Berkeley City Councilmember
Terry Taplin
District 2

CONSENT CALENDAR
September 12, 2023

To: Honorable Mayor and Members of the City Council

From: Councilmember Terry Taplin (Author), Councilmember Rigel Robinson (Cosponsor), Councilmember Mark Humbert (Cosponsor)

Subject: 51B BRT + University/Shattuck Corridor Mobility Improvements

RECOMMENDATION

1) Refer to the City Manager commencement of a feasibility analysis and community engagement process to develop options for the implementation of Bus Rapid Transit (BRT) improvements along AC Transit's 51B route; options are to be developed in tandem with internal city departments, including Public Works, Fire, Police Traffic Unit, and Economic Development, and interagency partners, including AC Transit, the Alameda County Transportation Commission, BART, Caltrans, UC Berkeley, and WETA; community engagement is to emphasize students, transportation advocates, transit riders, the disability rights community, the faith community, the senior community, local merchants, the business community, the arts community, and tenants; consultation with AC Transit and UC Berkeley Bear Transit on planning, scoping, and implementation is to begin as soon as possible; staff are encouraged to explore and pursue quick build improvements.
2) Refer $150,000 to the FY 2024-2025 budget process to increase the budget for the city's ADA Transition Plan capital project to prioritize and implement ADA improvements at the city's intersections, such as curb cuts, auditory functions of crossing signals, bulb-outs, shortening crossing distances, and other safety improvements.
3) Refer $150,000 to the FY 2025-2026 budget process for consulting costs to conduct corridor studies along University Avenue, from Seawall Drive, to Oxford Street, and along Oxford Street and Fulton Street, from Virginia Street to Durant Avenue, to identify appropriate road safety improvements that advance city-adopted safety, transportation, and climate goals and are continuous with work currently underway on the Addison Bicycle Boulevard, and explore improvements for curb management, i.e. accessible parking (blue curbs), management of curb space for third party delivery service, etc.

POLICY COMMITTEE RECOMMENDATION

On July 19, 2023, the Facilities, Infrastructure, Transportation, Environment & Sustainability Committee adopted the following action: M/S/C (Harrison/Robinson) to send the item to the full Council with a positive recommendation. Vote: All Ayes.

BACKGROUND

Existing Transit Lanes
Currently, Berkeley has a transit lane on Bancroft Way between Telegraph and Downtown that is used by westbound buses, and a transit lane is planned for Durant Ave for eastbound buses. Bus lines using these lanes continue on to Shattuck, University, and Telegraph.

Shattuck, University, and Telegraph Avenues
Berkeley's University Avenue runs West to East from the Berkeley Marina and I-80 Freeway to its termination at UC Berkeley's Crescent Lawn. University Avenue is dubbed the "Gateway to Berkeley" due to the location of the city's lone Amtrak Station at the intersection of Fourth Street, the avenue's proximity to both the North Berkeley and Downtown Berkeley BART stations, the regularly congested I-80 exit onto the avenue, and the service of AC Transit's 51B, 52, 79, 88, 802, and FS lines. University Avenue is a wide street with two travel lanes in each direction, parking lanes, turn pockets, and a center median.

As the map below illustrates, the intersections of Ninth Street at University and Addison, respectively, are especially critical for safety at Rosa Parks Elementary.

FIGURE 5-2: LOW-STRESS BIKEWAY NETWORK VISION WITH BERKELEY SCHOOLS

PAVED PATH
BICYCLE BOULEVARD NETWORK
CYCLETRACK [4]

COMPLETE STREET CORRIDOR STUDIES - LOW STRESS BIKEWAY RECOMMENDATION
STUDY CYCLETRACK [4]*
PRIMARY TRANSIT ROUTE - STUDY CYCLETRACK [4]*

SCHOOL WITH 1/8 MILE BUFFER

ENROLLMENT BOUNDARIES

2017 Bicycle Plan

Berkeley's Shattuck Avenue runs North to South from Indian Rock Park in the Berkeley Hills to 45th Street in Oakland near the intersection of Telegraph Avenue. Shattuck Avenue serves as the main street of Berkeley, running through its Downtown, which is home to the Downtown Berkeley BART Station, AC Transit and Bear Transit stations, and various restaurants and office spaces.

Telegraph Avenue, from Woolsey Street on the Oakland border up through Dwight Way near UC Berkeley, is in the midst of its own Multimodal Corridor Project[1] that may result in BRT infrastructure in the coming years. Should this project be completed or significantly underway at the time of the development of BRT plans for Shattuck and University Avenues, close attention should be paid to its initial impacts, successes, and failures so that future applications of BRT infrastructure build on these lessons.

Bus Rapid Transit

While diverse in their application around the world, Bus Rapid Transit is typically a transportation corridor that prioritizes fast and efficient bus service that may include dedicated bus lanes, traffic signal priority, elevated platforms, and off-board fare collection.[2] There is no one-size-fits-all approach to BRT and a University Avenue BRT is sure to look different than it might on Telegraph Avenue or International Boulevard in Oakland. However, pursuit of a quicker and more efficient bus corridor along University should result in dedicated bus lanes and elevated platforms at existing AC Transit stops. Most transit planners consider center running bus lanes--such as provided on International Boulevard and Van Ness Avenue in San Francisco--as more effective than curbside bus lanes. However, this would have to be determined in the course of planning the project. Relative to other rapid transit improvements such as light rail, BRT's advantages include lower upfront capital requirements, a higher degree of flexibility in their application, and a much quicker implementation timeline.[3]

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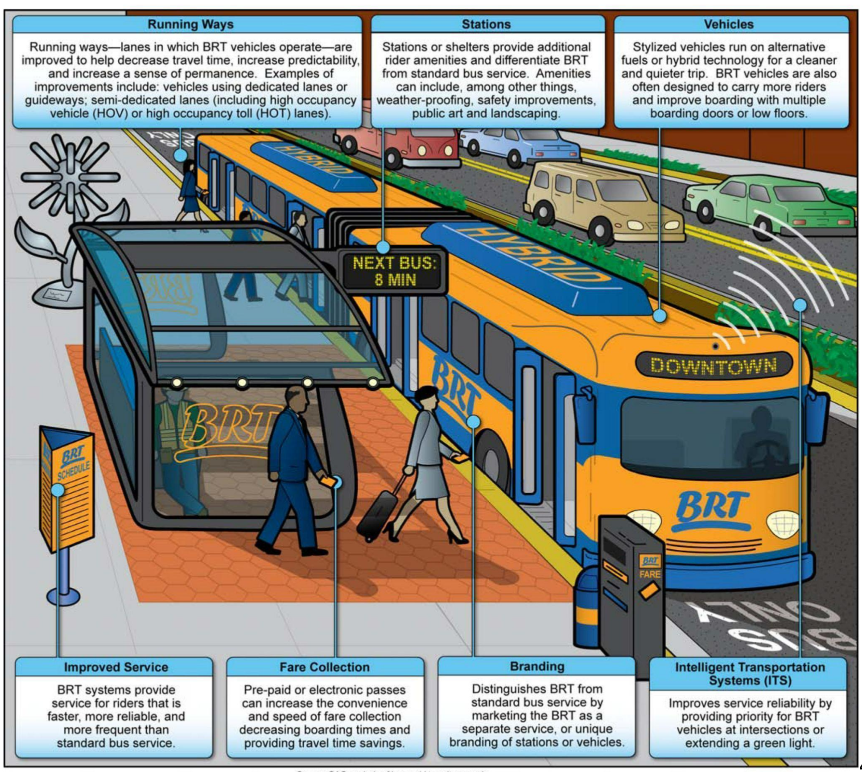
[1]https://berkeleyca.gov/your-government/our-work/capital-projects/telegraph-avenue-multimodal-corridor-project#:~:text=The%20Telegraph%20Avenue%20Multimodal%20Corridor,bike%20lanes%2C%20and%20transit%20improvements.

[2] https://www.transit.dot.gov/research-innovation/bus-rapid-transit

[3] https://digitalcommons.usf.edu/cgi/viewcontent.cgi?article=1023&context=jpt

Van Ness Avenue, San Francisco

Figure 1: Characteristics of Bus Rapid Transit



[4]

Source: GAO analysis of bus rapid transit research.

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[4] https://www.gao.gov/blog/2016/04/13/rapid-buses-for-rapid-transit

Population Trends

According to the City of Berkeley's 2023 Housing Element Update,[5] the city's population has grown steadily since 2000, increasing approximately 9% each decade. The Department of Finance estimates that the city's population was 122,580 in 2020. The Association of Bay Area Governments' Plan Bay Area 2040 projections anticipate Berkeley's population to reach about 136,000 by 2030 and 141,000 by 2040.

Pedestrian Collisions

The City of Berkeley's 2020 Pedestrian Plan[6] determined that Shattuck and University Avenues represent two of the top five streets with pedestrian collisions between 2008 and 2017, ranked first and fifth, respectively, as well as two of the top four streets with fatal or severe pedestrian collisions in the same time period, ranked first and third (tied) respectively.

AC Transit

In AC Transit's 2019 Annual Report[7], they reported a systemwide ridership of over 53 million customers, reflecting a 2.5% increase (1.28 million riders) over the previous year. This occurred at a time when major transit providers nationwide reported a ridership decline of 2.8%. Key factors attributed to this growth included proactive efforts to maintain high service levels, adding service frequency, and a robust local economy. That same year, AC Transit released its first Strategic Plan[8] in about 20 years. In April of 2022, an Addendum[9] was added to address the effects of the ongoing COVID-19 pandemic.

The pandemic has had an enormous impact on transit operations and economic activity. In 2020, fewer people needed to ride the bus, whether to commute to work or get around the city for personal errands and activities. Schools and colleges closed their campuses and several office workers began working from home. Although there has been a recovery in ridership[10] beginning in 2021, pre-pandemic levels have not been reached. Fiscal Year 2021-2022 saw an annual ridership of almost 29 million customers, which was a 36% increase (7.6 million riders) over the previous fiscal year. Service is at around 85% of pre-pandemic levels, which is the equivalent of deleting one out of every seven trips.

Feedback Received

The District 2 Council office has solicited feedback from businesses, organizations, and othercommunity members through several in-person and virtual listening sessions, meetings, emails, and phone calls in the development of this item.

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[5]https://berkeleyca.gov/sites/default/files/documents/Combined_HousingElementFinal_redline.pdf

[6]https://berkeleyca.gov/sites/default/files/2022-01/2020-Pedestrian-Plan.pdf

[7]https://www.actransit.org/sites/default/files/2021-03/0017-20%20Annual%20Report%202019_small_FNL.pdf

[8]https://www.actransit.org/sites/default/files/2021-03/AC%20Transit%20Strategic%20Plan.pdf

[9]https://www.actransit.org/sites/default/files/2022-12/0230-22%20Strat%20Plan%20Adden_FNL.pdf

[10]https://www.actransit.org/ridership

Opposition from some participants includes concerns about transit priority lanes, bulb-outs, loss of on-street parking, loss of median trees, and cycling improvements of any kind, as well as assigning blame to public transit for business closures in San Francisco.

Support from some participants includes stances in favor of drivers having to slow down and not drive recklessly, reducing our transportation greenhouse gas emissions, reducing our reliance on vehicles, and improving and incentivizing public transit, therefore reducing the fiscal impact of owning and maintaining a vehicle.

Other participants want a greater emphasis on uniform ADA improvements at major intersections city-wide, for standard ADA guidelines to be the floor for improvement considerations, as they often do not account for issues such as not enough room on raised platforms for multiple wheelchair users or fatigue due to inclines, and for the Fire Department to be involved every step of the way in order to review potential impacts to disaster and emergency responses.

The District 2 Council Office has also solicited feedback from city staff and partner agencies. AC Transit has emphasized their desire to strengthen interagency collaboration throughout this process and has highlighted our inclusion of language that specifically states that not every type of BRT improvement can work at every intersection along a route. The Fire and Public Works Departments have also voiced their support of being involved throughout the process, with Director Garland generously providing the updated language for Recommendation #3 in this report, regarding ADA improvements.

Responses to Feedback
The June 2023 revisions to this item incorporated significant additions to address concerns with respect to the Americans with Disabilities Act (ADA). Uniformity and consistency are key features of accessibility improvements. The Fire Department will also be closely integrated into the scoping and planning of any corridor study.

Feedback from some opponents illustrates that infrastructure upgrades, that are nevertheless consistent with already-existing City Council policy on Complete Streets, may modify motorist behavior in ways that are conspicuous and consciously involuntary rather than incentivized by reflex or instinct. It is important to underscore that certain notifications to motorist behavior, such as slower speeds, are an intentional outcome of street improvements to reduce serious injuries and fatalities.

For example, surveys on other commercial corridors in San Francisco[11] and Oakland[12] have shown initial overestimations of the share of corridor patrons who arrive by personal motor vehicle vs. transit, walking, or other modes. Additionally, research has demonstrated that demand-based pricing for parking can reduce Vehicle Miles Traveled by reducing time spent searching for parking.[13] In Downtown Berkeley, the new Center Street Garage in particular has a surplus of vacant parking spaces throughout the day and has yet to regain pre-pandemic revenues. To the extent that public policy is concerned with convenience for motorists one way or another, it is important to focus on the availability or elasticity of vacant parking rather than its gross supply. This paradigm is compatible with the City's ongoing efforts to maximize the positive externalities of reduced VMT and pedestrian safety, as exemplified in the Climate Action Plan and Vision Zero Action Plan.

The community has been clear that a vibrant, mixed-use corridor such as University Avenue will need to carefully balance the need for loading zones and curbside management to accommodate commercial uses while ensuring safe access for all road users and improving public transit reliability. Neglecting this reality would risk illegally double-parked vehicles thwarting any traffic-calming efforts. Therefore, Staff's consultation with merchants and logistics experts will be critical for maintaining a safe and harmonious environment for the variety of uses along the corridor. Traffic fatalities and increasing automobile dependence are not only an unacceptable cost to pay for economic development; implementing evidence-based solutions for congestion and safety can and should foster a thriving environment for local commerce.

There is no empirical evidence showing that the business closures in downtown San Francisco were caused by public transit improvements. San Francisco retailers have blamed recent closures on a variety of factors ranging from crime to online shopping or remote work, but not public transit.[14] To the contrary, as cited above, surveys have found that public transit is essential for a significant share of customers shopping in commercial corridors.

RATIONALE

City of Berkeley Plans

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[11] https://sf.streetsblog.org/wp-content/uploads/sites/3/2013/08/Geary-Presentation-Mar-07_31_13.pdf

[12] https://www.ocf.berkeley.edu/~abroaddu/wp-content/uploads/2015/01/FINAL-REPORT.pdf

[13] Shoup, D. C. (2006). Cruising for parking. Transport policy, 13(6), 479-486.

[14] Li, R. & Whiting, S. (2023). Westfield mall blamed 'rampant criminal activity' for Nordstrom closing in S.F. Here's what the data says. San Francisco Chronicle. Retrieved from https://www.sfchronicle.com/sf/article/westfield-mall-blamed-nordstrom-closure-criminal-18076486.php

The City of Berkeley's Climate Action Plan,[15] adopted in 2009, envisions public transit, walking, cycling, and other sustainable mobility modes as the primary means of transportation for residents and visitors. To do so, it lists various goals, such as increasing the safety, reliability, and frequency of public transit and managing parking effectively to minimize driving demand and encourage and support alternatives to driving. It also addresses the fact that transportation emissions are the largest source of greenhouse gas emissions, a trend that has continued as of the 2019 Greenhouse Gas Inventory.

The Berkeley Strategic Transportation Plan[16], adopted in 2016, envisions the city's streets, sidewalks, and pathways as multimodal, serving people walking, bicycling, riding transit, driving, and moving goods. To do so, it lists various goals, such as encouraging people to walk, bicycle, and ride transit, improving transit efficiency, designing street networks that ensure comfortable, safe environments for users of all abilities, and prioritizing transit services along transit routes.

The City of Berkeley's Strategic Plan[17], adopted in 2018, includes long-term goals such as providing state-of-the-art, well-maintained infrastructure, amenities, and facilities, creating a resilient, safe, connected, and prepared city, and fostering a dynamic, sustainable, and locally-based economy. That same year, the city declared a climate emergency and committed to mobilize to end greenhouse gas emissions swiftly.

The Berkeley Vision Zero Action Plan[18], adopted in 2019, is a strategy to eliminate all traffic fatalities and severe injuries while increasing safe, healthy, and equitable mobility for all. To do so, it lists various goals, such as creating safer transportation options for people who walk, bike, and take transit, which would make these modes more attractive and reduce the number of car trips in Berkeley, which can mean fewer severe and fatal collisions.

AC Transit's Recovery

Supporting AC Transit's recovery enhances the mobility and safety of Berkeley residents while simultaneously improving the walkability and bikeability of the city as well as breathing life into the local economy.

Any successful transportation project that seeks to increase the speed and reliability of AC Transit service in Berkeley will need to serve a longer route than the single relatively short corridor segment within Berkeley. There are several transit corridors within Berkeley connecting to other cities that AC Transit has identified as needing upgraded types of service. It would be important for the city to work with AC Transit to identify the routings which would be the most productive.

Shattuck, University, and Telegraph Avenues

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[15]https://berkeleyca.gov/sites/default/files/2022-01/Berkeley-Climate-Action-Plan.pdf
[16]https://berkeleyca.gov/your-government/our-work/adopted-plans/berkeley-strategic-transportation-best-plan
[17]https://berkeleyca.gov/sites/default/files/2022-01/Berkeley-Strategic-Plan.pdf
[18]https://berkeleyca.gov/sites/default/files/2022-02/Berkeley-Vision-Zero-Action-Plan.pdf

The central location of University Avenue and the variety of communities it connects makes this corridor an incredibly important focus for the city's housing and transportation planning for the coming decades. University Avenue has had a number of housing developments completed recently, with additional developments under construction. With University Avenue likely seeing a growth in new housing development under the forthcoming Housing Element, it is important for Berkeley's transportation infrastructure to keep up with the changing needs of its old and new residents. On top of the expected growth in Berkeley's population and thus its transportation needs, climate change and the urgency of pedestrian and cyclist safety require that the transportation system of the City's future be one that prioritizes public transit and bicycle travel over the use personal automobiles. With this in mind, the 2017 Bicycle Plan recommends a Complete Streets Corridor Study for University Avenue.[19]

Furthermore, these three avenues are each unique and each present their own problems when considering the addition of BRT. The application of BRT on the downtown stretch of Shattuck Avenue, which could improve the service of AC Transit's 18 and various other lines which briefly serve Shattuck Avenue at the start and end of their routes, will require careful consideration of the already congested conditions of the street. The construction of elevated platforms on University Avenue as a pilot for BRT while completion of Telegraph Avenue's project is underway and Shattuck Avenue rapid transit is being considered will allow for some near-term service improvements while giving staff the time necessary to study how to bring multimodal improvements to the rest of the corridors as fastidiously as possible.

Breakdown of Recommended Improvements
Dedicated bus lanes improve travel speeds and reliability by reducing delays caused by other traffic. Transit signal priority uses technology to reduce dwell time at traffic signals for transit vehicles, such as extending the duration of green lights or shortening that of red lights. Raised platforms make it easier and more accessible for passengers to board or alight from buses by decreasing the distance between the platform and the vehicle, therefore increasing route efficiency.

ADA Compliance
The recommended improvements also help advance the city's goal of increasing mobility access for transit riders and cyclists with disabilities. ADA Accessibility Standards for transportation facilities are issued by the US Department of Transportation and include guidance for bus boarding and alighting areas, shelters, signs, and more.[20]

Impact to Local Businesses and Economy
In addition to advancing various climate and public safety goals of the city, investing in bus and bicycle infrastructure benefits local businesses and the economy. The League

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[19]https://berkeleyca.gov/sites/default/files/2022-01/Berkeley-Bicycle-Plan-2017_AppendixH_Complete%20Streets%20Corridors.pdf
[20]https://federalist-e3fba26d-2806-4f02-bf0e-89c97cfba93c.app.cloud.gov/preview/atbcb/usab-uswds/ada-alternative/ada/#ada-810

of American Bicyclists's report entitled "Bicycling Benefits Business"[21] illustrates that the bicycle industry and its related transportation, tourism, and health benefits spur job creation, economic activity, and cost savings. The Outdoor Industry Association reported that outdoor recreation consumers spend $887 billion annually and create 7.6 million jobs.[22]

The National Institute for Transportation and Communities published a peer-reviewed study examining BRT lines and found that the areas within a half-mile of BRT corridors increased their share of new office space by one third from 2000-2007, and new multifamily apartment construction doubled in those half-mile areas since 2008.[23] PolicyLink released a report entitled "Business Impact Mitigations for Transit Projects"[24] that address BRT projects, concluding that best practices include providing the right type of financial and technical assistance and proactive outreach to businesses built on constant communication, flexibility, and trust.

ENVIRONMENTAL IMPACTS

The City estimates that transportation-related emissions accounts for approximately 60% of our community's total annual greenhouse gas emissions.[25] By encouraging alternatives to car transportation by making public transportation options quicker and more appealing, policy stands to lower the emissions from our community's dominant source of carbon emissions.

The goal of any new public transportation initiative must be to increase the local mode share of residents choosing public transportation over personal automobiles for commuting and other trips.. BRT offers many advantages for this pursuit. The U.S. Government Accountability Office reviewed implemented BRT projects in 2012 and found that "13 of the 15 project sponsors…reported increases in ridership after 1 year of service and reduced average travel times of 10 to 35 percent over previous bus services."[26] Additionally, a 2013 study of Fruitvale and Ashby BART stations found that improved bicycle facilities such as protected bike lanes and secure bike storage increased the bicycle mode share of BART commuters.[27] Paired with the multimodal project along Telegraph Avenue, Berkeley has the potential for a large increase in transit ridership and thus a decline in greenhouse gas emissions if the City follows through on BRT in the coming years.

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[21] https://bikeleague.org/sites/default/files/Bicycling%20Benefits%20Business.pdf

[22] https://outdoorindustry.org/resource/2017-outdoor-recreation-economy-report/

[23] https://t4america.org/wp-content/uploads/2016/01/NATIONAL-STUDY-OF-BRT-DEVELOPMENT-OUTCOMES-11-30-15.pdf

[24] https://www.policylink.org/sites/default/files/FINAL%20PolicyLink%20Business%20Impact%20Mitigation%20Strategies_0.pdf

[25] https://www.cityofberkeley.info/Clerk/City_Council/2018/12_Dec/Documents/2018-12-06_WS_Item_01_Climate_Action_Plan_Update_pdf.aspx

[26] https://www.gao.gov/products/gao-12-811

[27] Cervero, R., Caldwell, B., & Cuellar, J. (2013). Bike-and-ride: build it and they will come. Journal of Public Transportation, 16(4), 83-105. https://www.sciencedirect.com/science/article/pii/S1077291X22017611

FISCAL IMPACTS

Staff and consultant costs. An estimated $150,000 for consulting costs to conduct corridor studies, an estimated $150,000 to increase the budget for the city's ADA Transition Plan capital project to prioritize and implement ADA improvements at the city's intersections, and costs associated with commencing a feasibility analysis and community engagement process for potential bus rapid transit improvements.

CONTACT

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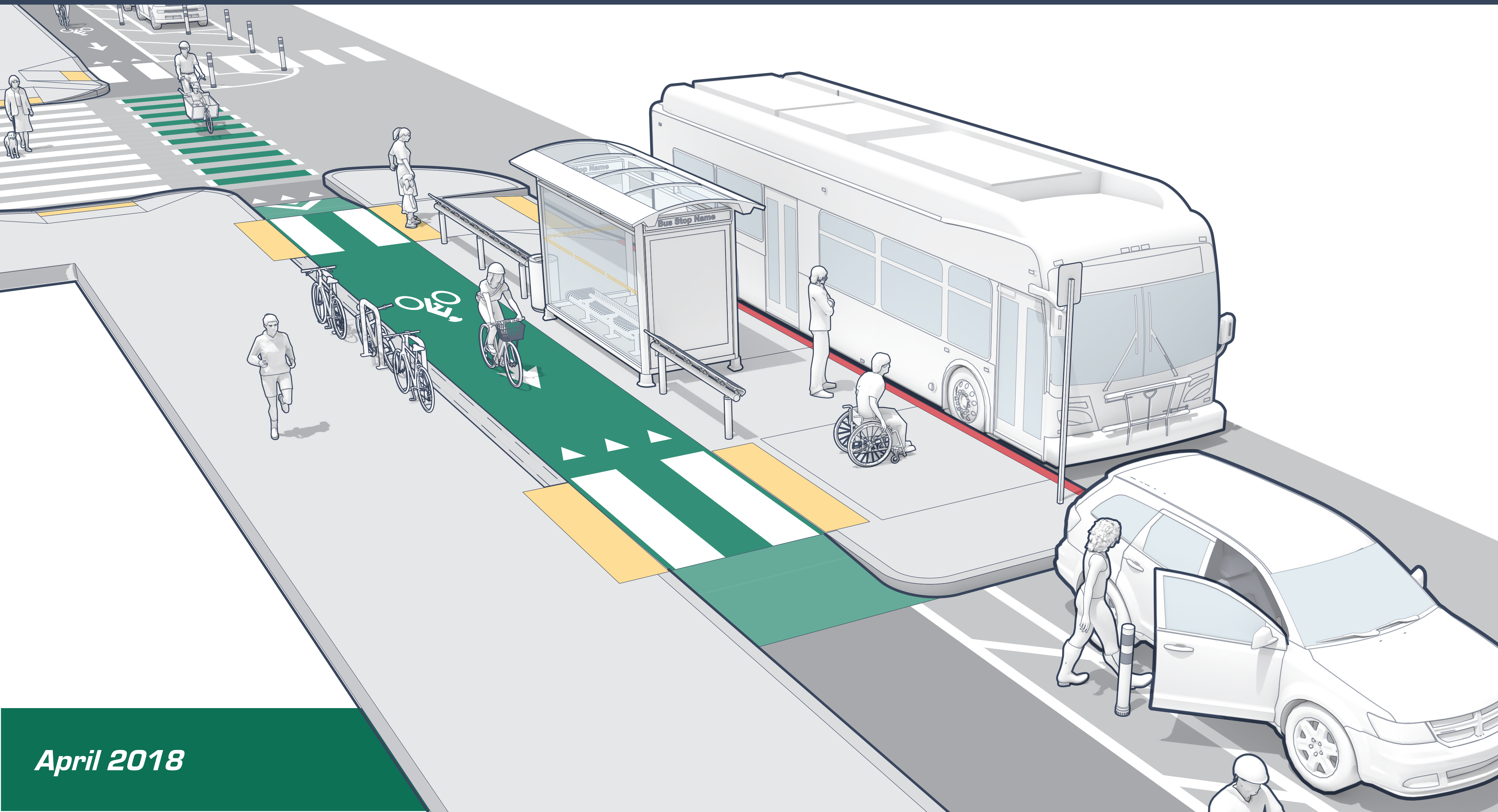
ATTACHMENTS

1. AC Transit Multimodal Corridor Guidelines
2. Councilmember Kate Harrison's Budget Referral (11/12/19)

AC TRANSIT

Multimodal Corridor Guidelines



April 2018

Acknowledgments

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1.0 Guide Overview

Minneapolis, MN

Introduction

The AC Transit Multimodal Corridor Guidelines was developed to provide clear design standards for a range of typical roadway conditions to help ensure efficient transit operations, accommodate the needs of bicyclists, and facilitate safe access to and from bus stops for AC Transit passengers. This document offers guidance on design elements of bus stops adjacent to bicycle infrastructure. It is organized around five different typologies that vary based on the type of bicycle facility being considered and its location with respect to the curb, parking lane, and moving traffic. Ultimately, this guide will help create a more predictable, safe, and uniform experience for bus patrons, drivers, bicyclists, and pedestrians as they travel through the jurisdictions that comprise the Alameda-Contra Costa Transit District.

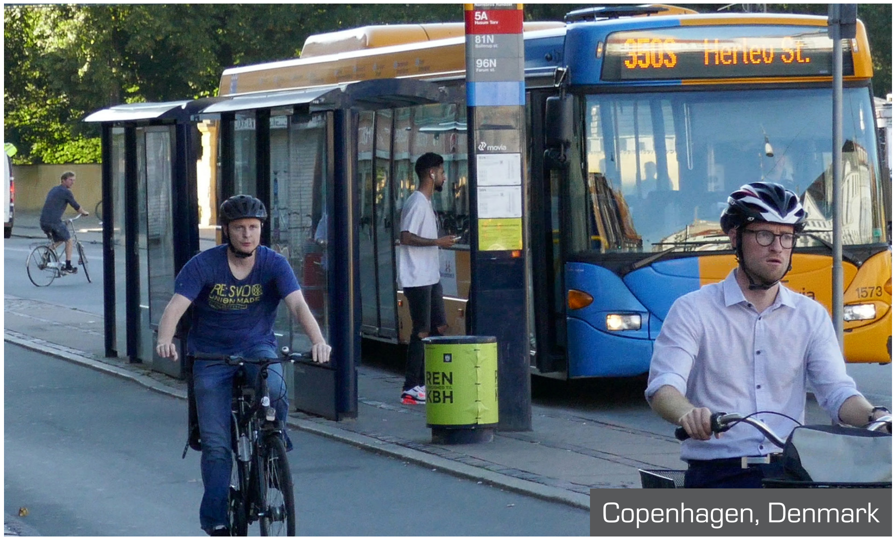
1.1 Goals of the Guide

A. Purpose

This guide has been developed to support the planning and design of bicycle facilities that will complement AC Transit's bus operations. AC Transit has set a goal to improve travel times and reliability on routes throughout its service area, especially on high-ridership corridors. The agency also seeks to promote safe pedestrian environments around its bus stops. This guide will help to establish a basis for collaboration on multimodal corridor projects with local jurisdiction staff and other stakeholders within the AC Transit service area. The guide draws from local, state, and national best practices guidance for multimodal corridor facilities while allowing for design flexibility to provide context-sensitive solutions.

The guide will address the following:

- **Americans with Disabilities Act (ADA) requirements for bus stop access, bus boarding, and sidewalk clearance outlined in the Designing with Transit handbook**
- **Spacing needs at bus stops for buses entering/exiting and clearance from crosswalks outlined in the Designing with Transit handbook**
- **Complementary designs for transit and bicycle facilities to ensure projects are integrated from the outset**
- **AC Transit's preference for in-lane bus stops and far-side bus stops in most scenarios**
- **Corridor typologies that reflect the various types of places present in the AC Transit service area**
- **Best practices for transit operations and accommodations for transit customers and bicyclists in existing designs and for innovative facilities such as separated bike lanes**
- **Methods to reduce conflicts among bicyclists, buses, and pedestrians to ensure safety while maintaining efficient operations**



Copenhagen, Denmark

- **Guidance for designing bicycle facilities to increase bicyclist comfort and encourage more people of all ages and abilities to ride bicycles**

The guide serves as AC Transit's official resource for planning and designing bus stops when accommodating bicycle facilities in transit corridors. The guide is intended to provide additional design guidance that supports existing planning and policy guidance published by the District. Therefore, this document should be used in conjunction with the Designing with Transit handbook and other approved policies or guidelines.

AC Transit hopes that this guide will serve as both an internal and external resource for local jurisdiction staff and developers when planning multimodal facilities and Complete Streets projects in the AC Transit service area. Complete Streets are generally defined as roadways built to enable safe travel for pedestrians, bicyclists, transit riders, and motorists. AC Transit will prioritize project support for projects that incorporate these design elements. These guidelines are a mechanism for AC Transit to clarify its roadway and curbside needs to stakeholders with the goal of streamlining the process of designing streets that support all modes.

B. Project Background

Multimodal corridors are major transportation facilities which accommodate auto, bus, bicycle and pedestrian travel. These corridors provide for travel across town and connect with the regional transportation system. Many cities and agencies in AC Transit's service area are expanding the reach of their multimodal corridors by designing and building innovative bicycle facilities along roadways. Many of these new bicycle facilities are built as Complete Streets projects which seek to enhance alternative modes of transportation, including bicycling, transit, and walking.

For cyclists, these new facilities can reduce the stress of riding a bicycle by providing physical separation from moving vehicles. However, there is an opportunity for Complete Streets designs to better address traditional bus transit operations. In the highly-constrained rights-of-way in Alameda and Contra Costa Counties, facilities such as separated bikeways, parking-protected bike lanes, or conventional bike lanes require reallocation of roadway space. This reallocation can be achieved by relocating or eliminating on-street parking and/or narrowing, realigning, or eliminating traffic lanes. In some cases, these changes have shifted the travel lanes used by buses further from the curbside where bus stops are commonly located, creating challenging and time-consuming maneuvers for bus operators to pull in and out of traffic. Furthermore, the roadway configuration can induce buses to move in and out of bicyclists' path of travel, which affects both bicyclist safety and bus operations (often referred to as a "leap-frogging" effect). With rates of bicycling increasing and jurisdictions rapidly constructing bicycle infrastructure, minimizing conflicts between bicycle and bus operations is critical to the success of these bikeway facilities. Efficiently managing and reallocating roadway space for these specific users will benefit all people using the streets.

Berkeley, CA

Among many considerations, a multimodal corridor should include bicycle facilities that do not impinge on overall bus travel speeds, on-time performance, or safety. Bus stop designs can separate bicyclists from buses by routing bicyclists behind bus stops to avoid bus-bicyclist conflicts. Also, restricting motor vehicle turning movements, a component of some bicycle facility designs, can reduce delay to buses by minimizing motor vehicle conflicts and queues. Bicycle facility projects may also restrict on-street parking in select locations or along entire blocks, which could reduce the likelihood of cars encroaching into bus stops.

AC Transit recognizes that healthy communities require safe pedestrian and bicycle facilities and effective bus services, often in the same corridors. The Bay Area needs regionally-focused guidance that reflects current best practices in reducing conflicts at bus stops and along corridors, promoting pedestrian and bicyclist safety in coordination with bus operations, maintaining or improving transit operations, providing travel time predictability, and recognizing the local context where bicyclists and buses share roadway space. AC Transit's Multimodal Corridor Guidelines addresses this gap in guidance in multimodal corridor design by offering templates for bicycle facilities that are compatible with high-quality bus transit service.

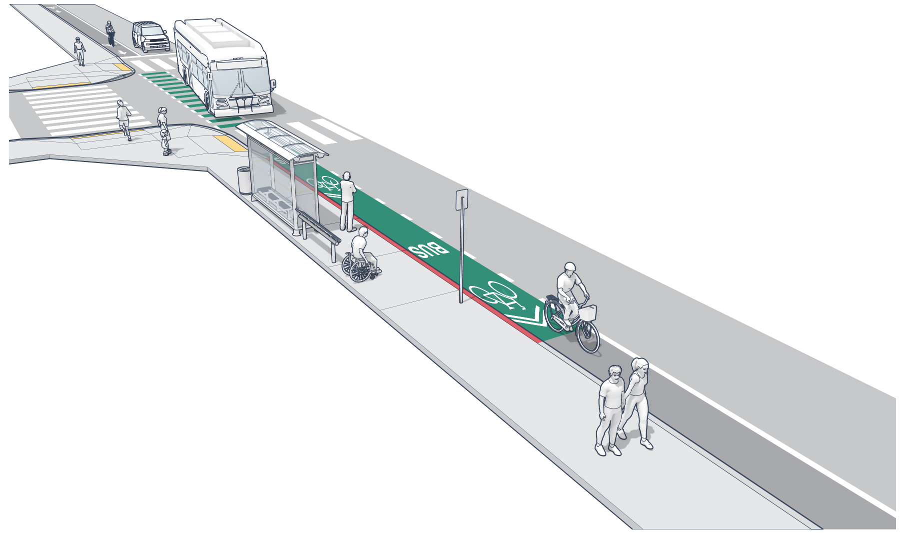
1.2 Guide Outline

The Multimodal Corridor Guidelines document is not a regulatory document. While much of the design guidance presented here represents best practices as published and endorsed by State and national agencies, the practices do not necessarily represent the adopted standards of these agencies. Therefore, users of these Guidelines should also consult regulatory standards such as the Caltrans *Highway Design Manual*[1] (for State facilities), the California *Manual on Uniform Traffic Control Devices*[2] (for State and local facilities), and any adopted local street design standards, to identify where design exceptions may apply.

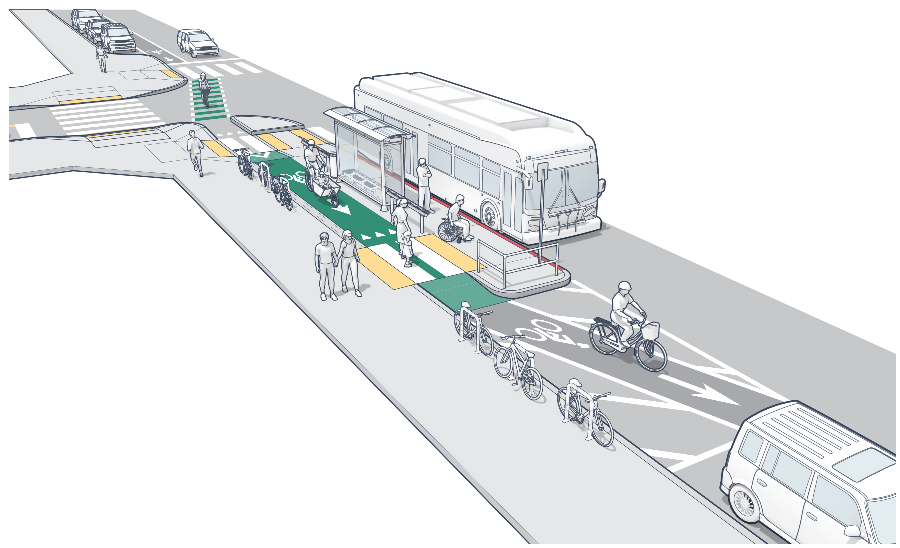
The guide begins with a discussion of general bus stop design elements related to stop spacing, location, design, and dimensions. A list of existing guidelines that may be referenced in conjunction with the Multimodal Corridor Guidelines is also presented.

Next, the guide presents five different bus stop typologies. These typologies vary based on the type of existing or proposed bicycle facility being located at the bus stop with respect to the curb, parking lane, and moving traffic. These bus stop typologies represent common contexts in the AC Transit service area. The five bus stop typologies are:

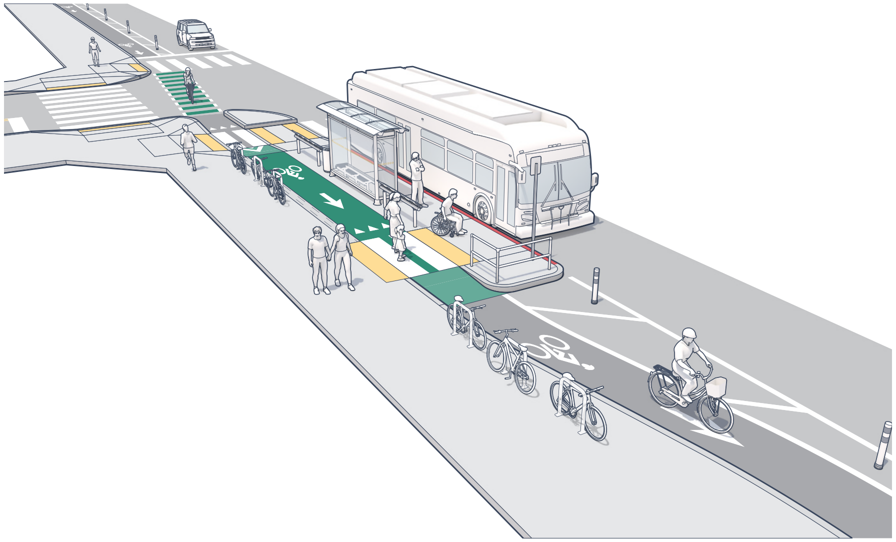
Typology 1
Class II Bicycle Facility between the Curb and a General Traffic Lane



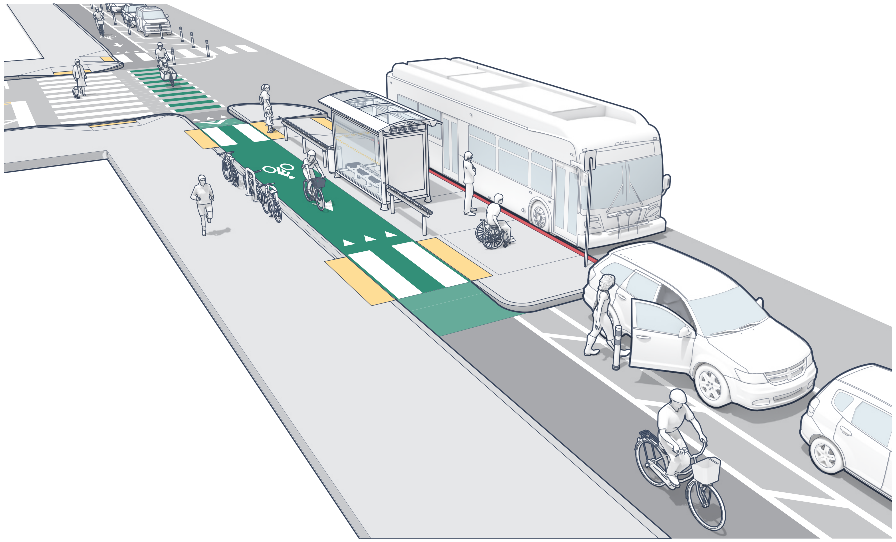
Typology 2
Class II Bicycle Facility between Curbside Parking Lane and General Traffic Lane



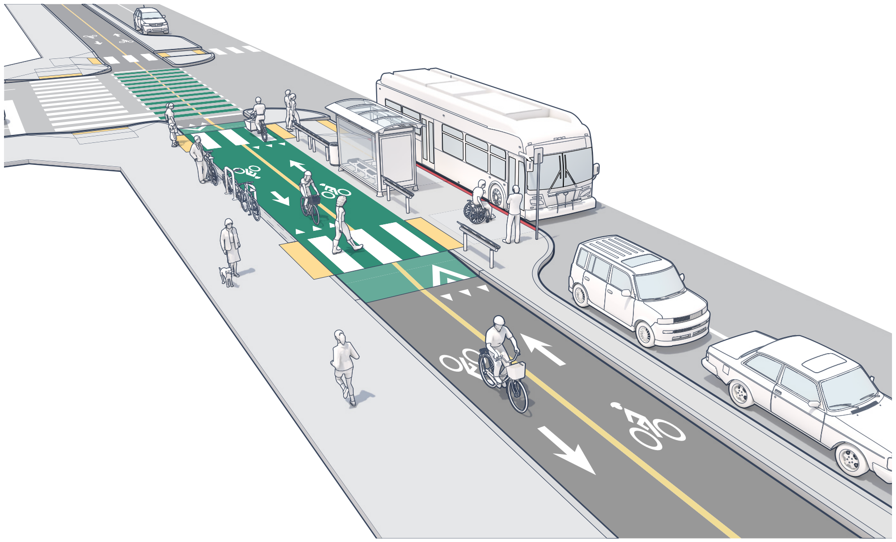
Typology 3
Class IV Bicycle Facility (Separated Bikeway) between the Curb and a General Traffic Lane



Typology 4
Class IV Bicycle Facility (Separated Bikeway) between the Curb and a Parking Lane



Typology 5
Class IV Bicycle Facility (Two-way Separated Bikeway) between the Curb and a Parking Lane



The guide concludes with a discussion on selecting the appropriate bus stop typology. Five guiding principles are presented to help jurisdictions understand the factors that should influence bus stop design and the relationships between these factors.

2.0
General Design Elements

Plainville, CT

The Guide supplements existing engineering practices and requirements to meet the goals of Complete Streets policies in the jurisdictions served by AC Transit. Design guidelines, standards, and other policies on Complete Streets, transit stops, and bikeways, have been published by local and national entities. In implementing the Guidelines, local agencies should consider any supporting documentation required to address existing local and State design standards. Ultimately, local agencies must evaluate, approve, and document design decisions.

Existing conditions in urban environments can be complex; design treatments must be tailored to the conditions present in individual contexts. Good engineering judgment based on comprehensive knowledge of multimodal transportation design, with special consideration to bicyclists, should be part of any multimodal design. Decisions should be thoroughly documented.

The following section (2.1) provides a summary of existing design guidelines that can be referenced when making planning and design decisions about local streets and roads. These resources provide a much wider breadth of information on designing Complete Streets, which fall outside the localized scope of this guidebook. Section 2.2 summarizes key elements of bus stop design, as they relate to the five bus stop typologies presented in this Guide.

2.1 Existing Guidelines

The following design guidelines, prepared by national and local bodies, are a selection of resources which closely relate to the Guide. These resources may be referenced in conjunction with the Guide when making planning and design decisions related to Complete Streets, bikeways, and transit.

AC Transit *Bus Stop Policy*

The AC Transit *Bus Stop Policy*[3] outlines the District's standards for bus stop spacing, bus stop location, bus stop enforcement, and bus stop installation or removal. Some of these policies are reiterated in the Guide.

AC Transit *Designing with Transit*

The *Designing with Transit*[4] handbook supports planning that is centered on transit access. The handbook is also intended to encourage multimodal transportation planning: planning and engineering which supports transit, walking, and bicycling, not just automobiles. The handbook is particularly focused on the often-overlooked needs and potential of bus transit, the most widely-used mode of transit. It outlines AC Transit's analysis of how the East Bay can be rebuilt in a more transit-friendly manner and aims to provide practical guidance about how these can be achieved through land use planning, development of pedestrian facilities, and traffic engineering.

Alameda CTC *Central County Complete Streets Design Guidelines*

The Alameda *Central County Complete Streets Design Guidelines*[5] document helps ensure that Central Alameda County street designs consider the full range of users on every street and accommodate all users wherever possible. While the goal of these design guidelines is to help staff from the three Central Alameda County jurisdictions (San Leandro, Hayward, and Alameda County) clearly understand how to implement Complete Streets for each street type, for different modal priorities, and for varying contexts, the design guidance provided can be applied by jurisdictions throughout Alameda and Contra Costa counties. The *Central County Complete Streets Design Guidelines* build on the street typology developed as part of the Alameda County Transportation Commission (Alameda CTC) Multimodal Arterial Plan (MAP).

Caltrans *Highway Design Manual*

Caltrans encourages local agencies to develop designs that help ensure the needs of non-motorized users in all products and project development activities, including programming, planning, construction, maintenance, and operations.

Design guidance for bikeway projects is provided in Chapters 100, 200, 300, and 1000 of the Caltrans *Highway Design Manual*. Alternatives to bikeway design guidance must meet the criteria outlined in Section 891 of the California Streets and Highways Code.

Projects within State right-of-way must refer to Caltrans standards and guidance, including but not limited to:

- **Caltrans *Highway Design Manual***
- **Design Information Bulletin, Separated Bikeways**
- **Design Information Bulletin, Caltrans ADA standards**

AASHTO *Guide for Development of Bicycle Facilities*

The AASHTO *Guide for the Development of Bicycle Facilities*[6] is the primary national reference for the planning and design of on-street bikeways and shared use paths. This guide represents AASHTO policy on bikeway planning and design, and addresses network planning principles, dimensions and treatments for bikeway design, and transitions between on-street bikeways and shared use paths. State DOTs and local jurisdictions often refer to this document when planning and designing bicycle facilities.

NACTO *Urban Street Design Guide*

A blueprint for designing 21st century streets, the NACTO *Urban Street Design Guide*[7] provides a toolbox and tactics for cities to use to make streets safer, more livable, and more economically vibrant. The guide outlines both a clear vision for Complete Streets and a basic road map for how to bring them to fruition. The guide focuses on the design of city streets and public spaces, emphasizing city street design as a unique practice with its own set of design goals, parameters, and tools.

NACTO *Transit Street Design Guide*

The NACTO *Transit Street Design Guide*[8] provides design guidance for the development of transit facilities on city streets, and for the design and engineering of city streets to prioritize transit, improve transit service quality, and support other goals related to transit. The guide sets a new vision for how cities can harness the immense potential of transit to create active and efficient streets in neighborhoods and downtowns alike.

NACTO *Urban Bikeway Design Guide*

The purpose of the NACTO *Urban Bikeway Design Guide*[9] is to provide cities with state-of-the-practice solutions that can help create Complete Streets that are safe and comfortable for bicyclists. The *Urban Bikeway Design Guide* addresses treatments not directly referenced in the AASHTO *Guide for the Development of Bicycle Facilities*, although they are virtually all (with two exceptions) permitted under the *Manual on Uniform Traffic Control Devices* (MUTCD)[10]. The Federal Highway Administration has posted information regarding MUTCD approval status of all the bicycle-related treatments in this guide.

2.2 Bus Stop Design

It is AC Transit's policy to encourage counties, cities, and developers to coordinate with AC Transit when locating bus stops on roadways. However, AC Transit does not own or maintain the bus stop areas, and the local jurisdiction can make the ultimate decision to site the bus stop.

When properly located, adequately designed, and effectively enforced, bus stops can improve service without disrupting general traffic flow. Decisions regarding bus stop spacing and location call for a careful analysis of passenger service requirements (demand, convenience, and safety), the type of bus service provided (local, rapid, Transbay/ express, or flexible service/community circulator), and the interaction of stopped buses with general traffic flow. The following sections summarize general bus stop design elements.

A. Bus Stop Spacing

Bus stops are designated locations for bus passengers to board and alight. Therefore, bus stops must be conveniently located to enable easy passenger access. Convenience and speed must be balanced in determining appropriate bus stop placement, as too many bus stops can slow down travel times. Outside of downtown areas, the ideal spacing of bus stops is 1,000 feet apart. This target has been established with the goal of increasing travel speed for AC Transit buses, and means that some existing stops may be eliminated. Passenger usage of bus stops is an important factor when considering bus stop placement or removal.

Bus stops should be close enough that passengers can walk to them easily, but far enough apart to help buses move quickly. Table 1 provides general guidelines for bus stop spacing. Some discretion may be applied when balancing AC Transit's interest in improving service and preserving traffic flow with consideration of passenger needs.

Service Type	Spacing (feet)	Explanation
Local (trunk, feeder, etc.)	800-1,300 feet	Stops may be located more closely than listed based on trip attractors, stop activity or demand, transfer points or other land uses that may warrant it.
Rapid	1,700-5,000 feet	Stops may be located more closely than listed based on trip attractors, stop activity or demand, transfer points or other land uses that may warrant it provided that the increased stops do not cause operational delays
Transbay/ Express	1,000-2,600 feet	Service may use local stops as necessary to provide geographic coverage and to minimize delay for longer-distance passengers.
Flexible or Community Circulator	TBD	Stops would be determined on a route by route basis and would consider trip attractors, transfer areas or other factors.

Table 1: AC Transit Bus Stop Spacing Guidelines (AC Transit Policy No. 508)

Table 1 lists AC Transit's intended bus stop spacing for the four different Service Types. It is AC Transit's preference to use the maximum bus stop spacing unless superseded by other determining factors such as topography (hills), limited access areas (freeways, bridges, airports), surrounding attractors, and transfer points. As a result, existing AC Transit routes may have stops that do not conform to the spacing criteria in this policy.

B. Bus Stop Siting

The optimal stop location should improve or minimize impact to bus travel times, maximize reliability and route efficiency, and be safe and accessible, while maintaining or enhancing bus passenger access to destinations and amenities. The siting of a bus stop not only impacts transit passengers, but also motorists, pedestrians, and bicyclists near the stop.

Multiple factors are used to determine the appropriate siting of a bus stop including:

Demographics and Land Use

Ridership – Assess both existing and projected boardings and alightings, as well as the ridership profile (for example, a large proportion of seniors or students) at the stop. Low-ridership stops, particularly those near higher-ridership stops, may be considered for consolidation or removal. The threshold for a low-ridership stop will be determined by comparing its ridership to that at other stops along the route, or by comparing with a similar bus route, while also considering the frequency of service provided at the stop.

Existing and Future Land Uses – Note sensitive land uses, including medical facilities, municipal buildings, senior housing, and major transit trip generators such as shopping malls, schools, and dense commercial or residential complexes. Stop locations may be adjusted or added to provide better access to passenger origins and destinations, although this determination will also be dependent on pedestrian connections and conditions.

Seattle, WA

Existing Service and Passenger Amenities

Bus Route Connections – Consideration should be given to maintaining and/or improving bus stops serving parallel or intersecting bus routes. Under certain circumstances, the relocation of an existing bus stop may be necessary, and doing so may increase the access distance for passengers transferring between intersecting routes. Priority should be given to relocating the stop in close proximity of its former location, thereby minimizing the additional distance a transferring passenger would have to walk between stops.

Passenger Amenities – Evaluate opportunities to add amenities to new or existing stops and maintain or upgrade amenities at existing stops. Many bus stop amenities are justified by high ridership and a desire to improve passenger comfort. Implementation of amenities such as lighting or real-time arrival displays may require a nearby power source or solar panels.

Pedestrian Environment

Connections and Condition – Sidewalks immediately at the stop and those providing access to the stop and surrounding area are an important consideration. When choosing a site to establish or relocate a stop, choose the widest, most level sidewalk near the desired location. Stops should also be located to maximize ridership. A designer will need to balance the demands of pedestrian connections and bus ridership.

Crossings – Where bus stops are located near pedestrian crossings, the crossing should be marked and preferably located behind the stop, so that passengers are encouraged to cross behind the bus. Ideally, crossings should be signalized, especially in high-traffic and high-speed environments. Intersections and at-grade driveway crossings should have ADA-compliant curb ramps.

Safety and Bus Stop Visibility

Lighting – Lighting should be provided at stops for the safety and security of bus patrons. Bus stop lighting simultaneously offers bus operators better visibility of waiting passengers. Lighting can be cast by pedestrian-scale light fixtures, lighted shelters, overhead street lights, or brightly-lit signs.

Sight Distance – Consider sight distance for transit passengers, bus operators, and other motorists. Avoid obstructions to sightlines between bus operators and passengers such as trees, signs, buildings, shelters, and topography.

For optimal sight distance between bus operators and other motorists, bus stops should not be located over the crest of a hill, immediately in or after a roadway curve to the right, or at locations that might reduce visibility between buses and other vehicles.

Speed Limit (MPH)	Sight Distance (feet)
15	200
20	265
25	335
30	400
35	465
40	530
45	600
50	665

Table 2: Sight Distance for Siting Bus Stops

Adapted from AASHTO 2016 and AASHTO 2011.
Note: Assume a 9-second time gap is required for buses to re-enter traffic without undue interference to traffic flow.

Approaching vehicles need to have adequate visibility of stopped buses and buses entering or exiting a stop, particularly when stops are located in the travel lane. Similarly, bus drivers need to be able to see vehicles approaching from behind when exiting a stop. Table 2 provides the recommended sight distance for bus stops, given the posted speed limit. At a minimum, bus stops should be sited to meet the minimum stopping sight distance provided by AASHTO.

It is not recommended to place stops where there is inadequate sight distance, and existing stops with poor visibility should be considered for relocation or removal. In addition, stopped buses can impact sight distance for vehicles exiting side streets. Depending on the location of the stop relative to an intersection, different vehicular turn movements can be affected.

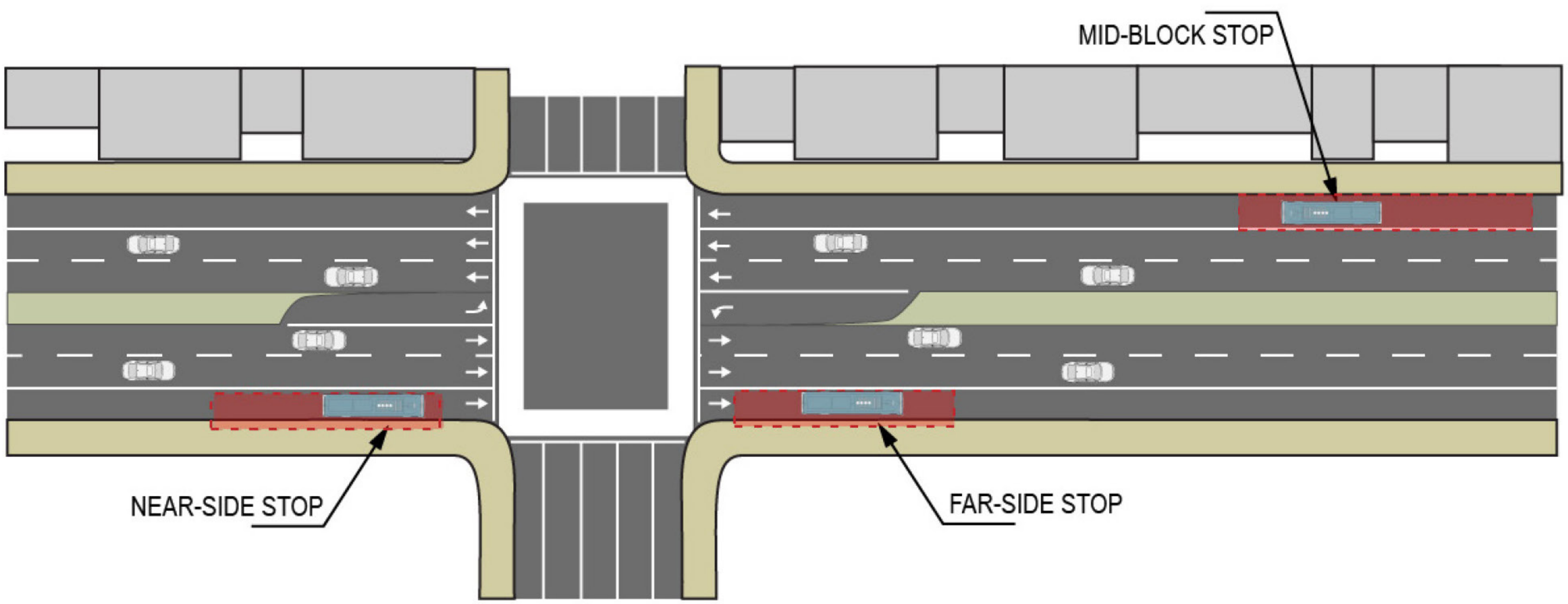
C. Spatial Location of Bus Stop

The specific location of a bus stop within the right-of-way is important for bus operations. A good bus stop location is one that is operationally safe and efficient for buses and is safe and convenient for passengers. The stop should be located where it causes minimal interference with pedestrian movements and other traffic, including bicycle traffic.

On-street bus stops are usually located along the street curb for direct safe passenger access to and from the sidewalk and waiting areas. Stops may be located on the far side of an intersection, the near side of the intersection, or at a point mid-block.

Far-side stops are stops located after an intersection in the direction of travel. They are generally preferred because they reduce conflicts between right-turning vehicles and stopped buses, eliminate sight-distance deficiencies on approaches to an intersection, and encourage pedestrian crossing at the rear of the bus. Additionally, since Rapid and BRT routes use transit signal priority to expedite travel across an intersection, far-side stops are integral to Rapid and BRT route implementation. Also, far-side stops allow passengers to cross the street from multiple directions to access the bus boarding area, due to its location on the corner of the intersection.

Near-side stops are stops located before an intersection in the direction of travel. They are acceptable when a far-side stop is deemed unsafe or impractical. They may also be used when a stop serves multiple routes that go in different directions after the downstream intersection. Like far-side stops, the stop's location allows passengers multiple crossing locations to access the bus boarding area, due to the location on the intersection corner.



Rhode Island bus Stop Design Guide. Providence: Rhode Island Public Transit Authority, 2017.[11]

Mid-block stops are stops that are not located in the general vicinity of an intersection. They are typically considered in special cases and are to be used only when no alternative is available. AC Transit and the jurisdiction where the bus stop will be located must approve any mid-block bus stops. This stop location generally has poor access due to the lack of formal street crossings near the stop, sometimes inducing passengers to reach the bus boarding area by crossing at undesignated locations.

In the typologies presented in Section 3, the diagrams feature far-side stops, as this is the stop location preferred by AC Transit. These typologies can be adapted to near-side or mid-block stops, if necessary.

D. Bus Stop Design

Floating bus stops are bus stops where the boarding platform is separated from the sidewalk by a bike lane. The bike lane is brought behind the bus stop to eliminate any potential conflict points between buses pulling into the stop and cyclists in the bike lane.

The appropriate width of a floating bus stop depends on many factors, including the width of travel lanes, width of bike lanes, and need for sidewalk space. A minimum width of eight feet is required for floating bus stops to ensure ADA-compliant access. However, where space permits, particularly for stops with large passenger volumes, a wider floating bus stop based on preferred dimensions may be designed.

The floating bus stop functions similarly to a bus bulb in that it allows the bus to stop in the travel lane. This design saves travel time for the bus by eliminating the need for the bus driver to merge in and out of traffic. The floating bus stop also provides a waiting area for passengers, and can relieve sidewalk congestion. This design may also save linear space compared to a traditional pull out bus stop, because when buses stop in the travel lane, pull-in or pull-out taper space is no longer required for buses to exit or enter the travel lane.

Vancouver, Canada

It is often a concern that buses stopping in traffic to serve a bus stop will slow traffic, but Federal Highway Administration studies show that stopping in the lane may actually increase traffic speeds on roadways with two travel lanes per direction (Kay Fitzpatrick, Kevin M. Hall, Stephen Farnsworth, and Melisa D. Finley: TCRP Report 65: Evaluation of Bus Bulbs (Washington, D.C.: Transportation Research Board, 2001), 2.).[12] Stopping in the travel lane reduces the phenomenon of bus drivers stopping with the bus protruding into traffic, thereby regularizing traffic flow. Typically, floating bus stops should not be installed on high-speed roads where the average travel speed is 35 miles per hour or greater, as stopping in the travel lane in such conditions may be unsafe.

On roadways with a single travel lane in one or both directions, local conditions, including vehicle volume and bus stop activity, should inform the use of floating bus stops. Floating bus stops may still cause the bus to partially block the travel lane when the bus boards and alights passengers. Therefore, motorists will need to wait for the bus to finish loading before they can progress. At a far-side stop, this wait time could cause cars to queue into the intersection and potentially block the intersection when the signal phase changes. Motorists may also try to divert around a stopped bus by entering the opposite-direction travel lane, which could be a safety concern.

AC Transit prefers that bus pullouts (turnouts) are avoided. Bus pullouts are generally detrimental to bus operations under most circumstances found in the AC Transit district and should be avoided. At a pullout, the roadway is widened just at the bus stop to channel the bus into a special curb lane. The bus then stops and serves the stop outside the travel lanes. Pullouts are generally not desirable for bus operations because they require the bus exit the traffic stream. Leaving the travel lanes can slow bus operations, particularly when the bus seeks to reenter traffic. Pullouts are generally designed for the convenience of other vehicles, not buses. Further, on Complete Street roadways with bicycle lanes, a bus pullout creates conflict with cyclists by requiring buses to fully cross the bike lane to pull in and out of the bus stop, as illustrated in the photo below.

Special cases where pullouts may be appropriate are unusually narrow roadways, such as those consisting of one very narrow travel lane (without a parking lane) in each direction. High-speed roadways without parking lanes may also be appropriate for pullouts. Further, there might be cases where bus pullouts could be useful for schedule adherence or layovers. However, these situations should be analyzed on a case by case basis. Finally, Transit Cooperative Research Program (TCRP) report 65 suggests pullouts for roads where traffic speeds are 40 mph and above.

Portland, OR

E. Bus Stop Dimensions

The required length of a bus stop is made up of the following components. Depending on the configuration of the bus stop (i.e. in lane vs. pull-out stop, near-side stop vs. far-side stop), not all elements will be present. Therefore, the total space required for a bus stop will be informed by the design and placement of the stop.

Bus Stop – total distance/area required for a bus to safely and efficiently pull into a stop, stop and load/unload passengers, and pull away from the stop and return to the travel lane. (Pull-in Taper + Platform + Pull-out Taper)

Platform – the area where the bus comes to a complete stop against the curb and from/to which passengers board and alight.

Pull-in Taper – the distance/area required for a bus to decelerate and exit the travel lane to reach the bus platform.

Pull-out Taper – the distance/area required for a bus to leave the bus platform, accelerate, and reenter the traffic stream.

Clearance from Crosswalk – the distance/area required from the front or rear of the bus and the adjacent crosswalk to ensure pedestrians and drivers have adequate sightlines.

Bus Stop Length

In addition to the selection of an appropriate location, there are other important requirements for bus stops. The required length of a bus stop is determined by the type of stop, stop location, stop amenities, roadway speed limit, and the number and type of buses expected to use the stop. There must be enough curbside space to enable bus operators to pull the bus parallel to the curb, open the doors onto the sidewalk, and pull away from the stop into the travel lane. Providing bus stops with sufficient length also prevents buses from straddling crosswalks, which can block access for pedestrians.

Required bus stop lengths vary depending on several factors:

- **Location of the stop relative to the intersection (far-side, near-side, or mid-block)**
- **Stop configuration**
- **Approach of bus turning movement**
- **Roadway speed, and thereby deceleration and acceleration space**
- **Presence of crosswalks, on-street parking, and driveways**
- **Location of landscaping and street furniture along the sidewalk edge**
- **Number of buses serving and/or laying over at the stop**

Because bus stop length will vary depending on the type and design of a specific bus stop, each typology presented in Chapter 4 includes a table detailing the dimensions required for that bus stop design. General design principles are described in the next subsections.

For buses that stop in the travel lane, the only consideration for the overall bus stop length is the platform itself, since no separate entering and exiting distance is required. The platform length is primarily determined by the size of the bus used on the route and the number of buses servicing the stop at peak hours.

At stops where the bus must pull out of the travel lane, the length required for a bus stop consists of three elements – the pull-in taper, platform/boarding length, and the pull-out taper. The stop must be long enough so that buses can not only stop there, but also get into and out of the stop easily. Adequate-length bus stops make it more likely that the bus driver will pull completely into the stop, rather than leave the back of the bus protruding into the travel lane. Because stopping flush with the curb is key for passengers with mobility impairments, providing a sufficiently long stop is an ADA issue.

Pull-In/Pull-Out Taper

Pull-in/pull-out taper applies only to curbside stops where the buses pull out of the travel lane. The length required for pull-in or pull-out taper is determined from the posted speed limit or prevailing speed, whichever is greater. If prevailing speed data cannot be collected, the posted speed limit should be used.

The stop location also affects the pull-in or pull-out taper distance required. Far-side stops do not require any additional pull-in taper because the bus can use the intersection to decelerate and pull into the stop. Conversely, for near-side stops, no pull-out taper is required because the intersection provides space to accelerate and merge back into the travel lane.

Platform Length

The length required for the platform is primarily a function of the type of bus the stop is designed to serve and the number of buses the stop must serve simultaneously. At a minimum, all AC Transit stops should be designed to serve a 40-ft bus. On routes where articulated buses are used, stops should be designed to serve 60-ft buses. The length of a platform should increase if it is determined that the stop must accommodate multiple buses simultaneously. The Transportation Research Board provides guidance for determining when stops should be designed to accommodate multiple buses, based on the number of buses per hour, average dwell time, and adjacent intersection signal cycle times.

Stop Amenities

Stop amenities include bus shelters, benches/seating, wayfinding, fare vending machines, bike parking, trees/landscaping, trash cans, lighting, and other amenities that are located within the bus platform area. Stop amenities can help attract customers and increase passenger comfort, improve operational efficiencies, and foster local civic pride and economic development.

The presence of stop amenities, particularly bus shelters or other large amenities, may impact the required platform length. Bus shelters and other large stop amenities restrict the space available for passenger circulation and movement and may require that the platform length be increased. The ADA requires bus stop boarding and alighting areas at the front door landing area, and an accessible route between the landing area, sidewalk, and bus shelters. A clear zone at the first rear door is also required by AC Transit.

Crosswalk Clearance

For all far-side and near-side stops, clearance from the crosswalk is required for pedestrian safety. NACTO's guidelines recommend a minimum of 10 feet of clearance between the rear of the bus and the crosswalk at a far-side stop. With a near-side stop, a minimum of 10 feet of clearance between the front of the bus and the crosswalk is recommended.

F. Door Locations and ADA Access

AC Transit utilizes a variety of fleet types, including 30-ft, 40-ft, and 60-ft buses, which have two, three, or four doors, depending on the vehicle model. Landing areas and clear zones should be laid out to accommodate the bus fleet in operation. Landing areas and clear zones should be free of driveways, curb ramps, and obstructions such as utility poles, hydrants, and other street furniture. AC Transit's design guidelines recommend designing all stops with two door landing areas to accommodate the first two doors of all vehicles, regardless of vehicle length or model.

For the first door landing area, ADA guidelines require that a minimum width of 5 feet along the curb, and a minimum depth of 8 feet perpendicular to the curb, be provided at the landing area, to the extent feasible and within the control of the transit agency. The location of the landing area is primarily dependent on the siting of the stop relative to the intersection, and secondarily, on the availability of sidewalk space to accommodate an ADA-compliant landing area. The first door landing area should begin one foot behind the bus stop pole.

To accommodate rear door passenger activity, bus stops should also have a second door landing area. On AC Transit vehicles manufactured by Van Hool, the second door serves as the ADA-accessible ramp entrance. Therefore, providing a second landing zone is important to ensure that the stop is ADA-compliant. The second door landing area should be 11.5 feet wide along the curb, with a minimum depth of 8 feet perpendicular to the curb. The second door landing area should begin 12.5 feet behind the bus stop pole.

The critical path of travel for passengers at a bus stop is the connection between the landing area and the sidewalk and bus shelters. The ADA requires that there be an accessible route between these points. Sidewalks and bus shelters shall be connected to the landing area by an accessible route. This requirement means that a clear, unobstructed, ADA-compliant path of travel must be provided. AC Transit prefers a 4-foot wide path, although the ADA requires a minimum 3-foot wide path, which can be used in extenuating circumstances.

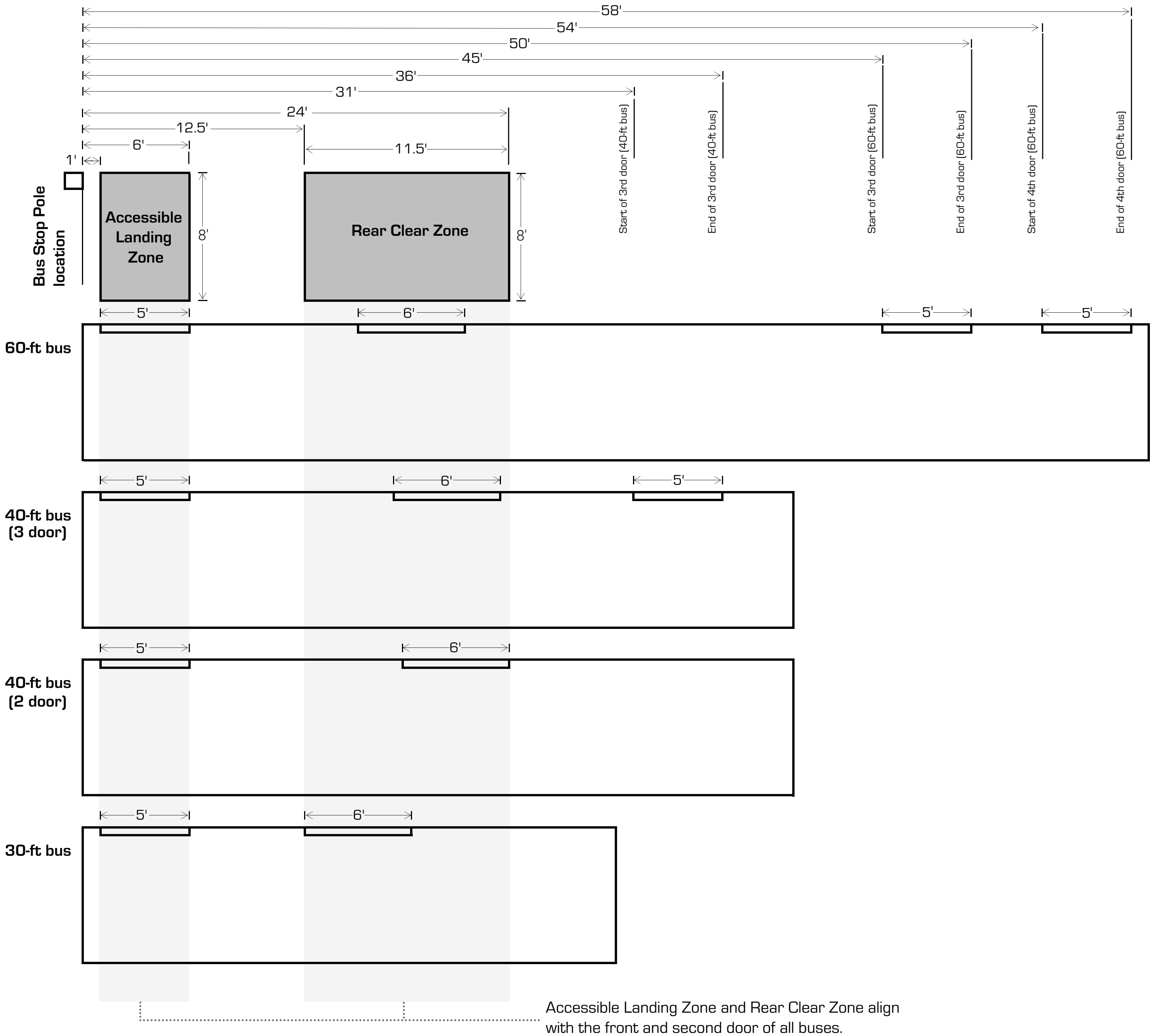


Exhibit 1: AC Transit Landing Area Dimensions of Common Bus Types

G. Bus Stop Pads

Bus pads are highly durable areas of the roadway surface at bus stops, usually constructed of concrete, that address the common issue of asphalt distortion at bus stops.

Conventional asphalt pavement is flexible, and can be moved by the force and heat generated by braking buses and trucks, leading to wave-shaped mounds along the length of a bus stop. This issue is pronounced at high-volume stops where dwelling buses further heat the roadway surface, as well as near-side stops in mixed-traffic lanes where trucks can add to wear.

Bus pads should be at least 8.5 feet wide to accommodate both wheels of a bus, but should be wider at locations without precision loading to provide consistent service when the bus does not pull fully to the curb. Bus pad length should be determined based on the length of the platform area.

At stops where the bus crosses a bike lane, the concrete bus pad should end at either the curbside edge of the bike lane or the outside edge of the bike lane (including its full width) to prevent the creation of a longitudinal joint within the bike lane. Bus pads should end before the crosswalk to prevent lateral or longitudinal pavement joints within the crosswalk. If a bus pad must be extended into the crosswalk, it should extend across the full width of the crosswalk to prevent joints between concrete and asphalt.

H. Curbs

The curb alongside the bus stop should be painted red to prevent cars from parking within the bus stop space or within the pull-in or pull-out zone that is required at traditional bus stops where buses must pull out of the travel lane. If cars are parked at a bus stop or within the pull-in or pull-out zone, then the bus will not be able to stop flush along the boarding platform which is inconvenient and dangerous for passengers, and can prevent bus ramps from being deployed, resulting in ADA accessibility issues. Curb height and design should be informed by local conditions or design standards.

I. Service Type and Level of Service

Finally, the service type and level of service provided on a route and/or corridor should be considered when determining the design of bus stops and prioritizing capital improvements. AC Transit has identified eight primary service types operated by the District. These are outlined in AC Transit Board Policy No. 550.[13]

Trunk Routes and Major Corridors – These are the services operating on corridors where residential densities are at least 20,000 residents per square mile (or comparable commercial densities). Routes in these corridors provide the backbone of the transit system; operate along the arterial streets and provide a high level of local and limited stop service. These routes have the highest priority for capital improvements.

Rapid - Provides limited stop service along a Trunk Route or Major Corridor featuring wide stop spacing, headway based schedules, transit signal priority and passenger amenities. Underlying local service contributes to aggregate service frequency.

Urban Secondary, Crosstowns and Feeder Routes – These are the routes operating in medium density corridors (10,000 – 20,000 residents per square mile or comparable commercial densities). These routes complement the trunk route network, providing a high level of local stop service. These corridors also are candidates for capital improvements to assist in bus operations.

Suburban Crosstowns and Feeder Routes – These are the routes operating in low density corridors (5,000 – 10,000 residents per square mile). These routes feed BART, park and ride lots, or other AC

Transit routes, or serve neighborhood circulation functions with a high level of service.

Low Density Routes – These are primarily routes operating in areas of very low density (fewer than 5,000 residents per square mile).

Community Flex Services – These are primarily routes operating in areas of very low density, again, fewer than 5,000 residents per square mile, that provide a more flexible operation than traditional fixed route service.

All-Nighter (Owl) Routes – These are the routes providing service between 12 midnight and 6 am. All-Nighter routes operate as a lifeline service during the "owl gap" period.

Transbay Routes – These are the routes providing service to downtown San Francisco via the Bay Bridge Corridor.

These service types form a hierarchy of service both in terms of service investment (annual service hours) and ridership. Therefore, AC Transit's policy directs staff to prioritize capital investments for service types with the highest levels of service and highest ridership. Additionally, because the service type classifications closely correspond with service frequency and ridership, they can be used to inform the bus stop design, dimensions, and amenities.

Table 3 outlines AC Transit's service types, span of service standards, and weekday peak frequency standards.

Service Type	Span of Service Standard	Weekday Peak Frequency Standard
Trunk and Major Corridors	19-24 hours daily	15-20 minutes
Rapid	14-16 hours daily	10-14 minutes
Urban Crosstown/ Feeder	14-16 hours daily	15-20 minutes
Suburban Crosstown / Feeder	14-16 hours daily	21-30 minutes
Very Low Density	14-16 hours daily	31-60 minutes
All-Nighter (Owl)	Owl gap period	31-60 minutes
Transbay	17-18 hours daily	21-30 minutes

Table 3: Span of Service and Weekday Peak Frequency Standards

Adapted from AC Transit Board Policy No. 550

3.0 Typology Design Considerations

Seattle, WA

Properly-placed design elements are critical to a positive overall experience for transit users. When reviewing individual bus stops and their context, designers must consider a wide range of issues that are unique to each location. In many transit corridors, the adjacent streetscape design elements may also contribute to the bus stop design. Due to constrained right-of-way, it is not feasible or practical to include all design elements at each bus stop location. The placement and use of design elements at bus stops should maximize safety, visibility, and comfort for all users. Designers are encouraged to consult with AC Transit or local guidance for additional design considerations.

3.1 General Guidance for Context Zones

For the purposes of this guide, establishing context zones simplifies the process of defining the roadway cross section along a corridor. Zones establish a foundation for designers to appropriately locate design elements tailored to the different uses expected of a roadway user. Exhibit 2 illustrates each zone with subsequent text describing the relationship between the zones and the design elements that commonly contribute to multimodal bus stop design.

Pedestrian Zone - This zone is generally reserved for pedestrian mobility for users of all ages and abilities to access pedestrian oriented destinations.

Furnishing Zone - This zone is generally reserved for seating, bicycle racks, street lights, parking pay stations, stormwater infrastructure, street trees, transit shelters, trash receptacles, in addition various utilities that support a multimodal environment. This zone can also be flexible and may vary between blocks and along a corridor.

Bus Stop Bypass Zone - This zone is generally reserved to route the bikeway around the rear of the bus stop between the furnishing zone and floating bus stop furnishing zone.

Bus Stop Furnishing Zone - This zone is generally reserved to function similar to the furnishing zone and may consist of seating, lean bar or railing, transit shelter, or vertical railings as space provides. The available width and length of the floating bus stop will determine the amount, type, and function of design elements placed in the floating bus stop furnishing zone.

Floating Bus Stop - This zone is generally reserved for users waiting in a dedicated space to access transit.

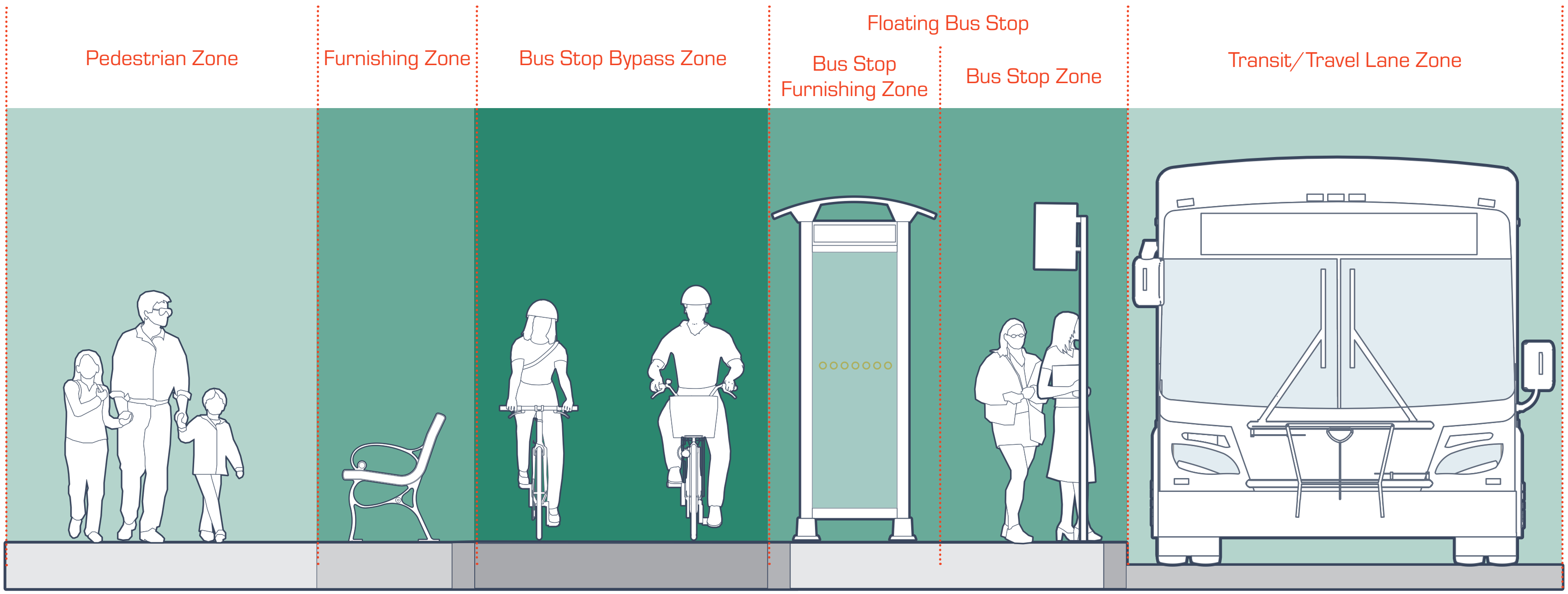


EXHIBIT 2: Context Zones

3.2 Design Elements

All bus stops should consider utilizing appropriate design elements to provide a safe, accessible, and high-quality transit experience. This section defines typical bus stop design elements either as standard, recommended, or optional. Standard design elements are typical of bus stops, bicycle facilities, pedestrian facilities, etc. Including recommended design elements should result in a high quality bus stop for all users. Design elements have been noted as optional to be sensitive to design preferences of jurisdictions.

Accessible Landing Pad (Furnishing/pedestrian zone or bus stop furnishing zone) – Standard

ADA guidelines require a minimum of 5 feet along the curb and a minimum depth of 8 feet perpendicular to the curb to be provided at the landing area. It should be a firm, stable surface, with a maximum 2% cross slope. The landing area should match the roadway running slope to the extent practicable and be parallel to the roadway.

Benches (Furnishing/pedestrian zone or bus stop furnishing zone) – Optional

Providing seating at bus stops is a pleasant amenity for transit users waiting for the bus. Benches may be stand-alone or integrated into a shelter. ADA does not provide guidance for outdoor benches, however the Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG) suggests that benches providing full back support and armrests better assist pedestrians with mobility impairments to sit and stand.

Vancouver, Canada

Bicycle Facility Elevation (Bus stop bypass zone) – Standard

Bicycle facilities may be provided at the same elevation with the sidewalk, at street level, or at an intermediate height with a 2- to 3-inch curb reveal between the sidewalk and street level. The appropriate elevation of the bicycle facility will often be based on known physical constraints or design feasibility. The advantages or disadvantages of these designs are discussed thoroughly in separated bike lane guidance. A designer should consult these references prior to choosing the appropriate bikeway elevation treatment.

Bicycle Racks (Furnishing zone or bus stop furnishing zone) – Recommended

Installing bicycle parking at bus stops increases a transit passenger's flexibility to park their bicycle and take transit. These decisions may be based on many external factors including distance, weather, convenience, and effort. This amenity improves first- and last-mile connections and can increase the desirability of combined bicycle and transit trips.

Furthermore, if the bus bicycle rack is at capacity, bicycle parking allows bicyclists to lock their bike if they choose. Bicycle racks should be placed outside of the path of travel at the bus stop and positioned so that no matter how a bicycle is locked, a one foot buffer from the bikeway and the edge of the locked bike will be maintained. Refer to the Association of Pedestrian and Bicycle Professionals (APBP) Bicycle Parking Guidelines for the appropriate type and placement of bike racks.

Essentials of Bike Parking: Selecting and Installing Bike Parking that Works. Association of Pedestrian & Bicycle Professionals. 2015.[14]

Bike Ramp (Bus stop bypass zone) – Standard

When the elevation of the bicycle facility changes at a floating bus stop, a smooth ramp transition should be provided to allow comfortable passage for bicyclists through the bus stop influence area.

Cambridge, MA

Bus Shelters (Furnishing zone or bus stop furnishing zone) – Optional

Shelters provide a safe, secure, and comfortable space for users waiting for their bus. Shelters offer protection from inclement weather, and, in some cases, include lighting, heating, and opportunities for additional seating. Transit information, including route numbers, timetables, and, in some cases, maps, may also be provided at shelters.

The design of shelters should be simple, functional, and easy to maintain. The size of shelters will largely depend upon the amount of available space at a bus stop location.

Bus Stop Pole (Furnishing zone or bus stop furnishing zone) – Standard

Bus passengers need information to understand which bus routes will stop at their location. This pole and sign can also include information such as the route direction, schedule, etc.

Channelization (Bus stop bypass zone) – Recommended

Channelizing infrastructure can be designed to manage pedestrian and bicyclist movements between the travel lane, bikeway, and pedestrian facility. Pedestrians and bicyclists can be separately and effectively channelized by locating a vertical object (e.g., planter) to physically deflect and direct users to desired areas. For example, pedestrians could be channelized to designated crossings of the bikeway between sidewalk and floating bus stop. Effectively channelizing bicyclists and pedestrians through a bus stop can improve safety, provide maximum convenience, and enhance functionality.

Portland, OR

Crosswalks (Pedestrian zone) – Standard

Crosswalks provide designated routes for pedestrians to cross another facility. Maintaining a pedestrian access route between the sidewalk, floating bus stop, and additional bus stop design elements is required. All crosswalks should be located to maximize visibility for pedestrians and of pedestrians by drivers and bicyclists. Bus stops should connect to a marked pedestrian crossing, preferably a crosswalk behind the stop, so that passengers are encouraged to cross behind the bus. Intersections and at-grade driveway crossings should have ADA-compliant curb ramps.

Detectable Warning Surface (Pedestrian zone) – Standard

The ADA requires that bus stop boarding and alighting areas shall be connected to streets, sidewalks, or pedestrian paths by an accessible route. Detectable warning surfaces provide a tactile and noticeable message that a change of environment will occur between these areas.

Green Colored Pavement (Bus stop bypass zone) – Optional

The consistent use of green colored pavement may be used to delineate the bicycle zone or to emphasize areas of potential conflict. An alternative option is to use contrast to mark the separate zones, such as different colored concrete, or using asphalt for the bikeway and concrete for the floating bus stop and sidewalk.

Green colored pavement may be considered for optional use in marked bicycle facilities and in extensions of bicycle facilities through intersections and other traffic conflict areas. The use of dashed green colored pavement indicates merging areas for the bicycle facility and vehicular traffic. Solid green colored pavement may be used to designate the bike lane zone

Lean Bar or Lean Rails (Pedestrian/Furnishing Zone or bus stop furnishing zone) – Optional

Lean rails may be used in place of traditional benches. These amenities establish a narrow barrier between the bus island and the bus stop bypass to deter transit passengers from crossing the bicycle facility in non-designated spots. They also invite passengers to use these amenities casually as they wait for their bus.

Lighting (Furnishing Zone or bus stop furnishing zone) – Recommended

Bus stop lighting provides safety and security for all users while also increasing visibility of waiting passengers for bus operators. Sufficient illumination can be achieved with pedestrian-scale fixtures, lighted shelters, and street lights. The Illuminating Engineering Society provides guidance on how much illuminance to provide. Refer to Illuminating Engineering Society (IES), Roadway Lighting RP-8-14. 2014.[15]

Railings (Bus stop furnishing zone) – Optional

Vertical railings may be useful at channelizations (bus stop bypasses), as they establish a barrier between the bus island and the bicycle facility routing behind it, deterring transit users from crossing the bicycle facility in non-designated locations.

Rear Landing Area (pedestrian/furnishing zone, bus stop furnishing zone) – Standard

The clear zone is the area where the back doors of the bus open onto the sidewalk or floating island. AC Transit requires bus stops to have a clear zone for the first rear door. The clear zone should be free of driveways, curb ramps, and obstructions such as utility poles, hydrants, and other street furniture. Although there is no requirement for the clear zone to be ADA-compliant, it is desirable, and at a minimum should be a level surface area. The clear zone should be 11.5 feet wide by 8 feet deep.

Street Trees and Stormwater Infrastructure (furnishing zone or bus stop zone) – Optional

Properly selected and maintained landscaping helps enhance passenger comfort at a bus stop and may improve the overall aesthetic of transit service. Street trees at bus stops can help provide shade and protection from adverse weather. Placement of street trees or stormwater infrastructure should not disrupt safety, visibility, or service at the bus stop location. Street trees, landscaping, and stormwater infrastructure should be selected based on environmental performance, maintenance, and aesthetic goals of the jurisdiction.

Trash receptacles (furnishing zone) – Optional

Trash and recycling receptacles or solar compactors are desirable at higher-ridership stops, stops in commercial areas and retail centers, and stops with shelters. AC transit recommends locating trash and recycling receptacles on the sidewalk to clarify that maintenance is a City responsibility, which may assist with keeping the overall buildup of debris to a minimum.

Sydney, Australia

4.0
Bus Stop Design Typologies

Seattle, WA

Designing a safe, comfortable, and functional bus stop for all users with special consideration to bicycle users is a primary purpose of this guide. Local jurisdictions are implementing more separated bike lanes on transit corridors and need design guidance to safely and seamlessly maintain bikeways through the bus stop. Based on common roadway and bikeway configurations, transit operations, and other considerations, five bus stop design typologies have been identified:

- **Typology 1: Class II Bicycle Facility between the Curb and a General Traffic Lane**
- **Typology 2: Class II Bicycle Facility between Curbside Parking Lane and a General Traffic Lane**
- **Typology 3: Class IV Bicycle Facility (Separated Bikeway) between the Curb and a General Traffic Lane**
- **Typology 4: Class IV Bicycle Facility (Separated Bikeway) between the Curb and a Parking Lane**
- **Typology 5: Class IV Bicycle Facility (Two-way Separated Bikeway) between the Curb and a Parking Lane**

Each design typology contains design elements reflecting the context of the roadway environment. Required and optional design elements are specified within the typologies, but the designer should use engineering judgment when selecting and locating design elements for a bus stop design. These bus stop typologies are intended to illustrate how and why design elements are included to provide a safe, comfortable, and functional bus stop.

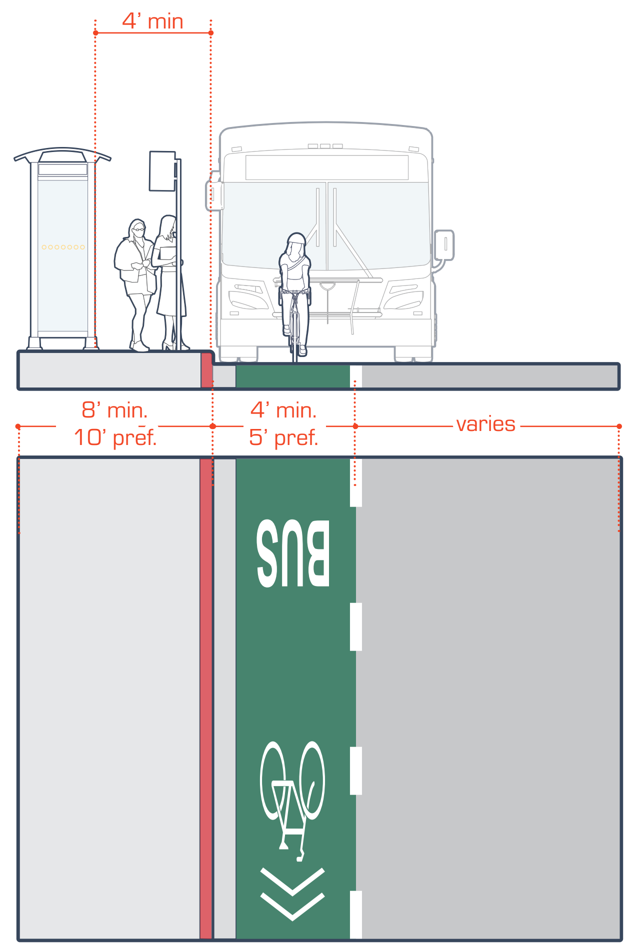
Bus stops should be provided curbside (against a curb) in most instances, as this is the most functional location for a bus stop. In the typologies, the bus stop curb is located either along the sidewalk (Typology 1) or along a floating bus stop (Typologies 2-5).

Four of the five typologies utilize floating bus stops, which are sidewalk-level platforms built between the bicycle lane and the roadway travel lane. When using floating bus stops, bicyclists are directed behind the bus stop, reducing or eliminating most conflicts between buses and bicyclists. By eliminating the need for buses and bicycles to interact, floating bus stops have large safety benefits for bicyclists. They can also benefit pedestrians, as the floating bus stop doubles as a pedestrian refuge, which if designed efficiently, can shorten crossing distances and enable shorter signal cycles.

4.1 Typology 1
Class II Bicycle Facility between Curb and a General Traffic Lane

The first Typology illustrates locations where the bike lane is located adjacent to the curb on a roadway. This typology more likely pertains to transit routes outside of a priority bicycle network. The section view illustrates that the bus will position itself on top of the bike lane to board and alight passengers. This means the bus may block motorists and bicyclists. These roadway users may have to wait or move around a bus during boarding/alighting operations.

A. Typology 1: Section View



If a transit corridor consistently implements Typology 1, normal bus operations may cause a "leap-frogging" effect for bicyclists. Leap-frogging is described as: A) a bus will pass a bicyclist between bus stops, B) the bus boards/alights passengers, C) the bicyclist passes the dwelling bus, and D) then the bus passes the bicyclist between the bus stops again. The leap-frogging process could repeat several times, especially if the average bus speed is similar to a bicyclist's riding speed. This effect is uncomfortable for bicyclists and increases the likelihood they will exit the bike lane into mixed traffic to pass a dwelling bus, which increases their crash risk with automobiles.[16] Leap-frogging is a known operational issue and is usually mitigated by implementing more separation between the vehicle lane and the bike lane, which may then necessitate the use of the subsequent design typologies described in this document.

Several design elements have been explicitly called out for Typology 1. A bus stop has minimum design constraints so that an accessible landing zone and a rear clear zone are provided. The location of these zones at the bus platform varies depending on the prevailing bus size. Also, this typology includes design elements typically employed at roadways and bus stops such as a furnishing zone, bus stop pole, and detectable warning surfaces on the sidewalk ramps. Lastly, note the optional design elements such as the bus shelter, green pavement markings, and red curb zone. The exact location and scale of these design elements may vary based on the constraints and context of the bus stop.

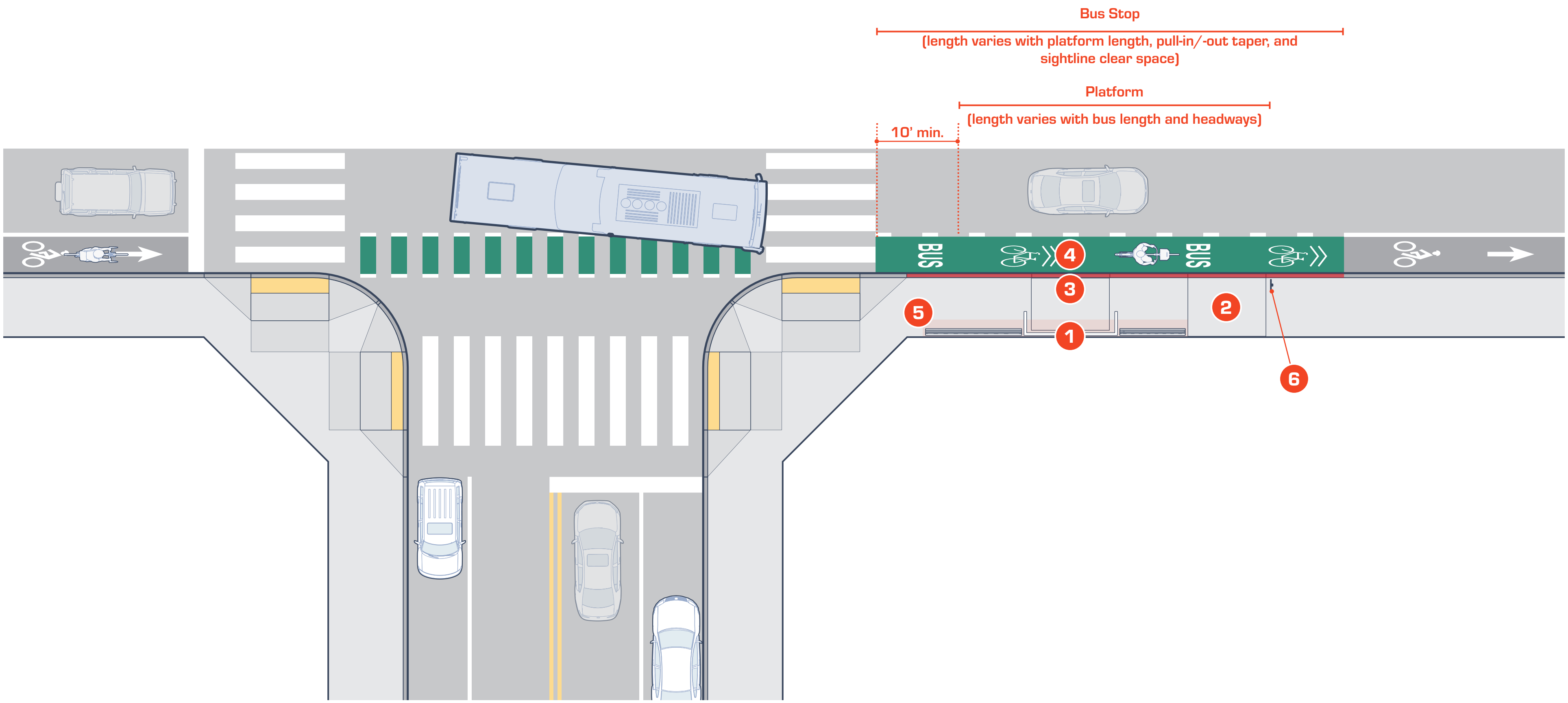
The bus stop and platform length will vary based on many factors including the pull-in/-out taper, sight distance, physical bus dimensions, and headways. Table 4 provides guidance for these dimensions on Typology 1, but the designer should use engineering judgment based on the roadway context and design constraints.

	Arterial Speed Limit		
	< 20 MPH	20-35 MPH	>35 MPH
Platform			
40' Bus	40'	40'	40'
60' Bus	60'	60'	60'
Two 40' Buses	120'	120'	120'
One 40' Bus and One 60' Bus	140'	140'	140'
Two 60' Buses	180'	180'	180'
Pull-in Taper			
Far-side Bus Stop	N/A	N/A	N/A
Near-side Bus Stop	10'	15'	20'
Mid-block Bus Stop	10'	15'	20'
Pull-out Taper			
Far-side Bus Stop	10'	15'	20'
Near-side Bus Stop	N/A	N/A	N/A
Mid-block Bus Stop	10'	15'	20'
Clearance from Crosswalk			
Far-side Bus Stop	10'	10'	10'
Near-side Bus Stop	10'	10'	10'
Mid-block Bus Stop	N/A	N/A	N/A

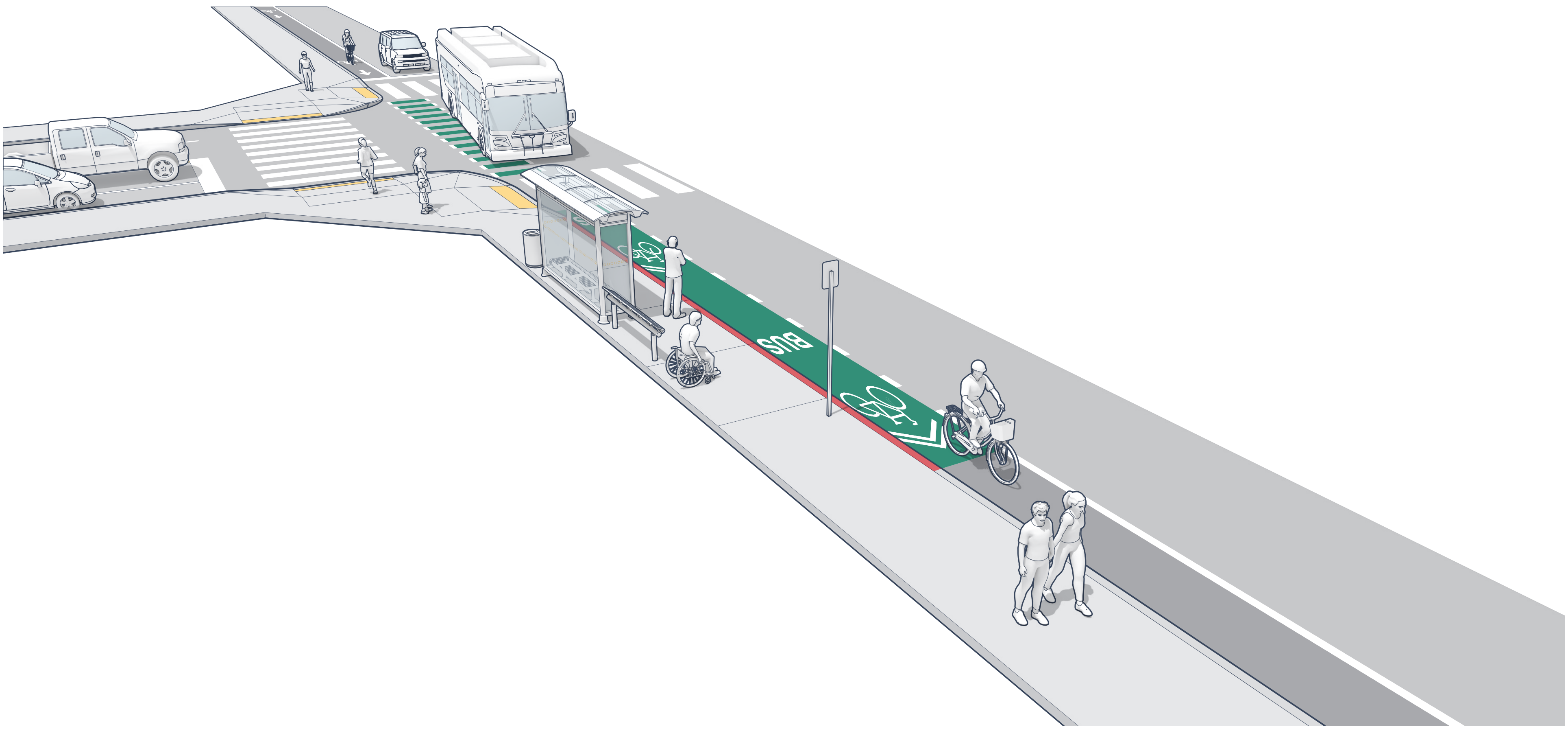
Table 4: Typology 1 Influence Area Minimum Dimensions

B. Typology 1: Plan View

1. Bus shelter (optional)
2. Accessible landing zone (min. 5' x 8')
3. Rear clear zone (11.5' x 8')
4. Green pavement (optional)
5. Furnishing zone
6. Bus stop pole



C. Typology 1: Perspective View



4.2 Typology 2
Class II Bicycle Facility between Curbside Parking Lane and a General Traffic Lane

A. Stop Placement and Bike Facility Alignment

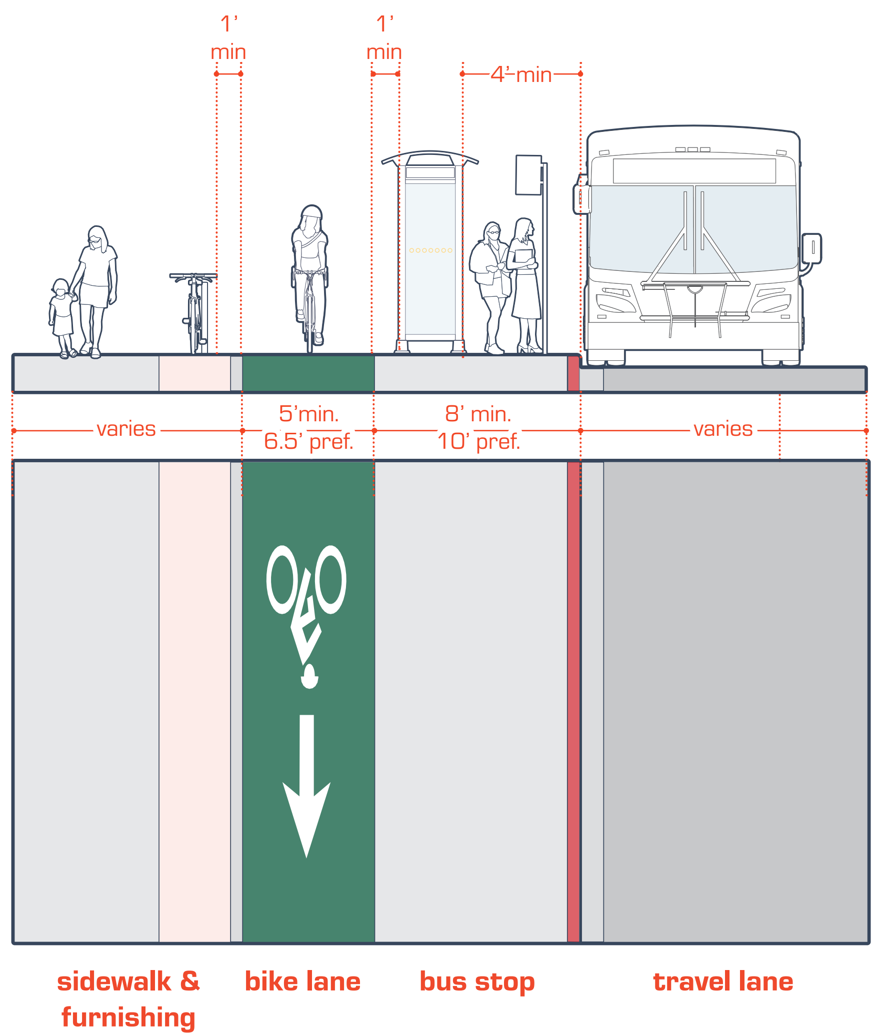
Adding parking to the roadway influences the spatial relationship between the bus boarding/alighting operation and the bike lane. Parking operations may cause conflicts with bus operations, and the door zone of parked vehicles can be a hazard for bicyclists. However, implementing a floating bus stop is an improvement for bicycle and transit operations, because the bus boarding/alighting operations can be performed independently of through bicycle movements.

AC Transit prefers far-side bus stops for a variety of bus-related operational reasons (AC Transit Policy No. 508); however, the designer can consider using near-side or mid-block bus stops. Note that conventional mid-block bus islands are illustrated but are not a preferred design because they create a potential conflict with bicyclists by requiring buses to fully cross the bike lane to pull in and out of the bus stop.

The key design characteristic of Typology 2 is the routing of the bike lane behind the bus stop, which minimizes conflicts between the bicycle movement and the bus boarding/alighting operation. The design elements at the floating bus stop and the furnishing zone should be located at least one foot from the edge of the bike facility. If a bicycle rack is located in the furnishing zone, the edge of a parked bicycle should be at least one foot from the edge of the bike facility, which may necessitate moving the bike rack further toward the building frontage. This shy distance improves bike operations and minimizes safety hazards from handlebar or pedal strikes.

Bus passengers have two designated bike lane crossings from the sidewalk to the floating bus stop, which helps manage pedestrian/bicycle interactions. Importantly, bicyclists are required to yield to pedestrians

B. Typology 2: Section View



at these designated crossings with the use of yield markings and an optional “Bike Yield to Pedestrians” MUTCD R9-6 sign. The furnishing zone and/or detectable edge assists with managing bus passenger crossings at those two locations.

Furnishing elements could include bicycle racks, trash receptacles, etc. Alternatively, detectable longitudinal panels can be embedded along the bike lane to guide visually impaired pedestrians to the designated bike lane crossing, as shown in exhibit 3 and in the photo to the right. These directional indicators are in accordance with International Standard 23599 and their color should contrast with adjoining concrete or asphalt pavement.


Delft, Netherlands

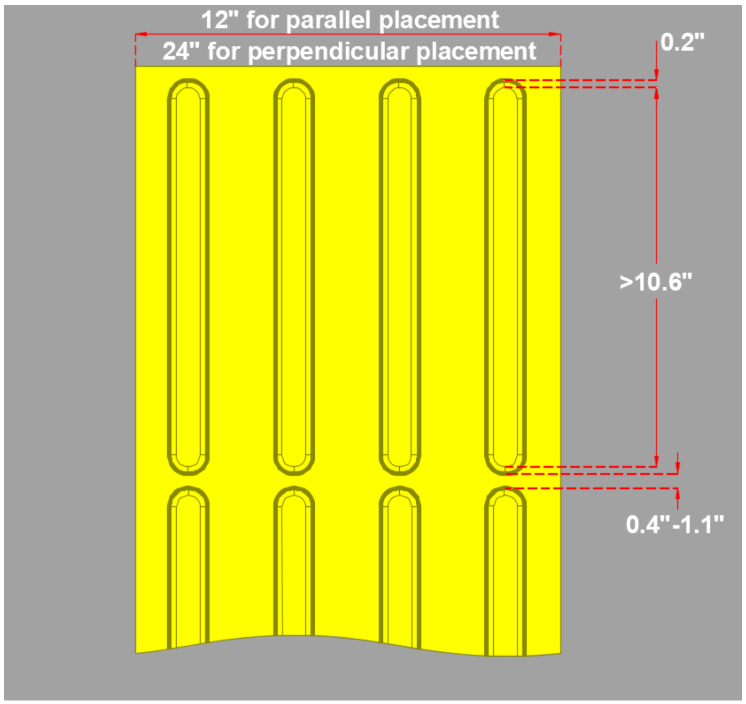


Exhibit 3: Longitudinal detectable edge

There are several bike lane-specific design elements which should be included when designing a bus stop based on Typology 2.

6 The bicyclist yield area provides space for bicyclists to stop for crossing pedestrians while also being protected from traffic.

7 The maximum bicycle ramp slope should be 1:12 from street to sidewalk level.

9 The bike lane transition taper of 1:10 is preferred, with a maximum of 1:5.[17]

Providing more space for bicyclists to yield for pedestrians and/or constructing a gentler slope or taper for the bike lane will improve comfort for bicyclists.

Lastly, vertical railings or lean rails may be optionally employed in Typology 2.

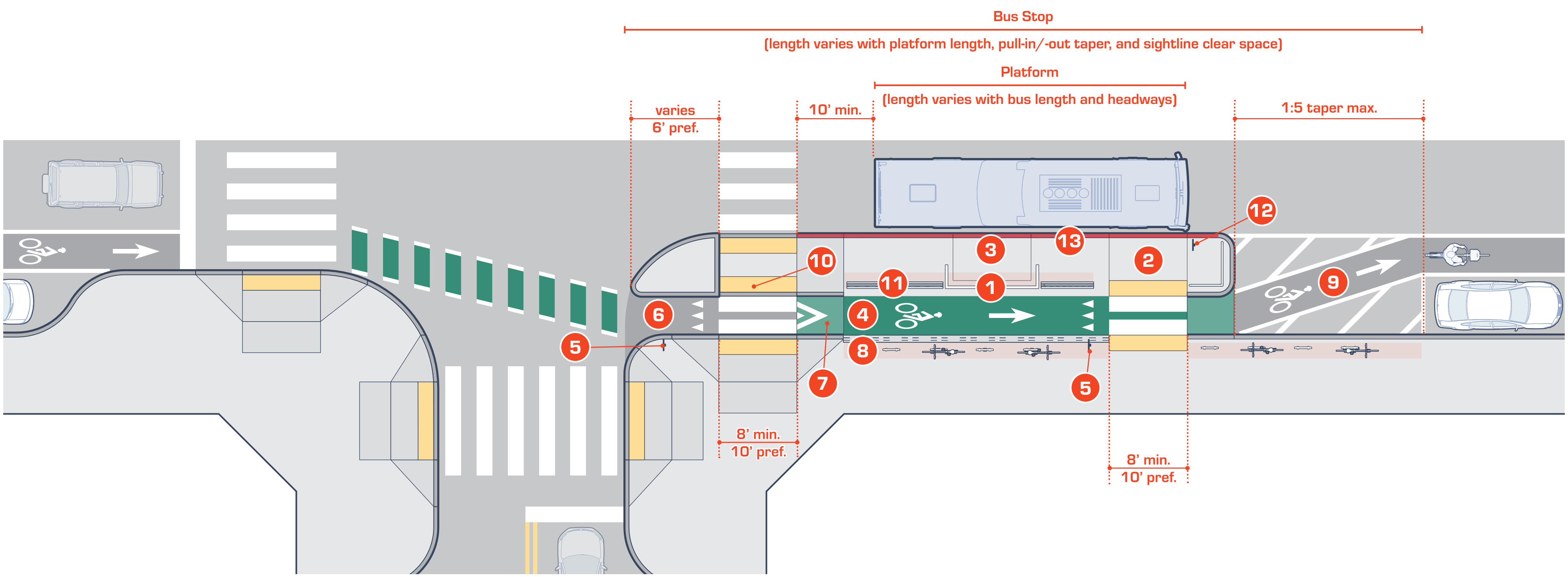
Table 5 provides guidance for these dimensions on Typology 2.

	Arterial Speed Limit
	All Speeds
Bus Stop Island	
40' Bus	40'
60' Bus	60'
Two 40' Buses	120'
One 40' Bus and One 60' Bus	140'
Two 60' Buses	180'
Entering Bike Lane Taper Distance	
Far-side Bus Stop	N/A
Near-side Bus Stop	24'
Mid-block Bus Stop	24'
Exiting Bike Lane Taper Distance	
Far-side Bus Stop	24'
Near-side Bus Stop	N/A
Mid-block Bus Stop	24'
Clearance from Crosswalk	
Far-side Bus Stop	10'
Near-side Bus Stop	10'
Mid-block Bus Stop	N/A

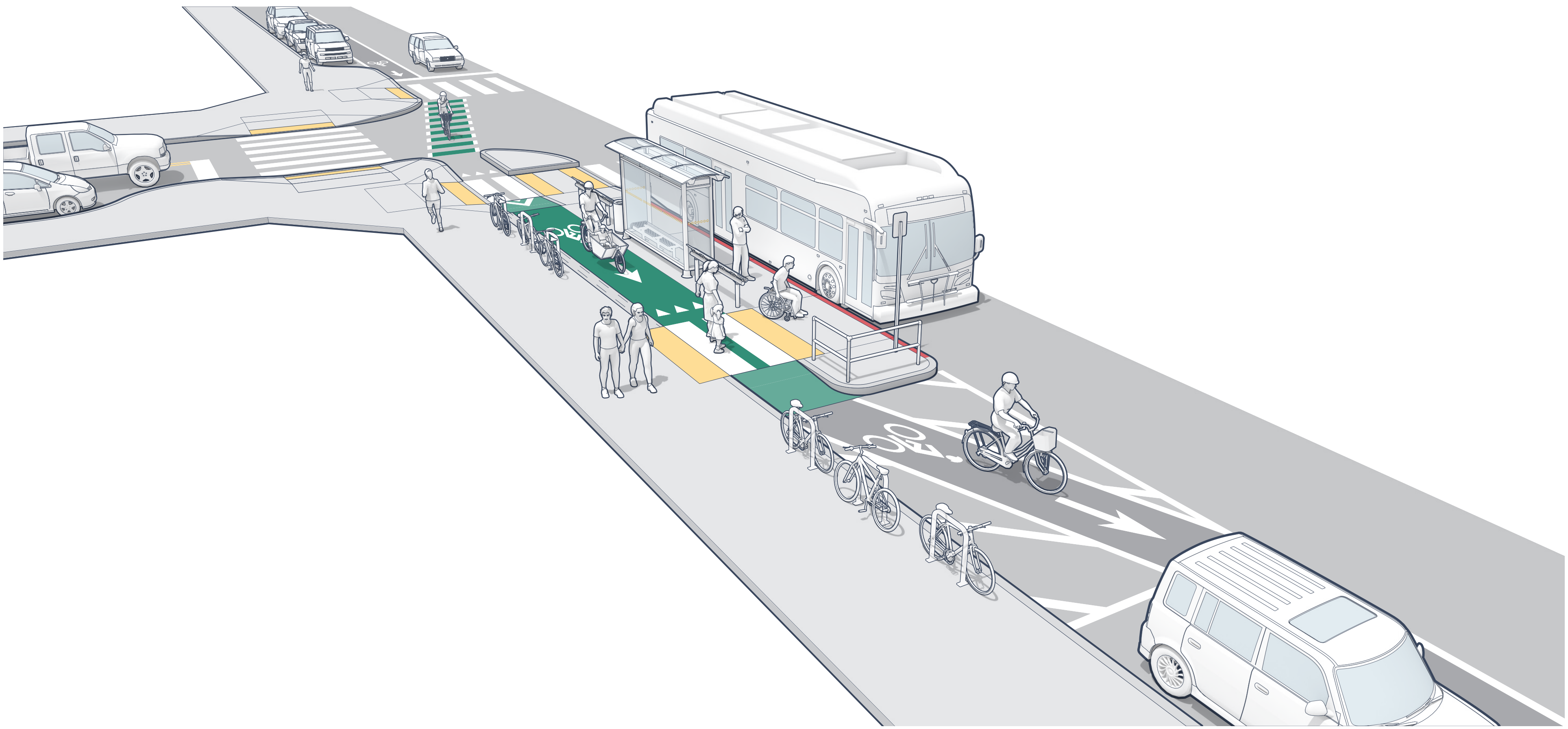
Table 5: Typology 2 Influence Area Minimum Dimensions

C. Typology 2: Plan View

1. Bus shelter (optional)
2. Accessible landing zone (min. 5' x 8')
3. Rear clear zone (11.5' x 8')
4. Green pavement (optional)
5. Bikes yield to peds sign (optional)
6. Bicyclist yield area
7. Bicycle ramp (max 1:12 slope)
8. Furnishing zone/Detectable edge
9. Bike lane taper (preferred 1:10 / max. 1:5)
10. Detectable warning surface
11. Vertical railing (optional)
12. Bus stop pole
13. Red curb zone (optional)



D. Typology 2: Perspective View



4.3 Typology 3
Class IV Bicycle Facility (Separated Bikeway) between the Curb and a General Traffic Lane

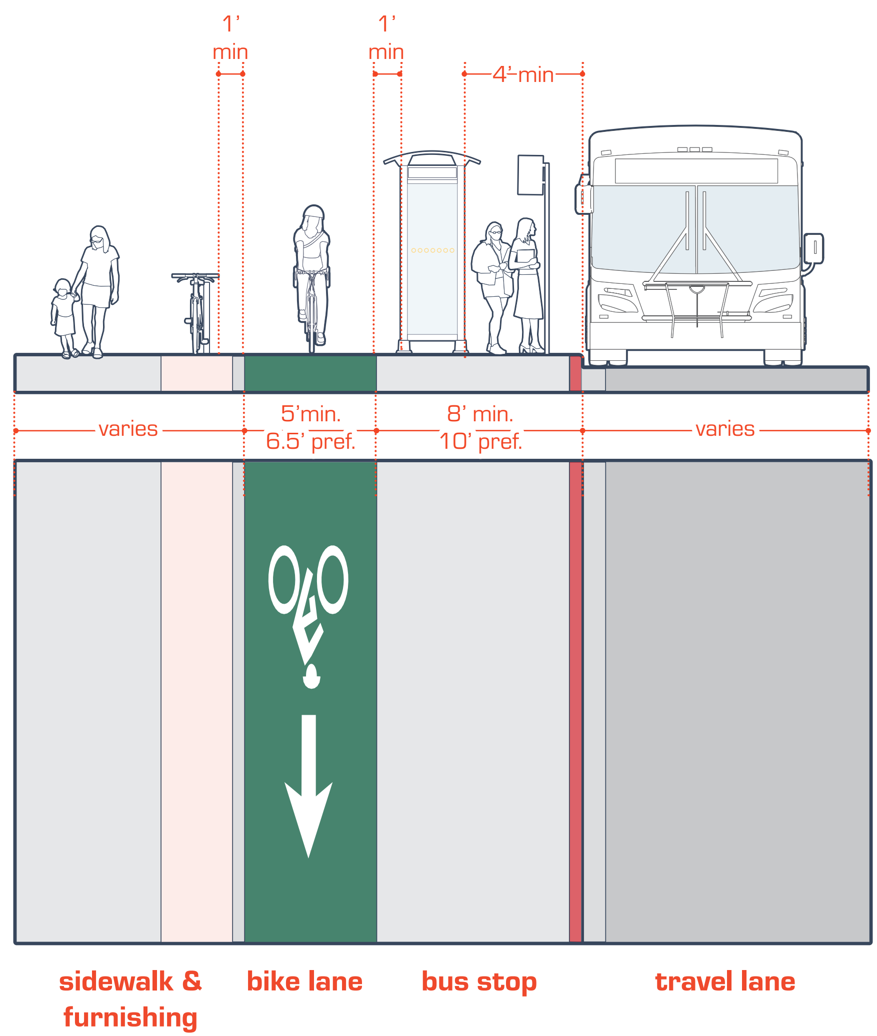
Typology 3 contains the same elements and dimensions in the cross-sectional view as Typology 2. Both designs route the bike lane behind the floating bus stop platform with a 1-foot shy distance between the bike lane and any furnishing or bus stop elements.

The difference between Typologies 2 and 3 is the presence of parking. In Typology 2, a parking lane is located to the inside of the bicycle lane; in Typology 3, there is no parking lane. Parked vehicles influence the bike lane taper lengths through intersections and exiting the bus platform area.

Typology 3 illustrates vertical separation with white plastic flexposts between the travel lane and the bikeway. There are many different forms of vertical separation that can be employed and there are several guidebooks discussing their benefits and drawbacks. In general, choosing any form of approved vertical separation will be appropriate in conjunction with a floating bus stop design.

Table 6 provides guidance for these dimensions on Typology 3.

A. Typology 3: Section View

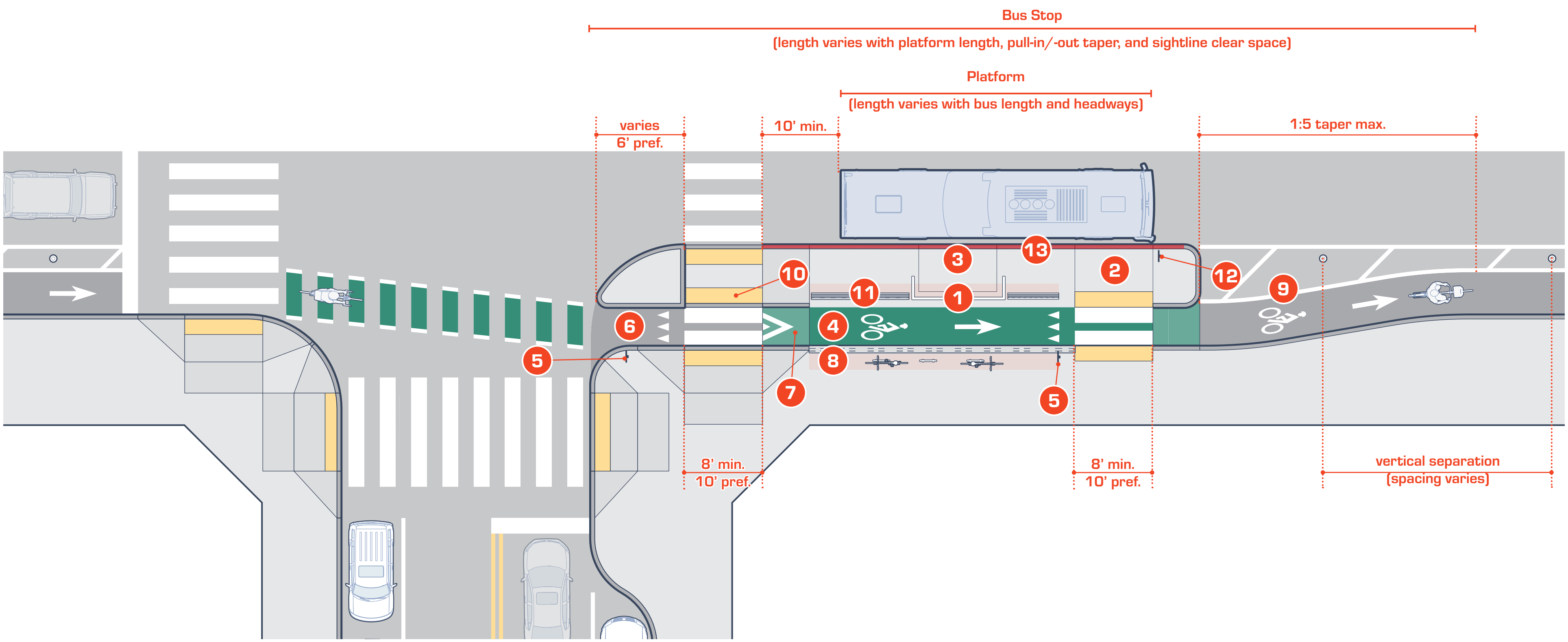


	Arterial Speed Limit
	All Speeds
Bus Stop Island	
40’ Bus	40’
60’ Bus	60’
Two 40’ Buses	120’
One 40’ Bus and One 60’ Bus	140’
Two 60’ Buses	180’
Entering Bike Lane Taper Distance	
Far-side Bus Stop	N/A
Near-side Bus Stop	18’
Mid-block Bus Stop	18’
Exiting Bike Lane Taper Distance	
Far-side Bus Stop	18’
Near-side Bus Stop	N/A
Mid-block Bus Stop	18’
Clearance from Crosswalk	
Far-side Bus Stop	10’
Near-side Bus Stop	10’
Mid-block Bus Stop	N/A

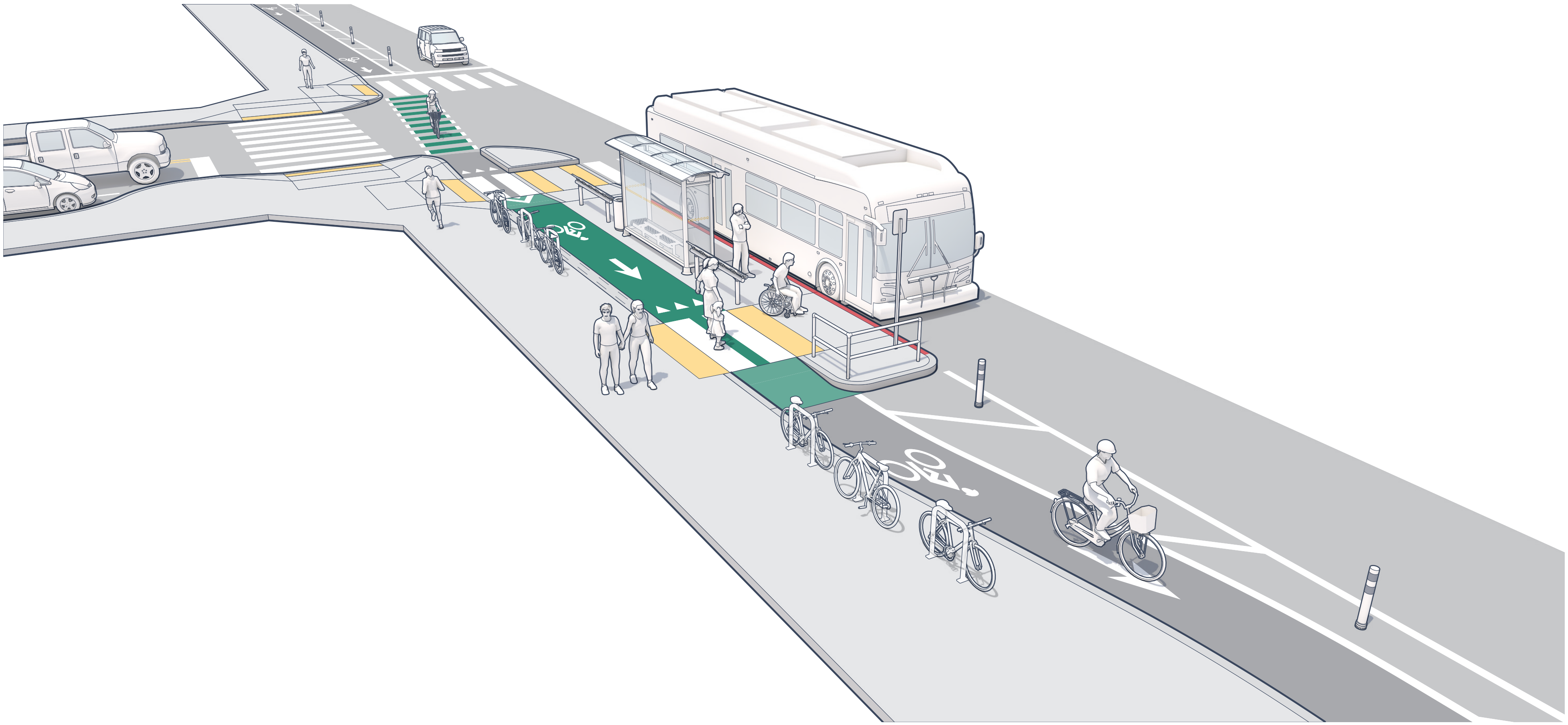
Table 6: Typology 3 Influence Area Minimum Dimensions

B. Typology 3: Plan View

1. Bus shelter (optional)
2. Accessible landing zone (min. 5' x 8')
3. Rear clear zone (11.5 x 8')
4. Green pavement (optional)
5. Bikes yield to peds sign (optional)
6. Bicyclist yield area
7. Bicycle ramp (max 1:12 slope)
8. Furnishing zone/Detectable edge
9. Bike lane taper (preferred 1:10 / max. 1:5)
10. Detectable warning surface
11. Vertical railing (optional)
12. Bus stop pole
13. Red curb zone (optional)



C. Typology 3: Perspective View



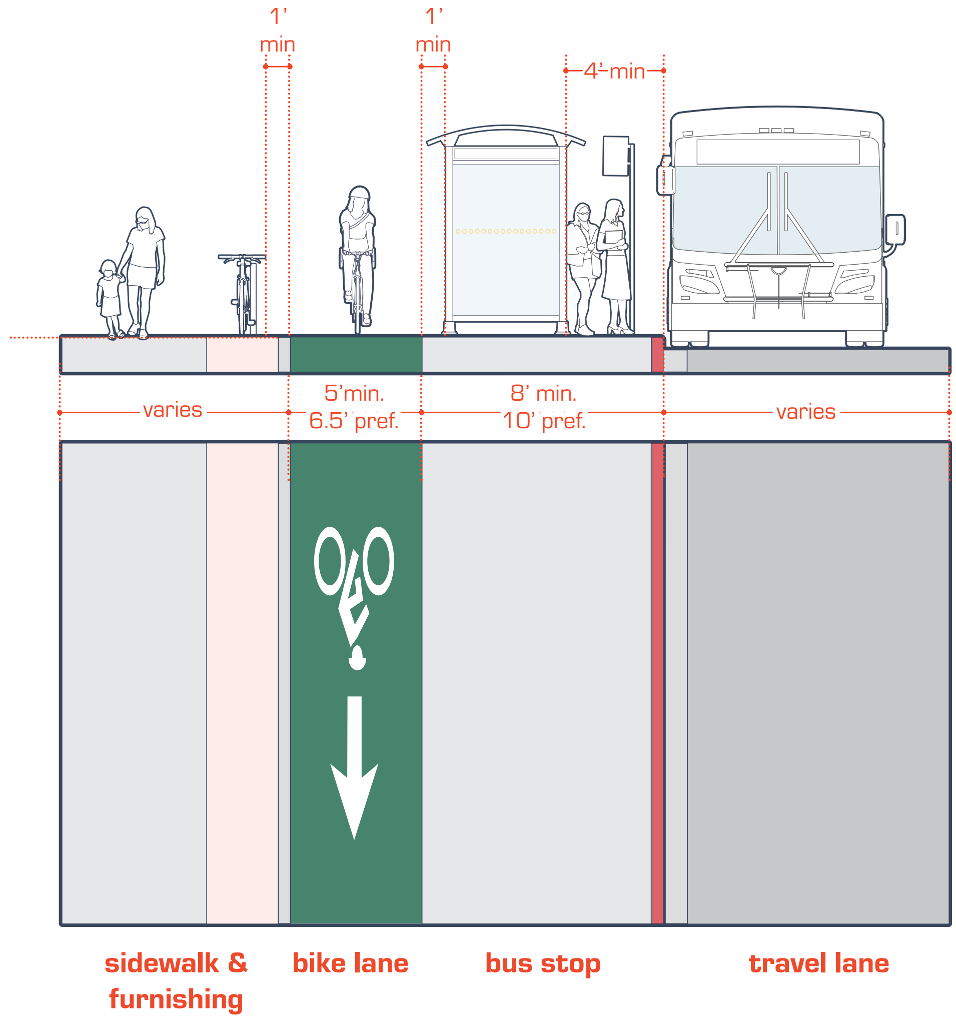
4.4 Typology 4
Class IV Bicycle Facility (Separated Bikeway) between the Curb and a Parking Lane

Typology 4's section view is also the same as the section views shown in Typologies 2 and 3.

A separated bikeway adjacent to parking can create a geometric cross section eliminating bikeway tapers through the intersection and exiting the floating bus platform area. Like Typologies 2 and 3, required, preferred, and optional design elements are annotated. The designer should consider the context of the area when including or excluding these design elements.

Table 7 provides guidance for these dimensions on Typology 4.

A. Typology 4: Section View



B. Typology 4: Plan View

1 Bus shelter (optional)

2 Accessible landing zone (min. 5' x 8')

3 Rear clear zone (11.5' x 8')

4 Green pavement (optional)

5 Bikes yield to peds sign (optional)

6 Bicyclist yield area

7 Bicycle ramp (max 1:12 slope)

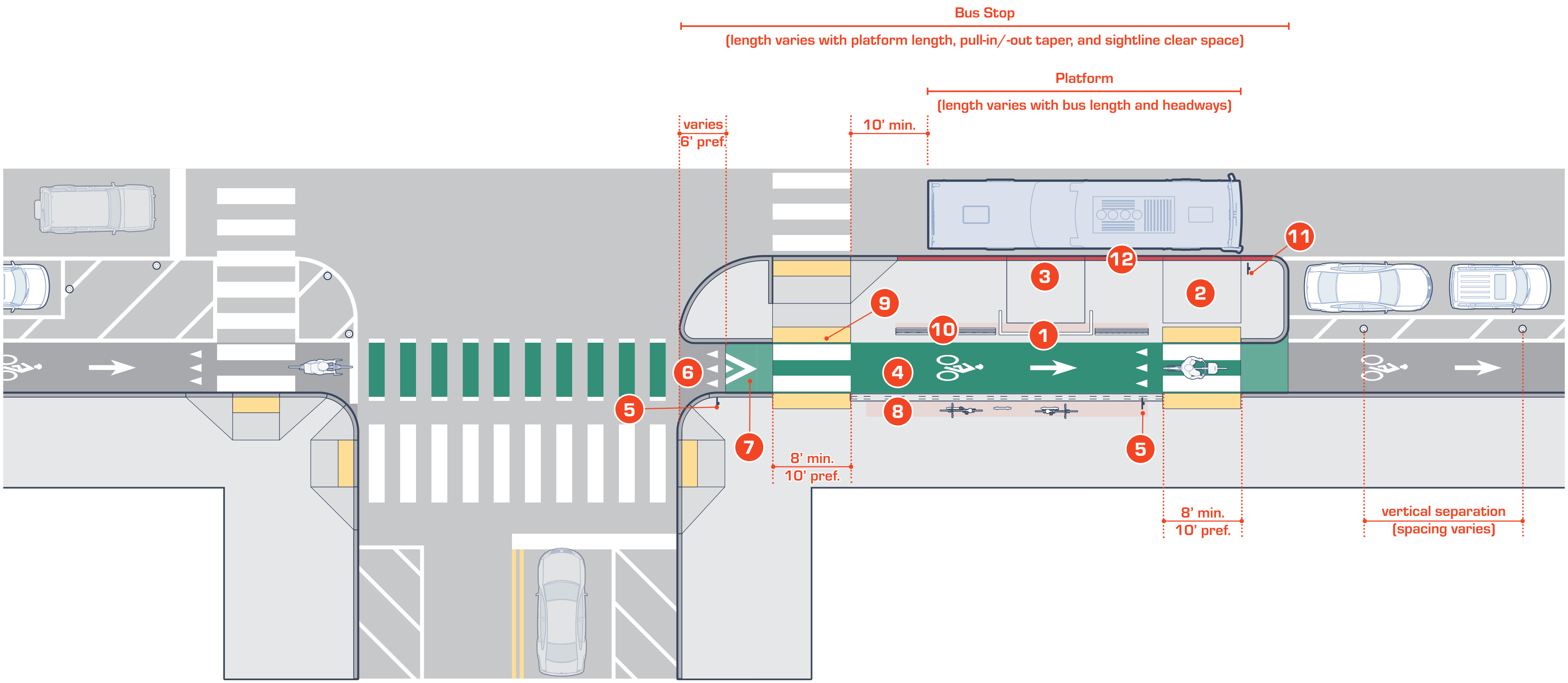
8 Furnishing zone/Detectable edge

9 Detectable warning surface

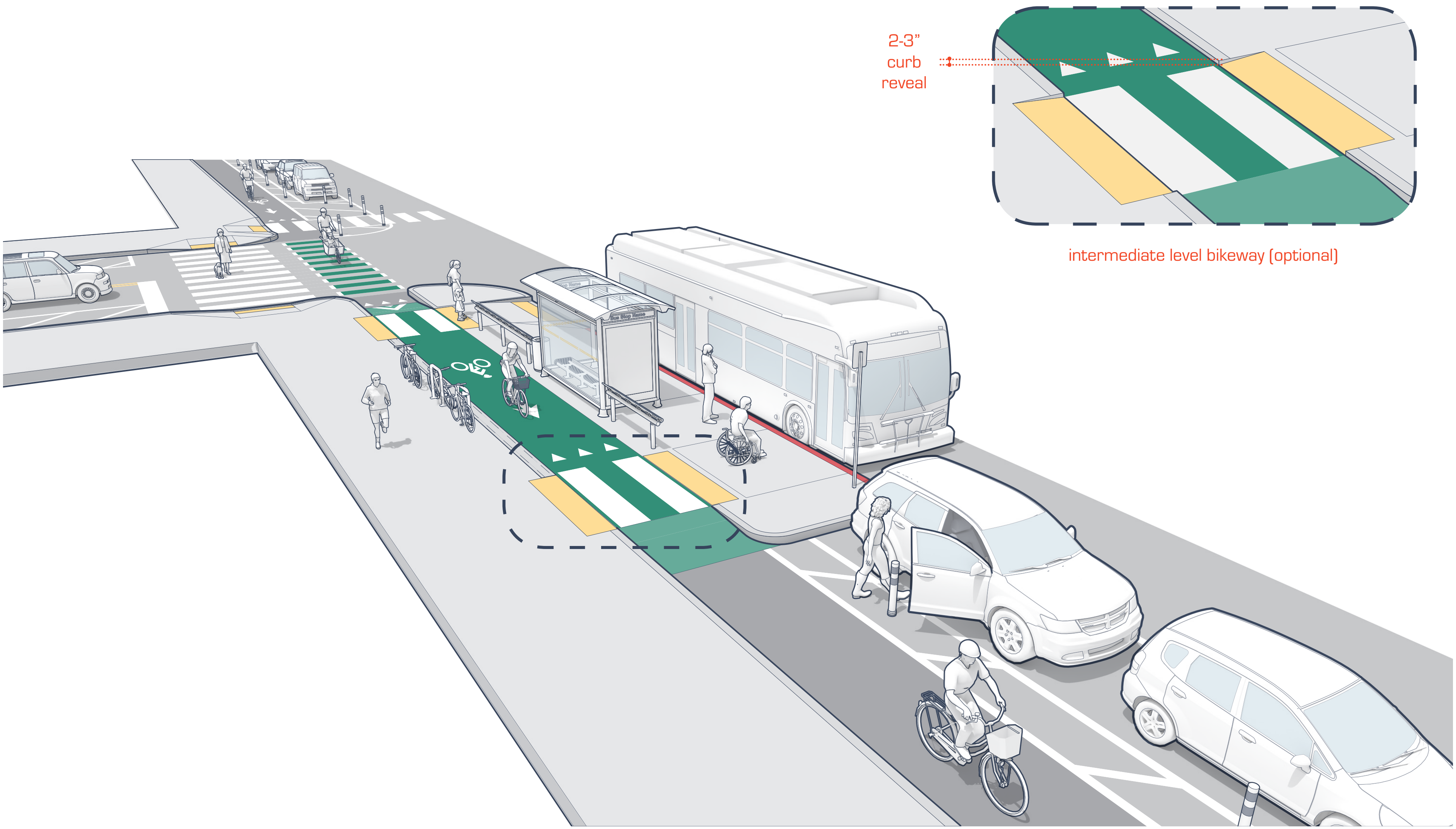
10 Vertical railing (optional)

11 Bus stop pole

12 Red curb zone (optional)



C. Typology 4: Perspective View



	Arterial Speed Limit
	All Speeds
Bus Stop Island	
40’ Bus	40’
60’ Bus	60’
Two 40’ Buses	120’
One 40’ Bus and One 60’ Bus	140’
Two 60’ Buses	180’
Clearance from Crosswalk	
Far-side Bus Stop	10’
Near-side Bus Stop	10’
Mid-block Bus Stop	N/A

Table 7: Typology 4 Influence Area Minimum Dimensions

The perspective view of Typology 4 on the previous page features a callout diagram of an intermediate level bikeway design. A 2- to 3-inch curb reveal can be used to create an intermediate-level bikeway in lieu of a sidewalk-level bikeway adjacent to the floating bus stop island. There are several benefits and drawbacks of this optional design:

Benefits of Intermediate-level Bikeway Design

- **Vertical separation helps define the pedestrian and bicycle operating space. Cities with mature bicycling infrastructure regularly construct vertical separation between bicycle and pedestrian facilities.**
- **Decreased bike ramp length is needed between the street and bus platform level.**
- **The curb reveal provides a detectable edge between the sidewalk and the bikeway, eliminating the need for other longitudinal detectable elements. However, ADA-compliant ramps including detectable elements are required at pedestrian crossings of the bikeway.**

Drawbacks of Intermediate-level Bikeway Design

- **This design increases construction complexity.**
- **Drainage and maintenance of the bikeway in the bus stop platform area will require extra attention due to water pooling, leaf and debris buildup, etc.**

Importantly, curbs 4 inches or greater increase the risk of bicycle pedal strikes, so a 2- to 3-inch curb reveal is critical. Lastly, the 2- to 3-inch curb can be used in Typologies 2 through 5.

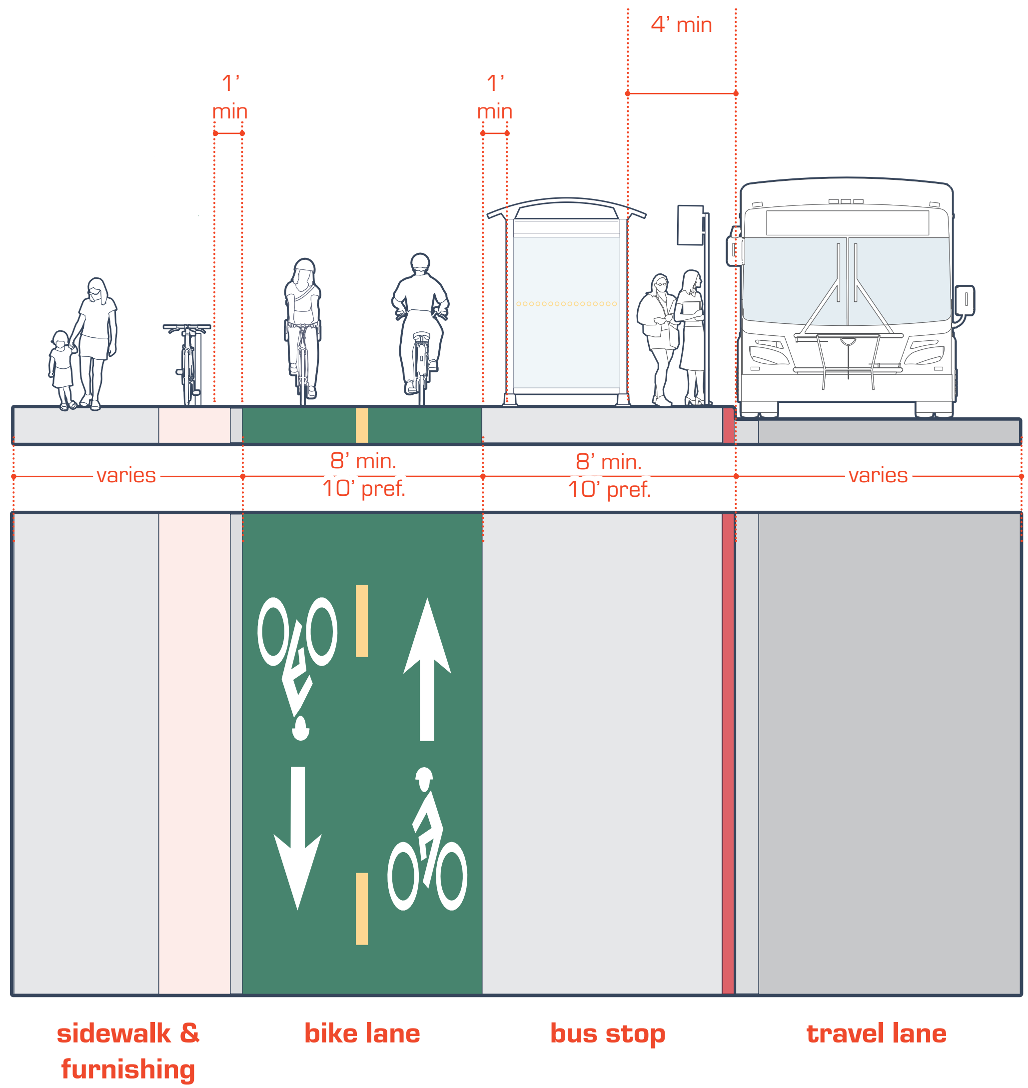
4.5 Typology 5
Class IV Bicycle Facility (Two-way Separated Bikeway) between the Curb and a Parking Lane

The cross section of Typology 5 uses the basic form of Typologies 2 - 4 where the bikeway is routed behind the floating bus stop platform and adjacent the sidewalk. Unique to Typology 5, the bikeway is designed for two-way travel, which necessitates increased minimum and preferred bikeway widths.

The plan view in Typology 5 illustrates fully curbed separated bikeway designs adjacent to parking. Again, there are many different vertical buffer treatments available to the designer, who should consider the context and constraints. When implementing Typology 5, special consideration should be given to increasing awareness of two-way bikeway travel at the floating bus stop platform. Signs, pavement markings, and other visual cues should be employed near the bus stop consistent with design guidance for two-way separated bike lanes.

Table 8 provides guidance for these dimensions on Typology 5.

A. Typology 5: Section View

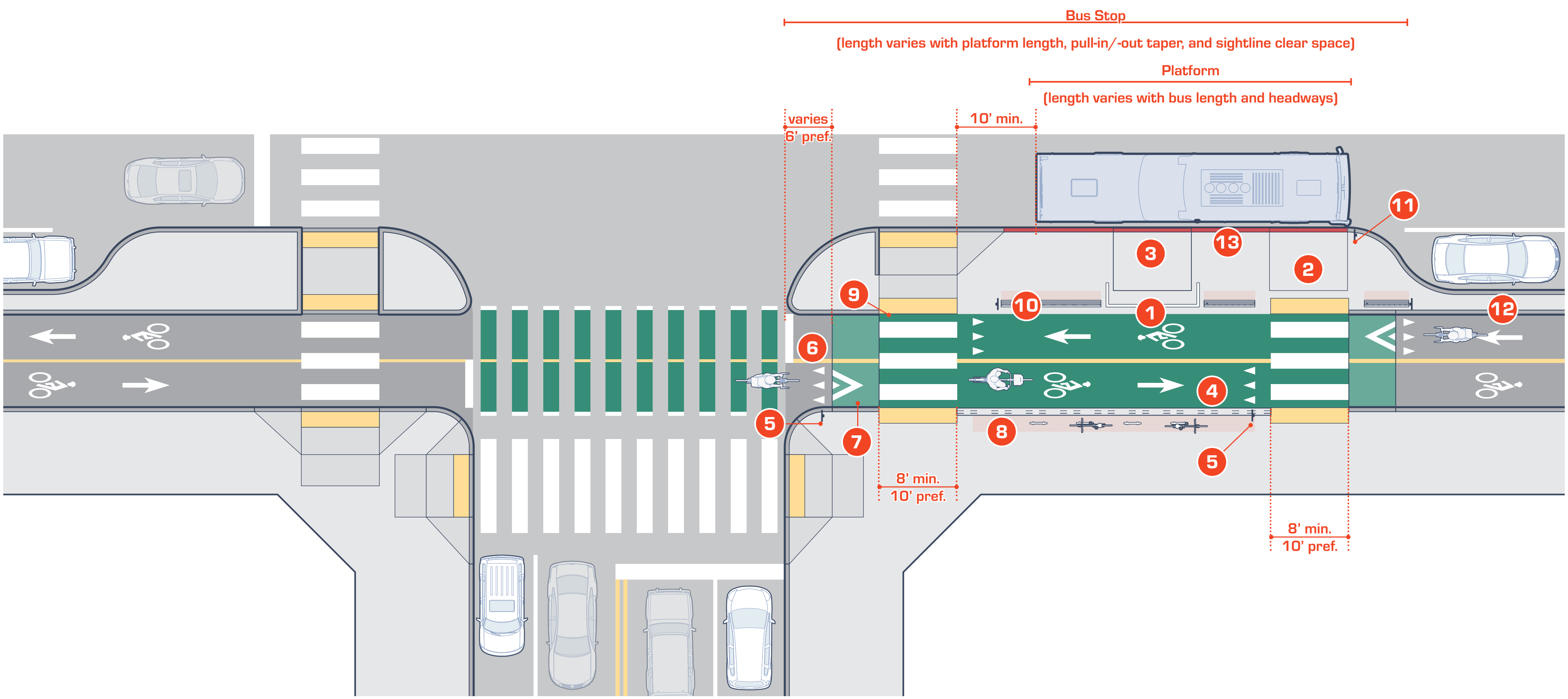


	Arterial Speed Limit
	All Speeds
Bus Stop Island	
40’ Bus	40’
60’ Bus	60’
Two 40’ Buses	120’
One 40’ Bus and One 60’ Bus	140’
Two 60’ Buses	180’
Clearance from Crosswalk	
Far-side Bus Stop	10’
Near-side Bus Stop	10’
Mid-block Bus Stop	N/A

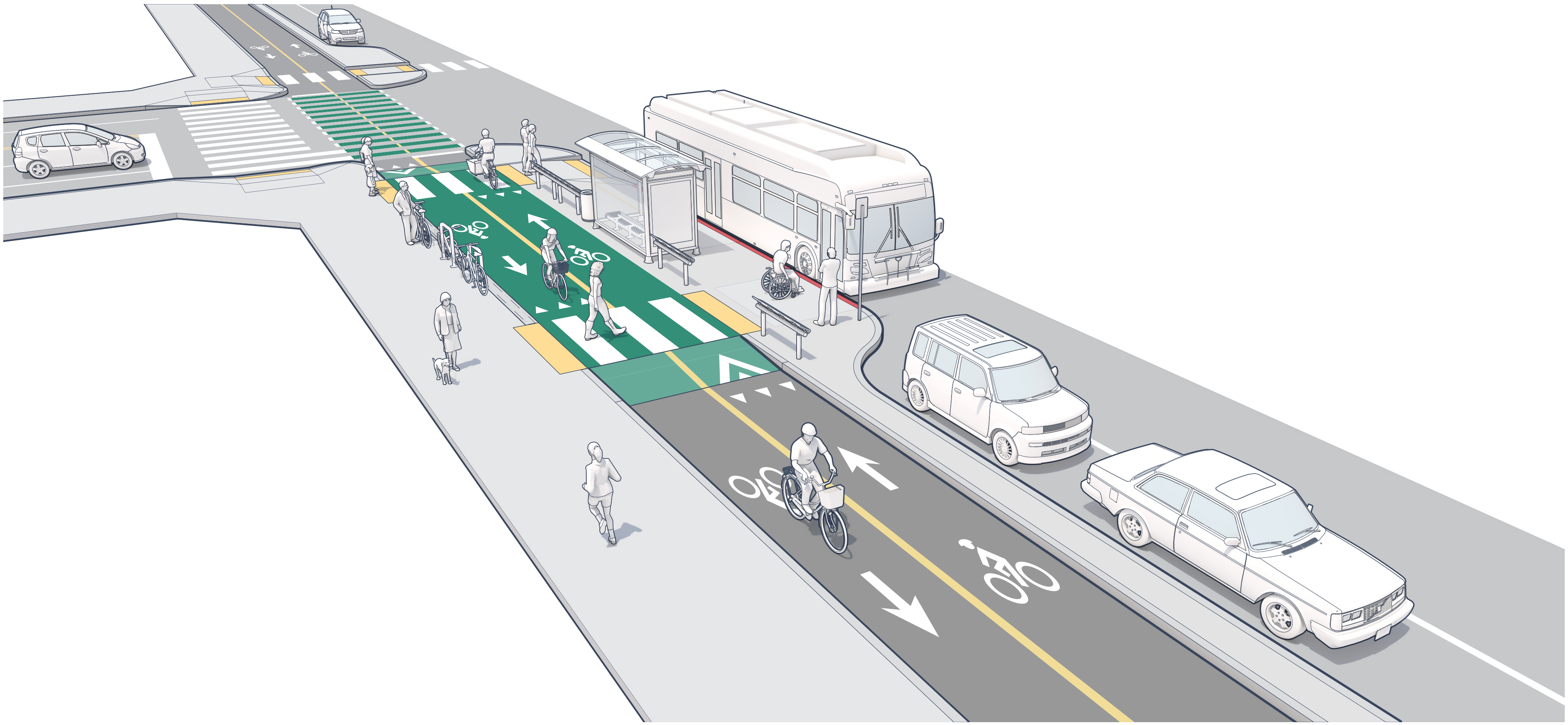
Table 8: Typology 5 Influence Area Minimum Dimensions

B. Typology 5: Plan View

1. Bus shelter (optional)
2. Accessible landing zone (min. 5' x 8')
3. Rear clear zone (11.5' x 8')
4. Green pavement (optional)
5. Bikes yield to peds sign (optional)
6. Bicyclist yield area
7. Bicycle ramp (max 1:12 slope)
8. Furnishing zone/Detectable edge
9. Detectable warning surface
10. Vertical railing (optional)
11. Bus stop pole
12. Buffer treatment varies
13. Red curb zone (optional)



C. Typology 5: Perspective View



5.0 Typology Selection

Edmonton, Canada

Designing an appropriate bus stop depends on many factors including but not limited to the roadway configuration, posted/actual vehicle speeds, and bus passenger activity. Due to this contextual variability, it is possible to select multiple typologies on a single transit corridor. Subsequently, tailoring design elements for each bus stop will depend on site constraints, context, and local jurisdictional preference. While designers should strive for consistency, being flexible with the final design could result in a safer, more comfortable, and better-functioning bus stop for all users

5.1 Typology Selection Guidance

Selecting a typology is influenced by several factors:

- **Roadway classification**
- **Roadway constraints**
- **Traffic posted/actual speeds**
- **Vehicle volumes**
- **Bike volumes**
- **Bus volumes**
- **Passenger activity**

Choosing a bus stop typology based on the relationship between these factors is challenging because a local jurisdiction may prioritize some roadway uses over others. AC Transit is sensitive to these local priorities and encourages designers to consider these alongside the guiding principles presented in this Guide when selecting a typology and eventual bus stop design.

Guiding Principle 1 – The proposed roadway configuration should be the primary determinant in the choice of a typology.

The presence of vehicle lanes, parking, buffers, bike lanes, and other roadway elements may be the more static elements of a roadway configuration as compared with dynamic roadway characteristics such as posted speeds, user volumes, and passenger activity. The presence of a bike lane, separated bike lane, or two-way separated bike lane provides one filter of typology choice. The presence of parking is another important consideration in choosing a typology.

Also, some static objects within the roadway configuration are less permanent than others. Vehicle lanes, parking and design elements of the furnishing zone are commonly removed, rearranged, or re-sized to accommodate other uses. Removing or resizing vehicle lanes and/or parking spaces may be needed to provide appropriate entering/exiting tapers for the bikeway. If there are existing design elements such as bus shelters, they could be too large to fit into a new floating bus stop location based on the typology dimensions. The local jurisdiction should work with AC Transit to develop solutions to design issues considering the range of roadway users.

However, there are several unique roadway configurations which could make selecting a typology difficult:

- **Suburban/rural locations with no sidewalks**
- **Roadway configurations with mixed-traffic bicycle facilities**
- **Locations with exclusive bus lanes**
- **Roadways with angled parking**
- **Shared street**
- **Other roadway configurations**

In these cases, the stop location should be examined in detail and engineering judgment should be applied to develop a design solution that balances the needs of all roadway users.

Guiding Principle 2 – Floating bus islands are preferred for bus routes with headways of 15 minutes or less.

Floating bus islands have two types of bus operational benefits. When a bus approaches a floating bus stop, it does not need to exit and re-enter the vehicle lane to serve each request for boarding or alighting. Merging back into the travel lane can be challenging for bus operators due to motorists failing to yield to the merging movement. Eliminating this issue can lead to travel time savings, which translates into operational cost savings and improved travel experience for customers. The other operational benefit includes a designated area for passengers to wait for their bus. This additional space allows AC Transit, and potentially the local jurisdiction, to add further bus stop amenities to improve the passenger transit experience. Given a bus route with 15-minute headways, the operational and passenger benefits of floating bus islands may accumulate over a typical day and beyond.

Guiding Principle 3 – Floating bus islands are not preferred for roadways with posted speeds of 35 mph or higher.

Implementing a floating bus island means that a bus will stop in traffic and subsequently block traffic. With posted speeds of 35 mph or higher, a boarding/alighting event may create a safety issue between vehicles and bus operations. In these situations, a bus pull-out may be a more appropriate bus stop design treatment.

Consideration should be given to how bicyclists travel through a bus pullout. Bus pullouts may remove the bus completely from the vehicle and bike lane, allowing an unobstructed bicycle through movement. Designers should consider routing the bikeway behind the bus stop pullout, especially on higher speed roads and where bicycle through movements may be blocked by a stopped bus.

Where roadways have posted speeds of 35 mph or higher, separated bike lanes are recommended due to the increased risk bicyclists face on these types of roads. If separated bike lanes are implemented, their separation should be continued through a bus stop and potential bus pullout. In this situation, Typologies 3 to 5 may be appropriate to reference when designing the bus stop.

Guiding Principle 4 – A typology choice should incorporate future curbside use and future roadway configurations.

Choosing a typology could involve planning for future transit and/or roadway projects. AC Transit may make route enhancements or modifications in a corridor, and there could be changes to land use or other transit demand-related contexts. When these transit-related changes are being planned, changes to bus frequency could justify a floating bus stop at certain locations along the new route. Integrating an appropriate typology corresponding to the planned change may be especially important given the presence of bikeways and parking.

Local jurisdictions should consider floating bus stops when redesigning a corridor that carries an existing transit route and has existing bicycle facilities. Even if the transit route is low-frequency, designing the corridor with floating bus stops will allow for higher-quality bikeways and result in a safer, more balanced, comfortable, and functional corridor.

Emeryville, CA

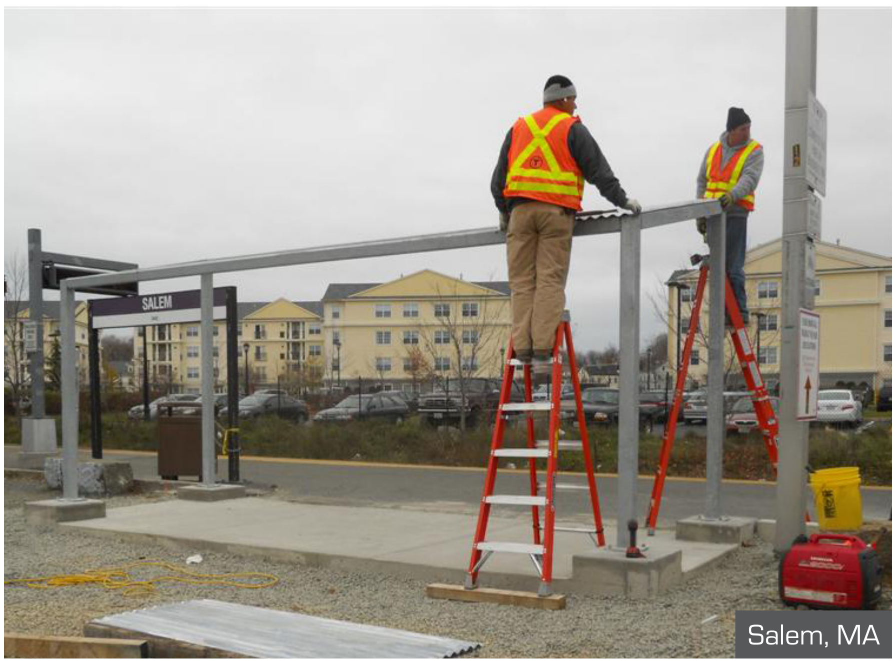
6.0 Maintenance Considerations

Washington, D.C.

Bus stop locations are typically on the edge of the roadway corridor and located in densely populated environments which accumulate debris during all seasons. Providing and implementing an effective maintenance program ensures continuity throughout the system.

Bus stops require routine maintenance to ensure functionality and provide a pleasant environment for all users. Litter can accumulate at bus stops and trees or other vegetation may drop foliage regularly or seasonally. Vandalism can also occur and should be remedied. Regular, seasonal, and as-needed maintenance agreements should be established with local jurisdictions or property owners. Some of these maintenance costs can be offset with bus stop and bus-related advertising.

Floating bus stops have special maintenance considerations because of the channelization created for the bikeway route. Bikeways may catch debris, dirt, and leaves, which should be swept on a regular or seasonally. Leaves, especially when wet, are very slippery and can create hazards for bicyclists passing through the area. Bus stop maintenance workers can use a variety of techniques to keep these areas clean, including hand sweeping, pressure washing, small hand-operated machines, or narrow maintenance vehicles.



Salem, MA

Lastly, bus stops should be regularly inspected and the quality of design elements should be noted over time as they slowly deteriorate and lose their colorful luster. Inspecting and inventorying design elements could yield valuable information on longevity, replacement, and cost expectations. The information could then be used to investigate more robust design elements to be installed for existing or future bus stops.

7.0 Reference Endnotes

Berkeley, CA

Reference Endnotes

[1] Highway Design Manual, 6th Edition. Caltrans. 2017

[2] California Manual on Uniform Traffic Control Devices. State of California. Caltrans. California State Transportation Agency. 2014.

[3] Bus Stop Policy. AC Transit. Policy No. 508 Board Policy. Adopted 1989, Amended 2005.

[4] Designing with Transit: Making Transit Integral to East Bay Communities. AC Transit. 2004.

[5] Central County Complete Streets Design Guidelines. Alameda County Transportation Commission. 2016.

[6] Guide for the Development of Bicycle Facilities, 4th edition. American Association of State Highway Transportation Officials. 2012.

[7] Urban Street Design Guide. National Association of City Transportation Officials. 2013.

[8] Transit Street Design Guide. National Association of City Transportation Officials. 2016.

[9] Urban Bikeway Design Guide. National Association of City Transportation Officials. 2014.

[10] Manual on Uniform Traffic Control Devices. Federal Highway Administration. 2009 Edition.

[11] Rhode Island Bus Stop Design Guide. Rhode Island Public Transit Authority. 2017.

[12] Transit Cooperative Research Program Report 65: Evaluation of Bus Bulbs. Fitzpatrick, et al. Transportation Research Board, Washington DC. 2001.

[13] Service Standards and Design Policy. AC Transit. Policy No. 550 Board Policy. Adopted 1994, Amended 2004, 2008.

[14] Essentials of Bike Parking: Selecting and Installing Bike Parking that Works. Association of Pedestrian & Bicycle Professionals. 2015.

[15] Roadway Lighting RP-8-14. Illuminating Engineering Society. 2014.

[16] A Summary of Design, Policies, and Operational Characteristics for Shared Bicycle/Bus Lanes. Florida Department of Transportation Research Center. 2012.

[17] Design Information Bulletin Number 89. Class IV Bikeway Guidance (Separated Bikeways/Cycle Tracks). California Department of Transportation (Caltrans). 2015.

Kate Harrison
Councilmember District 4

CONSENT CALENDAR
November 12, 2019

To: Honorable Mayor and Members of the City Council

From: Councilmember Kate Harrison

Subject: Budget Referral: Evaluation and Implementation of Pedestrian and Bicycle Safety Along Oxford Street

RECOMMENDATION
Refer $75,000 to the FY20 2019 AAO Process for the purpose of assessing, identifying, and implementing improvements to pedestrian and bicycle safety across Oxford Street, particularly between University Avenue and Bancroft Street.

BACKGROUND
Oxford Street connects the University to Downtown Berkeley, and hundreds of pedestrians and cyclists cross it every day. As a four-lane street with a curve at Kittredge Street, drivers approach at high speeds and limited visibility, and there are frequent collisions (see Attachment 2).

Pedestrian safety measures were installed at Addison and Oxford; there have not been collisions involving a pedestrian or cyclist since 2013. Similar measures should be considered for other intersections along this stretch, particularly at Kittredge and/or Allston.

A similar budget referral was passed by the Council in 2017 but not funded (see Attachment 1). Since 2017 the street continues to pose a threat to the safety of pedestrians and cyclists.

FISCAL IMPLICATIONS
$75,000 from excess equity.

ENVIRONMENTAL SUSTAINABILITY
Protecting the safety of pedestrians and bicyclists is directly in line with the Climate Action Plan and subsequent plans as it has the potential to lower greenhouse gas emissions by encouraging residents to use bicycles and other low-carbon methods of transportation.

CONTACT PERSON
Councilmember Kate Harrison, Council District 4, (510) 981-7140

ATTACHMENTS
1: Item 32, “Budget Referral: Evaluation and Implementation of Pedestrian Safety Features at Oxford Street and Kittredge Street.” May 30, 2017 Berkeley City Council Meeting
2: Collision data along Oxford Street. Organized by cross-street, then date. Data gathered from TIMS (Transportation Injury Mapping System).

Councilmember Kate Harrison
District 4

CONSENT CALENDAR
May 30, 2017

To: Honorable Mayor and Members of the City

From: Councilmember Harrison

SUBJECT: Budget Referral: Evaluation and Implementation of Pedestrian Safety Features at Oxford Street and Kittredge Street

RECOMMENDATION

Refer to the City Manager to assess, identify, fund, and implement improvements to pedestrian safety for the crosswalk across Oxford St. at Kittredge St. Our office requests that the Department evaluate the installation of pedestrian activated beacons, such as those at Oxford and Addison, or a similarly effective improvement for the Oxford and Kittredge intersection.

FISCAL IMPACTS OF RECOMMENDATION

Cost of improvements to be determined.

ENVIRONMENTAL SUSTAINABILITY

No ecological impact.

BACKGROUND

This pedestrian intersection at across Oxford at Kittredge is adjacent to a parking garage, a carwash, an affordable housing development, and a bus stop for the 6 and the F bus lines. At the intersection, Oxford is a four-lane street with limited visibility for drivers, who often approach the crosswalk at high speeds from around a curve. No significant pedestrian safety features currently exist at this crossing.

CONTACT PERSON
Kathryn Harrison, Councilmember
District 4, 510-981-7140

Collision Data on Oxford/Fulton

Between University and Durant

(Organized by Intersection, then by date)

Highlights represent collisions involving pedestrians and/or bicyclists.

Cross Street	Month, Year	Kind of Collision	How many injured?	How many killed?
University	January 2011	Broadside: 2 cars	4	0
	August 2012	Broadside: 1 car and 1 bicycle	1	0
	October 2014	Vehicle-Pedestrian	1	0
Addison	January 2013	Vehicle-Pedestrian	1	0
	November 2013	Sideswipe: 2 cars	1	0
	April 2016	Rear End: 2 cars	1	0
	June 2017	Read End: 2 cars	1	0
Center	September 2011	Rear End: 2 cars	1	0
	September 2012	Vehicle-Pedestrian	1	0
	July 2013	Rear End: 1 car and 1 bicycle	1	0
	September 2015	Vehicle-Pedestrian	1	0
Oxford Lane	December 2011	Sideswipe: 1 car and 1 bicycle	1	0
	April 2015	Sideswipe: 1 car and 1 bicycle	1	0
	July 2016	Vehicle hit a fixed object	3	0
Allston	January 2011	Sideswipe: 1 car and 1 bicycle	1	0
	April 2013	Rear End: 2 cars	1	0
	April 2016	Vehicle hit a fixed object	1	0
	November 2016	Vehicle hit a fixed object	1	0
	September 2017	Head-on Collision: 2 cars	1	0
Kittredge	July 2012	Rear End: 1 moving car and 1 parked car	1	0
	December 2012	Vehicle-Pedestrian	1	0
	June 2013	Sideswipe: 2 cars	1	0

	February 2016	Vehicle hit a fixed object	1	0
Bancroft	September 2011	Broadside: 1 car and 1 bicycle	1	0
	July 2012	Broadside: 1 truck and 1 bicycle	0	1
	October 2013	Vehicle-Pedestrian	1	0
	December 2017	Rear End: 2 cars	1	0
	July 2017	Vehicle hit a fixed object	1	0
Durant	May 2013	Broadside: 2 cars	1	0
	February 2014	Rear End: 1 moving car and 1 parked car	1	0
	August 2014	Broadside: 2 cars	1	0
	September 2014	Broadside: 2 cars	1	0
	January 2017	Vehicle-Pedestrian	1	0
	August 2017	Vehicle-Pedestrian	1	0
	September 2017	Sideswipe: 2 cars	1	0