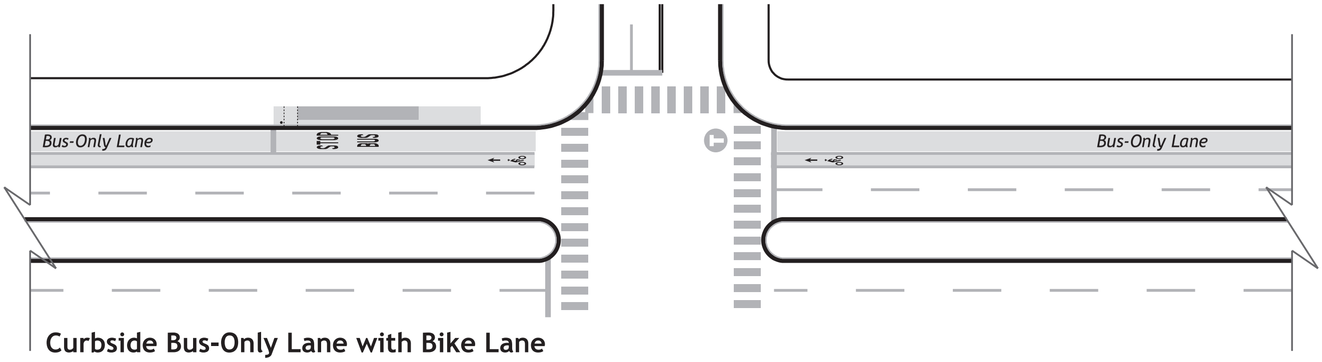



Notes:
1.) A 120' passenger loading zone is adequate for a standard (40') bus and a standard (40') bus.
2.) For simultaneous arrivals, this configuration assumes that the rear bus will not depart until after the front bus, with a 5' gap between the front and rear buses. If buses have bicycle racks, this is 9'.
3.) If the rear bus is permitted to leave prior to the departure of the front bus, the pull-out distance between the two buses will vary according to the width of the lane it is entering.

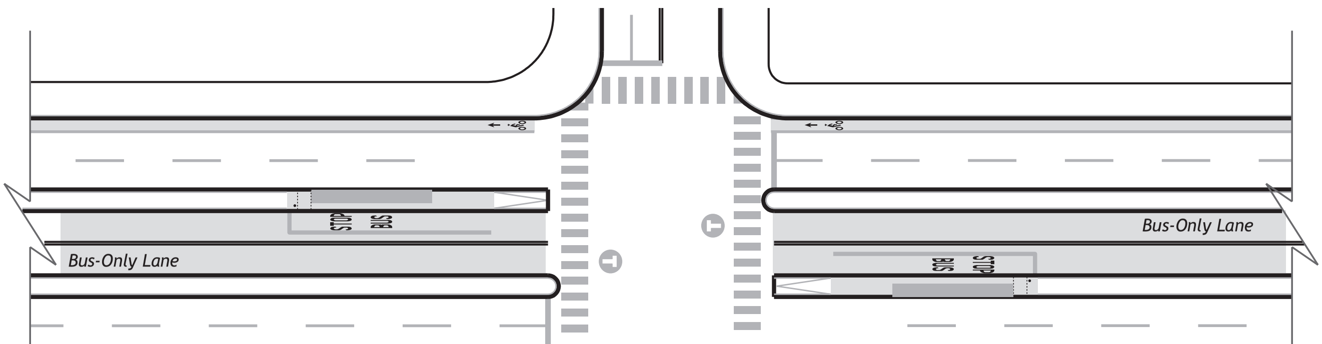



Notes:
1.) A 140' passenger loading zone is adequate for an articulated (60') and a standard (40') bus.
2.) For simultaneous arrivals, this configuration assumes that the rear bus will not depart until after the front bus, with a 5' gap between the front and rear buses. If buses have bicycle racks, this is 9'.
3.) If the rear bus is permitted to leave prior to the departure of the front bus, the pull-out distance between the two buses will vary according to the width of the lane it is entering.

**Example Station Concept (Santa Clara VTA *Bus Rapid Transit Service Design Guidelines*)**

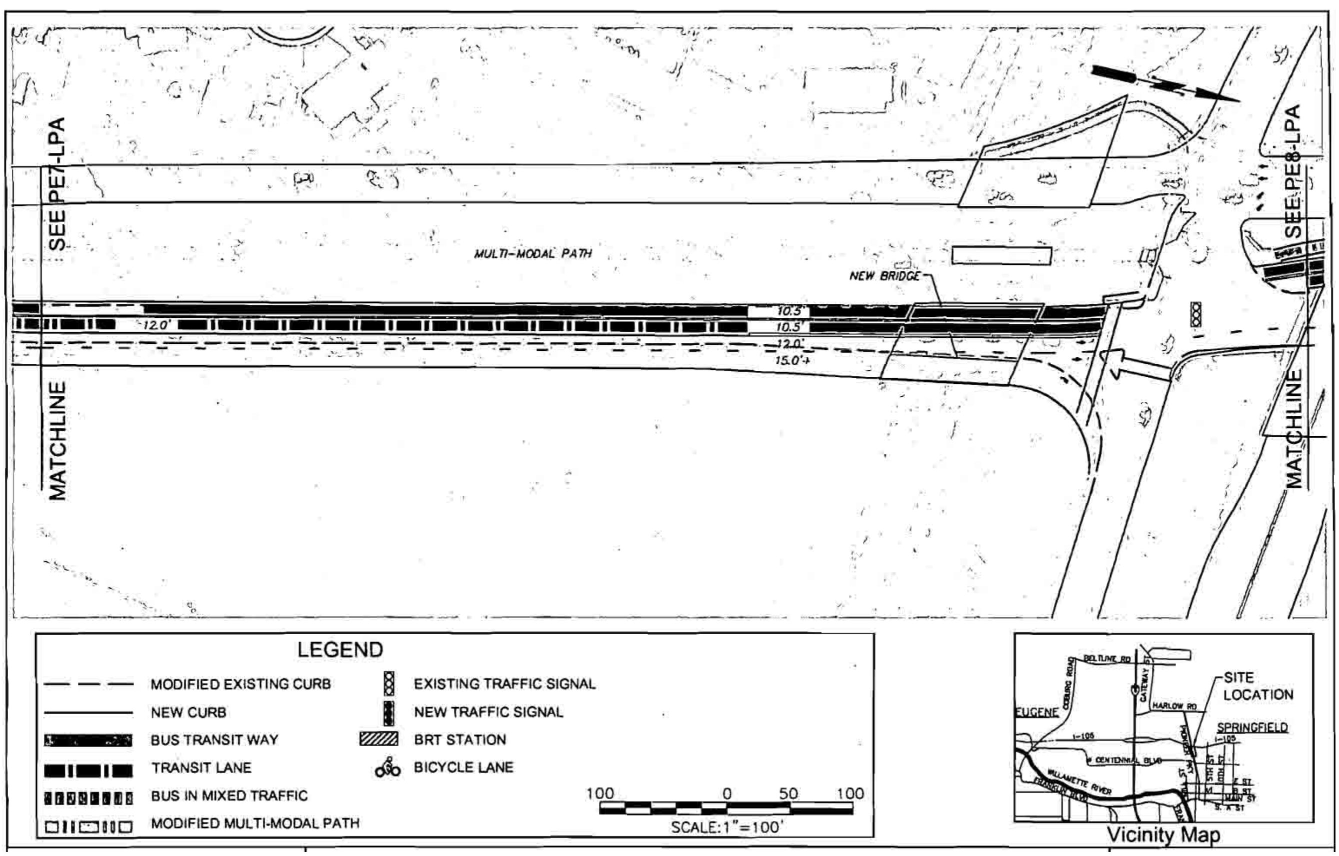



Curbside Bus-Only Lane with Bike Lane

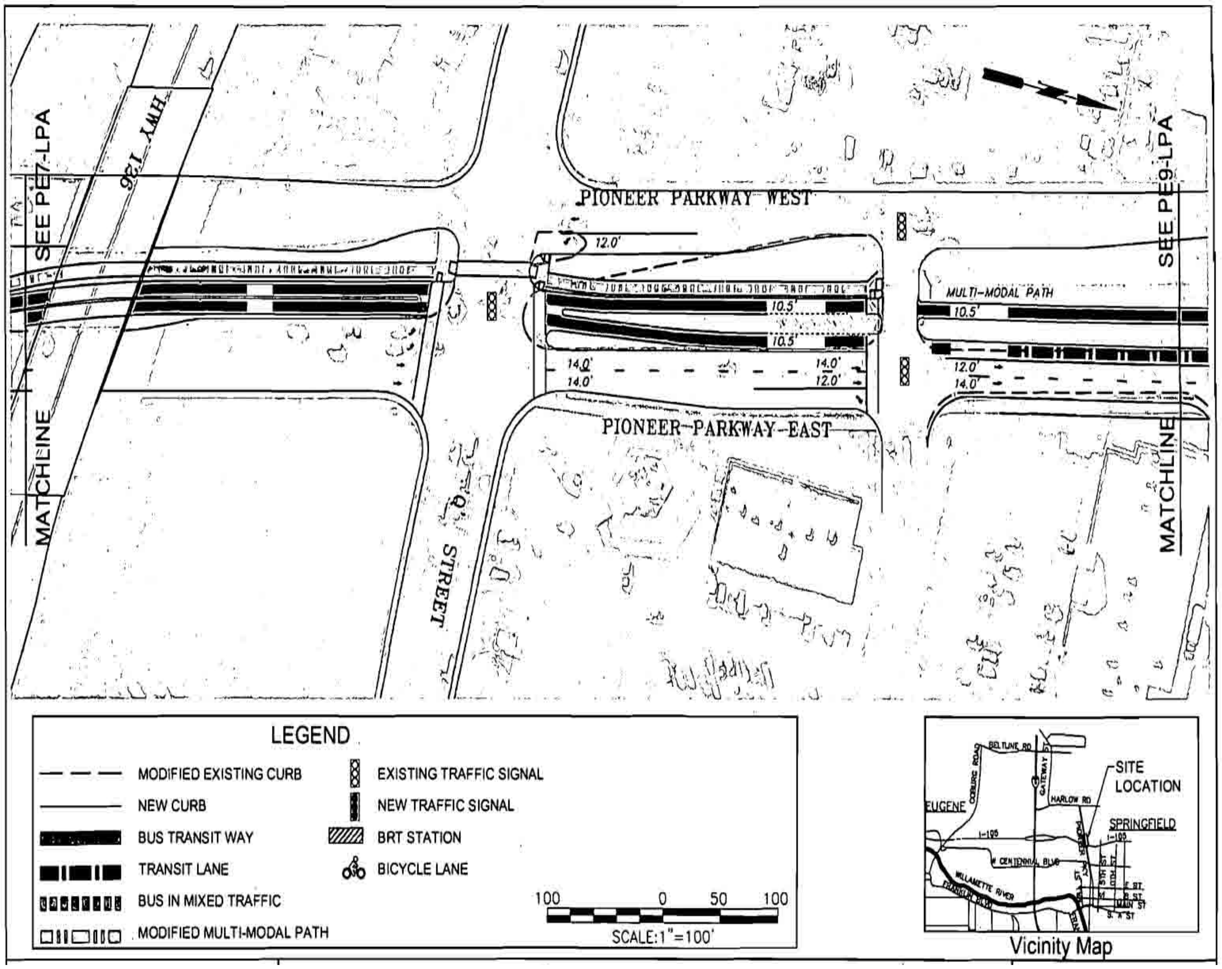



Median Bus-Only Lane with Bike Lane

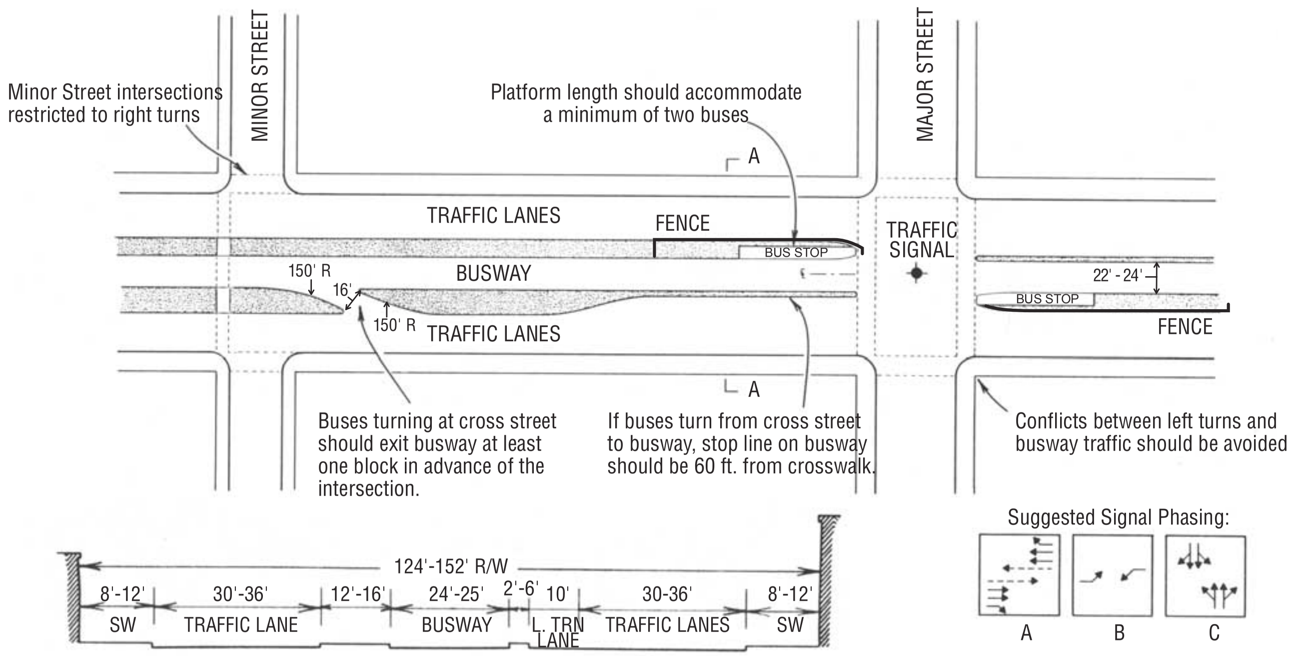
**Bike Lane Concepts (Santa Clara VTA *Bus Rapid Transit Service Design Guidelines*)**




**EmX Intersection Concept - Pioneer Parkway**
***(Bus Rapid Transit System Improvements for the Pioneer Parkway Corridor - Springfield, OR***

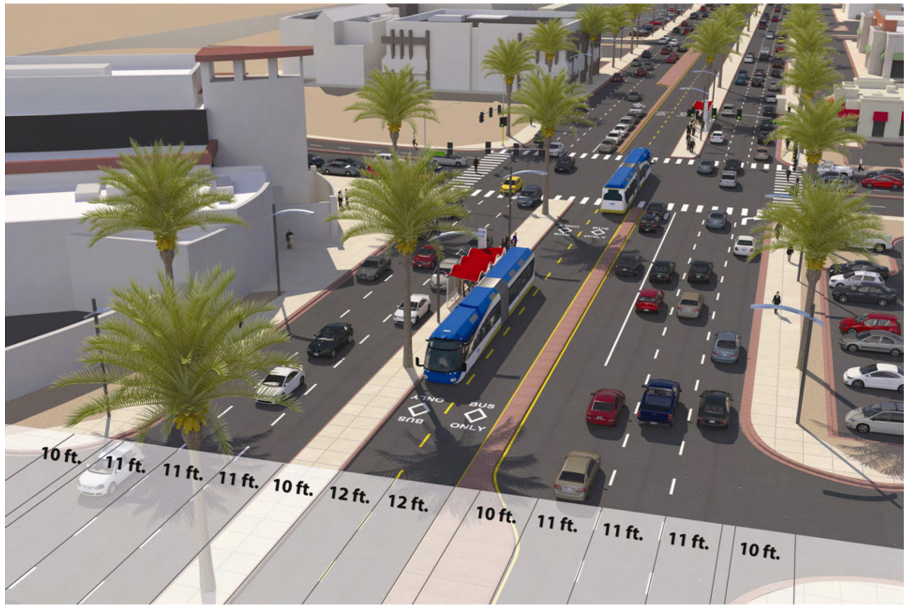



**EmX Intersection Concept - Pioneer Parkway**
***(Bus Rapid Transit System Improvements for the Pioneer Parkway Corridor - Springfield, OR***



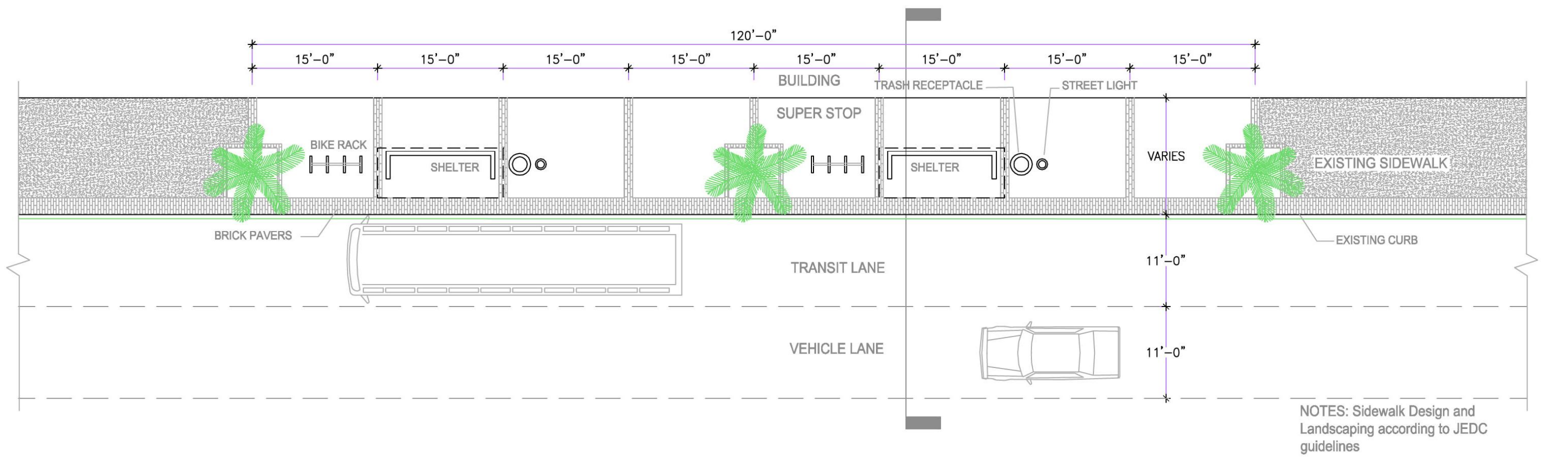

(SOURCE: Adapted from Levinson et al., 1975)

**Sample Cross Section (TCRP Report 90, *Bus Rapid Transit, Volume 2: Implementation Guidelines***



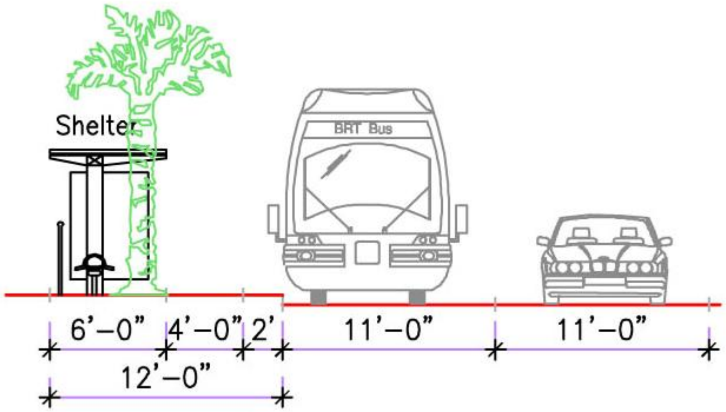

**Flamingo Road BRT Concept - Alternative 1** ***(Flamingo Road Corridor Study)***


**Flamingo Road BRT Concept - Alternative 2** ***(Flamingo Road Corridor Study)***

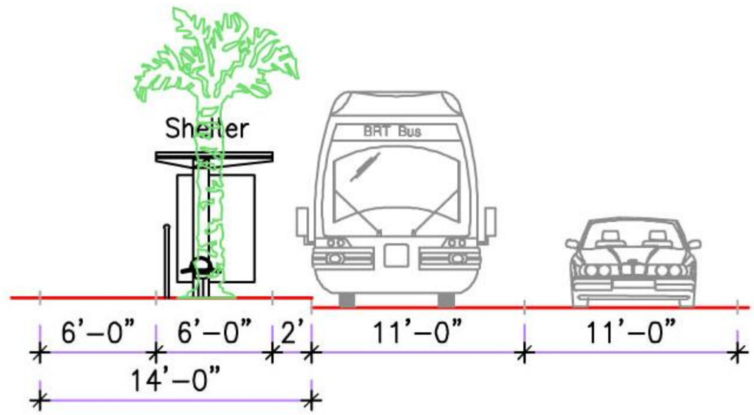



**TYPICAL SUPER STOP CONFIGURATION**
**(Layout along existing sidewalk; similar layout applies to curb extension)**

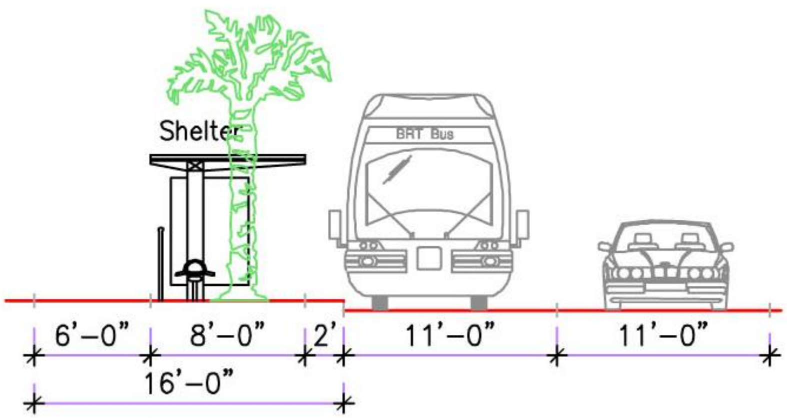
**Downtown BRT Enhancement Project Super Stop - Jacksonville**



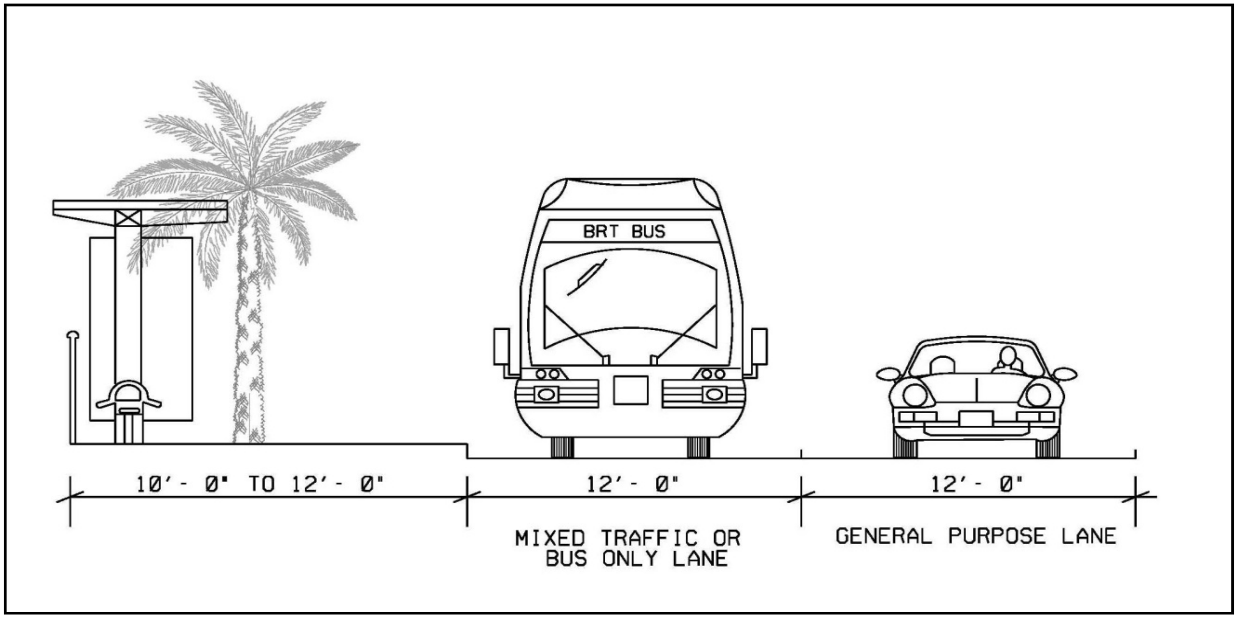

Typical Section at Super Stop
Existing Sidewalk 12' to 14'



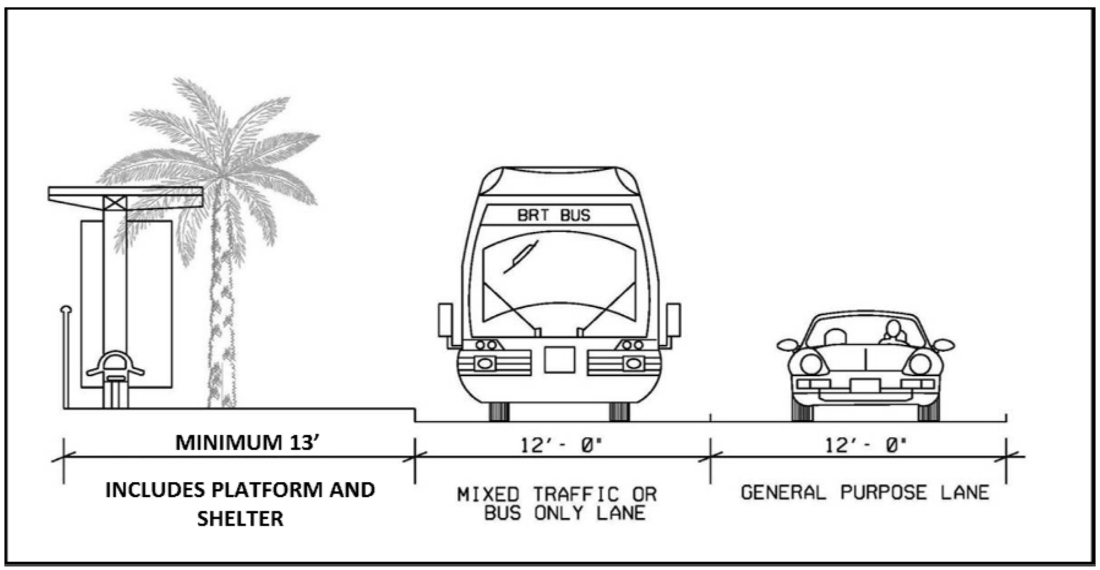

Typical Section at Super Stop
Existing Sidewalk 14' to 16'




Typical Section at Super Stop
Existing Sidewalk 16' and Greater

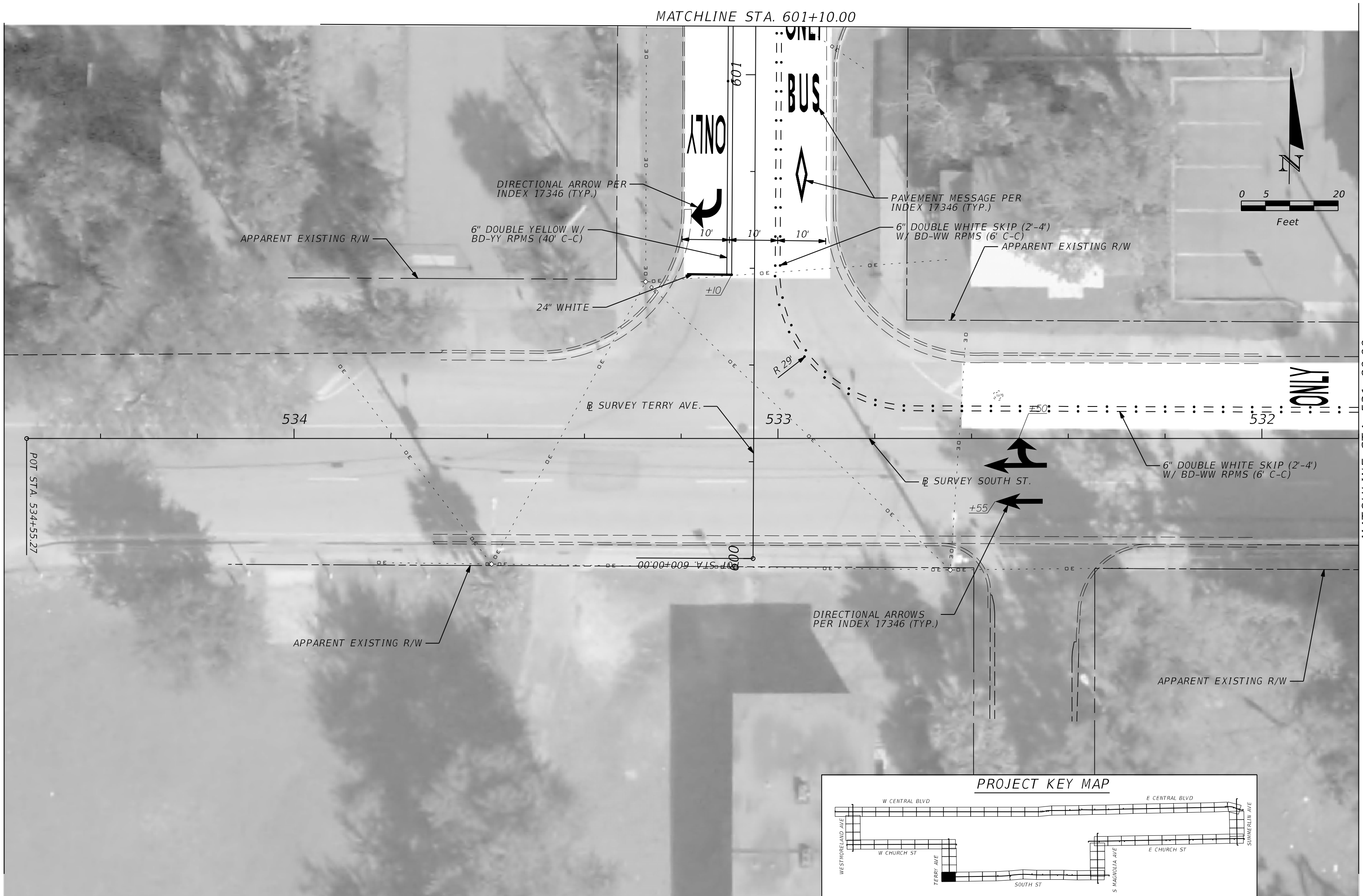



**North Corridor BRT Station - Jacksonville**




Park-n-ride or kiss-n-ride locations are proposed at Station 3 (J. Turner Butler Boulevard), Station 5 (Avenues Walk), and Avenues Mall (Station 6). Further examination of park-n-ride/kiss-n-ride locations are discussed in Section 3.3.

**Southeast Corridor BRT Station - Jacksonville**




| REVISIONS | | | |
|---|---|---|---|
| DATE | DESCRIPTION | DATE | DESCRIPTION |
| | | | |

TROY W. VARGAS, P.E. LICENSE NO. 57621

WBQ Inc. Design & Engineering — 201 N. Magnolia Ave. Suite 200 Orlando Fl. 32801 Phone 407.839.4300 Fax 407.839.1621

CERTIFICATE OF AUTHORIZATION NO. 6796

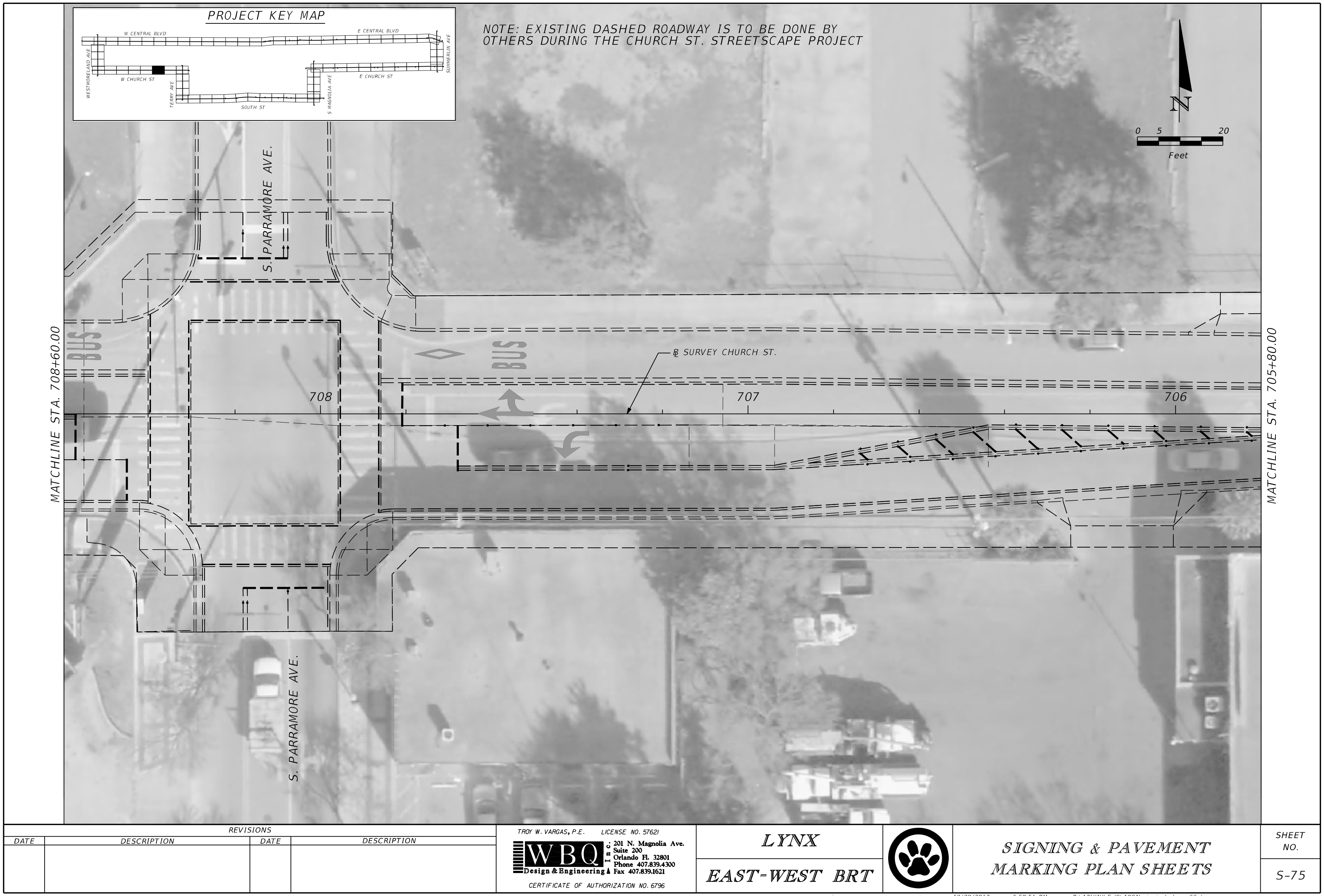
LYNX
EAST-WEST BRT

SIGNING & PAVEMENT MARKING PLAN SHEETS

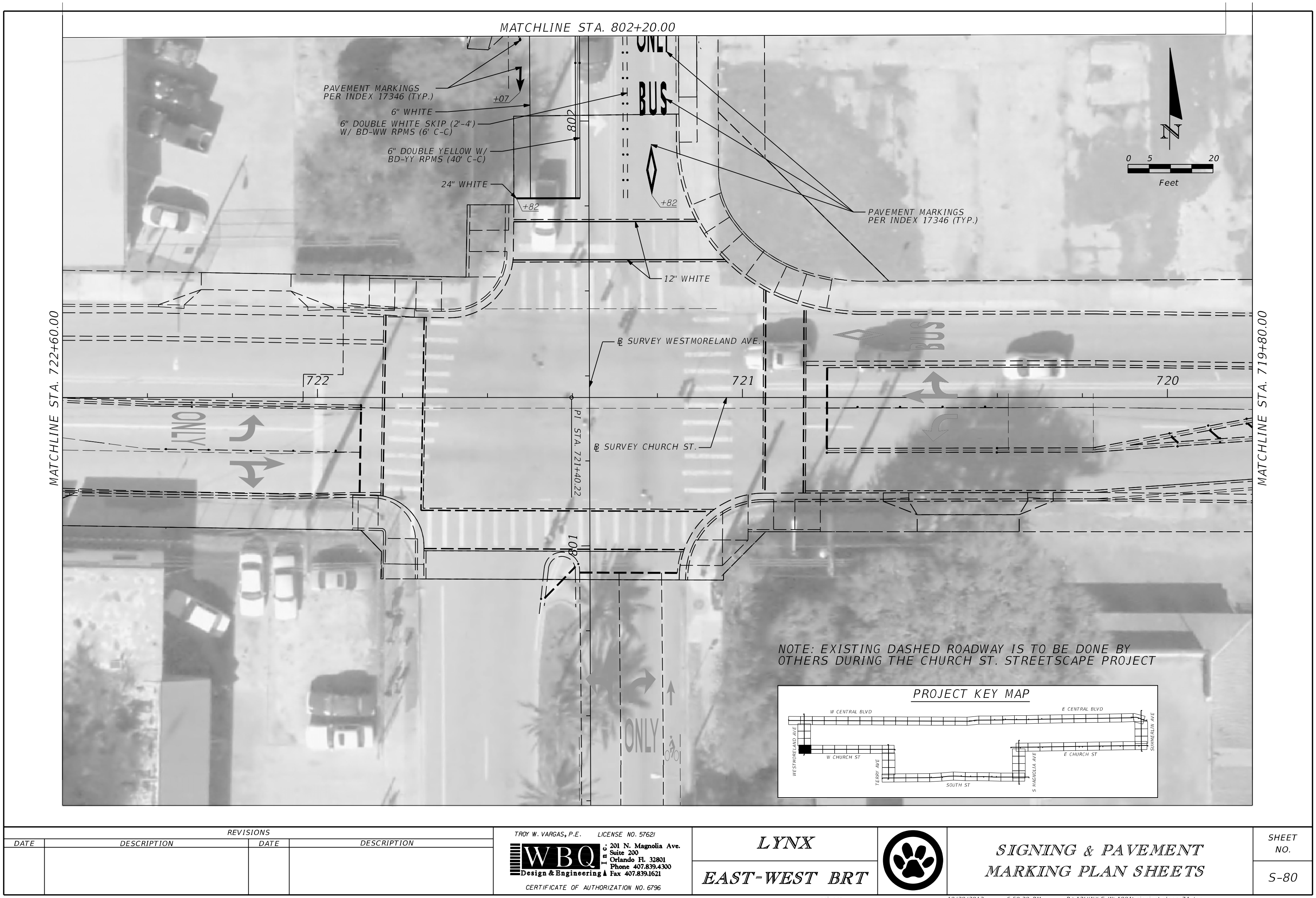
SHEET NO. S-69

privera 10/29/2012 6:58:08 PM P:\12LYNX.E-W\1001\signing\plansp60.dgn

**Lymmo East-West Concept - Orlando**

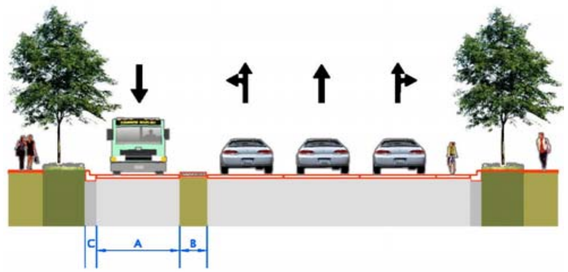



**Lymmo East-West Concept - Orlando**




**Lymmo East-West Concept - Orlando**

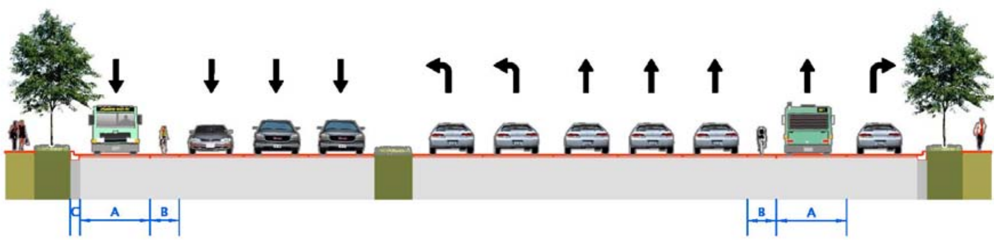
Contraflow Curbside Bus Lanes on a One-Way Street, Typical At-Station Section




| Designation | Description | Dimension (feet) | | Notes |
|---|---|---|---|---|
| | | Preferred | Constrained | |
| A | BRT/bus lane | 12 | 10.5 | |
| B | Separator | 4 | 0.5 | May be ripple paint stripe. |
| C | Curb and gutter | 2 | 2 | |

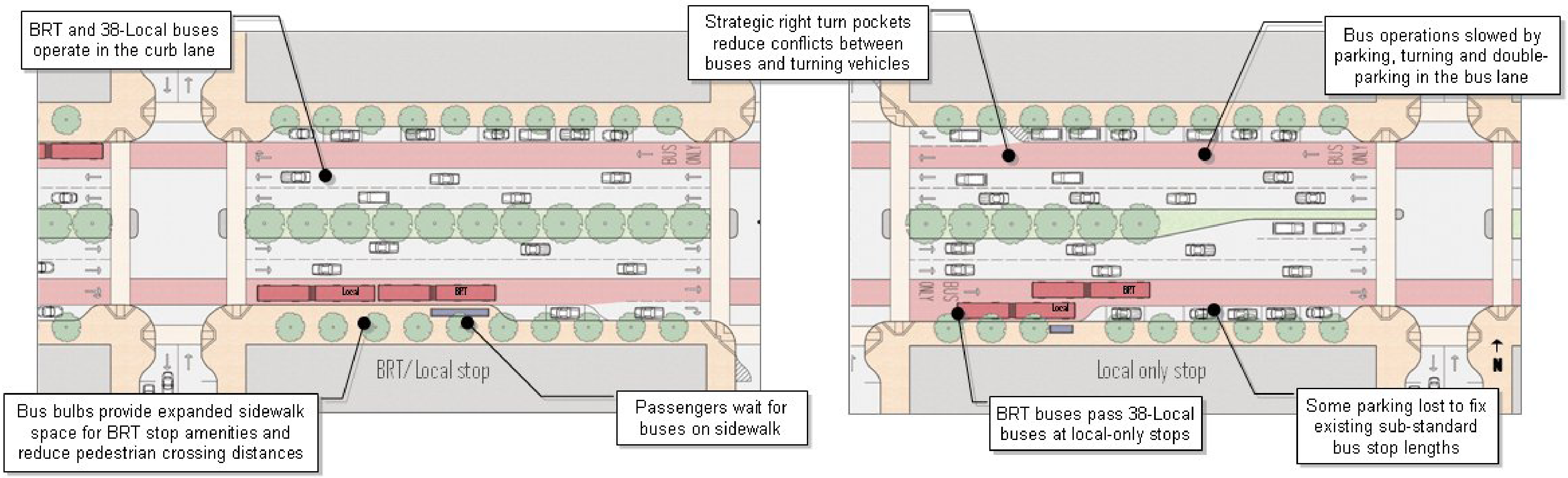
**Intersection - Concurrent Flow Curbside Bus Lane on Two-Way Arterial**
***(Designing Bus Rapid Transit Running Ways)***

Concurrent Flow Curbside Bus Lanes on a Two-Way Street, Typical Intersection Section

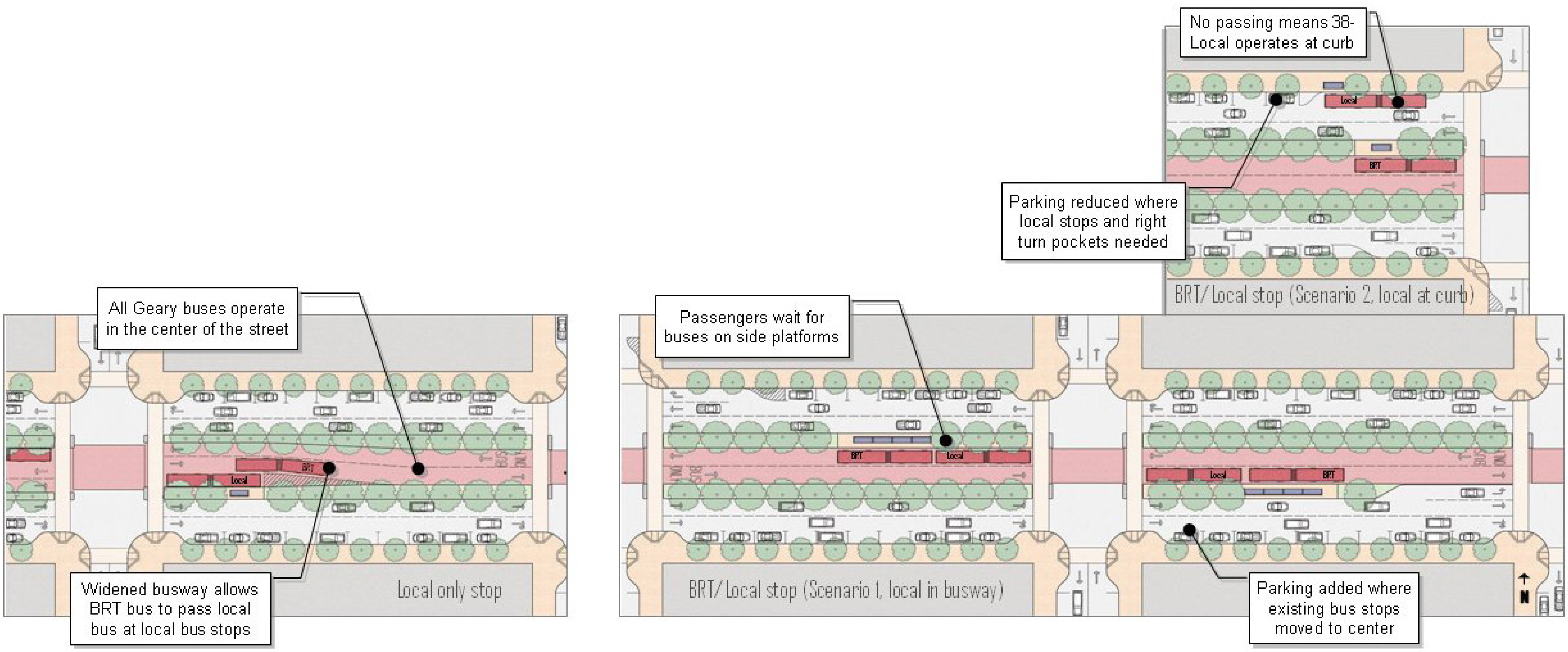



| Designation | Description | Dimension (feet) | | Notes |
|---|---|---|---|---|
| | | Preferred | Constrained | |
| A | BRT/bus lane | 12 | 10.5 | |
| B | Bicycle lane | As required | As required | |
| C | Curb and gutter | 2 | 2 | |

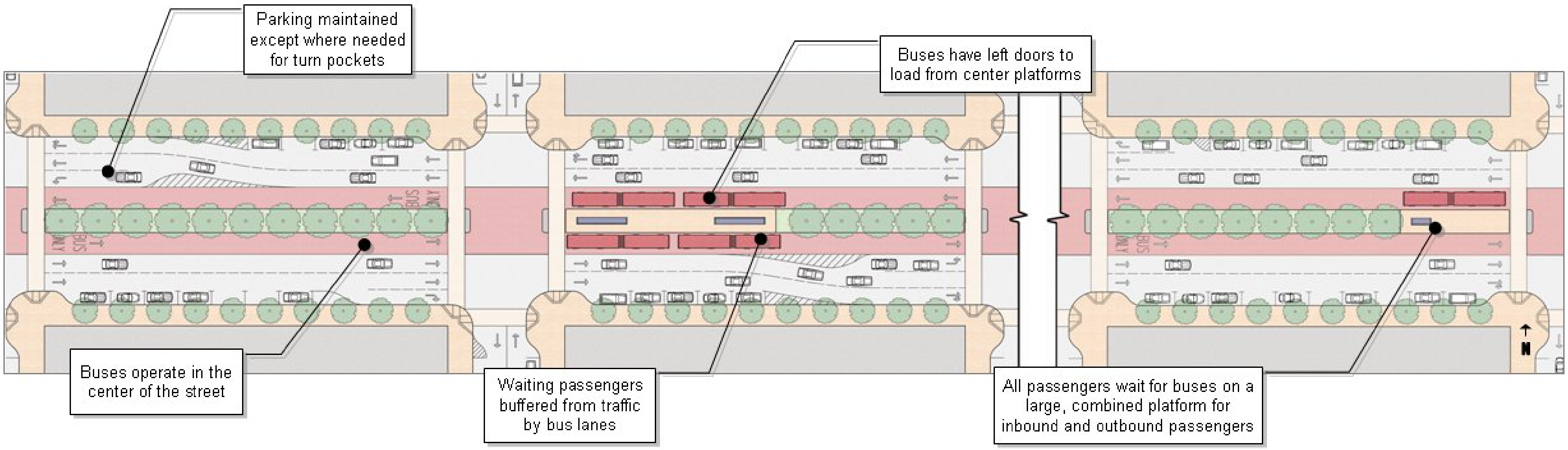
**Intersection - Contraflow Curbside Bus Lane on One-Way Arterial**
***(Designing Bus Rapid Transit Running Ways)***




**Example BRT Concept** ***(Geary Corridor BRT Study)***



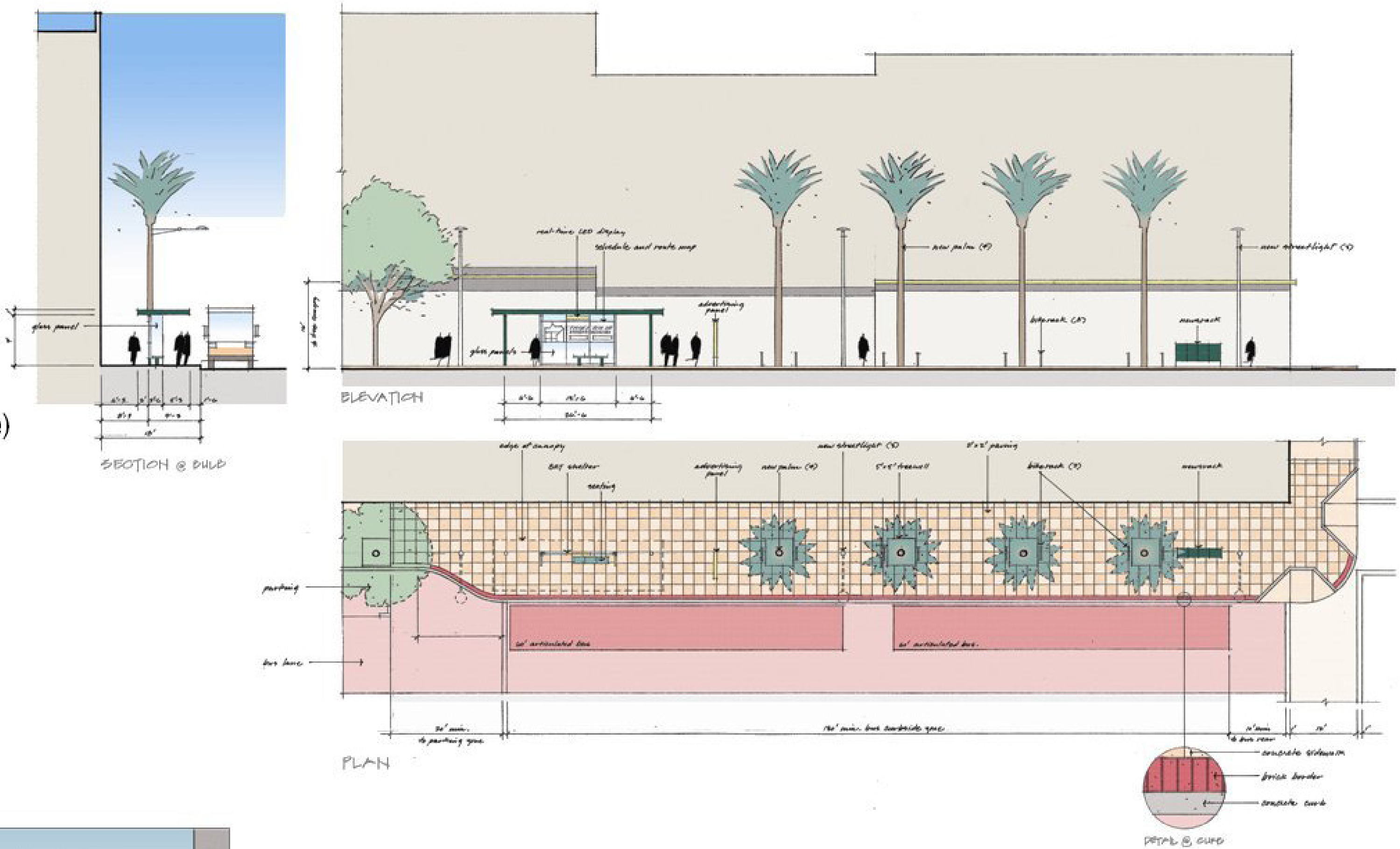

**Example BRT Concept *(Geary Corridor BRT Study)***

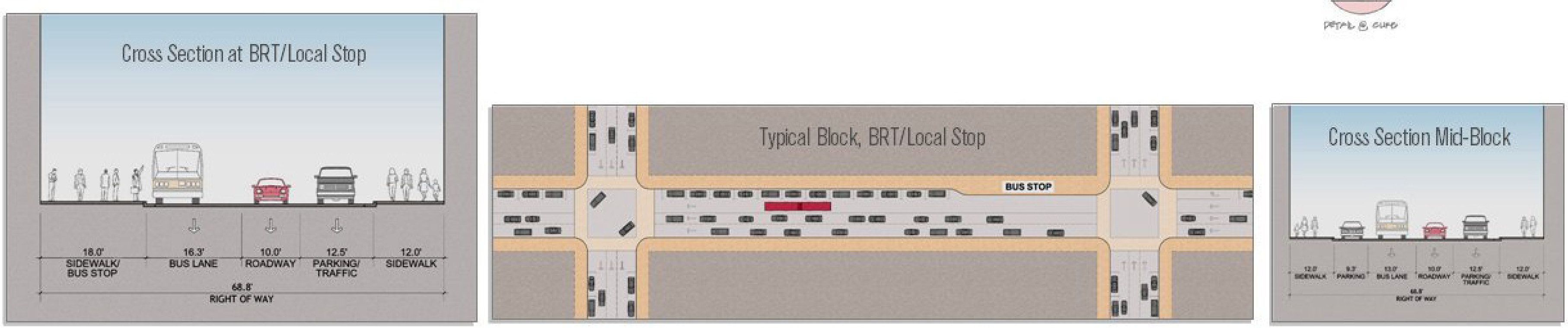



**Example BRT Concept** ***(Geary Corridor BRT Study)***

Key Elements at BRT Stops

- Shelter
- Lighting
- Seating
- Bus Bulbs
- NextBus Information
- Maps
- Landscaping
- Bicycle Racks
- Advertising (for maintenance)




**Example BRT Concept *(Geary Corridor BRT Study)***


**"Jeffrey Jump" Concept (Chicago Transit Authority)**


*Typical layout between stations*

*Typical layout at station*

**Western & Ashland Concept (Chicago Transit Authority)**


*Typical layout between stations*

*Typical layout at station*

**Western & Ashland Concept (Chicago Transit Authority)**


*Typical layout between stations*

*Typical layout at station*

**Western & Ashland Concept (Chicago Transit Authority)**


*Typical layout between stations*


*Typical layout at station*

**Western & Ashland Concept (Chicago Transit Authority)**


Example - Washington


Example - Madison

Central Loop Concept (Chicago DOT and Chicago Transit Authority)


Example - Washington


Example - Madison

**Central Loop Concept (Chicago DOT and Chicago Transit Authority)**

Central Loop Concept (Chicago DOT and Chicago Transit Authority)


Example - Madison

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

FLP

Office of Freight, Logistics and Passenger Operations