Transit First Toolkit

BACKGROUND

Street design in the City of San José is governed by the *Complete Streets Design Standard and Guidelines* (CSDSG), adopted May 2018. This document provides detailed information on how to build streets that are "safe, efficient, and convenient for multimodal travel while also supporting public life, neighborhood livability, and economic vitality" (CSDSG, p. 2). The CSDSG includes engineering designs for sidewalks, curb lanes, travel lanes, and transit stops and stations. However, the CSDSG does not give detailed guidance as to where and when to implement these designs and how spatial, throughput, and timing priorities and conflicts should be resolved in street design.

PURPOSE

The Transit First Toolkit is a guide to help city staff select appropriate technology and infrastructure to achieve policy goals. Every street and intersection, like each community in San José, is unique. The toolkit is meant to provide high level guidance, *a list of options, their tradeoffs, and appropriate siting context*, that project teams can use to develop site-specific designs and applications.

This toolkit helps determine *which* infrastructure is appropriate. An implementation guide is shown below to help contextualize when and where to implement each tool. The tools are described in detail below, with a high-level sense of costs and benefits, implementation considerations, and appropriate installation context. The toolkit is further divided into infrastructure and technology subsections. Once the appropriate transit-serving infrastructure is selected, the CSDSG provides explicit engineering standards denoting how it should be built.

Each tool within the toolkit supports one or more of four key sub-goals:

- Transit vehicle mobility (TVM): The ability for a bus or train to move quickly and reliably through San José
- Transit vehicle access (TVA): The ability for a bus or train to access a pedestrian loading area and/or a station
- Transit rider mobility (TRM): The ability of a transit rider, including those facing mobility challenges, to access a transit vehicle from a transit stop to complete the first and last leg of their journey
- Transit rider access (TRA): The ability for a transit rider to wait, alight, and disembark from a transit vehicle safely and comfortably

Infrastructure

1. Transit Only Street

Transit Mall (NACTO, Flickr: user AE Creations)

Purpose: Transit Vehicle Mobility

Description: A roadway dedicated solely to public transit, including paratransit, and depending on jurisdiction, taxis. These streets can move larger amounts of travelers with lower street traffic, due to the higher capacity of a transit vehicle over a private car. These streets are ideal to maintain person throughput while minimizing impact to pedestrians and street life and can support lively pedestrian and retail environments.

Benefits:

- Reduces transit vehicle queuing due to congestion
- Dramatically increases transit service speed
- Supports high quality transit service
- Helps make transit a more equitable form of mobility
- Dramatically improves transit vehicle reliability

Impacts & Cost:

- Removes access to private autos
- Reduces private auto mobility
- Reduces or eliminates curbside parking
- May impact deliveries (deliveries may be shifted to off-peak hours)
- Will require turn restrictions for private autos on adjacent streets
- Quick-build versions can be very low cost and accomplished quickly, often through signage and signal timing
- Hardscape version can become expensive depending on design

Implementation:

- Can be implemented as quick-build, hardscape, or phased

- Quick-build versions can be coupled with pavement maintenance / re-striping resulting in minimal cost and construction time increases
- Will require parking restriction
- Appropriate for transit corridors especially in areas that would also benefit from pedestrianization, I.e., Downtown

2. Dedicated Bus Lane

Bus Only Lane, Downtown San José

Purpose: Transit Vehicle Mobility

Description:
A travel lane on a public road reserved for the exclusive use of transit vehicles. In some cases, right-turning movements for private autos can be accommodated at intersection approaches. These lanes can be either side or center running, and can be separated / delineated either with hardscape, i.e., concrete curbs or plantings, or quick-build materials such as paint and plastic posts.

Benefits:

- Reduces transit vehicle queuing due to congestion
- Dramatically increases transit service speed
- Supports high quality transit service
- Helps make transit a more equitable form of mobility
- Dramatically improves transit vehicle reliability

Impacts & Cost:

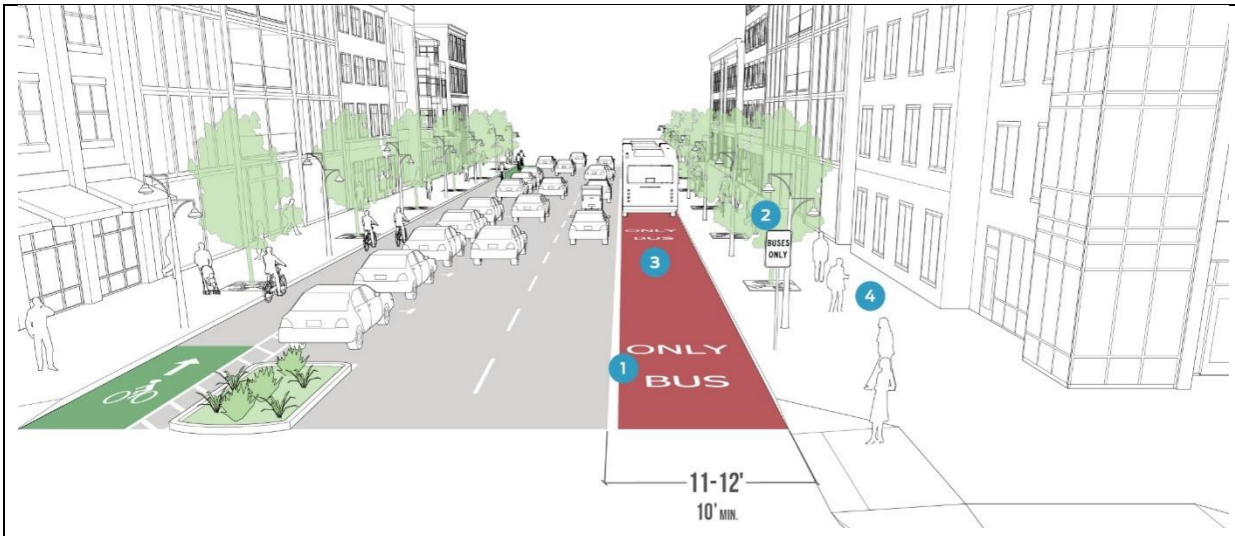
- Reallocates road space from other users, typically repurposing a general travel lane, resulting in less space dedicated to single-occupant vehicles
- May require the restriction of curbside parking
- May limit or eliminate right-turn pockets
- Quick-build versions can be very low cost and accomplished quickly
- Hardscape version can become expensive depending on design, typically requiring at least some concrete curb installation

Implementation:

- Can be implemented as quick-build, hardscape, or phased

- Quick-build versions can be coupled with pavement maintenance / re-striping, resulting in minimal cost and construction time increases
- Hardscape versions can be coupled with street beautification and storm water / urban greening projects
- Should be paired with parking and turn restriction where necessary
- Appropriate for transit corridors

3. Public Service Lane



Curbside Dedicated Bus Lane (NACTO)

Purpose: Transit Vehicle Mobility

Description:
Identical to Dedicated Bus Lanes except allowing for use by emergency services vehicles

Additional Benefits:

- Can speed response time for emergency vehicles
- Can increase emergency vehicle response reliability and improve traffic safety

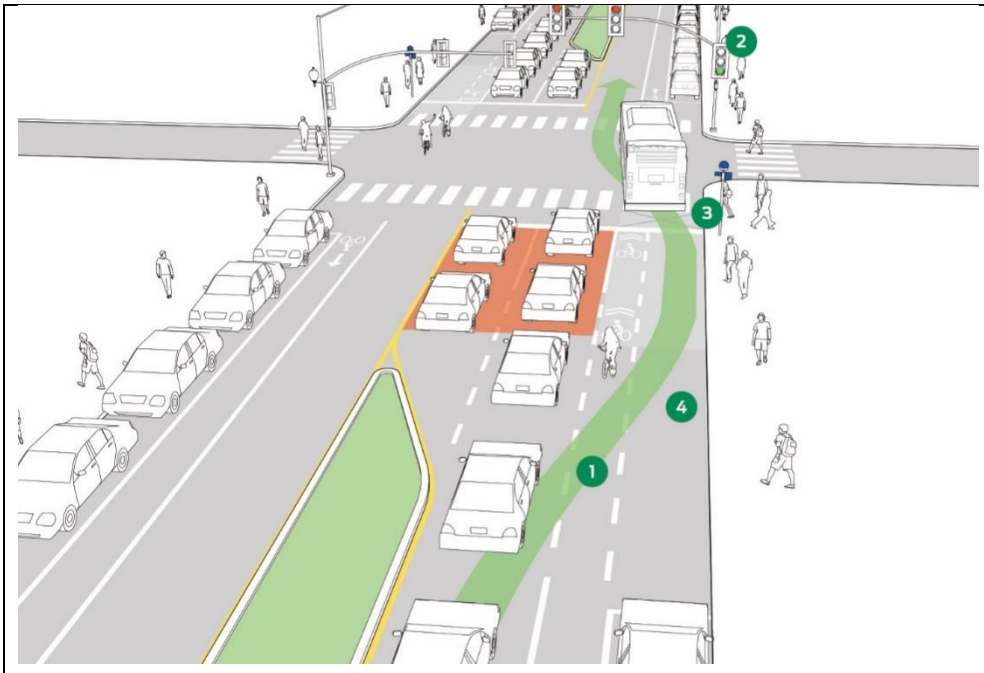
Additional Impacts & Cost:

- Design may need to be adjusted to accommodate non-transit vehicle entry and exit to the lane

Additional Implementation Considerations:

- Design may need to be adjusted to accommodate non-transit vehicle entry and exit to the lane, I.e., curbs separating facility from travel lanes may need to be mountable

4. Queue Jump



Bus travel path using a queue jump (NACTO)

Purpose: Transit Vehicle Mobility

Description:

A designated area of public road reserved for the exclusive use of transit vehicles to enable passing of stopped or queued non-transit vehicles. This typically occurs at an intersection approach and allows a transit vehicle to pass queued private autos waiting at a light.

Benefits:

- Reduces transit vehicle queueing time at intersections
- Allows transit vehicles to pass queued private autos
- Allows transit vehicles to better access / utilize transit signal priority intersections
- Improves transit vehicle reliability

Impacts & Cost:

- May require parking removal near intersections
- May prevent bulb out / curb extension intended for pedestrian safety
- May limit or eliminate right turn pockets
- If coupled with transit signal priority, preemption signal upgrades may be required

Implementation:

- Can be implemented in phases or as standalone signal improvements
- May require signal upgrade, increasing cost and construction time
- Should be paired with parking restriction
- Appropriate for intersections without transit only or public service lanes and low right-turn demand

5. Turn Restrictions

Right Turn Restriction to Prioritize Transit, Downtown San José

Purpose: Transit Vehicle Mobility

Description: Total or time-based restrictions of turning movements at specific intersections. These restrictions can be a blanket ban, based on specific times such as peak hours, or on special events affecting local traffic such as the conclusion of a major sporting event. These restrictions can apply to left or right turns leaving or entering a roadway. Such restrictions can limit traffic signal cycle length, reduce congestion and conflict at intersections, and free roadway space to be reallocated to other uses.

Benefits:

- Reduction of conflict due to turning movements at intersections
- Reduction of traffic signal cycle lengths
- Reduces transit vehicle queuing due to congestion
- Dramatically increases transit service speed
- Supports high quality transit service
- Improves transit vehicle reliability
- Improves safety to pedestrians at crossings

Impacts & Cost:

- Reduces private auto mobility
- Reduces private auto access
- Signals may need retiming
- Signal heads may need to be removed or covered

Implementation:

- Can be implemented in phases or as standalone signal improvements
- May require signal upgrade increasing cost and construction time
- Appropriate for intersections along transit corridors where congestion is present due to turning conflicts, queuing for turns, or signal cycles set to accommodate turns

6. Parking Removal

Bus Pulling Away from a Red Curbed Bus Stop, Downtown San José

Purpose: Transit Vehicle Mobility, Transit Vehicle Access

Description: Reallocation of the curb lane from private auto parking to a more productive use. These new uses can include transit right of way, improved transit stops such as boarding islands supporting in lane stopping or expanded pedestrian and street life space.

Benefits:

- Expanded pedestrian and street life zone
- Reduces transit vehicle queuing due to congestion (turns, and vehicles accessing curbside parking)
- Dramatically increases transit service speed
- Supports high quality transit service
- Helps make transit a more equitable form of mobility
- Dramatically improves transit vehicle reliability
- Reduction of crossing distance for pedestrians
- Potential traffic calming due to narrowing of roadway

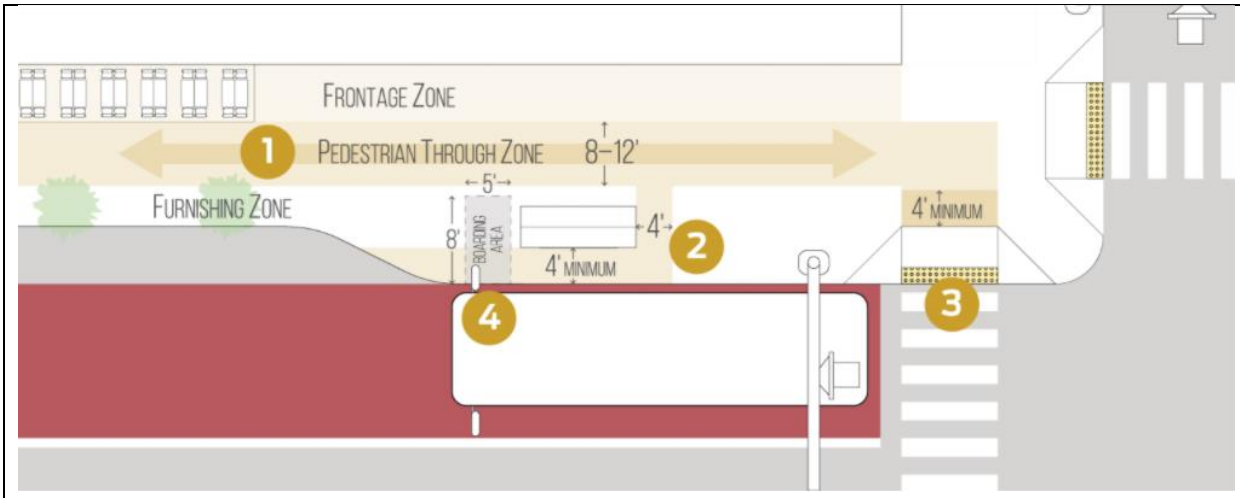
Impacts & Cost:

- Elimination of on-street parking
- Parking usage analysis may be required to understand impacts

Implementation:

- Short sections near transit stops or intersections may be advanced individually or as part of a larger corridor-wide restriction
- Impact to business access for vehicles and deliveries may be mitigated by re-configuring curb uses on adjacent streets
- Cost and complexity vary greatly with new use: paint and plastic can be used for short term transit lanes; hardscape can be used for long term sidewalk expansions
- Appropriate for transit corridors

7. Transit Bulb-Out



Transit Bulb-Out with amenities near intersection (NACTO)

Purpose: Transit Vehicle Access; Transit Rider Access

Description:

A raised, hardened extension of a sidewalk or other similar pedestrian facility used to better facilitate and improve pedestrian access to a transit vehicle and a transit vehicle's access to the curb.

Benefits:

- Reduced time and maneuvering required for transit vehicles to access the curb
- Provides for increased clear space for transit vehicle access and amenities, I.e., boarding ramps and shelters
- Provides dedicated space for waiting / alighting passengers outside of the sidewalk through zone, separating passengers and sidewalk activates allowing for greater throughput and comfort for both
- Allows for in-lane transit vehicle stopping
- Likely to not require significant parking loss, as curb space used is typically already occupied by curbside bus facilities

Impacts & Cost:

- In-lane stopping may cause impacts to autos using concurrent lanes
- In case of attached bulbs, (typical) hydraulic impact is high; curb and gutters must be rebuilt at significant cost
- During construction, longer-term local roadway closure required (if sewer / gutter work is required)
- Medium cost (typically less than $30K per basic bulb, assuming no major gutter or sewer work)

Implementation:

- Can be implemented in phases or as standalone stop improvements
- Can be required as mitigation assigned to adjacent building
- Can complement an off-curb transit only or public service lane
- Should be paired with parking restriction

- Appropriate at all bus stops, especially on high traffic corridors
- Should be located at far side of intersection to maximize benefit from TSP
- Design guidance available in CSDSG (pg. 54, 63)

8. Transit Boarding Island

Transit Boarding Island with protected Cycle infrastructure (CSDSG)

Quick-Build Transit Boarding Island at SJSU

Purpose: Transit Rider Access, Transit Rider (& Cyclist) Mobility

Description:

A raised, hardened island or other similar pedestrian facility physically separated from the sidewalk used to separate waiting / alighting passengers from other road users and to better facilitate and improve pedestrian access to a transit vehicle and/or transit vehicle access to the curb. These facilities are typically used to provide separation for a protected bicycle facility, or to maintain hydraulic function of an existing gutter.

Benefits:

- Reduced time and maneuvering required for transit vehicles to access the curb
- Provides for increased clear space for riders accessing transit and amenities, I.e., boarding ramps and shelters
- Allows for in-lane transit vehicle stopping
- Separates transit riders from cyclists in protected bikeways, reducing bus / bike conflicts
- Maintains exiting curb and gutter and hydrology
- Likely to not require significant parking loss, as curb space used is typically already occupied by curbside bus facilities

Impacts & Cost:

- In lane stopping my cause impacts to autos using concurrent lanes
- During construction, short-term local roadway closure required (typically less than a week)
- Medium cost (typically less than $30K per basic boarding Island)

Implementation:

- Can be implemented in phases or as standalone stop improvements
- Can be required as mitigation assigned to adjacent building
- Appropriate for bus stops on corridors with curb-running bike infrastructure
- Should be located at far side of intersection to maximize benefit from TSP implementation
- Design guidance available in CSDSG (pg. 54, 63)

9. Wayfinding

Low-cost wayfinding (CSJ)

Downtown San José wayfinding map (CSJ)

Purpose: Transit Rider Mobility

Description:

Informative, intuitive digital or static signage to help orient transit riders and other road users to nearby attractions and points of interest such as hospitals, libraries, and entertainment venues, and what can be accessed via the transit network.

Benefits:

- Orient transit riders to local points of interest to improve last mile connections
- Improves walkability of nearby areas and transit network
- Help transit riders understand / use transit network
- Build user confidence in new riders
- Digital wayfinding can be an easily updatable and effective communication tool for city governments and partners

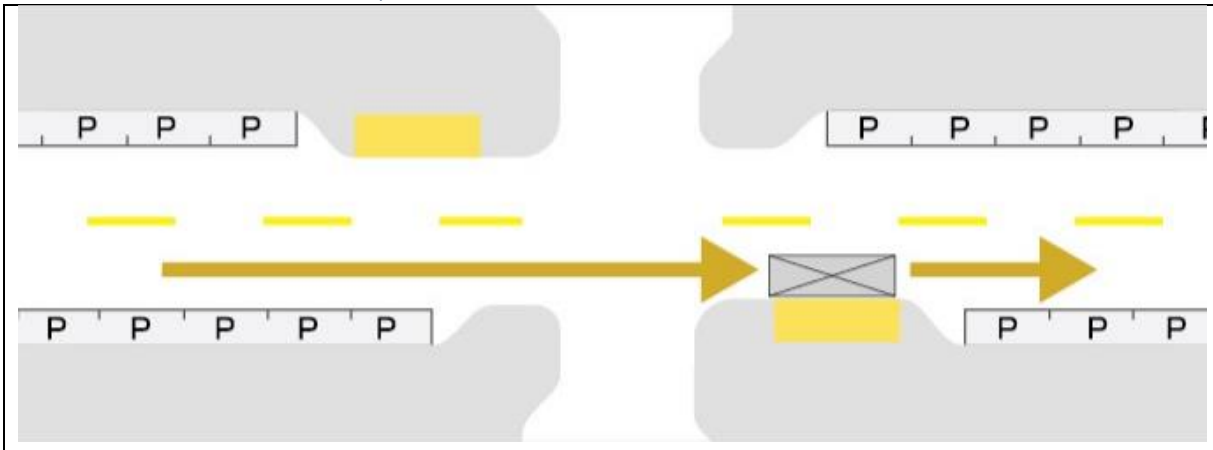
Impacts & Cost:

- Material, design, and installation cost varies
- Kiosk or shelter space may no longer be available for other uses including advertisement

Implementation:

- Wayfinding can be integrated into transit stop on an ad hoc basis
- Low-cost wayfinding can be mounted to existing public light and street sign poles
- For best effect, wayfinding should be coordinated across agencies to form an integrated seamless user experience
- Appropriate for all bus stops, especially in heavily pedestrian areas

10. Far Side Transit Stops



Far side of intersection transit stop (NACTO)

Purpose: Transit Vehicle Mobility, Transit Vehicle Access

Description:

Transit stops are located on the far side of intersections relative to the route of a transit vehicle. This allows transit vehicles to cross an intersection before stopping to board / alight passengers, meaning that a transit vehicle need not wait for a light to change to reenter the roadway after servicing a stop.

Benefits:

- Improved transit time (likelihood of queueing at stop light reduced)
- Improved transit reliability (likelihood of queuing at stop light reduced)
- Improved TSP operation (ETA of transit vehicles more predictable)
- Reduction in conflicts between right turns and transit vehicles at intersections
- Potential for stop improvements, if stops are rebuilt

Impacts & Cost:

- Stop relocation is generally expensive, typically both waiting area facilities and a concrete bus pad in the roadway must be built
- Depending on design, construction impacts may be significant

Implementation:

- Can be implemented in phases or as standalone stop improvements
- Can be required as mitigation assigned to adjacent building
- Should be implemented with best design practices, i.e., waiting area and bus bulb improvements
- Appropriate for most bus stops at intersections
- Highly recommended with TSP deployment to achieve optimum travel time and reliability

11. Rider Waiting Area

Transit Rider Waiting Area, Downtown San José

Purpose: Transit Rider Access

Description:

Making the area where transit riders wait inviting and safe. This includes shade trees and structures, large waiting areas free of obstruction, support for amenities like benches, transit canopies, and other treatments such as transit bulb-outs, etc.

Benefits:

- Improved rider experience, including shade and comfort
- Improved perception of transit service
- Provides space for wayfinding
- Some facilities, i.e., refuse bins, are available to other street users

Impacts & Cost:

- Installation cost dependent on design
- May restrict curb activities if additional curb space is needed
- May reduce clear throughway on sidewalk
- May reduce space for other placemaking / public use of street

Implementation:

- Can be implemented in phases or as standalone stop improvements
- Can be required as mitigation assigned to adjacent building
- Can be implemented as part of streetscaping / beatification project
- Appropriate for all bus stops

12. Pedestrian Access

Wide high-visibility crosswalks provide better access to transit stops (NACTO)

Purpose: Transit Rider Mobility

Description:

Street features to improve ease, safety, and directness of access to transit boarding areas. This includes larger sidewalks, crosswalks, pedestrian lighting, shade trees, and structures.

Benefits:

- Improved rider experience, including shade and comfort
- Improved perception of transit service
- Improved safety and comfort for all road users
- Improved area walkability
- Provides space for wayfinding

Impacts & Cost:

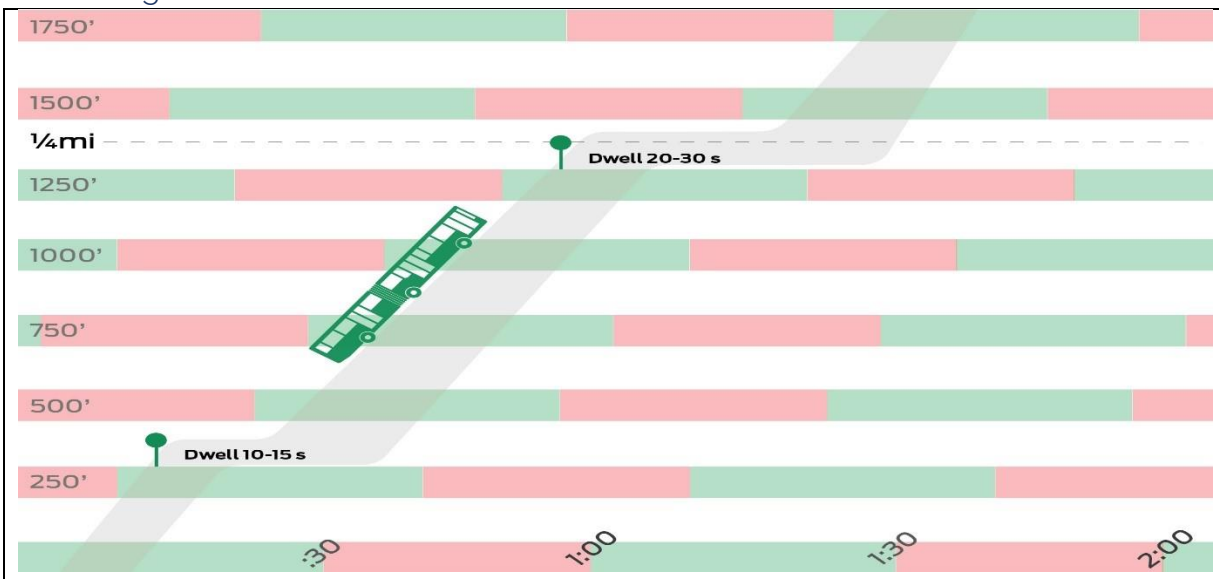
- Installation cost dependent on design
- May restrict other curb uses
- May reduce traffic speed or result in traffic queueing

Implementation:

- Can be implemented in phases or as standalone stop improvements
- Can be required as mitigation assigned to adjacent development project
- Can be implemented as part of streetscaping / beatification project
- Appropriate for all bus stops

Technology

13. Signal Coordination



Visualization of traffic signals coordinated with bus schedule (NACTO)

Purpose: Transit Vehicle Mobility

Description:

Traffic signals are coordinated or timed to allow for uninterrupted or reduced travel times of through travel for transit vehicles. This allows for a PSL, or travel lane used by buses to remain open and free flowing through intersections as to not interrupt or delay transit vehicles.

Benefits:

- Improved transit time (likelihood of queueing at stop light reduced)
- Improved transit reliability (likelihood of queueing at stop light reduced)
- May be used to better control speed of all traffic on a corridor

Impacts & Cost:

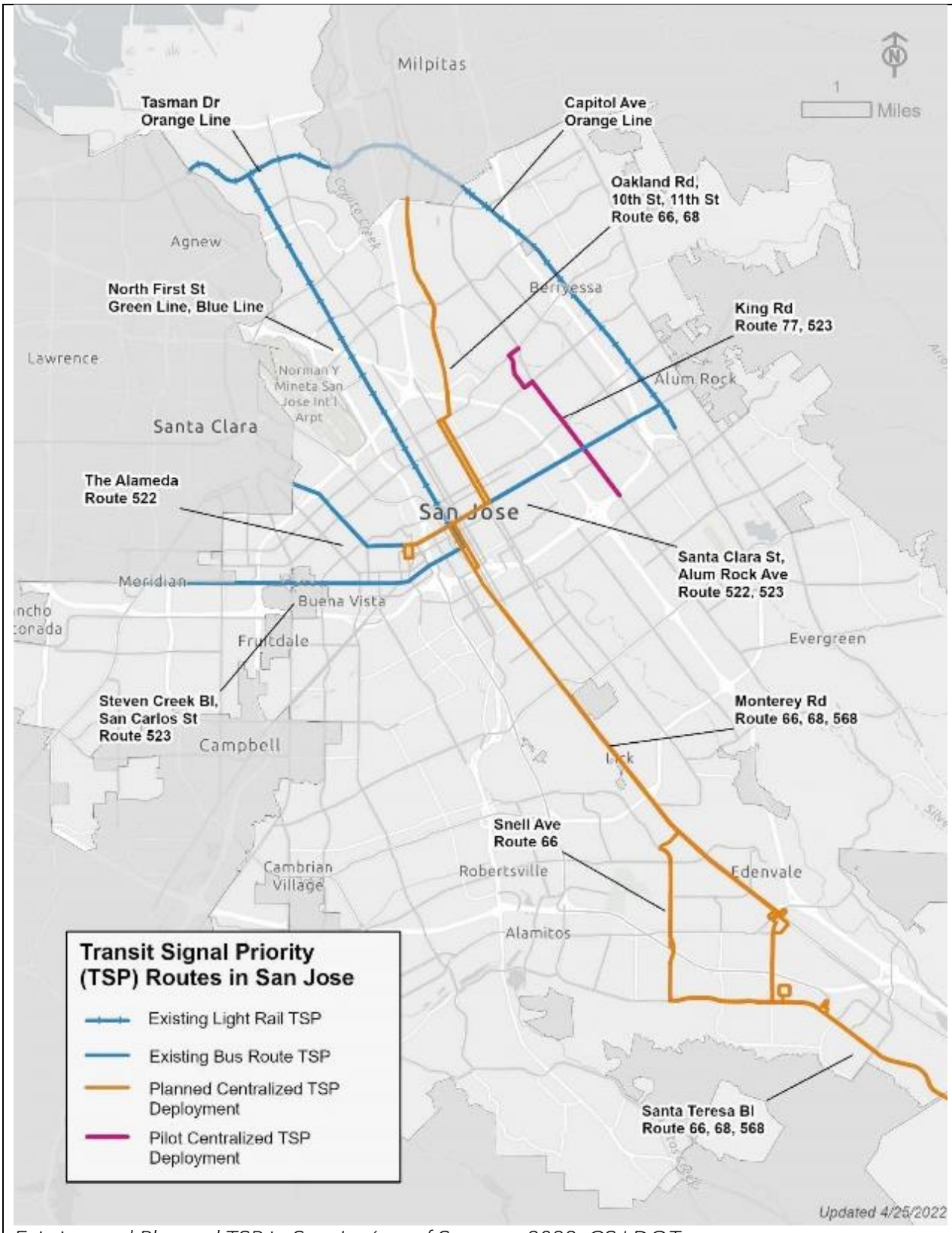
- May disrupt existing signal timing
- May increase cycle times
- May increase waiting / queuing at intersections for autos
- Additional signals may be necessary to achieve transit travel reliability

Implementation:

- Should be implemented along a full corridor / route to be effective
- Can be required as mitigation assigned to adjacent development project
- Supported by adaptive traffic management system
- Appropriate at signalized intersections

14. Transit Signal Priority

A Transit Priority Signal (White Symbol Right of Traffic Light) Gives a LRT Vehicle Permission to Enter the Intersection Before Autos, Downtown San José



Existing and Planned TSP in San José as of Summer 2022, CSJ DOT

Purpose: Transit Vehicle Mobility

Description:

Priority at traffic signals is given to transit vehicles to reduce interruptions to through travel of transit vehicles, by reducing the frequency and duration of stops at signals. Note, this technology is applicable to transit vehicles traveling in either direction along a route regardless of frequency. TSP can be implemented through hardware deployed locally at the intersection or, more preferably, centrally utilizing location information and cloud-based platforms or on-premise software. This request can be implemented by the signal in one of two ways:

1) When arriving at the end of a green, the signal provides more time for the approaching transit vehicle, or

2) When arriving on the red, the signal shortens the side-street green time for a quicker return to a green light for the waiting transit vehicle

Benefits:

- Improved transit time (likelihood of queueing at stop light reduced)
- Improved transit reliability (likelihood of queueing at stop light reduced)
- Likely greater reliability improvements for Transit Vehicles than signal coordination
- Civil improvements not necessarily required; solution can be entirely software based

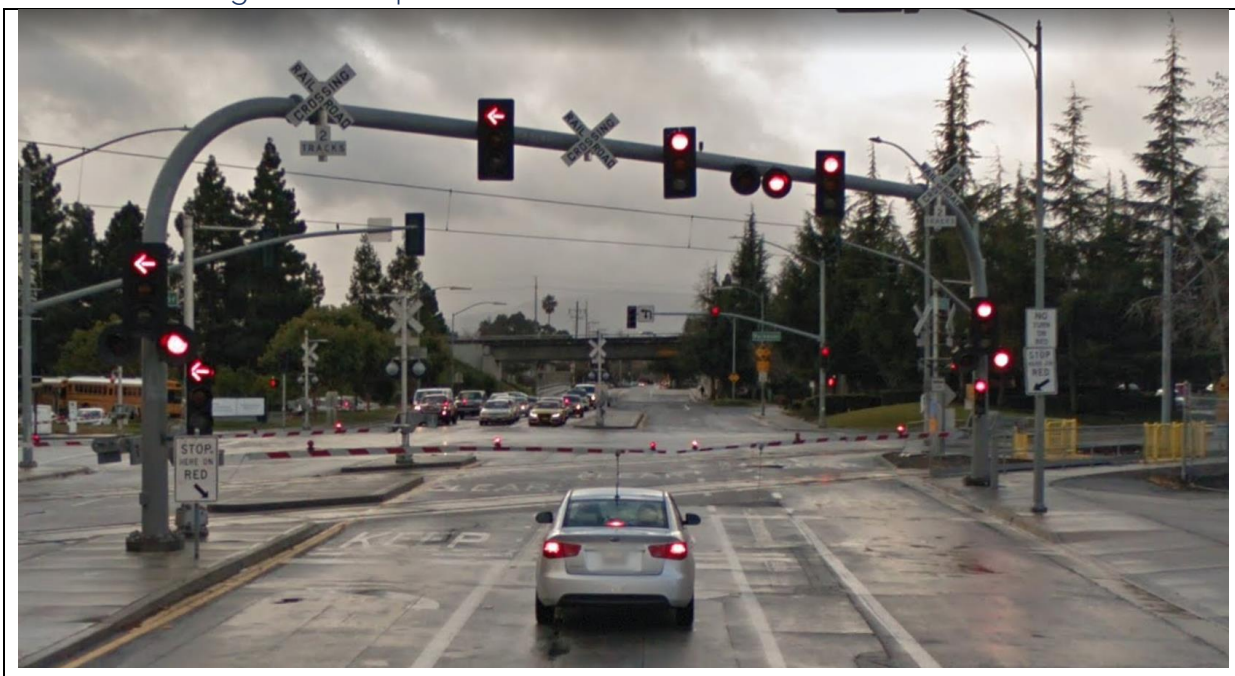
Impacts & Cost:

- Minor disruption to existing signal timing
- May increase waiting / queuing on side streets for all roadway users including pedestrians
- Significant startup cost to initiate a TSP system city wide plus projected $1k for software maintenance per intersection per year

Implementation:

- Can be implemented along a corridor / route to achieve maximum system benefit
- Can be required as mitigation assigned to nearby development projects
- Supported by existing adaptive traffic management system
- Appropriate at signalized intersections
- Software based TSP systems provide greater flexibility, uptime, and lower maintenance

15. Transit Signal Preemption



A Private Car Waits at a Controlled Train Crossing, Midtown San José - courtesy Google Streetview

Purpose: Transit Vehicle Mobility

Description:

Traffic signals are preemptively triggered to allow for the uninterrupted through travel of transit. This is primarily used by emergency vehicles and heavy rail.

Benefits:

- Improved transit time (likelihood of queueing at stop light reduced)
- Improved transit reliability (likelihood of queueing at stop light reduced)
- Greater transit reliability than traffic signal priority

Impacts & Cost:

- Disruption of existing signal timing
- May increase cycle times
- May increase waiting / queuing at intersections for autos and others waiting to cross transit/rail routes
- Installation cost is site specific

Implementation:

- Can be required as mitigation assigned to adjacent development project
- Supported by existing adaptive traffic management system
- Appropriate at signalized intersections or gated crossings

16. Arrival Information

Arrival Information Display, Downtown San José

Purpose: Transit Rider Access

Description:

Digital displays at transit stops or on personal mobile devices (real time app-based arrival and departure information) display accurate predicted arrival time of next arriving transit vehicles to aid in passenger trip planning.

Benefits:

- Increased rider confidence and higher likelihood of riders choosing to ride transit
- Displays may be available for wayfinding / public service message

Impacts & Cost:

- High initial system cost
- Per stop / display cost
- Ongoing maintenance cost (may increase due to vandalism)

Implementation:

- Can be implemented in phases or as standalone stop improvements
- Appropriate at all stops / stations, however most utilized / highest ridership stops / stations should be prioritized
- Currently in use by VTA at some Rapid and LRT stops

17. Leading Pedestrian Interval (LPI)

(LPI timed signal by Elementary School, Northside San José)

Purpose: Transit Rider Access

Description:

Pedestrians are given a head start crossing an intersection (typically 3-7 seconds), with pedestrian crossing signals showing "walk" before vehicle signals turn 'green.' This allows pedestrians to enter and begin crossing an intersection before autos enter. This makes pedestrians more prominent and visible to drivers, especially during turning movements.

Benefits:

- Improved pedestrian safety
- Improved walkability
- Improved access to transit

Impacts & Cost:

- Signal timing change
- May reduced vehicle throughput
- May increase waiting / queuing
- May require hardware upgrades in the traffic signal equipment (~$15k/int)

Implementation:

- Can be implemented along an entire corridor or at individual intersections
- Can be implemented with other intersection / intersection timing improvements
- Appropriate at intersections, however intersections with highest pedestrian use should be prioritized
- Most effectively used to address permissive left-turn conflicts

Adaptive Pedestrian Crossing

Purpose: Transit Rider Mobility
Description: Enhanced pedestrian detection is used to provide extended signalized crossing times where and when required.
Benefits: • Enhanced pedestrian mobility and safety • Improved transit time
Impacts & Cost: • Current technology not fully optimized to support accurate pedestrian detection • Implementation must factor limiting factors such as detection accuracy, range and time of day performance • Not applicable for all locations
Implementation: • Appropriate for intersections within the transit walk shed • Because of current detection technology limiting factors, minimum crossing standards must always be maintained in case detection fails

18. Multi-Stage Pedestrian Crossing

A Multi-Stage Pedestrian Crossing in West San José

Purpose: Transit Rider Mobility

Description:

Primarily implemented at intersections with boarding islands located in the median, this utilizes more than one pedestrian phase to complete the curb-to-curb crossing.

Benefits:

- Enhanced pedestrian mobility and safety

Impacts & Cost:

- Signal modification and other technology implementation

Implementation:

- Appropriate for intersections within the transit walk shed

Summary: Tool Implementation Guide

Tool	Placement	Application	Goal
Transit Only Street	ROW	ROW to serve only for Transit Mobility	TVM
Dedicated Bus Lane	Travel Lane	Multi-lane roads served by frequent lines	TVM
Public Service Lane (PSL)	Travel Lane	Multi-lane roads served by frequent lines	TVM
Queue Jump	Intersection Approaches	Intersections feed by street segments not served by Dedicated Bus Lanes or PSL	TVM
Turn Restrictions	Intersection Approaches	Intersections feed by Dedicated Bus Lanes, PSL, or Queue Jump	TVM
Parking Removal	Curb Lane	Multi-lane roads served by frequent lines	TVM TVA
Transit Bulb-Out	Transit Stops	Transit stops that are shadowed by a parking lane	TVA, TRA
Transit Boarding Island	Transit Stops	Transit stops that conflict with bike infrastructure to separate modes	TRA
Wayfinding	Transit Stops, POI, CBD	Provide guidance to Transit Riders to help navigate first / last mile	TRM
Far Side Transit Stops	Transit Stops	Transit stops near intersections	TVM
Rider Waiting Area	Transit Stops	All transit stops, prioritizing based on usage and equity, i.e., stops in MTC EPC	TRA
Pedestrian Access	Public ROW	The streets, sidewalks, and crossings within a transit lines walkshed, including urban design guidance to private development	TRM
Signal Coordination	Intersections	Intersections along a corridor served by frequent transit lines	TVM
Transit Signal Priority	Intersections	Intersections served by transit lines	TVM
Transit Signal Preemption	Intersections	Intersections served by transit lines requiring guaranteed level of service, primarily used by emergency vehicles and heavy rail	TVM
Arrival Information	Transit Stops; Mobile App	Information for all Routes available via App; Digital displays to be prioritized at stops based on usage and service frequency / number of lines	TRA
Leading Pedestrian Interval	Intersections	The street crossings near transit stops and along major transit corridors	TRM
Adaptive Pedestrian Crossing	Intersections	The street crossings at transit stops	TRM
Multi-Stage Pedestrian Crossing	Intersections	The street crossings at transit stops	TRM