APPENDIX

06

Complete Streets Transit Toolbox

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Re: Caltrans Bay Area Transit Plan – Complete Streets Transit Toolbox

Introduction

Caltrans Bay Area (District 4) is planning how to improve transit on the State Transportation Network (STN). The *Caltrans Bay Area Transit Plan* is being developed in coordination with transit agencies, local and regional partners, and the public to identify infrastructure improvements that improve transit reliability, access to transit, and encourage more transit use – for a safer, healthier, and more sustainable transportation system in California. The Plan is also working to identify district-level best practices and strategies to support transit.

To complement this initiative, Caltrans Bay Area has developed this *District 4 Complete Streets Transit Toolbox*. The document presents guidance on the implementation of *transit priority* and *transit access* infrastructure. The document is intended for Caltrans, transit agencies, county transportation agencies, and other local and regional jurisdictions looking to build infrastructure along the State Transportation Network (STN). The toolbox has been developed to build off and complement the existing guidance presented in the Caltrans Complete Streets Elements Toolbox 3.0.1.

Guiding Principles for Transit

The Caltrans Bay Area Transit Plan literature and best practices review presented key principles for transit. These principles, listed below, provide a vision of how to streamline the implementation of successful transit programs and projects. They also offer guidance on how Caltrans Bay Area should think about transit services along the STN and prioritize improvements. The principles include:

- Transit should be treated as a public service to be managed well but not a business expected to achieve profitability. Transit is essential to achieving the region's climate and equity goals.
- Equity must be considered in all aspects of transportation planning and funding. Transit-dependent populations often face multiple interconnected barriers to mobility and access to economic opportunities.
- Streets that work for transit work for everyone. Transit-oriented streets support local businesses, pedestrians, vulnerable populations such as the disabled and elderly, the bicycle network, and safer access for drivers.
- Transit prioritization cannot be a one-size-fits-all approach. There are multiple paths to success in transit prioritization depending on transit service type, roadway design, development patterns, adjacent uses, geographic area, and local, regional, and state goals.
- Strong leadership and collaboration between stakeholder partners are vital for the success of the project.

- Agencies and funding bodies must consider the project's impact on the transit system at both macro and micro levels. Further, transit investment should consider the total cost and benefit [both operating and capital, including external costs and benefits] over the project lifetime to deliver the best value to each community and agency.
- Transit works best when local and regional policies support the transit network (e.g., parking pricing, congestion pricing, and zoning), and streets are designed to prioritize transit service delivery and access.
- Regional and state funding programs must inspire local jurisdictions to collaborate on fixing road conditions that delay transit vehicles and impact safe access and travel.
- Programs are needed to support both coordinated transit corridor investments (e.g., bus lanes, transit signal priority, and arterial transit lanes) and hotspot and quick-build solutions for specific bottleneck or hotspot locations that experience consistent transit delays.

Caltrans Bay Area Role

Caltrans Bay Area administers funding to local agencies to plan, implement, and evaluate transit services, all while not serving as a regional transit operator or provider. A major role of Caltrans Bay Area is to build and maintain the STN infrastructure where many transit routes operate. With a focus on environmental sustainability, Caltrans Bay Area can support transit service by incorporating infrastructure improvements along the STN to benefit transit service and access to the transit network. Caltrans also serves to coordinate its work with the adjacent communities and agencies to assure that the benefits of a comprehensive and integrated transit network approach are realized. This toolbox presents many facilities-based strategies that Caltrans Bay Area and local transit providers can employ in supporting transit services.

Intended Users

The focus of this Toolbox is to share best practices on the development of concrete elements used to prioritize transit use and travel. With proper planning and engineering, the toolbox provides information to assist local and regional transit agency and Caltrans project staff (including planners, project managers, engineers, designers) looking to build infrastructure along the STN. The toolbox shares best practices for infrastructure elements to meet relevant goals and objectives included in Caltrans' Strategic Management Plan and Complete Streets policy (DP-37). The toolbox has been developed to build off and complement the existing guidance presented in the Caltrans Complete Streets Elements Toolbox 3.0.1.

Reference Design Guidelines

The following documents were referenced as part of the development of this Toolbox:

- **California Highway Design Manual (CA HDM) 7th Edition –** *The Highway Design Manual* establishes uniform policies and procedures to carry out the state highway design functions of the California Department of Transportation. The current revision is the 7th Edition, adopted July 1, 2020.
- **California Manual on Uniform Traffic Control Devices (CA MUTCD) Rev 8 –** *The California Manual on Uniform Traffic Control Devices* is the manual on uniform traffic control devices in California, with standards and specifications for official traffic signs, markings, signals, and devices. The current revision is Rev 8, effective January 11, 2024, with a letter of substantial conformance from FHWA.
- **Caltrans Complete Streets Elements Toolbox (CSET) 3.0.1** - *The Caltrans Complete Streets Elements Toolbox* is a statewide "living document" that will be continually updated to reflect adopted Caltrans' guidance and new elements appropriate for use of the State Highway System. The current version is 3.01.1, updated in February 2024.
- **Design Information Bulletins –** *Design Information Bulletins (DIBs)* establish policies and procedures for the various design specialties of the Caltrans Division of Design. Some DIBs may eventually become part of the Highway Design Manual, while others are written with the intention to remain as design guidance in the DIB format.
- **Federal Highway Administration Manual on Uniform Traffic Control Devices (FHWA MUTCD) 11th Edition –** The *Manual on Uniform Traffic Control Devices* defines the standards used by road managers nationwide to install and maintain traffic control devices on all streets, highways, pedestrian and bicycle facilities, and site roadways open to public travel. The MUTCD is published by the Federal Highway Administration (FHWA) under 23 Code of Federal Regulations (CFR), Part 655, Subpart F. The current revision is the 11th Edition, adopted December 19, 2023.
- **MTC What is Transit Priority?** A guide from the Metropolitan Transportation Commission (MTC) on policies and infrastructure to help transit passengers get to their destination more quickly.
- **National Association of City Transportation Officials (NACTO) Transit Street Design Guide & Various Guidance Documents –** NACTO is an association of 100 major North American cities and transit agencies formed to exchange transportation ideas, insights, and practices and cooperatively approach national transportation issues. NACTO has written various transit-specific guidance documents.

Additional design guidelines and studies developed by local and regional transit agencies as well as transit research non-profits and universities were also referenced.

Glossary

Bus Rapid Transit:

High-quality bus-based transit system that delivers fast and efficient service that may include dedicated lanes, busways, traffic signal priority, off-board fare collection, elevated platforms and enhanced stations" (Federal Transit Administration (FTA)). Caltrans guidance on BRT includes Director's Policy 27-R1 - Bus Rapid Transit Implementation Support and Deputy Directive 98-R1 - Integrating Bus Rapid Transit into State Facilities.

Light Rail Transit

Streetcar-type of rapid transit that uses electric-powered single cars or short trains on fixed rails and operates on city streets, semi-exclusive rights of way, or exclusive rights of way (FTA).

Express Bus Routes

Provide direct service between two points with few stops.

Local Bus Routes:

Most common transit service type in existence in the US, with frequent stops along routes serving communities and business districts. Limited-stop transit services may overlap with local routes while servicing only a portion of the stops in order to have a shorter travel time along the route (NACTO).

1. Transit Priority Facilities

***Transit priority* facilities** include infrastructure treatments that focus on improving the speed and/or reliability of transit services. These treatments can be applied to an entire corridor or as individual spot improvements to address specific location issues. The primary types of facility improvements include *lane treatments* and *signal priority treatment*. Bus stop location and design can also improve speed and reliability but are discussed in the *Transit Access Facilities*. The transit priority toolbox items are presented in this section.

A. Lane Treatments

Lane treatments are transit priority infrastructure improvements related to travel lanes along the STN. The treatments can be implemented or repurposed to all or portions of existing travel lanes on roads or highways. The lane treatments presented consider not just transit movements but also coordination with other modes including biking, walking, and motor vehicles.

1. Transit Lanes

A transit lane is a traffic lane dedicated for use by transit vehicles. Transit lanes can accommodate Bus Rapid Transit, Light Rail Transit, express or limited-stop bus routes, or local bus service.

Bus rapid transit lane on Van Ness Avenue in San Francisco (source: SFMTA).

Typical Application

Transit lanes are often considered on urban streets and suburban corridors where there is frequent transit service and where traffic congestion would otherwise delay the transit service and impact its reliability.

Additional Considerations

- *Color treatment*: red colored pavement treatments assist in delineating public transit lanes from general vehicle traffic lanes and reduce illegal occupancy of transit lanes by non-transit vehicles and parking in transit lanes, resulting in reduced travel time of transit vehicles (FHWA, SFMTA). Some transit lanes without color treatment have experienced challenges of unauthorized entry by private vehicles.
- *Physical separation*: transit lanes may be physically separated from other traffic by a vertical element, such as a raised curb or vertical delineators. This physical separation protects the transit lane from incursion by unauthorized vehicles. Some transit lanes without physical separation have experienced challenges of unauthorized entry by private vehicles.
- *Enforcement*: Enforcement of rules and regulations related to transit priority infrastructure is used to maximize the effectiveness of transit lanes and includes automated camera enforcement, manual patrols, and other ways to address traffic infractions. While transit infrastructure that requires minimal enforcement tends to operate best, some level of enforcement is recommended, when available, for transit priority infrastructure to deter private vehicles from impacting transit operations. In the Bay Area, there are special provisions for limited automated camera enforcement for parking violations (AB 917).
- *Green Transitways*: For buses, grass can be planted between and adjacent to concrete running paths or guideways for bus wheels to substantially improve stormwater infiltration and retention, provide noise dampening benefits, and enhance the public space (NACTO).
- *Coordination of Transit Lanes with Bikeways*: Where both buses and bikeways are present in the same corridor, consideration should be given to minimizing conflicts between buses, bicyclists, and transit users. Conflict points between bus lanes and bikeways most commonly occur where both facilities are located adjacent to the curb. These preferences are rooted in the California Safe Systems Approach.

Green transit lanes for bus service example (source: NACTO).

Bus coordination with bikes in San Leandro (source: AC Transit).

Transit lane separation for Muni on Van Ness Avenue in San Francisco (source: SFMTA).

- Placing buses within a dedicated lane or separated space in the center of the street can improve transit travel time and reliability by reducing conflicts with other traffic, including bicycles, with resulting safety benefits, if considered with signal treatments and transit stop locations.
- Offset transit lanes utilize the right-most moving lane, but are offset from the curb by on-street parking or a bikeway or both. See section *2.A.4 Bus Boarding Islands* below for a discussion on the use of bus boarding islands for bus stops adjacent to bikeways.
- Americans with Disabilities Act (ADA) access and paratransit: transit lanes with separated bikeways require extra concern to ensure accessibility for paratransit parking and other ADA access. This could include breaks in the bike lane separation barrier, and curb ramps to the sidewalk at ADA parking spaces or regular intervals (OakDOT).

- *BRT:* Transit lanes can be combined with other transit infrastructure to create Bus Rapid Transit, a rapid mode of transportation that can provide the quality of rail transit and the flexibility of buses. Caltrans guidance on BRT includes Director's Policy 27-R1 - Bus Rapid Transit Implementation Support and Deputy Directive 98-R1 - Integrating Bus Rapid Transit into State Facilities

Reference Design guidelines

- **CA MUTCD Rev 8** -Sections 2B.19-22 for standards and guidance for lane control signage, 2G.01-15 for standards and guidance for preferential and managed lane signage, 3D.01-02 for standards and guidance for preferential lane markings, and 8B.13-17 for standards and guidance for signage concerning light rail lane usage and grade crossings.

Transit lane separation on SR 185 in Oakland (source: Caltrans).

- **FHWA MUTCD 11th Edition –** Section 3H.07 Red-Colored Pavement for Public Transit Systems. This new set of federal guidance was adopted from the former FHWA Interim Approval for the Optional Use of Red-Colored Pavement for Transit. This guidance is not yet included in the California MUTCD because the CA MUTCD is based on the 10th edition of the Federal MUTCD. Per 23 CFR, California has a 2-year period, through January 18, 2026, to develop a revised CA MUTCD in substantial conformance with the Federal.
- **CSET 3.0.1** - Section H50
- **NACTO -** Lane Design Controls, Transit Lanes & Transitways, Pavement Markings & Color, Separation Elements, Fare Vending (at transit stops, such as along Light Rail or Bus Rapid Transit lines)
- **Other resources:** UCLA Institute of Transportation Studies - Best Practices in Implementing Tactical Transit Lanes: this document provides guidance on the planning process and design considerations for developing low-cost, quick-build transit lanes.

Caltrans examples:

- SFMTA Van Ness Bus Rapid Transit (US 101), San Francisco; AC Transit Tempo Bus Rapid Transit on East 14th St/International Blvd (SR 185), Oakland and San Leandro; AC Transit San Pablo Avenue Bus Lanes and Bike Lanes Project (in development) (SR 123), Oakland, Emeryville, and Berkeley.

2. Part-Time Transit-Only Lanes

Part-time Transit-Only Lanes (including what is often referred to as "Bus on Shoulder") allow authorized transit buses to drive in dedicated lanes under specifically designated operating conditions, to bypass congestion during peak periods. This can help improve the travel time reliability of transit service and overall person-movement on the corridor while addressing roadway operational and performance issues. Part-time Transit-Only Lanes can be located in parking lanes or on freeway shoulders. When determining whether to implement a part-time lane, certain factors should be considered, including, but not limited to:

- Frequency and duration of congestion.
- Length of acceptable shoulder width.
- Cost to upgrade.
- Existing or planned managed lanes.

- Transit ridership and frequency. There should be a sufficient number of transit vehicles expected to use the lane to avoid the perception of lane underutilization. Part-time lanes for buses should be expected to carry no less than 4 buses per hour.
- Potential for reducing delay
- Potential for reducing vehicle miles traveled.
- Connectivity to transit hub, park-and-ride location, etc.

Typical Application

- Where the opportunity exists, transit services can benefit from utilizing parking lanes or the shoulders of a highway/freeway during peak commute times to avoiding traffic congestion and improve transit speed and reliability.
- An excellent example of using a parking lane can be seen in Santa Monica on Lincoln Ave between the I-10 Freeway overpass and the city limits at Ozone Avenue. During the peak commuter periods from 7-9am and 4-7pm, the parking spaces along Lincoln Ave are used for transit-only lanes. With access to this transit lane, transit riders can save eight minutes with one ride. Due to the success of this project, there are efforts to extend the temporary bus lanes beyond Santa Monica into Los Angeles to provide greater travel time savings.

Part-time transit-only lane in Santa Monica (source: Caltrans).

Additional Considerations:

- If located on the former shoulder, the structural section of the part-time lane must be adequate for the additional vehicle loading expected on it. This may require pavement reconstruction or rehabilitation. Roadway features not adequate for traffic loading, such as pull box covers and drainage systems, should be evaluated and upgraded or relocated as necessary.
- *Enforcement*: Similar to full-time transit lanes, enforcement of rules and regulations related to transit priority infrastructure is used to maximize the effectiveness of part time transit lanes, particularly parking enforcement [See 1.A.1 Transit Lanes].

Reference Design Guidelines

- **FHWA** - Use of Freeway Shoulders for Travel - Guide for Planning, Evaluating, and Designing Part-Time Shoulder Use as a Traffic Management Strategy; Decision Support Framework and Paraments for Dynamic Part-Time Shoulder Use

Part-time transit-only lane on SR 94 in San Diego (source: CSET).

- **CA MUTCD Rev 8 –** Sections 2B.19-22 for standards and guidance for lane control signage, 2G.01-15 for standards and guidance for preferential and managed lane signage, 3D.01-.02 for standards and guidance for preferential lane markings
- **CSET 3.0.1** – H50, H51
- **Caltrans Guidance for Implementation of Part-Time Lanes (forthcoming 2025)** - Caltrans is currently developing part-time transit lane design guidelines, which are to be finalized based on findings from the I-805/SR 94 Part-Time Transit-Only Lanes Pilot Demonstration Project in San Diego County conducted by the San Diego Association of Governments (SANDAG) in coordination with Caltrans, the California Highway Patrol (CHP), the Federal Transit Administration, and local stakeholder agencies. The pilot project started in Summer 2022 and will run through Summer 2025.
- **American Public Transportation Association** - Designing Bus Rapid Transit Running Ways (Section 3.2 "Bus use of shoulders")
- **Other Resources:** SANDAG – Bus on Shoulder Project: SR 94 and I-805; Monterey-Salinas Transit & Santa Cruz Metro - Monterey Bay Area Feasibility Study of Bus on Shoulder Operations on State Route 1 and the Monterey Branch Line

Caltrans examples:

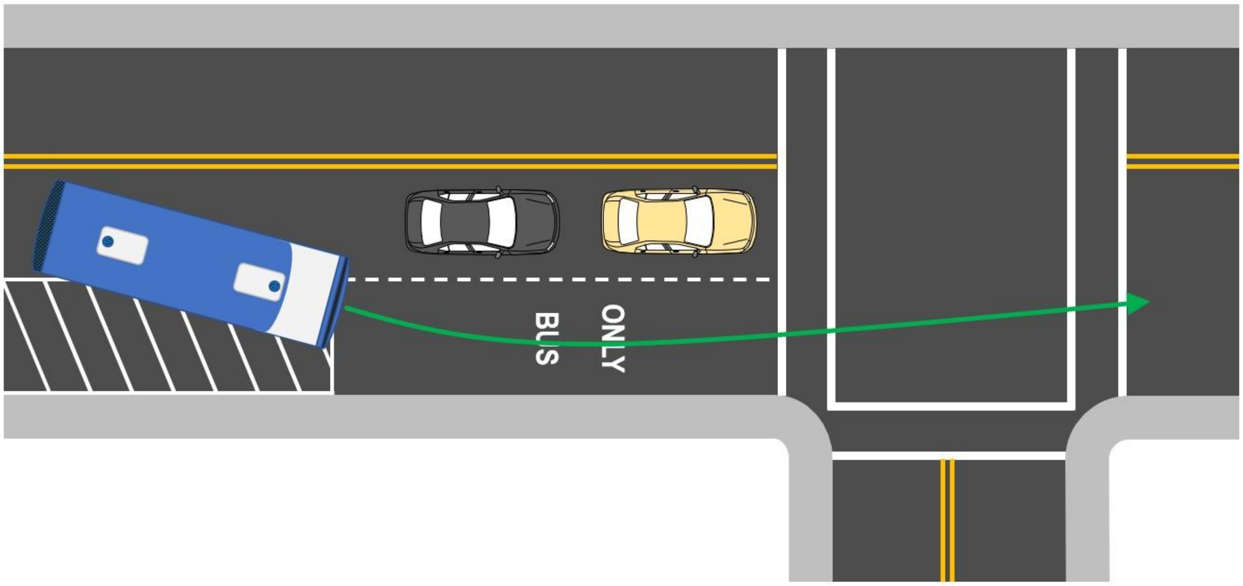
- Dumbarton Forward Project (in final design phase), Fremont and Menlo Park, with MTC; SR 94 & I-805, San Diego, with Metropolitan Transit System (District 11); Highway 1 (SR 1), Santa Cruz, with Santa Cruz METRO (D5) (planned); US 10; Lincoln Boulevard (US 1), with Big Blue Bus, Santa Monica (D7).

3. *Queue Jump Lanes*

A queue jump lane is a designated area when approaching an intersection designed to provide space for transit to bypass mixed traffic in adjacent lanes. Queue jump lanes improve transit service efficiency along corridors and can be paired with transit signal priority.

Typical Application

Queue Jump Lanes are often designed as right-turn lanes that permit transit to make through movements. Queue jump lanes have also been located in the left-turn lane or a center running lane for bypassing a heavy movement in an adjacent lane. Although the far side of the intersection is generally preferred as the bus stop location for signalized intersections, queue jump lanes at times may incorporate a bus stop at the near side of the intersection that enables the bus to merge into traffic at or near the front of the queue prior to a green signal indication for the adjacent mixed-traffic lanes. Where right turns are permitted at intersections, queue jump lanes work best when the volume of right turning traffic is low compared to the volume proceeding



Queue jump lanes example diagram, showing space for buses to pass as they approach an intersection (source: CSET).

straight, such that transit is not delayed by a queue of right turning vehicles when using the lane to bypass the queue of traffic proceeding straight. Queue jump lanes also have optimal effect where their length exceeds the average queue length in adjacent mixed traffic lanes during the peak period.

Reference Design guidelines

- CSET 3.0.1 – H99
- NACTO Queue Jump Lanes
- **Other Resources:** GET bus: Transit Facilities Design: A Manual for Coordinating Public Transit & Land Use in Bakersfield (Sec. 5.1, Pg. 56)

Caltrans examples:

- El Camino Real & Page Mill Rd (SR 82), Palo Alto; I-180 & Buchanan Ave, Albany.

4. *High Occupancy Vehicle (HOV) Lanes*

A High Occupancy Vehicle (HOV) Lane is a type of managed lane that is available for use by high occupancy vehicles (with a minimum required number of passengers per vehicle). Transit buses can utilize HOV Lanes to bypass congestion on freeways and expressways where they are provided.

Typical Application

- HOV Lanes can be designed to directly support transit when appropriate, with wayfinding and signage, queue jump lanes, and signal priority or other measures to bypass congestion.
- An HOV region-wide system is ideal, including freeway-to-freeway connectors, direct access ramps to local cross streets, park and ride/transit facilities, and rideshare inducement and promotional programs.

Additional Considerations:

- Conventional highways may be suitable for HOV lanes, in addition to controlled access freeways. Caltrans District 4 has recently partnered with SFMTA on the Park Presidio Lombard Temporary HOV Lanes pilot project. Early analysis from SFMTA has shown improved transit time reliability.

Reference Design Guidelines

- Caltrans High Occupancy Vehicle Guidelines
- Caltrans Managed Lane System Plan Guidelines

Caltrans Examples:

- I-80 Bay Bridge Forward Project, Park Presidio and Lombard, San Francisco.

HOV lane on I-80 in Hayward (source: MTC).

High Occupancy Vehicle (HOV) lane on the Park Presidio Bypass in San Francisco (source: SFMTA).

A note about High Occupancy/Toll (HOT Lanes)

A High Occupancy/Toll Lane (HOT Lane) is a type of managed lane that is available for use by high occupancy vehicles (with a minimum required number of passengers per vehicle) and is also available for use by vehicles not meeting the occupancy requirement in exchange for payment of a toll. While transit buses can utilize HOT Lanes to bypass congestion on freeways and expressways where they are provided, HOT should not be considered a transit priority facility, as they are primarily designed for single occupancy vehicles and increase VMT similarly to new general-purpose lanes. But with certain additional facilities, including, queue jump lanes, signal priority, and freeway access stations, HOT could be beneficial to transit (UC Davis).

B. Signal Priority Treatments

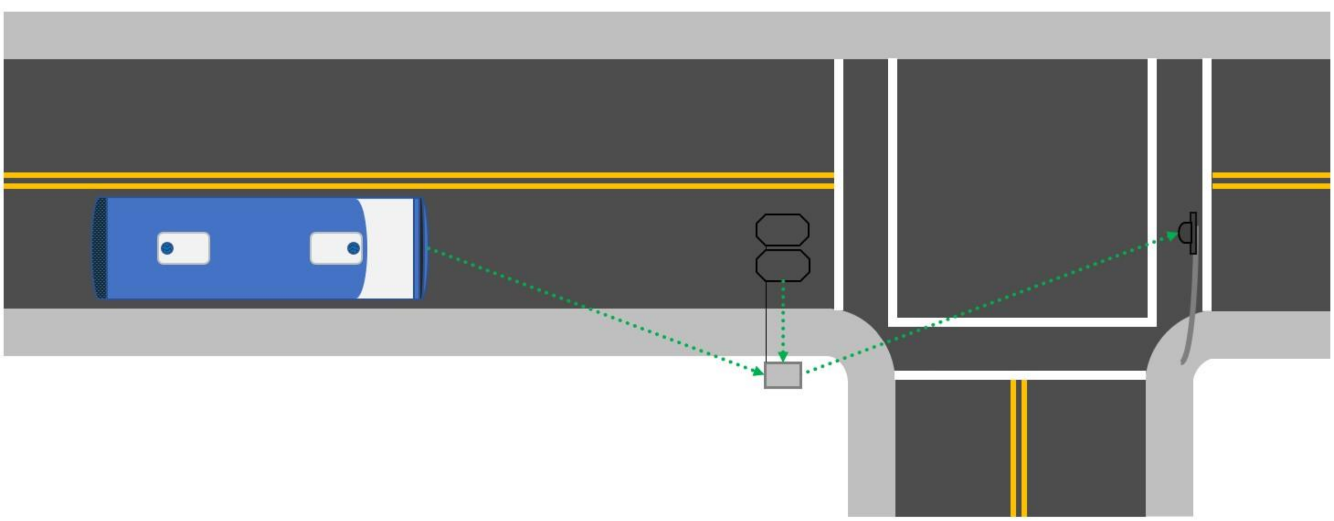
Signal priority treatments include special signal timing strategies and/or infrastructure that support transit operations at signalized intersections.

1. Transit Signal Priority (TSP)

Transit signal priority (TSP) utilizes a communication system between traffic signals and transit vehicles in order to extend the green signal indication when a transit vehicle is approaching an intersection, or to provide an early green signal indication when a transit vehicle is waiting at an intersection, thereby accommodating the vehicle's movement through the intersection without delaying its passengers at a traffic signal. TSP systems may be hardware-based or cloud-based. The benefits of TSP are improved transit travel time, reliability and on-time performance, and ability to utilize emergency vehicle pre-emption (EVP).

Typical Application:

- TSP should be utilized in conjunction with locating transit stops/stations on the far side of intersections, which means the transit stop is positioned after the intersection on the transit route, allowing transit to go through the intersection before stopping.
- TSP can be utilized in conjunction with transit-only lanes or queue jump lanes.
- Where transit operates in mixed traffic conditions, TSP can be utilized on streets where traffic signal delay interferes with transit schedule adherence, or where traffic signal wait times (often combined with dwell times - where transit must wait at transit stops) cause transit travel times to be longer.
- TSP detection can be accomplished by Loop Detection, Light-based Detection, Sound-based Detection, Radio-based Detection, and Satellite-based GPS detection.
- On-board and Off-board systems must work together for successful TSP operation, requiring coordination with the transit agencies.



TSP information relay diagram, showing approach signal passing between buses and traffic signals (source: CSET).

Additional Considerations:

- The TSP network needs to be compatible with Caltrans traffic controllers in order for the controller to receive and process the TSP signal from the transit vehicle.
- For hardware-based TSP, the current practice is for the local agency or transit agency to utilize a contractor to install the TSP network (auxiliary panel, phase selector, GPS radio antenna, cable, etc.) by way of the Caltrans encroachment permit process. Each transit vehicle is equipped with a transmitter.
- There are currently some limitations to existing Caltrans controller software:
    - Unless an exception is granted, currently Caltrans software can only provide TSP for movements on the mainline of the intersection, and not for both directions of traffic.
    - Transit agencies' ability to monitor TSP can often be difficult due to existing Caltrans signal controller software. Monitoring and evaluation are critical to maintaining TSP for optimized traffic and transit operations.
- TSP sensors may need to be mounted on new poles depending on the conditions and standards of the existing traffic signal poles, potentially contributing to higher costs.

Reference Design Guidelines:

- **CA MUTCD Rev 8 –** Section 4D.27
- Caltrans – Transit Signal Priority Research Tools, Development of an Integrated Adaptive Transit Signal Priority (ATSP) and Dynamic Passenger Information (DPI) System, Toward Deployment of Adaptive Transit Signal Priority Systems, Caltrans Complete Streets Elements Toolbox 3.0 H49
- **Other resources:** US DOT – Transit Signal Priority (TSP): A Planning and Implementation Handbook; NACTO - Active Transit Signal Priority

D4/Caltrans Examples:

- San Pablo Ave (SR 123), Oakland; International Boulevard (SR 185), Oakland & San Leandro; El Camino Real (SR 82); AC Transit Mission Boulevard TSP (SR 238), Fremont.

2. Transit-only advanced signal indication (with dedicated transit approach lane)

A transit-only advanced signal indication allows transit vehicles to proceed through or turn at an intersection ahead of other traffic.

Typical Application:

This treatment is installed in combination with a bus-only lane, rail-only lane, or queue jump lane, in order for transit vehicles to utilize a dedicated transit signal.

Reference Design guidelines

- **CA MUTCD Rev 8 –** Sections 2B.19-22 for standards and guidance for lane control signage, 4D.27 for standards and guidance for transit signal priority treatments
- **NACTO –** Active Transit Signal Priority (see: "Phase Insertions"), Transit Approach Lane

D4/Caltrans Examples:

- Webster (SR 61) at Willie Stargell Avenue, Alameda; Van Ness (US 101) & Broadway, San Francisco.

Transit-only advance signal for Muni in San Francisco (source: MTC)

2. Transit Access Facilities

Transit access facilities are infrastructure focused on improving the experience for transit passengers by providing generally direct, comfortable, and accessible infrastructure for pedestrians and bicyclists to access existing transit stop locations. This toolbox includes guiding passengers to bus stops, improving pedestrian and bicycle access to bus stops, mobility hubs, and park and ride lots.

A note on ADA and Planning for Accessibility

ADA accessibility standards for Caltrans are detailed in DIB 82-06, and are noted through the toolbox.

The United States Department of Transportation (USDOT) recently published a final rule that will increase accessibility for transit users by providing local governments and other owner-operators of the public right-of-way clear, uniform, and technically defined standards of accessibility to guide their design decisions for new construction and alterations of transit stops in the public right-of-way (US DOT).

Everyone benefits from improved access for those who most need it: for example, ADA requirements often improve access for those with a stroller or a bicycle, rolling down a curb cut or taking an elevator to a train platform, and many will age into needing ADA-required benefits, and “whether permanent or temporary, many of us will have times when we need a helping hand, and the ADA makes that possible.” ADA requirements are often considered “a floor, not a ceiling” for accessible design. (Transform).

There is a wide range of disabilities to consider when planning transit facilities, including but not limited to: physical disabilities such as mobility impairments (including wheelchair users, cane users, and more), sensory disabilities (including vision or hearing impairments), cognitive disabilities (including intellectual disabilities, dementia), developmental disabilities (including autism spectrum disorder), and mental health conditions. All these conditions can impact a person's ability to navigate and access transit and other transportation systems effectively, and require planning and coordination between ADA requirements, wayfinding, and other transit amenities referenced throughout this document.

A note on Paratransit

Paratransit services require unique and specific guidelines and planning. When relevant, some recommendations for coordination with paratransit are included here, but this toolbox is not exhaustive on paratransit needs.

Improvements envisioned for paratransit include standardizing eligibility requirements for all the agencies, managing transfers across agencies, and allowing paratransit riders to pay with Clipper cards.(Transform)

A. Bus Stops and Bus Stop Amenities

The following section includes guidance on bus stops and potential amenities. Additional items include considerations for locating bus stops, curb extensions/bus bulbs, and markings. These strategies improve the waiting experience for transit passengers, but many facilities can also improve speed and reliability for bus transit.

1. *Bus Stops (Location and General Design Guidance)*

Bus stop design and location is an important element in improving the quality of transit service, as it can both improve access and reliability.

Typical Application:

- In determining bus stop locations, key factors to consider are the type of transit system being served, and the transit travel demand related to the origins/destinations and built environment of the local area.
- At a minimum, bus stops need to be clearly marked and indicate the transit routes servicing the stop.
- The bus stop should have clear parking restrictions (signage and/or curb paint treatment), which should be long enough to accommodate one (1) bus length as well space to pull in and out of the stop. Bus stops with frequent bus services may require curb space to accommodate two (2) buses.

Bus stop amenities for TEMPO riders in Oakland on International Boulevard (source: AC Transit).

- The far side of the intersection is the preferred location for bus stops for both improved safety and operational reasons. The far side location allows:
    - Pedestrians to cross the intersection behind the bus where they are more visible to approaching drivers.
    - The bus to re-enter the travel stream following a break in traffic caused by the signal timing
    - Transit signal priority to work more efficiently, wherein the bus proceeds through the intersection using the extended green time before stopping on the far side to drop off and pick up passengers (see *Section 1.B Signal Priority Treatments [link]*).
- For some stop-controlled intersections with only one travel lane in each direction and no shoulder, near-side in-lane stops may be preferred (NACTO).
- Caltrans planners and designers need to coordinate with local transit providers on any modifications to bus stops, bus stop amenities, or bus stop location.

Additional Considerations

- *Coordination of Bus Stops with Bikeways*: There are numerous ways to configure bus stops, and the designer should conduct a site analysis to develop a context-sensitive and appropriate design. In general, preference should first be given to a design that provides space for bicyclists to move comfortably within their own travel way separated from the bus lane and the area where pedestrians wait for and board buses. The next-preferred design option would provide a lower degree of separation, integrating pedestrians and bicyclists through the boarding area. The third preference would be to provide a space shared by bicyclists and buses. These preferences are rooted in the California Safe Systems Approach.
    - Bus Pads: At pull-out stops where the bus crosses a bike lane, the concrete bus pad should end at either the right edge of the bike lane or the left edge of the bike lane (including its full width), to prevent the creation of a longitudinal seam within the bike lane. Where bikes pass stopped buses, as on shared bus-bike lanes, bus pads should be provided across the full width of the lane to provide a level surface to both buses and bikes.
- *Planning for people with disabilities:* the range of disabilities considered should include: physical disabilities such as mobility impairments (wheelchair users, cane users), sensory disabilities (vision or hearing impairments), cognitive disabilities (intellectual disabilities, dementia), developmental disabilities (autism spectrum disorder), mental health conditions, and neurological disorders; all of which can impact a person's ability to navigate and access public transportation systems effectively.
- Bus stop signs and information should follow the standards and guidelines now being produced by the Regional Mapping and Wayfinding Project (see Section 2.B.1 Wayfinding).

Reference Design guidelines

- **CA HDM 7th Edition –** Topic 108.2-5 for guidance on the process of developing transit loading facilities, Index 303.4(2-3) for design guidance on bus stops configured as bus bays and bus bulbs, Index 626.4(3) and 636.4(3) for structural section guidance for concrete bus pads
- **CA MUTCD Rev 8 –** Sections 2B.46.01, 2B.46.32, 2B.46.59-62, 2B.47.14, and 2B.48 for signage at bus stops; 3B.19 for bus stop pavement markings; 3B.23 for curb painting at bus stops; 3D.01 for bus-only lane markings at applicable bus stops

Bus stop accessibility improvements on SR 66 in San Bernardino (source: CSET).

- **CSET 3.0.1** – H27, H28
- Caltrans: Caltrans Traffic Calming Guide, Caltrans Roadway Lighting Manual (forthcoming)
- **DIB 82-06** - Section 4.3.16 for guidance on ADA requirements at bus stops
- **DIB 94** – Section 7 in-lane bus stops
- **FHWA:** Pedestrian Lighting Primer and Lighting Handbook
- **US Access Board:** Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way (final adopted Rule) Section R309 Transit Stops and Transit Shelters
- **AC Transit:** Multimodal Corridor Design Guidelines Section 2.2.F and Exhibit 1 for guidance on accessible landing zones and clear zones for ADA access at bus stops; ADA Accessibility and bus stop placements are governed by AC Transit Board Policy 501 (pending approval).
- **NACTO:** Station & Stop Principles; Universal Design Elements; Bus Stops; Small Transit Shelter; Large Transit Shelter; Passenger Information & Wayfinding and System Wayfinding & Brand Seating (benches and leaning rails); Accessible Paths & Slopes; Bike Parking; Platform Height; Transit Curbs
- **Project for Public Spaces:** Lighting Use & Design

Caltrans Examples:

- Van Ness Ave (US 101), San Francisco; East 14th and International Blvd (SR 185), Oakland; Webster St (SR 61) & Willie Stargell Ave, Alameda

3. *Freeway Access Stations*

Freeway access stations provide direct access to a transit line operating within the footprint of a freeway, expressway, or controlled-access ramp that links to a freeway or expressway.

Typical Application:

- Used at locations that have high demand for express transit services utilizing the freeway or expressway and where technically feasible, with sufficient available right-of-way for safe operations. Locations include freeway medians, transit centers, and mobility hubs (including park and ride lots).

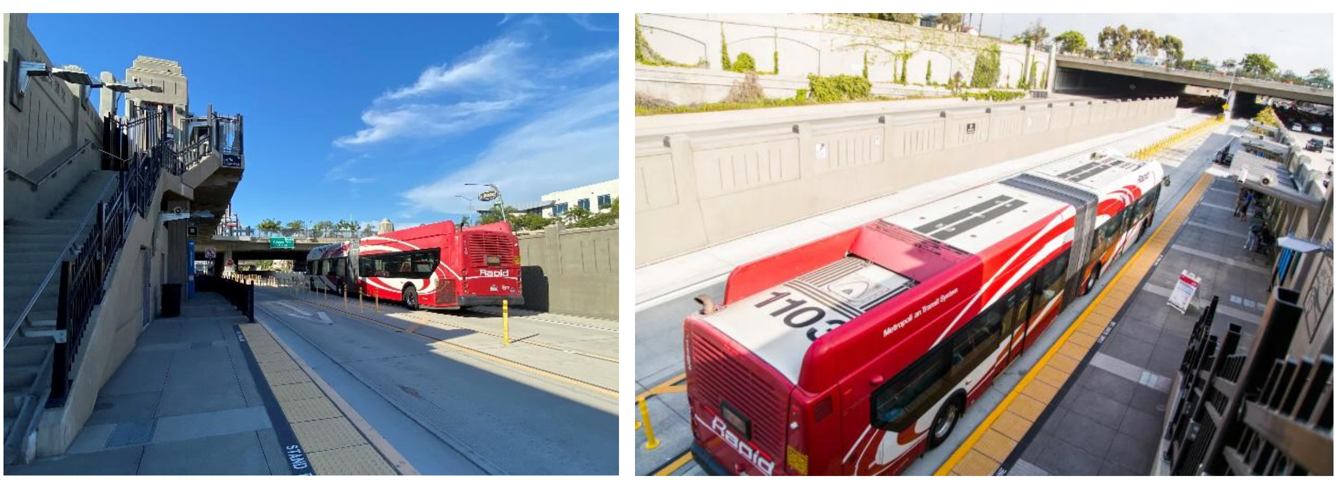
Additional Considerations:

- Historically, some freeway access stations have been located in locations that inadvertently encourage pedestrians and bicyclists to cross ramps at uncontrolled locations, which is not desirable; locating freeway access stations and bus stops to where ramps are directly connected to local streets rather than further towards the freeway is preferred for safety, though this may increase transit travel times. Ideal conditions include easy, safe access for pedestrians and bicyclists with minimal transit travel time disruption.

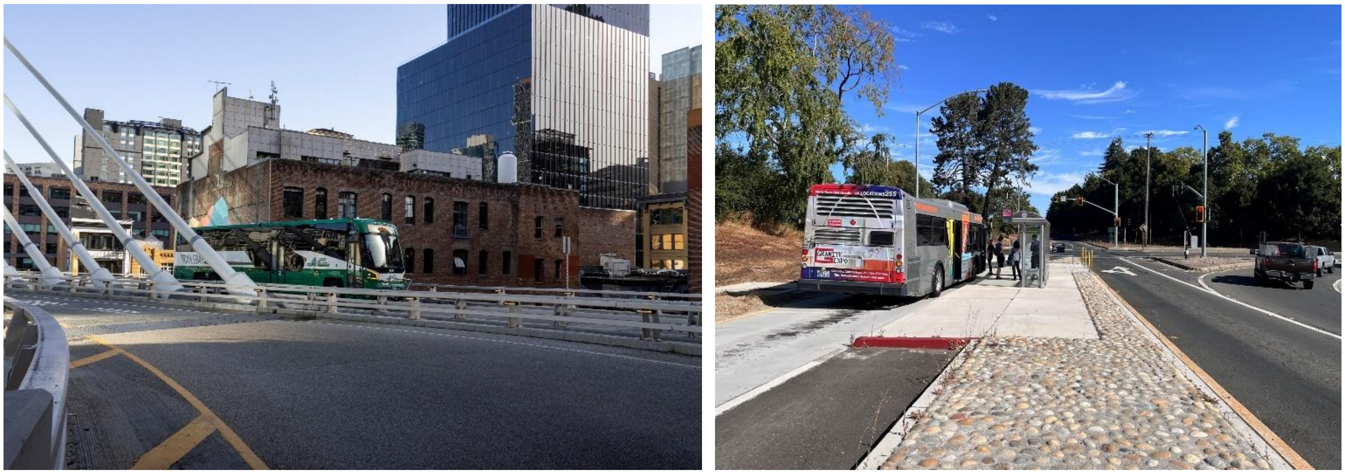
- When appropriate, locating bus stops within the freeway may be considered for commuter express bus service. This strategy helps with transit efficiency by locating the bus stop either at the end of an offramp or the beginning of an onramp, or in freeway medians (where space is available), such that the bus can quickly exit and re-enter the freeway. Current examples of this can be seen in Napa County, SR 29 at Imola Avenue.

- For existing freeway access bus stops that may be difficult to access by pedestrians and bicyclists, projects and treatments to improve pedestrian and bicycle access should be considered.

- A prominent, largescale example within the San Francisco Bay Area is the Salesforce Transit Center, also known as the Transbay Terminal. It is served by express buses that operate a significant portion of their route utilizing the freeway. The facility has bus bays (pullouts) for passenger boarding/alighting on an elevated, controlled-access ramp that links directly to the I-80 freeway and Bay Bridge. The bus bays are accessed by way of the Transit Center building.



Freeway access at the Boulevard Transit Plaza in San Diego from underpass level (left) and overpass level (right) (sources: Caltrans).



Freeway access for AC Transit Transbay buses to the Salesforce Transit Center in San Francisco (left) and for buses at the Imola Park and Ride in Napa (right) (sources: MTC).

Reference Design guidelines

- **CA MUTCD Rev 8 –** Section 2D.48 for guidance on transit operator signage at park-and-ride lots, Section 4L.103(CA) for guidance on flashing warning beacons at bus stops on freeway interchanges.
- **CSET 3.0.1** – H28

D4/Caltrans Examples:

- Salesforce Transit Center (to I-80), San Francisco; Boulevard Transit Plaza, El Cajon Boulevard and I-15, San Diego (D11); Fairfield Transit Center, Fairfield; Imola Park and Ride, Napa.

4. Bus Bulbs

A bus bulb is a curb extension that accommodates a bus stop, allowing the bus to dwell within the travel lane to pick up and drop off passengers.

Typical Application

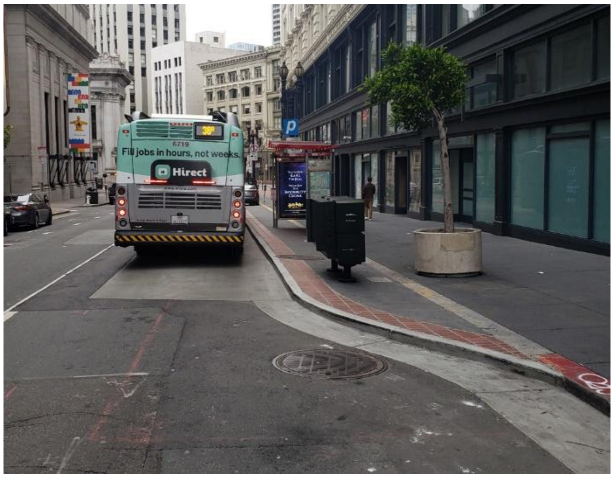
Bus bulbs are typically used where the bus has its own lane or where traffic volumes in the curbside lane would otherwise impede and delay buses from re-entering the lane from a pullout bus stop. In the latter case, bus bulbs provide some of the benefits of a transit lane by prioritizing the efficient operation of the bus as a very high occupancy vehicle, thus increasing person throughput and reducing traveler delay. Bus bulbs are also used where additional sidewalk space is needed to accommodate a shelter and seating at a bus stop (See Section Bus Boarding Islands for guidance where Class II bike lanes or a Class IV bikeway is present).

Additional Considerations

While stopping in the traffic lane may impact traffic operations, there are situations where preferential treatment for transit may be desirable, with the goal to minimize overall person delay. (Caltrans DIB 94)

Reference Design guidelines

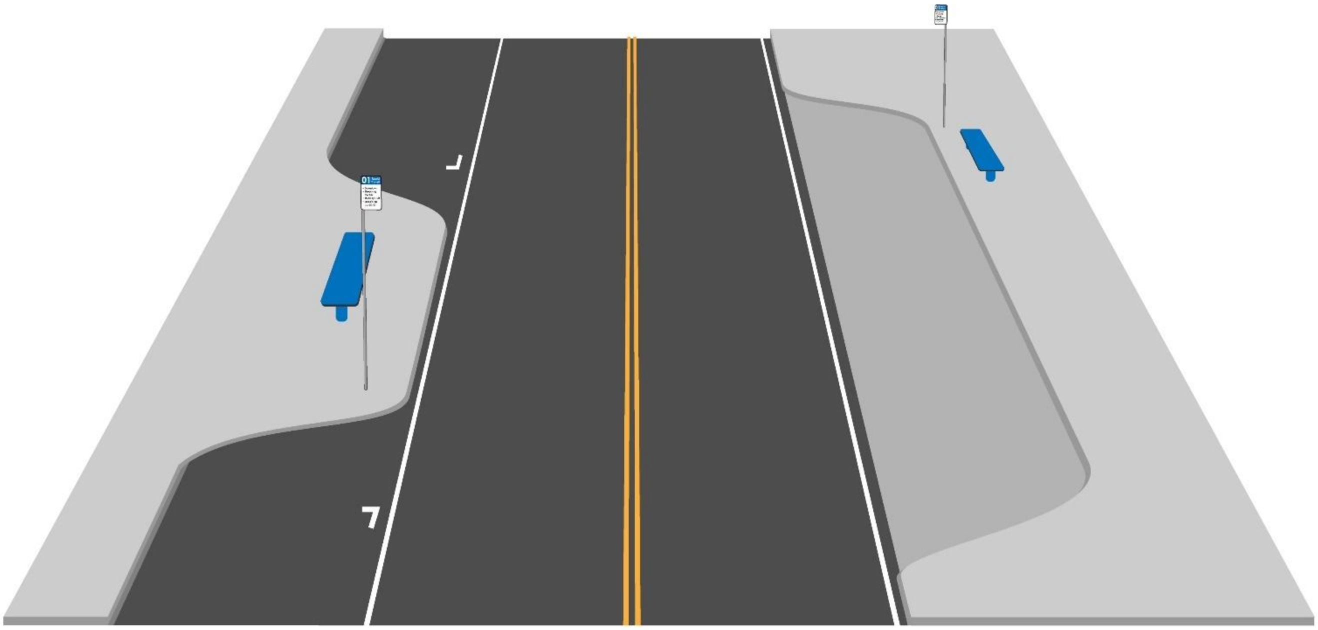
- **CA HDM 7th Edition** – Topic 303.4 for guidance on sidewalk bulb-outs, with Index 303.4(2) specific to bus bulbs
- **CSET 3.0.1** – H04, H14
- **CA MUTCD Rev 8** – see *Section 2.A.1 Bus Stops [link]*
- **DIB 82-06** - Section 4.3.16 for requirements for ADA accessibility
- DIB 94 – Section 7.2
- AASHTO Guide for Geometric Design of Transit Facilities on Highways and Streets



Bus bulb on O'Farrell Street in San Francisco (source: SFMTA).

Caltrans Examples:

- Euclid Ave & E 14th St. (SR 185), San Leandro; Sloat & 19th Ave (SR 1), San Francisco.



Example diagram of bus bulbs, with one stop extending into the parking lane on the left and one extending bus travel into the sidewalk zone on the right (source: CSET).

5. *Bus Boarding Islands*

Bus Boarding islands, or 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.

Typical Application

Bus boarding island example diagram with a platform separated from the sidewalk by a bike lane (source: CSET).

- Bus boarding islands are typically used on streets with a Class IV protected bikeway and can also be employed on streets with Class II bicycle lanes. They are located between the bikeway and the lane accommodating the bus, which can be either a bus-only lane, a mixed traffic lane, or a parking lane.
- Bus boarding islands place the bike lane behind the bus stop, which minimizes conflicts between the bicycle movement and the bus boarding/alighting operation. They also reduce the chance of a cyclist riding in a bus operator’s blind spot.
- Bus boarding islands also provide a dedicated space for passenger boarding/alighting and reduce transit vehicle dwell times at bus stops.

Additional Considerations

- 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. (AC Transit Multimodal Corridor Guidelines). The operational improvements offered by the in-lane bus stop can offset any operational delay for other motor vehicles when person-throughput, rather than vehicle-throughput, is considered.
- 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 regularly or seasonally. Leaves, especially when wet, are very slippery and can create hazards for bicyclists passing through the area. (AC Transit Multimodal Corridor Guidelines)
- Special attention should be given to the required ADA accessibility of the boarding island including a boarding and alighting area with a minimum of 8' of clear length measured perpendicular to the curb

and 5’ of clear width measured horizontal to the curb (see Caltrans DIB 82-06 Section 4.3.16). Evaluate whether a level pedestrian crossing should be provided between the sidewalk and the island, if feasible with the drainage design, as an alternative to the use of ramps. The benefits of a level pedestrian crossing are that it requires less exertion from wheelchair users, compared to the use of ramps, and that the level pedestrian crossing functions as a speed table within the bike lane in order to slow bicycle traffic and alert bicyclists to the pedestrian crossing.

Bus boarding island on Masonic Avenue in San Francisco (source: SFMTA).

- When possible, boarding islands should include amenities such as shade or seating, to encourage use by passengers and avoid extended boarding time (some passengers may wait on the sidewalk without amenities, leading to longer passenger boarding times).

Reference Design guidelines

- **CA MUTCD Rev 8** **–** see *Section 2.A.1 Bus Stops [link]*
- **DIB 82-06** **-** Section 4.3.16 for requirements for ADA accessibility (use guidance from the Complete Streets Elements Toolbox H47)
- **DIB 94** **-** Section 7.3
- **CSET 3.0.1** – H47
- **Caltrans District 4 Bike Plan** (update forthcoming 2025)
- **AC Transit Multimodal Corridor Guidelines** (update forthcoming 2025)

Caltrans Examples:

- San Pablo Ave Bus Lanes and Bike Lanes Project, Oakland, Emeryville, and South Berkeley (planned); Central Ave (SR 61) and 8th St, Alameda (planned).

Bus boarding island rendering for San Pablo Avenue in Alameda County (source: ACTC).

Bus stop amenities at a Tempo bus stop in Alameda County (source: AC Transit).

6. *Bus Stop Amenities*

Amenities at bus stops range from those that improve passenger comfort to those that increase the efficiency of transit operations. The level of amenities should be related to demand. They include:

- Transit shelters and shade or wind protection structures, including trees
- Real-time and static passenger information
- Wayfinding signage
- Seating
- Pedestrian-scale Lighting
- Bicycle & Pedestrian Access
- Secure Bike Parking (also e-Scooters)
- Level or Near-Level Boarding, including platforms or Transit Curbs
- Bus Stop Pavement Markings and Appropriate Queuing Space for Buses

Typical Application

Passenger amenities are found at a range of types of bus stops, with specific features dependent on the local context, available space, and funding provided. Caltrans planners and designers need to involve local transit providers in decision-making and funding. Bus stop amenities are also considered complete streets elements and are tracked in the Caltrans Asset Management Tool. Additional support and guidance may be available through District and Headquarters Complete Streets staff.

Additional Considerations

- Some localities are improving on the basic bus stop design by integrating the space into the local community and providing amenities to help pass the time while waiting. A key benefit of this approach is a real or perceived improvement in safety by increasing the visibility of the space through public use (APTA). The amenities offered at enhanced transit waiting areas can include:
    - Hydration station
    - Wi-Fi connectivity
    - Charging station for phones and/or tablets
    - A library
    - Play equipment such as swings
- Crime Prevention Through Environmental Design: this is a multidisciplinary approach to crime prevention that uses urban and architectural design and the management of urban and architectural environments (International CPTED Association)

Electronic Transit Information Display (eTID) in San Francisco (source: SFMTA).

Bike lockers on SR 178 in Ridgecrest (source: Caltrans).

Reference Design guidelines

- **CA HDM 7th Edition** – Index 626.4(3)
- **CA MUTCD Rev 8** – Section 2D.50.09-11 for guidance on placement of wayfinding signage oriented to pedestrians, 3B.19 for bus stop pavement markings, 9B.23 for guidance on bicycle parking area signage
- **CSET 3.0.1** – H27, H48, H99

- **DIB 82-06** - Section 4.3.16 for requirements for ADA accessibility
- **American Public Transportation Association –** Bus Stop Design and Placement Security Considerations
- **NACTO –** see *Section 2.A.1 Bus Stops [link],* Green Infrastructure
- **Other Resources:** Project for Public Spaces - Placemaking in Transit, Thinking Beyond the Station, The Placemaking Process, Lighting Use & Design;

  TransitCenter - From Sorry to Superb: Everything You Need to Know about Great Bus Stops

Caltrans Examples:

- Van Ness Ave (US 101), San Francisco; East 14th St/International Blvd (SR 185), Oakland; Webster St (SR 61) & Willie Stargell Ave, Alameda

Bus stop amenities at the Boulevard Transit Plaza on El Cajon Boulevard in San Diego (source: Caltrans).

B. Other Transit Access Amenities

1. *Pedestrian and Bicycle Access*

To access a transit stop or station, all passengers travel at least a short distance by foot, wheelchair, bicycle, or other assistive device; this is referred to as the “first-and last-mile” connections (the distance covered between a transit stop and the “final” destination). A well-developed and connected network that creates a low-stress experience suitable for all ages and abilities can encourage a mode shift from motor vehicles to utilizing pedestrian or bicycle access with transit.

Typical Application

The full breadth of pedestrian and bicycle access guidance can be found in the Caltrans Complete Streets Toolbox 3.0, including: considerations and strategies on appropriate use of bikeway classifications; crosswalk treatments and pedestrian refuges; bicycle intersection elements including bike boxes, two-stage turn queue boxes, and more.

People walking and using bikes in conjunction with transit (source: VTA).

Additional Considerations

- Improving the safety of non-motorists is imperative in promoting active transportation modes, especially around transit stations where different transportation modes have much higher rates of interaction (Mineta).
- A bicycle-to-transit trip typically extends the catchment area of a bus stop or train station (potentially up to two or three miles.) Thus, it is critical and beneficial for transit that stops and their surrounding environments are safe and accessible for all users.
- Secure bike parking is an important element in encouraging bicycle access to transit.

Reference Design guidelines

- **CSET 3.0.1**
- Mineta Transportation Institute at San Jose State University Enhancement of Multimodal Traffic Safety in High-Quality Transit Areas, 2021
- Caltrans District 4 Bicycle Best Practices (pending)
- Caltrans District 4 Pedetrian Plan and Bicycle Plan (update pending)
- FHWA: Pedestrian Safety Guide for Transit Agencies
- American Public Transportation Association: A Practical Transit Agency Guide to Bicycle Integration and Equitable Mobility

People biking between SMART and the ferry terminal on the Corte Madera Creek Greenway in Larkspur (source: Caltrans).

Caltrans Examples:

- Corte Madera Creek Bike Ped Greenway (connecting to SMART & Ferry Terminal), Larkspur. SMART Pathway/Great Redwood Trail, San Rafael.

2. *Wayfinding*

Wayfinding signage enables individuals to navigate a city, town, or region and assist them to find their destination of choice. This signage points out the services, amenities, or interesting locations nearby (CSET 3.0.1). Wayfinding signage can be designed for pedestrian, bicycle, and transit users. Wayfinding should be used at transit stops, park and ride lots, mobility hubs, and other key locations to assist people navigating an area.

Typical Application

- Signage should be placed between services at major decision points to support wayfinding and connections. Signage shall direct users to platforms, bus stops, taxis, parking, bicycle parking, adjacent streets, and exits. (MTC).
- MTC's Regional Mapping & Wayfinding Program is creating signage standards for transit stops throughout the region; all wayfinding on the STN should adhere to new regional wayfinding standards when applicable.

Wayfinding signage at BART and Caltrain station (source: CSET).

Additional Considerations

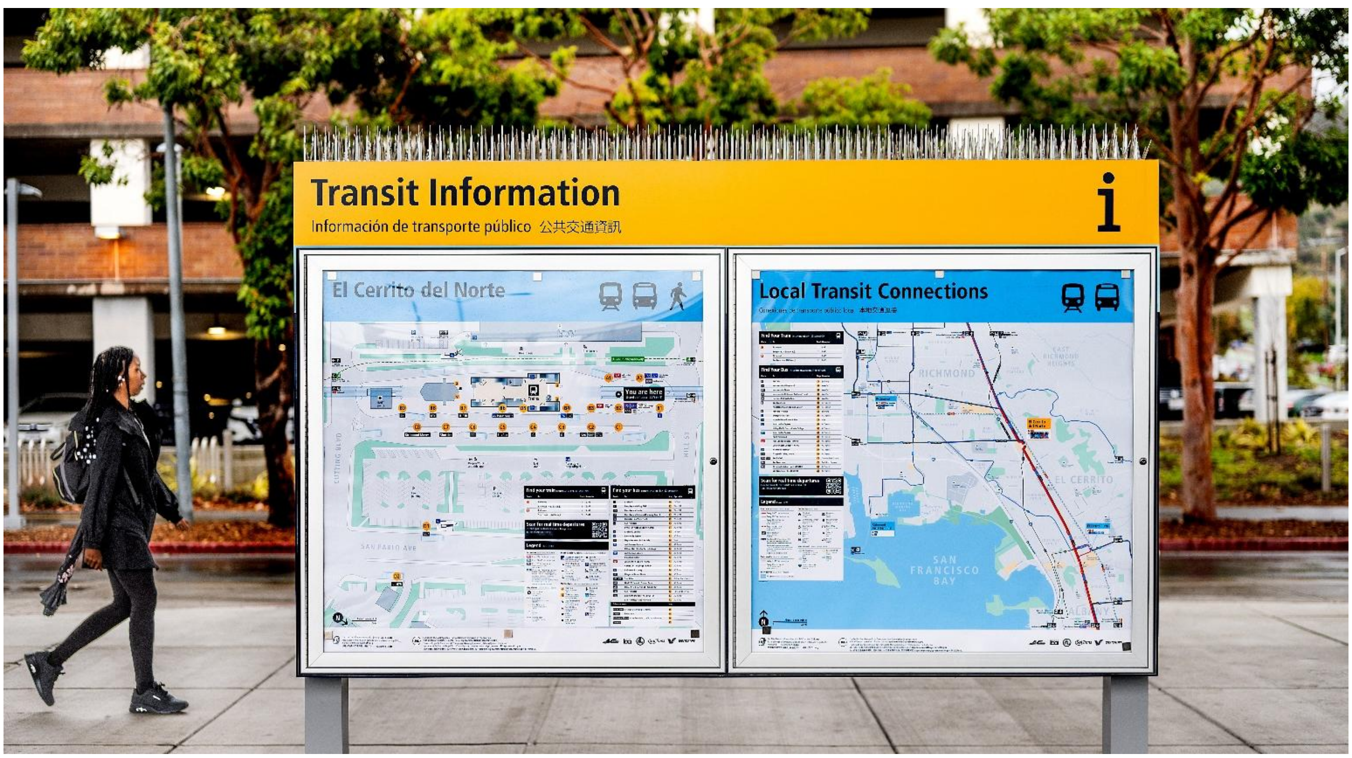
- Historically, freeway-located wayfinding for transit was primarily limited to rail transit hubs; as Mobility Hubs, high quality transit lanes, and other high frequency bus transit infrastructure is becoming more prevalent, Caltrans should consider utilizing freeway wayfinding for bus transit as necessary.

Reference Design guidelines

- **CA MUTCD Rev 8 –** Sections 2D.50 Community Wayfinding Signs
- **CSET 3.0.1** – H99
- **Caltrans** Tourist-Oriented Directional Signs Program
- **Caltrans** Mobility Hub Design & Operations Guidelines (forthcoming 2025)
- **MTC** Regional Transit Wayfinding Designs & Standards

Caltrans Examples:

- MTC Regional Transit Wayfinding Designs & Standards



Wayfinding signage for walking directions (top) and regional connections (bottom) at El Cerrito del Norte BART stop (sources: MTC).

3. *Mobility Hubs*

Mobility hubs are locations that provide an integrated suite of mobility services, amenities, and technologies to enable seamless multimodal trips serving the community at large and individual users. At Caltrans they are categorized into two categories: multimodal and commuter rideshare (SHSMP).

Typical Application

- Multimodal Mobility Hubs have more amenities and prioritize multimodal connectivity, including:
    - Access to two or more transportation services
    - Enhanced access for bicyclists and pedestrians to the site
    - Human-centered design that creates a sense of place
    - Context-sensitive programming and amenities
    - Flexible space to adapt to evolving needs.
- Mobility hubs are designed to enhance connectivity of multimodal travel while reducing greenhouse gas emissions, offering equity, safety, and value to a city or regional transit system. (CSET 3.0.1)
- MTC's Regional Mobility Hub Program envisions Mobility Hubs to serve as community anchors and offer a welcoming environment that enables travelers of all backgrounds and abilities to access multiple transportation options – including shared scooters, bicycles and cars, as well as transit – and supportive amenities in a cohesive space. Mobility hubs are places in a community that bring

Mobility hub example diagram of some travel options that may be available, including rail, bus, bike, and shared vehicles (source: MTC).

together public transit, bike share, car share, and other ways for people to get where they want to go without a private vehicle. (MTC)

- Mobility hubs are best utilized where commuters and non-commuters can also satisfy errand-based trips such as grocery shopping. (CSET 3.0.1)
- Mobility hubs can be located where transit services already come together, or in communities and locations where transportation is needed the most. MTC has prioritized investments for regionally significant mobility hubs. (MTC)

Fairfield Transportation Center mobility hub provides comfortable transfers and amenities (source: City of Fairfield).

Additional Considerations:

- Many Caltrans owned and operated Park and Ride lots are becoming outfitted with more amenities and will become either multimodal or commuter rideshare mobility hubs.
- Commuter Rideshare Mobility Hubs are considered Mobility Hubs, but these facilities are typically in rural locations where it may not be feasible or beneficial to have all the amenities and multimodal connections. Commuter Rideshares are more similar to traditional Park and Ride facilities as they are typically more focused on only carpool and vanpool uses. Coordination with transit agencies should occur to determine which amenities should be prioritized.

Reference Design guidelines

- **CA HDM 7th Edition** – Topic & Table 636.4, Topics 905 & 915
- **CA MUTCD Rev 8** – Section 2D.48 (Park-Ride Sign)
- **CSET 3.0.1** – H19, H99
- **Caltrans** Park & Ride Program Resource Guide, Caltrans Park and Ride Inventory, Park and Ride Program Resource Guide, Mobility Hub Design & Operations Guidelines (forthcoming 2025)
- 2020 VTA Bus Stop & Facility Criteria and Standard-Section 3

Other Resources

- MTC – Mobility Hubs, Bay Area Mobility Hub Implementation Playbook
- VTA – Bus Stop & Facility Criteria and Standards -Section 3

Caltrans Example:

- Salesforce Transit Center, San Francisco; Fairfield Transportation Center, Fairfield.