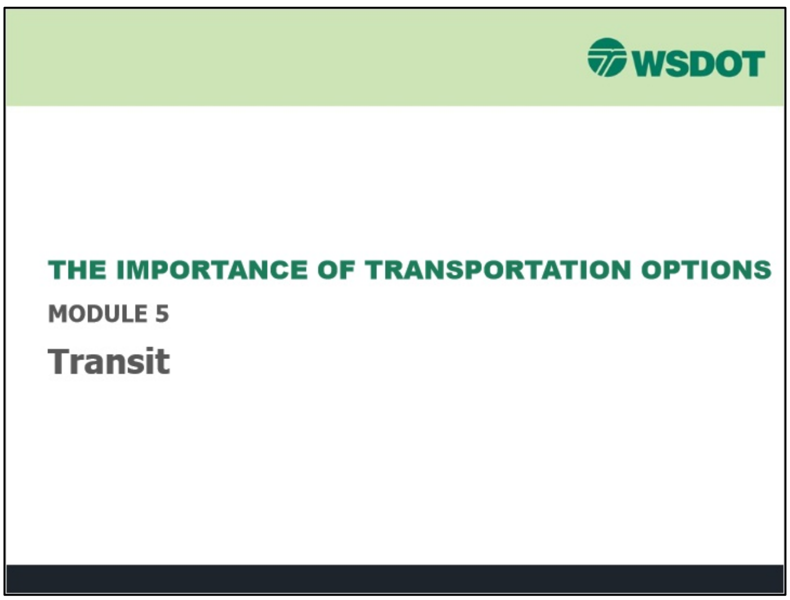
Module 5 Transit

1. Introduction

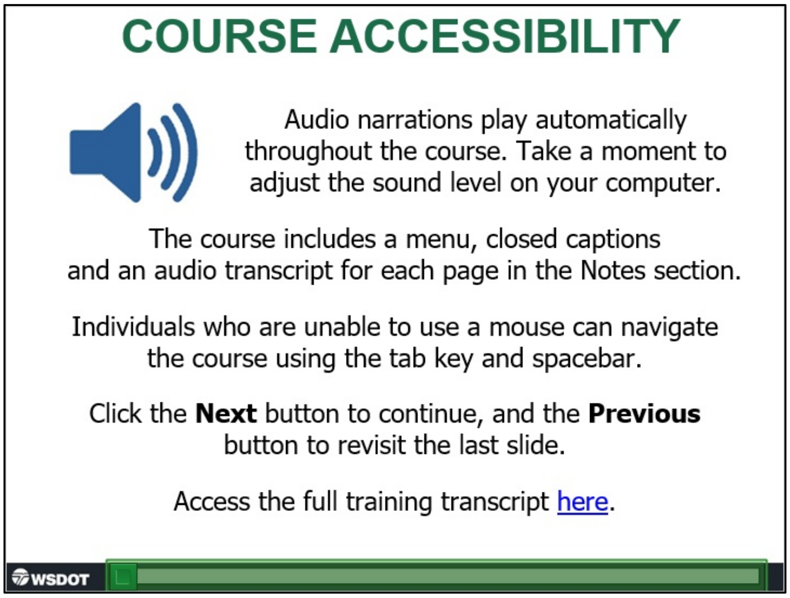
1.1 Start

1.2 Title



Notes:
Welcome to Module 5 of the Multimodal Fundamentals course - “Transit”.

1.3 Course accessibility



Notes:

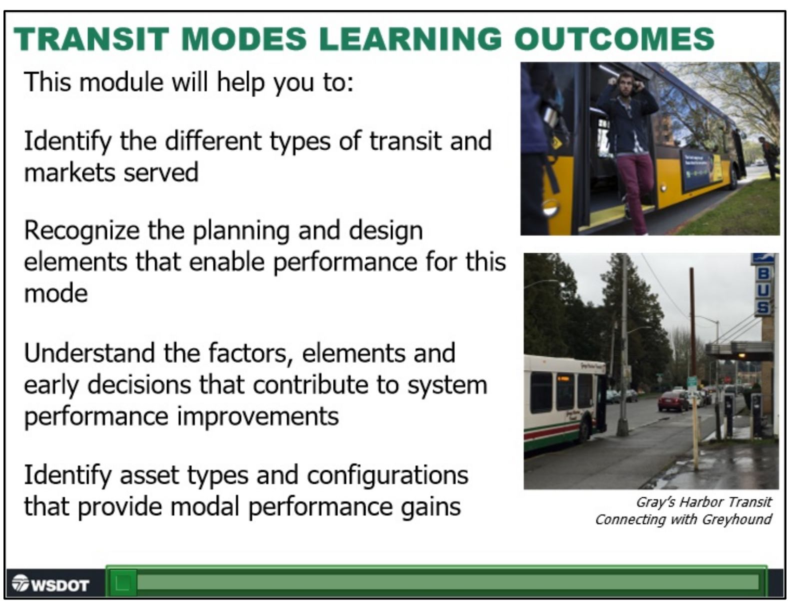
Audio narrations play automatically throughout the course. Take a moment to adjust the sound level on your computer.

The course includes a menu, closed captions and an audio transcript for each page in the Notes section.

Individuals who are unable to use a mouse can navigate the course using the tab key and spacebar.

Click the Next button to continue, and the Previous button to revisit the last slide.

1.4 Learning outcomes

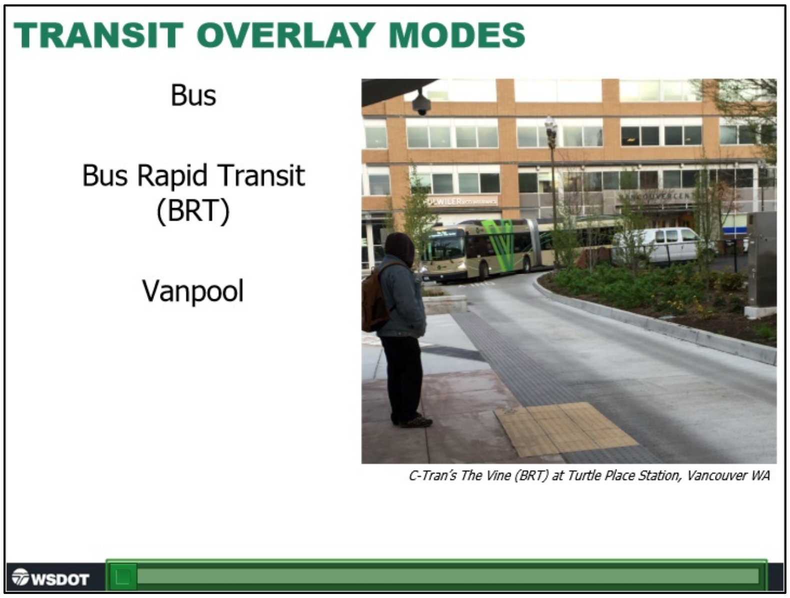


Notes:

This module will help you to identify the different types of transit and the markets served, recognize the planning and design elements that enable performance for this mode, understand the factors, elements and early decisions that contribute to system performance improvements, and identify asset types and configurations that provide modal performance gains.

2. Transit Types

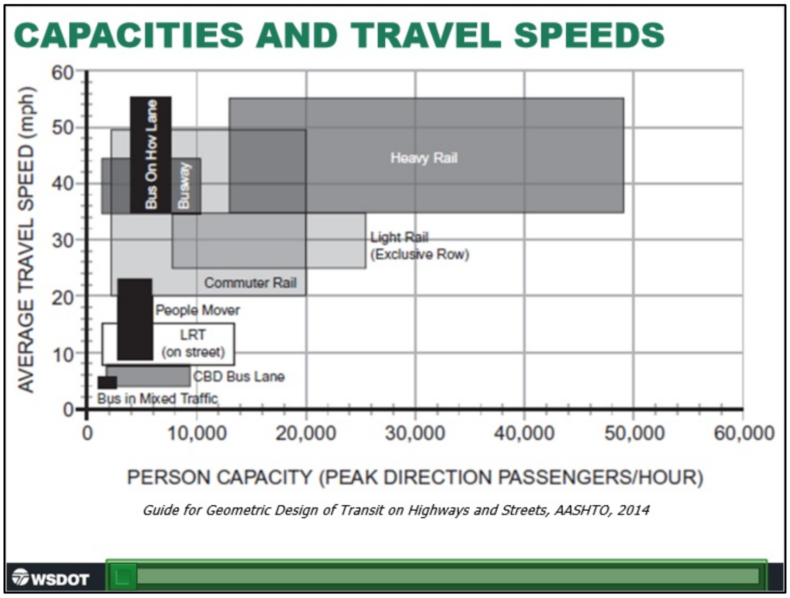
2.1 Transit overlay modes



Notes:
Transit overlay modes are simple enough to understand. These modes operate on highways and streets, while buses usually operate on fixed routes. Bus Rapid Transit, or BRT, systems usually require more assets to enable performance which usually includes routes with more access management, enhanced bus stops, and active traffic signal prioritization.

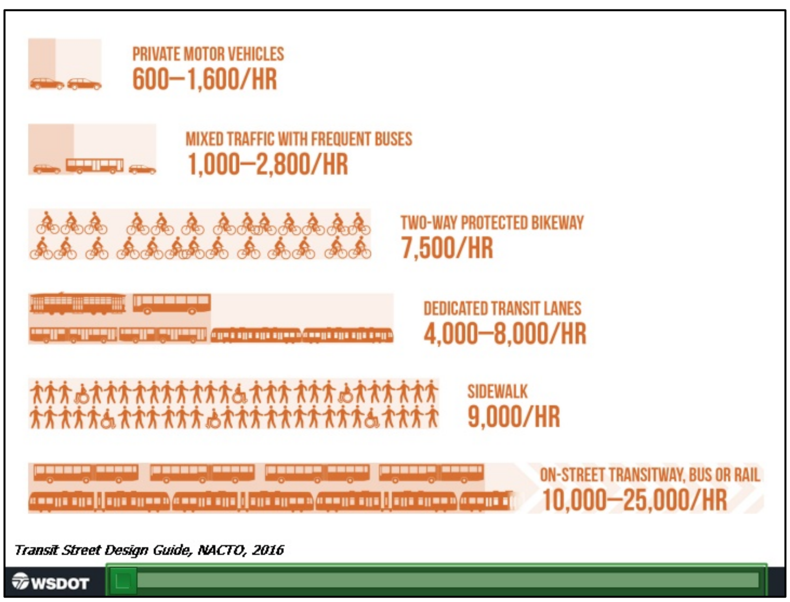
On routes with high ridership, dedicated transit lanes may be appropriate as well. Basically BRT performance may require more hard assets, making them somewhat less versatile. Vanpool programs are typically run out of transit agencies, and have proven to be an effective commute trip reduction treatment.

2.2 Capacities and travel speeds

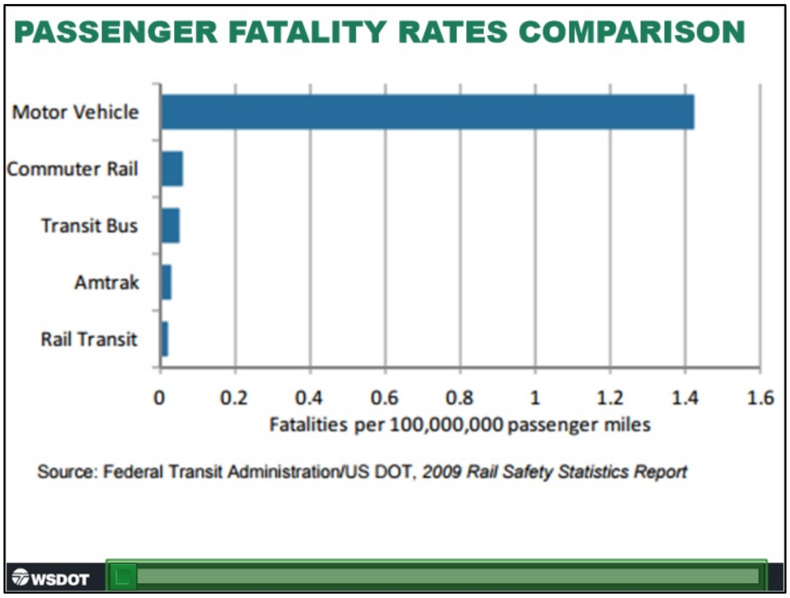


Notes:
This AASHTO Transit Green Book figure illustrates average speeds and capacity of various transit vehicles.

The highest bus volumes in North America are found on the Lincoln Tunnel approach to the Port Authority of New York/New Jersey's 210-berth Midtown Bus Terminal. Some 735 buses carrying 33,000 people per hour operate non-stop in exclusive bus lanes and bus-only ramps. Where bus stops or layovers are required, reported bus volumes are much lower.



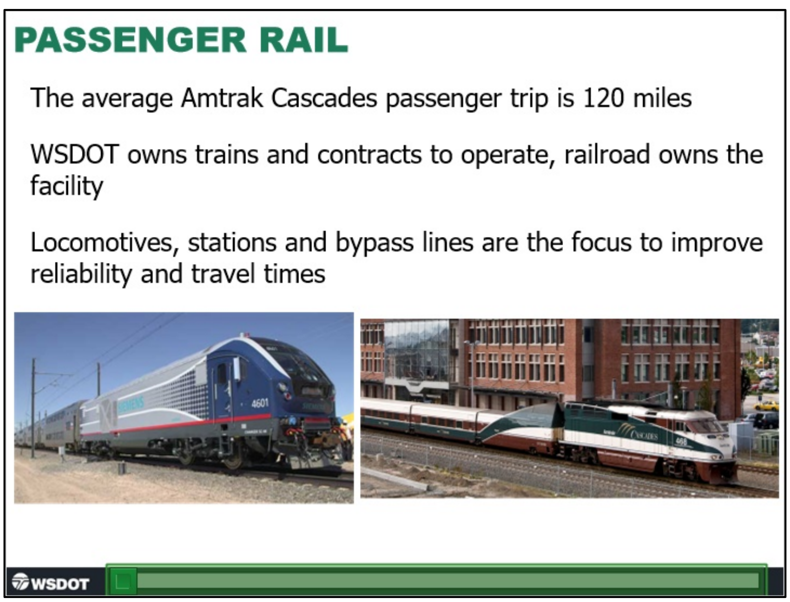
2.3 Passenger fatality rates



Notes:
Transit modes are fairly safe and have a significantly lower crash rate than motor vehicles. However, there is a perception problem; when incidents do occur on a mass transit system, they happen to a lot of people all at once.

Consequently, the image of transit related crashes have perception issues. In a way, just the safety performance of transit makes a case for cost effectiveness of these alternatives.

2.4 Passenger rail



Notes:
WSDOT's Cascades High-Speed Rail Program, with 18 of 20 projects aimed at increasing service reliability and trips, represents nearly $800 million in investments.

It's important to understand that WSDOT owns the trains, we have an operating agreement with

Amtrak to operate the trains, and agreements with the railroads to use their infrastructure.

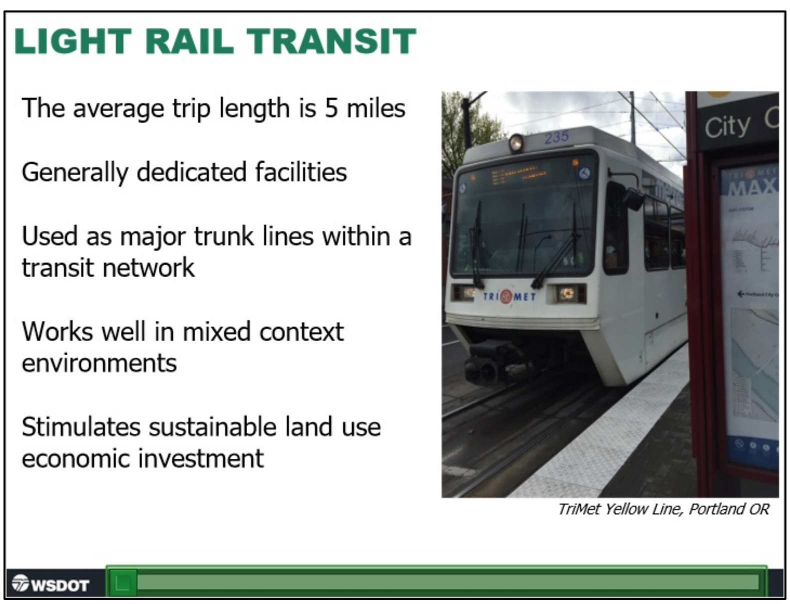
The Rail, Freight, and Ports Division oversees the management of the Amtrak Cascades, intercity passenger rail service along the Pacific Northwest Rail Corridor, one of eleven federally designated rail corridors in the United States.

The Amtrak Cascades service operates over 4,000 trains annually with daily stops in 18 Pacific Northwest cities, including 4 daily round trips between Seattle and Portland and 2 daily round trips between Seattle and Vancouver, B.C.

2.5 Commuter rail

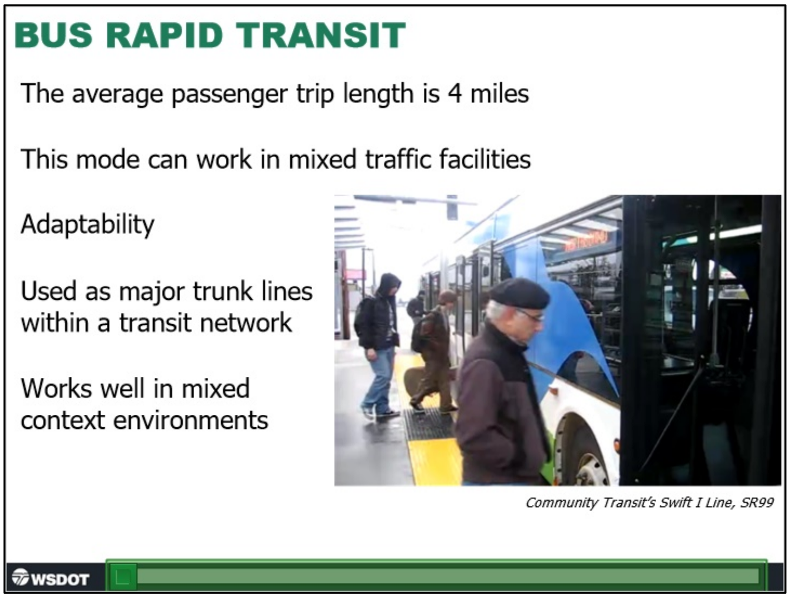
Notes:
Commuter rail serves outer suburbs typically not served by regional metro system.

2.6 Light rail transit



Notes:
Light Rail can be a large investment, and comes with additional design, facilities and construction requirements. That said, Light Rail Transit, or LRT, systems can move a lot of people, and typically stimulate transit-oriented developments at a broader scale.

2.7 Bus Rapid Transit



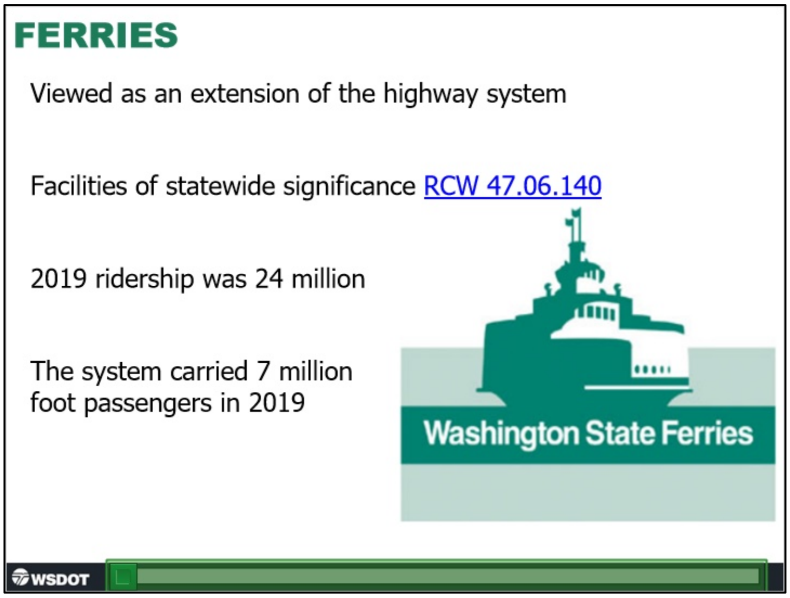
Notes:
Bus Rapid Transit, or BRT, is a fairly viable option on many state routes, and while they do require some new assets they are less costly than fixed rail options.

The SWIFT I line on SR99, for example, carries one third of all boarding on the Community Transit's network.

2.8 Buses

Notes:
Buses are highly versatile and have many potential route type options.

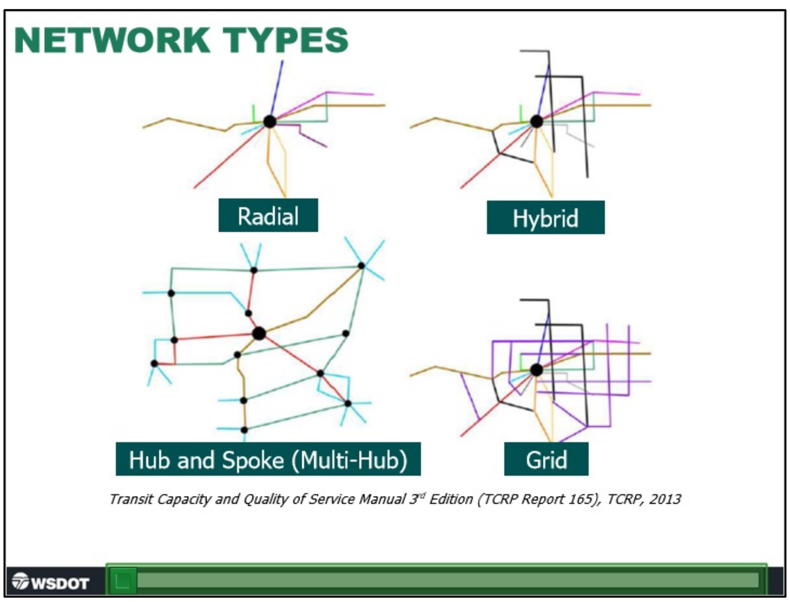
2.9 Ferries



Notes:
Washington State Ferries are not only a mode, but also an icon for the State. Our ferries system is one of the largest in the world and carried 24 million passengers in 2019.

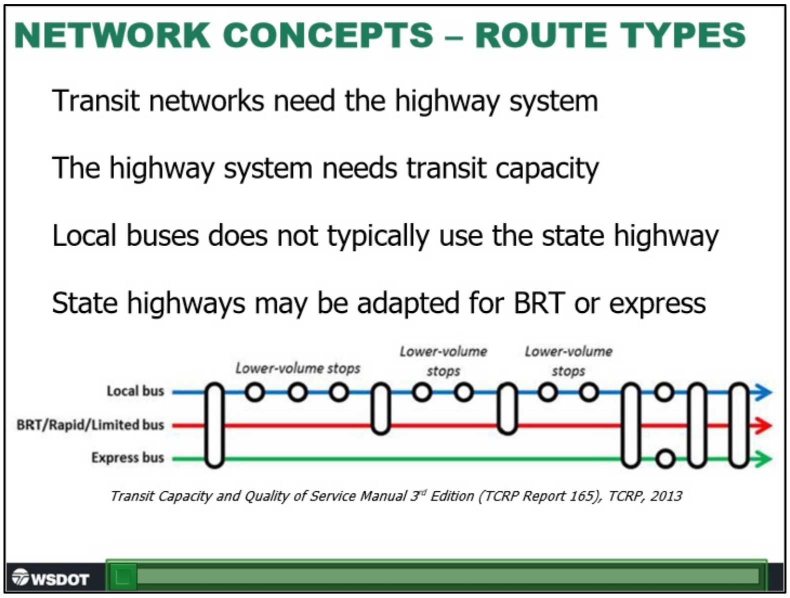
3. Networks

3.1 Network types



Notes:
In order to achieve capacities, it's necessary to arrange the network to optimize the transit system efficiencies.

3.2 Network route types



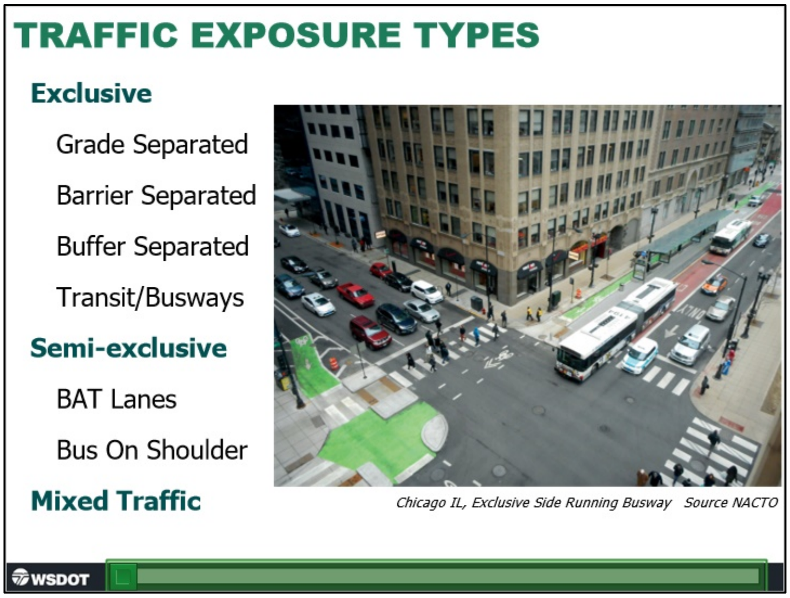
Notes:

Within the network there are several different route types. Relating this to highways, think of the trunk lines as arterials and the remaining as other parts of the network. It is a challenge for us at WSDOT to realize that many forms of these routes need to overlay on the highway network. Depending on the mode of transit, this can be everything from special lanes to the need to negotiate right-of-way for dedicated rail. In other cases it will be balancing the need for priority crossings.

Route types are discussed in Design Manual Chapter 1102, as a means of defining aspects of the transportation context. Please note that different agencies have offered greater detail in route types, than shown on this slide.

The NACTO Guide identifies Downtown Local, Local, Coverage, Rapid and Express route types. Terminology may also differ between transit agencies. In any event, its important to properly analyze the land use context and travel markets for both current and future use.

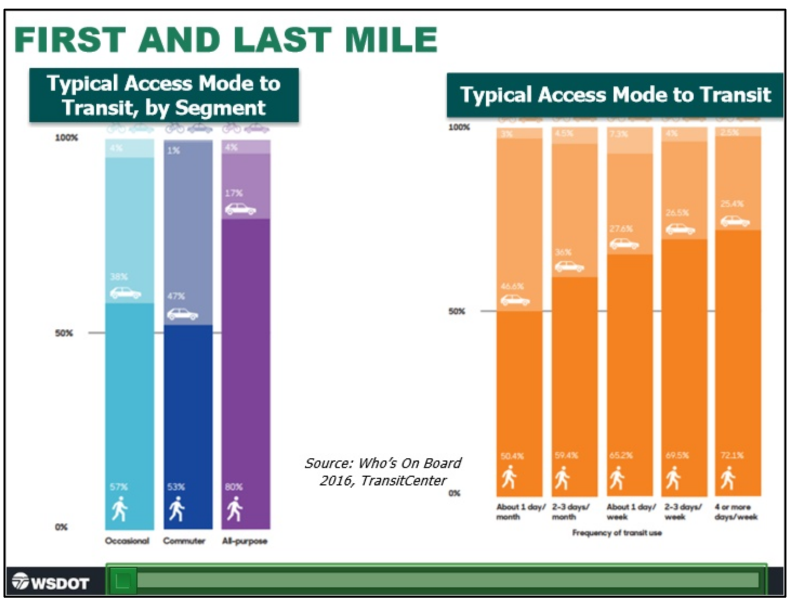
3.3 Traffic exposure types



Notes:
Different designs and managed lanes offer different levels of impact, based on integrating traffic and transit.

Some of these options may have more cost benefit that you would initially assume, depending on travel time savings offered by reducing the number of buses needed.

3.4 First and last mile

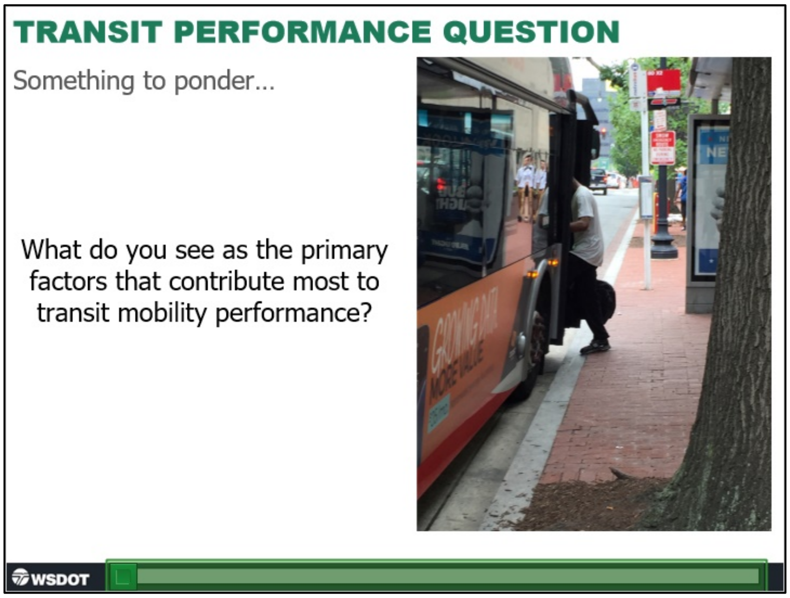


Notes:
The majority of transit riders, including 80 percent of all-purpose riders, typically walk to transit. This finding underscores the importance of putting transit stations in busy, walkable neighborhoods, building offices and housing within walking distance of transit, and providing more and safer pedestrian routes to transit.

Planning and designing for transit includes active mode facilities and parking. NACTO states that among the issues with low volume bus routes is pedestrian safety and accessibility.

4. Transit Performance

4.1 Something to ponder

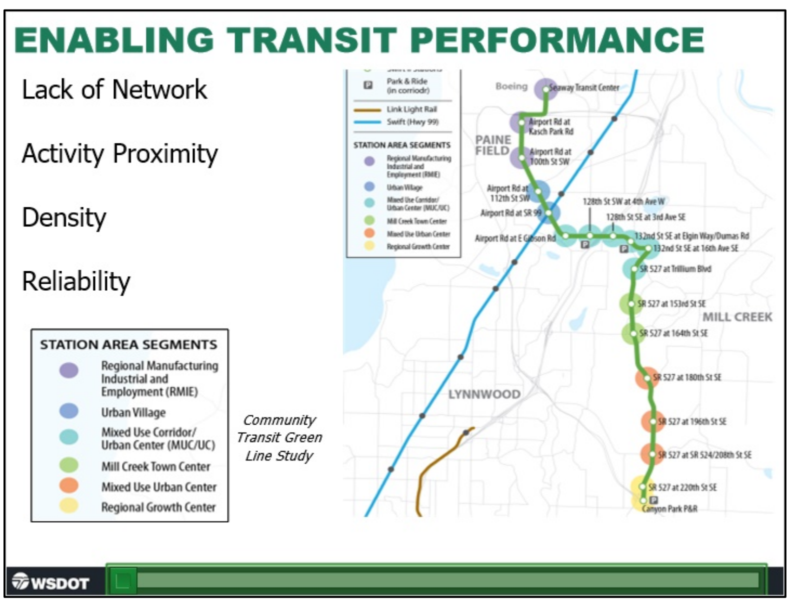


Notes:
Something to ponder…

What do you see as the primary factors that contribute most to transit mobility performance?

Some of the factors include reliability (but if you said frequency, you're good), density, and proximity to activity centers.

4.2 Enabling transit performance



Notes:
Transit networks, or the lack of a network, the proximity to activities, density and travel reliability all impact transit performance.

4.3 Enabling transit performance

ENABLING TRANSIT PERFORMANCE

Transit Service	Minimum Residential Density	CBD Commercial/Office Density
Local bus, 1 bus/h	4.5 dwelling units/net acre	5–8 million ft^2
Local bus, 2 bus/h	7 dwelling units/net acre	8–20 million ft^2
Local bus, 6 bus/h	15 dwelling units/net acre	20–50 million ft^2
Light rail, 5-min peak headway	9 dwelling units/net acre in 25–100 mi^2 corridor	35–50 million ft^2 (20 million ft^2 if 100% at-grade)
Rapid transit, 5-min peak headway	12 dwelling units/net acre in 100–150 mi^2 corridor	>50 million ft^2
Commuter rail, 20 trains/day	1–2 dwelling units/net acre	>100 million ft^2

Sources: Pushkarev and Zupan (*20*), Institute of Transportation Engineers (*22*), and Moore et al. (*23*).
Note: Assumes 20 h/weekday service span, 33% farebox recovery.

Transit Capacity and Quality of Service Manual 3rd Edition (TCRP Report 165), TCRP, 2013

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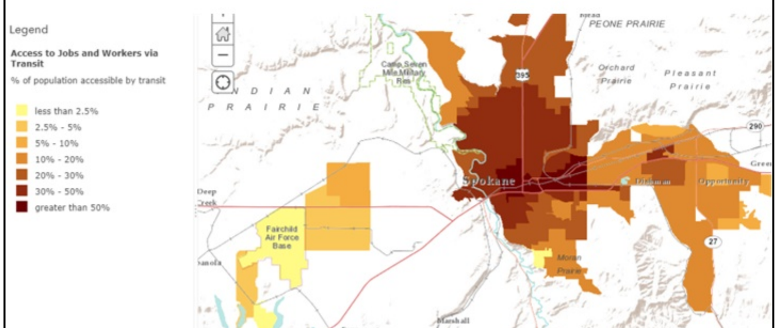
Notes:
While transit market analysis is more comprehensive than just looking at densities, you will have a good sense of planning and scoping for transit applicability by reviewing combined residential and job densities, along with trip lengths on the highway system.

GIS tools and data can provide quick lookups of this information. EPA's Smart Location Database has the ability to map proximity to transit stops, but there are gaps in some locations. WSDOT has comprehensive GIS data for transit stop locations for nearly all fixed route transit providers across the state as well. You can overlay residential and job densities, and work with your local transit agencies to determine potential markets.



EPA's Access to Jobs and Workers Via Transit tool

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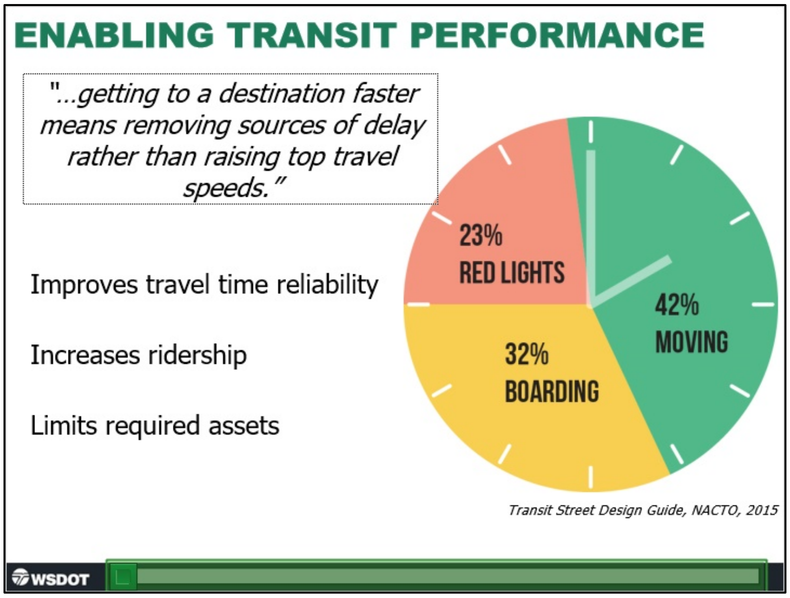
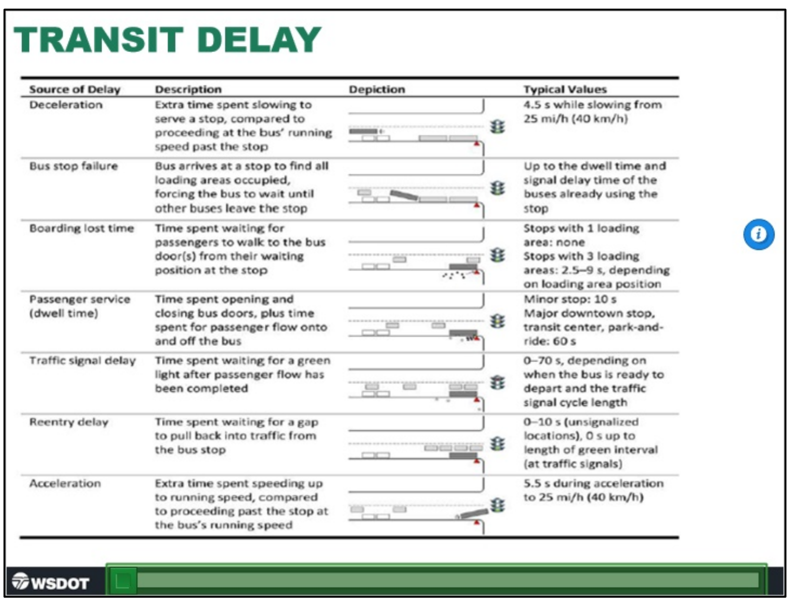
4.4 Enabling transit performance



Notes:
This graphic represents the Minnesota Metro Transit estimate for travel speeds. Most of the running time for transit vehicles is not time spent moving.

The NACTO Transit Street Design Guide says that "For urban transit, getting to a destination faster means removing sources of delay rather than raising top travel speeds."

4.5 Transit delay



TRANSIT DELAY

Source of Delay	Description	Depiction	Typical Values
Deceleration	Extra time spent slowing to serve a stop, compared to proceeding at the bus' running speed past the stop		4.5 s while slowing from 25 mi/h (40 km/h)
Bus stop failure	Bus arrives at a stop to find all loading areas occupied, forcing the bus to wait until other buses leave the stop		Up to the dwell time and signal delay time of the buses already using the stop
Boarding lost time	Time spent waiting for passengers to walk to the bus door(s) from their waiting position at the stop		Stops with 1 loading area: none Stops with 3 loading areas: 2.5–9 s, depending on loading area position
Passenger service (dwell time)	Time spent opening and closing bus doors, plus time spent for passenger flow onto and off the bus		Minor stop: 10 s Major downtown stop, transit center, park-and-ride: 60 s
Traffic signal delay	Time spent waiting for a green light after passenger flow has been completed		0–70 s, depending on when the bus is ready to depart and the traffic signal cycle length
Reentry delay	Time spent waiting for a gap to pull back into traffic from the bus stop		0–10 s (unsignalized locations), 0 s up to length of green interval (at traffic signals)
Acceleration	Extra time spent speeding up to running speed, compared to proceeding past the stop at the bus's running speed		5.5 s during acceleration to 25 mi/h (40 km/h)

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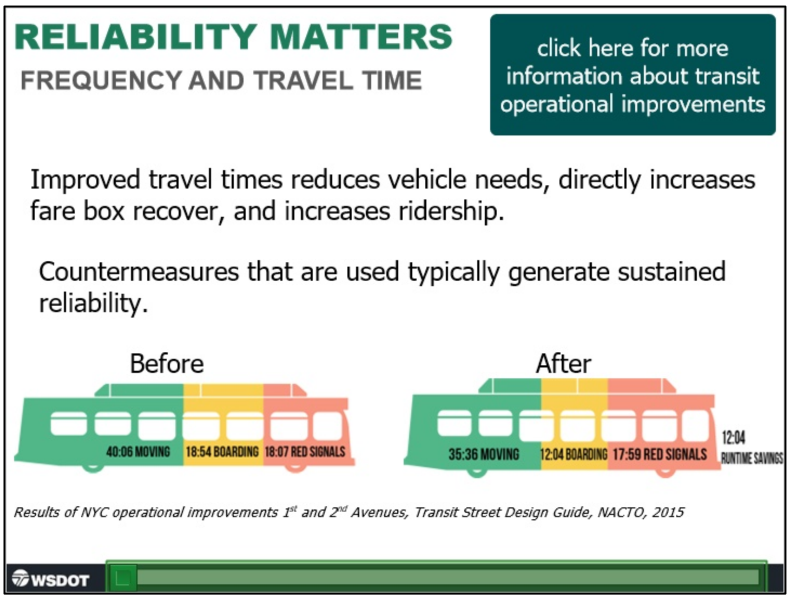
Notes:
This slide describes the types of transit delay.

Volume	Low	Moderate	High	Very High
NACTO Volume Criteria	• Over 15 minute headways • 4 or fewer buses per hour • Typically fewer than 100 passengers per hour	• 10–15 minute or shorter headways, generally 5–10 at peak • 4–10 buses per hour • 100–750 passengers per hour	• 2–6 minute combined headways • 10–30 buses per hour • 500–2,000 passengers per hour	• Combined headways under 2–3 minutes • More than 20–30 buses per hour • Over 1,000 passengers per hour on multiple routes, or over 2,500 per hour on one route with multi-unit vehicles
Suggested Strategies	• Enhanced stops • Intermodal stations • Active transit signal priority • Passenger information • Access to dedicated lanes • Combined queue jump/ turn lanes	• Active transit signal priority (all service) • Transit approach lanes and queue jumps • In-lane stops • Boarding islands/ bulbs; near-level boarding • Multi-door boarding • Dedicated transit lanes • Dedicated peak-only lanes • Shared bus-bike lanes	• Dedicated transit lanes or peak transit lanes • In-lane stops • Boarding islands/ bulbs • Low-speed signal progression • Active transit signal priority (late vehicles only) • Robust stops or stations • All-door boarding	• Transitways or dedicated transit lanes with turn management • Dual transit lanes or dedicated lanes with pull-out stops • On-street terminals • Boarding islands/bulbs • Transit signal progression

4.6 Reliability matters

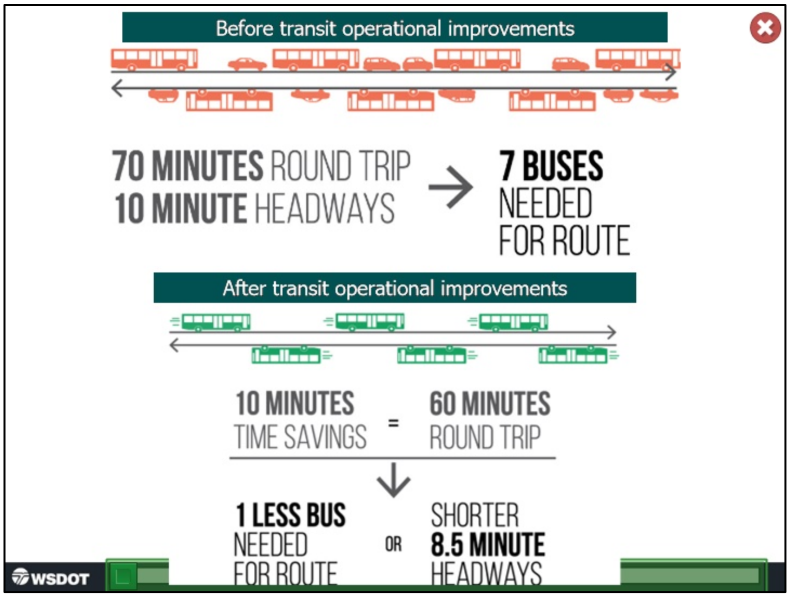


Notes:

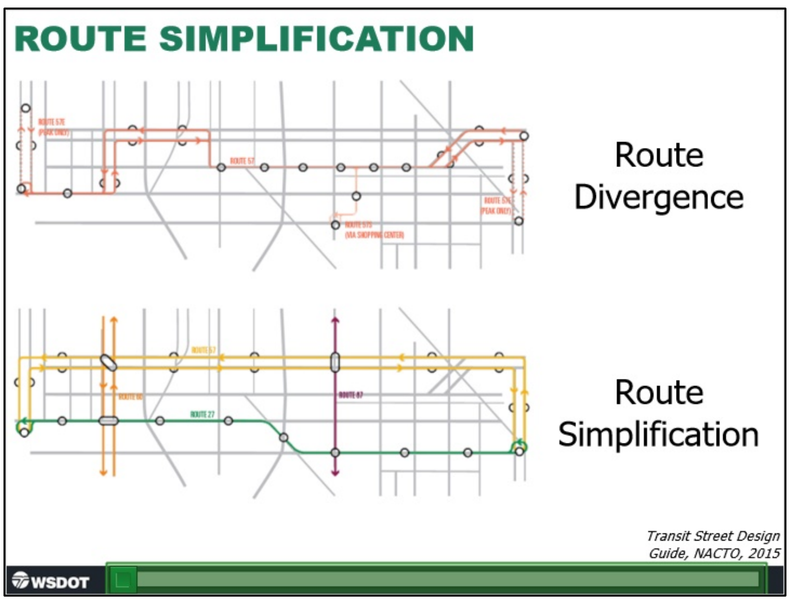
After implementing a series of street and service improvements including all-door boarding and dedicated lanes on First and Second Avenues, New York's Metropolitan Transportation Authority and Department of Transportation observed substantial travel time improvements on the M15 Select Bus Service compared with the previous M15 Limited service.

How can your work improve the operations of other modes?

Improving travel times by removing delay has real cost savings and service improvements that can factor into your cost-benefit analysis. Work with your transit agencies to develop an understanding about how to calculate these costs. These savings are why a 2-mile bus on shoulder application along a route can provide real savings to the public, despite some likely additional pavement preservation implications.



4.7 Route simplification



Notes:

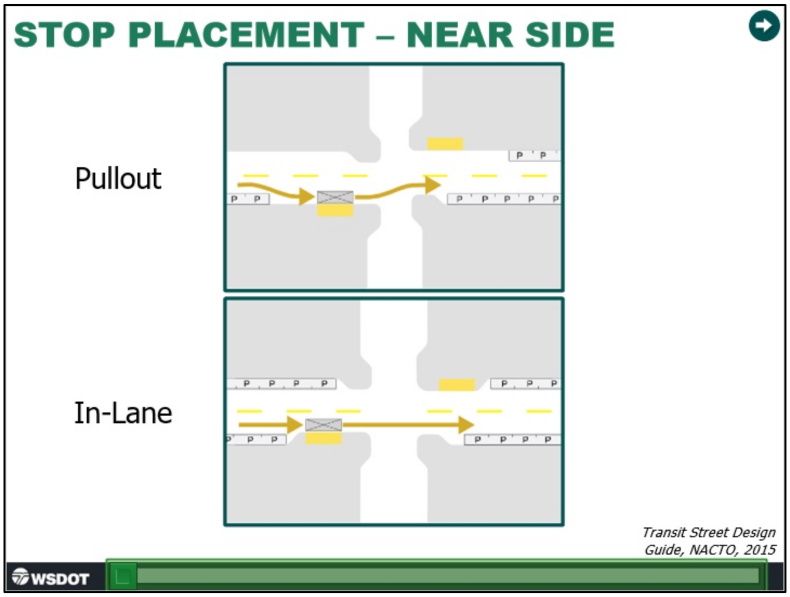
Route Simplification is one of the most critical ways that WSDOT can help support and enable transit performance. In many cases transit providers have avoided state routes due to past policies that prevented these arteries from performing well.

Our lack of allowing transit signal priority options, over-emphasis on SOV performance outcomes, requirements for bus pullouts, have all led our transit providers to arrange their networks in ways that avoided the state highway. We've effectively shut the door on this concept for so long that we may need to encourage our partners to help with planning and scoping strategies and solutions.

Our GIS bus stop data combined with proprietary software like Remix, can help quickly evaluate route simplification options. Some of our transit providers currently use Remix.

Understand that route simplification options that re-route onto state highways will likely have traffic operations implications and tradeoffs that will need to be considered along with the performance improvements in per-person throughput and economic vitality.

4.8 Stop placement



Notes:

There are two areas to think about with stop selection. These are placement along the corridor, and whether you have 'in-lane' or "pullouts". These are sometimes referred to as on-line and off-line, however, on-line also has specific meanings when transit networks are overlaid.

But there are tradeoffs beyond just traffic operations. Pullouts and where they are located can prevent curb bulb-outs viability, and increases the exposure for pedestrians.

Current WSDOT Design Manual policy calls for only far-side stops, due to the impression of impact to traffic operations. However, without analysis, this is misleading and can have impacts to both transit and traffic operations. Work with transit partners to help factor in bus stop capacity as it relates to stop placement.

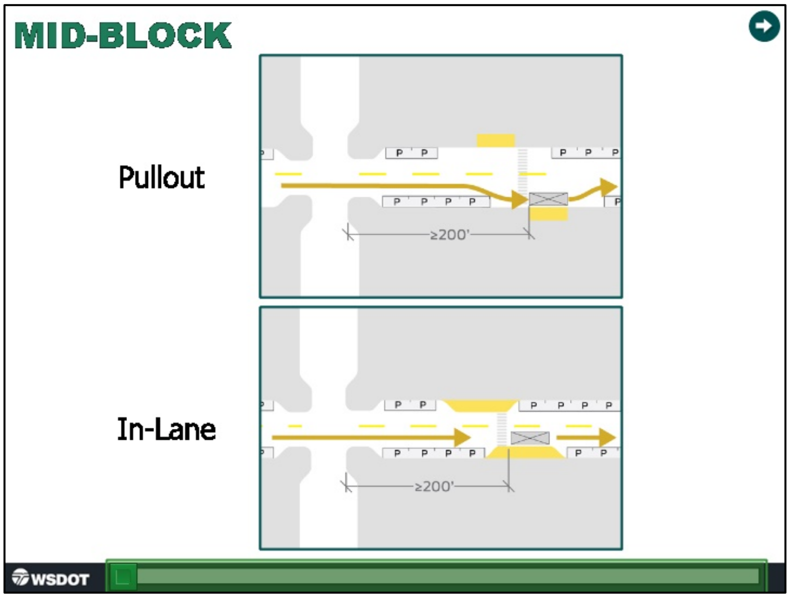
Factors like green-per-cycle and dwell time are obvious design factors that can effect placement, but dwell time is impacted by both design, vehicle type and passenger volume at the stop location. Clearance intervals and loading positions may also influence stop placement, particularly when multiple fixed routes operate on the same alignment. It takes close coordination between our traffic operational engineers and partnering transit engineers to work through how to best to coordinate signal operations along our corridors.

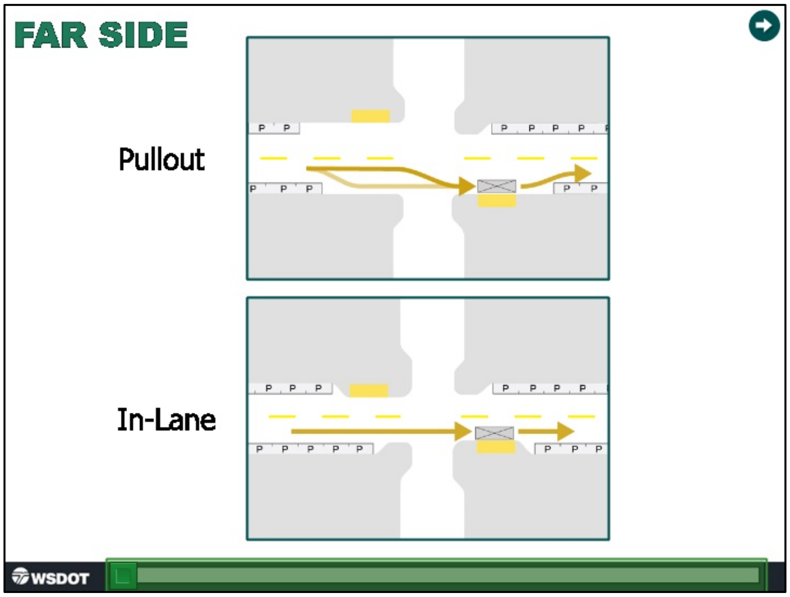
Factors to consider in bus stop capacity and stop placement:

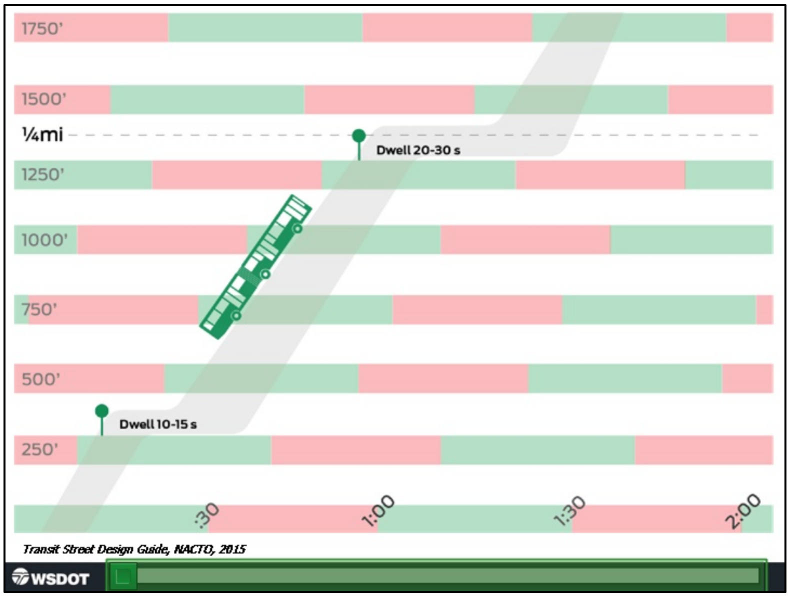
- Green-per-cycle (g/c)
- Dwell time
- Clearance interval between buses
- Loading positions per stop

WSDOT has changed its policy related to in-lanes stops:

From the Design Manual Chapter 1430: "Contact *the State Traffic Engineer for information on* *how to process a transit agency proposal for either an in-lane or pullout bus stop and for more information about the approval process."*

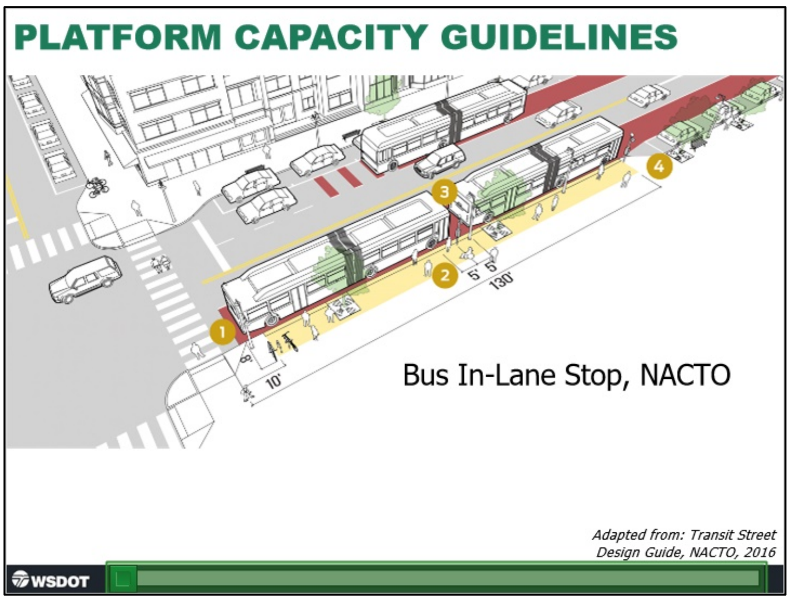






5. Transit Design

5.1 Platform capacity guidelines



Notes:

Transit stops with in-lane boarding require significantly less curb length and do not occupy sidewalk space that can interfere with the pedestrian thoroughfare. The reason for this is the taper needed to provide the bus pull-out. In-lane stops can help use that space for alternative uses, including expanded pedestrian capacity, green infrastructure, local business access and parking, or street furnishings.

Stop Position	40′ Bus	60′ Bus	2 x 40′ Bus	2 x 60′ Bus
Near-side	35′	55′	80′	115′
Far-side	45′	65′	90′	130′
Mid-Block	35′	55′	80′	115′

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Stop Position	40′ Bus	60′ Bus	2 x 40′ Bus	2 x 60′ Bus
Near-side	100′	120′	145′	185′
Far-side	90′	100′	125′	165′
Mid-Block	120′	145′	185′	210′

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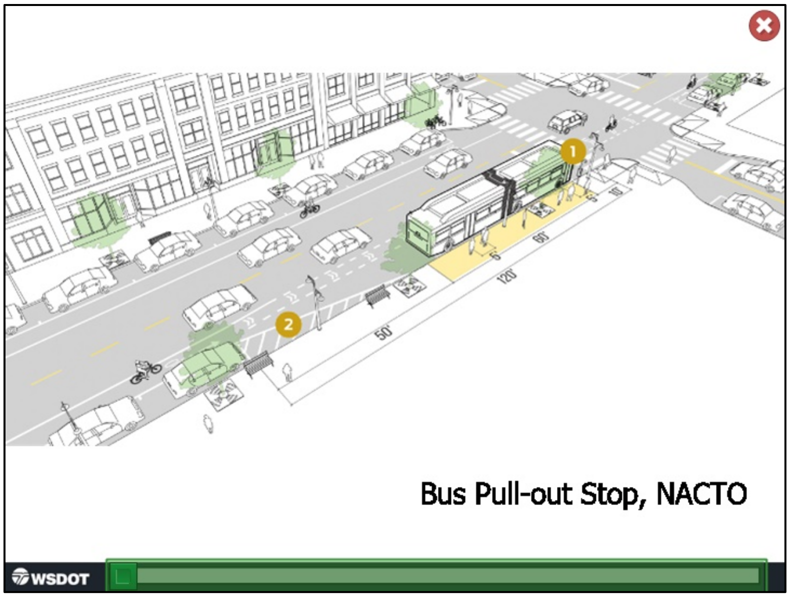

5.2 Reducing dwell time

REDUCING DWELL TIME

Platform Height

Platform Type	Height	Typical Vehicle Served
Street Level	at-grade	Street Cars
Sidewalk Level	4-6 in	Bus
Near-Level	8-11 in	BRT, Bus
Level	12-14 in	BRT, LRT, Streetcar, low-floor buses
Mini-High	Various	Older street Cars

Near-Level Boarding Platform, C-Tran

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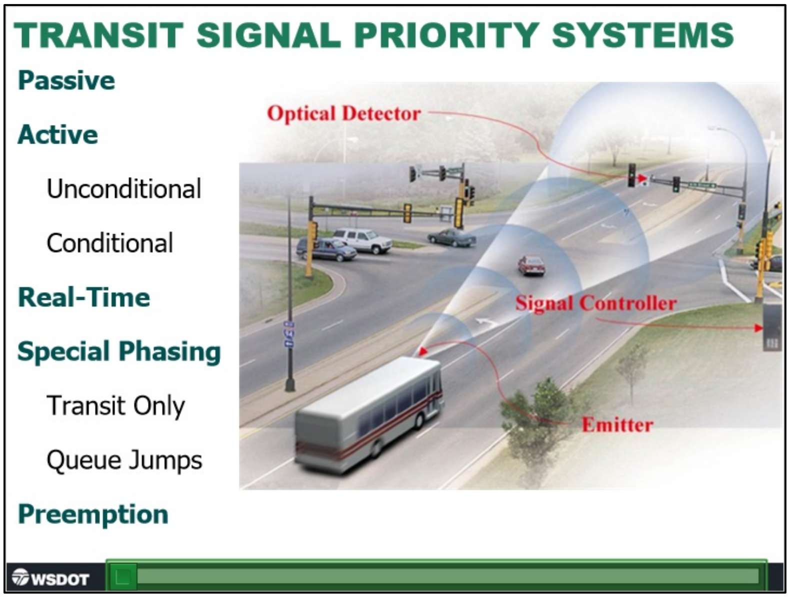
Notes:
Vehicle type can be a factor in what is needed in terms of platform height. Discuss vehicle types with your transit providers.

5.3 Transit signal priority systems



Notes:

Many have most likely heard the term preemption, which is cited in the WSDOT Design Manual and Traffic Manual, however, there is insufficient discussion in our manuals about all the transit signal priority strategies. True preemption can be disruptive and easily dismissed. The direct benefits of traffic signal priority, or TSP, are travel time savings and improved reliability, which could result in capital and operating cost savings.

The level of benefit a TSP system provides depends on a complex set of interdependent variables, including whether the signal system along the route was already optimized before a TSP application.

Documented travel time savings from TSP applications in North America and Europe have ranged from 2 to 18 percent, depending on the length of route, traffic conditions, bus operations, and the TSP strategy deployed. Travel time savings of 8 to 12 percent have been typical. The reduction in bus delay at signals has ranged from 15 to 80 percent.

Understand that active TSP's are different than preemption. However, both require supported signal controllers and vehicle technology to make use of these treatments. Agreements may be needed for both for transit signal priority and maintenance of the signal controller.

Treatment	Description
	PASSIVE PRIORITY
Adjust cycle length	Reduce cycle lengths at isolated intersections to benefit buses
Split phases	Introduce special phases at the intersection for the bus movement while maintaining the original cycle length
Areawide timing plans	Preferential progression for buses through signal offsets
Bypass metered signals	Buses use special reserved lanes, special signal phases, or are rerouted to non-metered signals
Adjust phase length	Increased green time for approaches with buses
	ACTIVE PRIORITY*
Green extension	Increase phase time for current bus phase
Early start (red truncation)	Reduce other phase times to return to green for buses earlier
Special phase	Addition of a bus phase
Phase suppression	Skipped non-priority phases
	REAL-TIME PRIORITY*
Delay-optimizing control	Signal timing changes to reduce overall person delay
Network control	Signal timing changes considering the overall system performance
	PREEMPTION*
Preemption	Current phase terminated and signal returns to bus phase

Transit Capacity and Quality of Service Manual 3rd Edition (TCRP Report 165), TCRP, 2013

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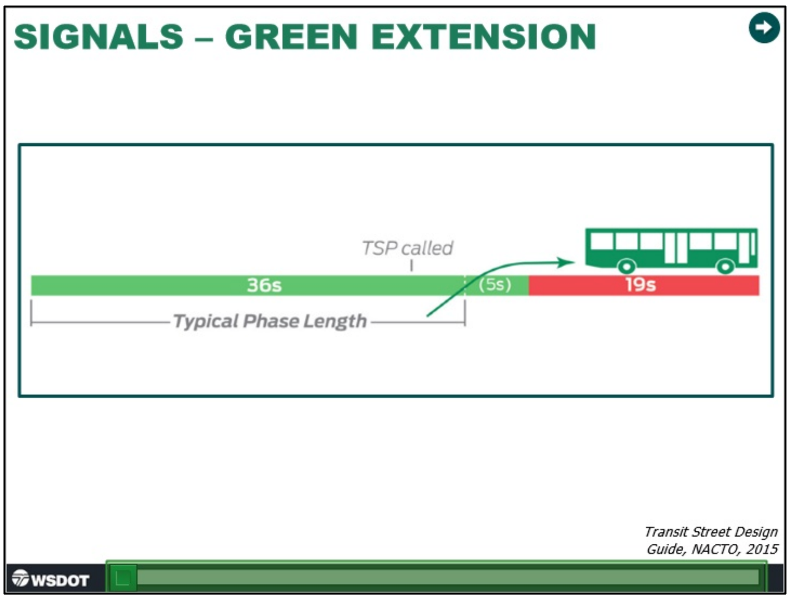
5.4 Signals



Notes:
Not all signal treatments are appropriate. The facility context and stop locations will affect the effectiveness on operational performance.

GREEN EXTENSION provides extra time for a detected transit vehicle to clear an intersection. Green extension is most applicable when transit runs at the back of the vehicle queue, as is common at the first signal after a far-side stop. Green extension may be the easiest form of TSP to implement on urban streets since it does not require unexpectedly truncating a pedestrian phase.

GREEN REALLOCATION shifts when in the signal cycle the green phase occurs-if the transit vehicle is on pace to arrive late, the green phase begins and ends late to accommodate transit.

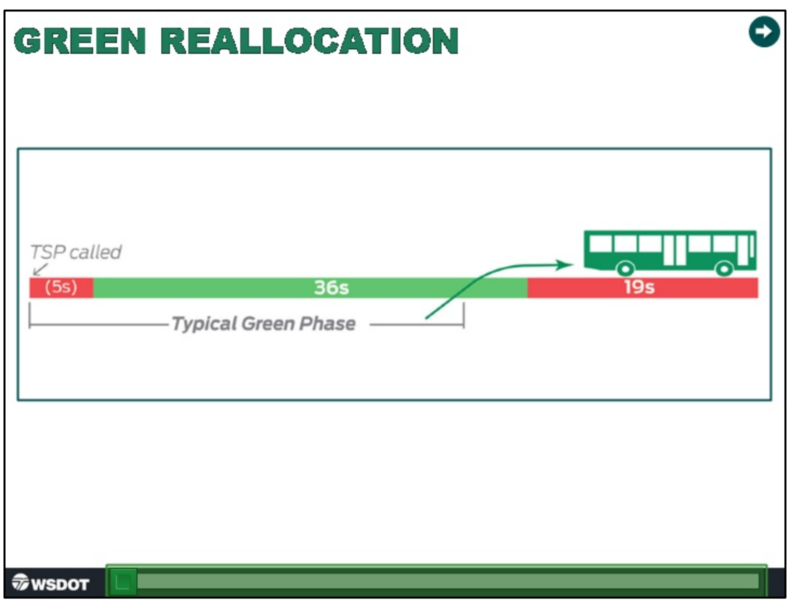
Phase reallocation provides similar benefits to phase extension, but with less impact to cross street traffic since the total green time per cycle does not change. This strategy requires automatic vehicle location technology.

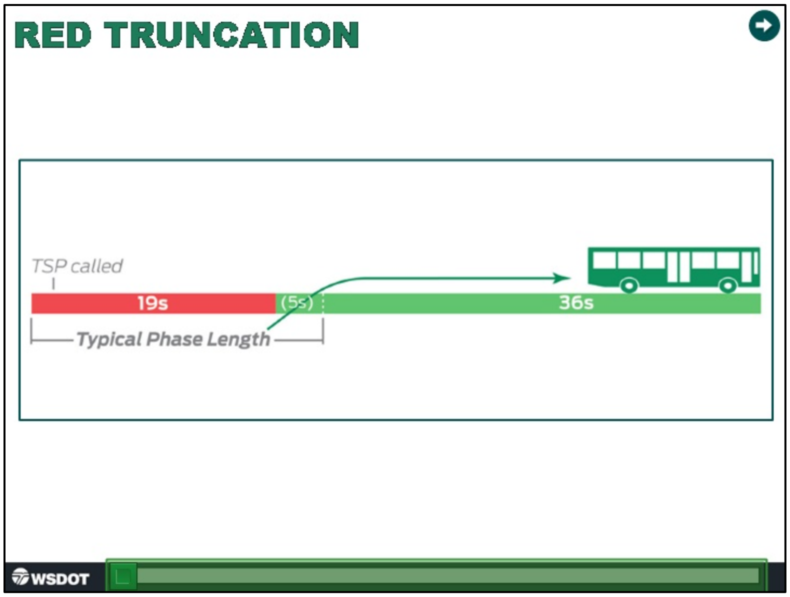
RED TRUNCATION provides a green phase earlier than otherwise programmed, clearing an intersection approach with a waiting transit vehicle sooner than otherwise. Red truncation requires the detection of the transit vehicle far enough away that the crossing pedestrian phase can clear. It is easiest to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

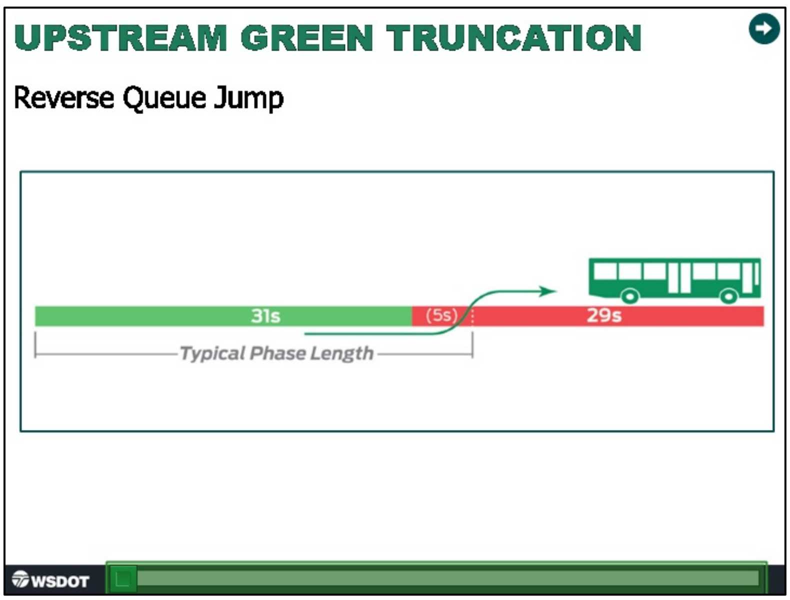
UPSTREAM GREEN TRUNCATION also known as a reverse queue jump, stops traffic behind a bus as boarding is completed, allowing the bus to re-enter the lane after a pull-out stop. Upstream green truncation can also be used to stop traffic at an intersection where transit makes a far-side in-lane stop, preventing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

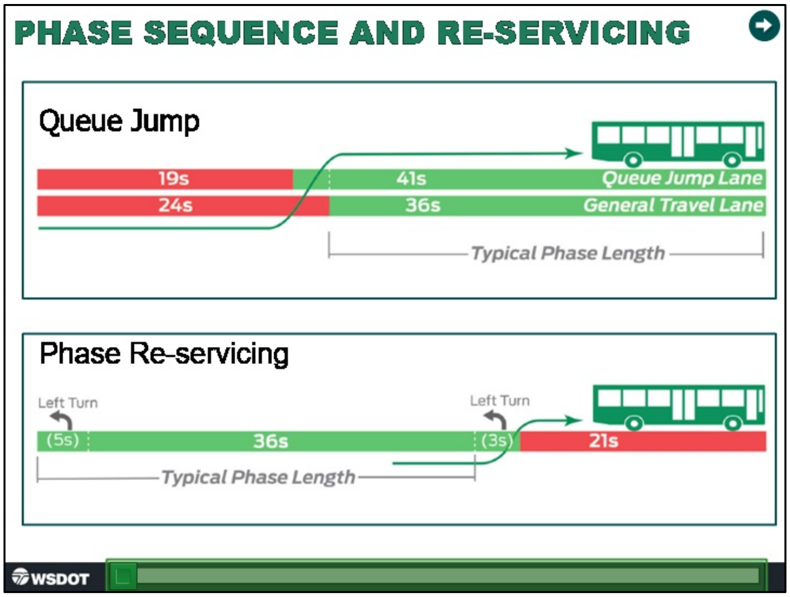
PHASE INSERTIONS and PHASE SEQUENCE CHANGES describe the special bus-only phases or prioritization of turn phases used for shared turn/queue jump lanes, and are also helpful when buses make left turns

PHASE RESERVICING provides the same phase twice in a given signal cycle, such as a left-turn phase or a queue jump. Re-servicing a phase can significantly reduce bus delay, particularly when the phase in question is relatively short.




RED TRUNCATION
TSP called
19s
(5s)
36s
Typical Phase Length
WSDOT


UPSTREAM GREEN TRUNCATION
Reverse Queue Jump
31s
(5s)
29s
Typical Phase Length
WSDOT



Signal Treatment	Lane Types	Stop Types
Green Extension	Transit Lane, Transitway, Mixed Travel	Far-Side; Pull-Out or In-Lane
Green Reallocation	Transit Lane, Transitway, Mixed Travel	Far-side; Pull-Out or In-Lane
Red Truncation	Transit Lane, Transitway, Shared Right Turn/Queue Jump	Near-Side or Far-Side; Pull-Out or In-Lane
Upstream Green Truncation	Mixed Travel	Near-Side or Far-Side; Pull-Out
Phase Insertion/Phase Sequence Change	Transit Lane, Transitway	Any
Phase Reservice	Transit Lane, Transitway, Mixed Travel	Any

Transit Street Design Guide, NACTO, 2015

WSDOT

5.5 Freeway applications

FREEWAY APPLICATIONS

Treatment	Minimum One-Way Peak Hour Volumes: Bus	Minimum One-Way Peak Hour Volumes: Passenger	Related Land Use and Transportation Factors
Exclusive busways on special right-of-way	40–60	1,600–2,400	Urban population: 750,000; CBD employment: 50,000; 1.85 million m² CBD floor space; congestion in corridor; save buses 1+ min/mi (0.6+ min/km).
Exclusive busways within freeway right-of-way	40–60	1,600–2,400	Freeways in corridor experience peak-hour congestion; save buses 1+ min/mi (0.6+ min/km)
Busways on railroad right-of-way	40–60	1,600–2,400	Potentially not well located in relation to service area. Stations required.
Freeway bus lanes, normal flow	60–90	2,400–3,600	Applicable upstream from lane drop. Bus passenger time savings should exceed other road user delays. Normally achieved by adding a lane. Save buses 1+ min/mi (0.6+ min/km).
Freeway bus lanes, contraflow	40–60	1,600–2,400	Freeways with six or more lanes. Imbalance in traffic volumes permits freeway LOS D in off-peak travel direction. Save buses 1+ min/mi (0.6+ min/km).
Bus lane bypasses at toll plazas	20–30	800–1,200	Adequate queuing area on toll plaza approach, so bus lane access is not blocked.
Exclusive bus access to non-reserved freeway or arterial lane	10–15	400–600	
Bus bypass lane at metered freeway ramp	10–15	400–600	Alternate surface street route available for metered traffic. Express buses leave freeways to make intermediate stops.
Bus stops along freeways	5–10	50–100*	Generally provided at surface street level in conjunction with metered ramp.

Transit Capacity and Quality of Service Manual 3rd Edition (TCRP Report 165), TCRP, 2013

WSDOT

Notes:
There are many different possible treatments that can be considered when coordinating with transit agencies. Some considerations are network applicability, dependence on land use and transportation characteristics, and dependence on transit agency policies.

5.6 Bus on shoulder

BUS ON SHOULDER

Used when congested period operating speeds are 35 mph or less

Four or more buses/hour can use the freeway

Minimum 10ft shoulder (Design Manual recommends 12')

Pavement structure

Transit Capacity and Quality of Service Manual 3rd Edition (TCRP Report 165), TCRP, 2013

WSDOT

Notes:
WSDOT currently has a few bus on shoulder managed lane applications at these locations:

- Southbound I-405 from the SR 527 on-ramp to the NE 195th Street off-ramp
- Southbound I-405 from SR 522 on-ramp to the NE 160th Street off-ramp
- C-Trans and SWR are launching a pilot on SR14 between I-205 and SE 164th Avenue in Vancouver

Note that Design Manual Chapter 1232 requires a design analysis document for transit shoulder use on freeways, however, the same level of analysis is not needed for highway applications discussed in Chapter 1231.

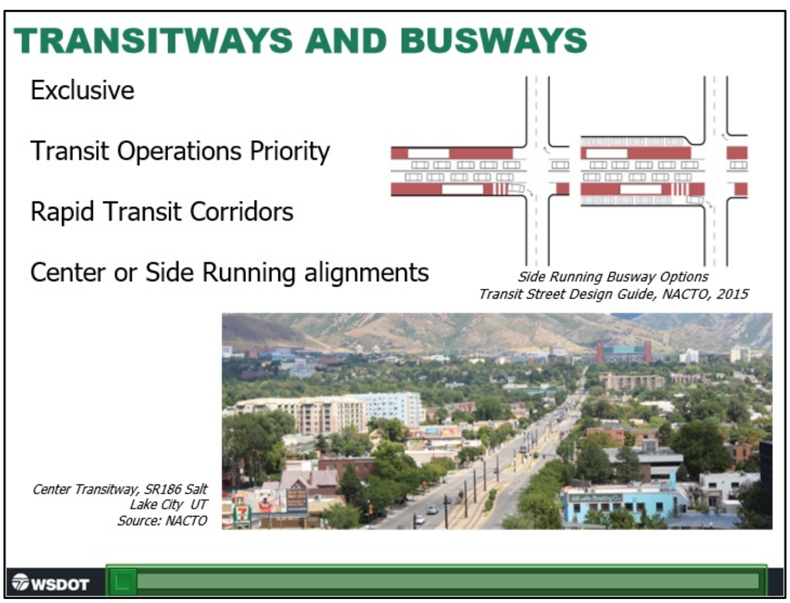
5.7 BAT lanes

Notes:

BAT lanes are another type of managed lane that provides a semi-exclusive traveled way for transit vehicles. Enforcement can be an issue and these may only be appropriate for Modified Limited Access to Managed Access Class 2 routes.

Community Transit's Swift I BRT and King Co. Metro's Rapid Ride BRT operate on SR99's BAT lane.

5.8 Transitways and busways



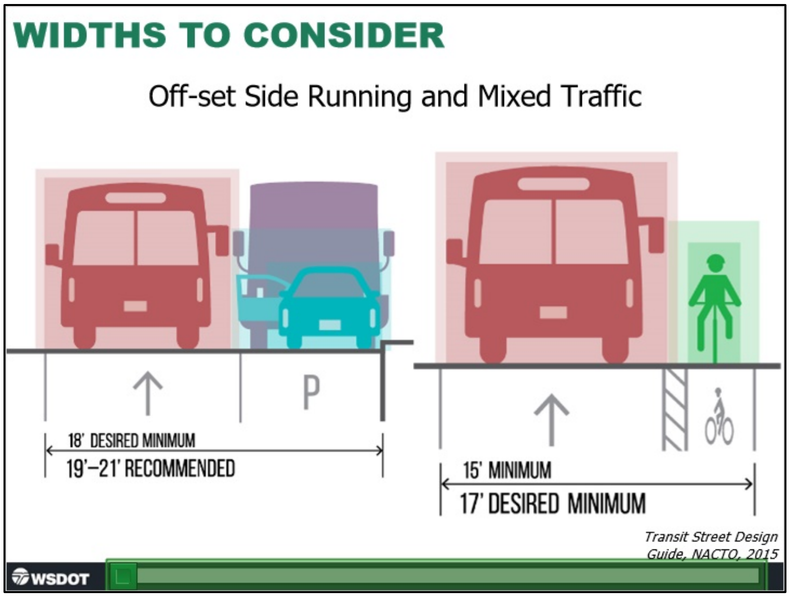
Notes:

Transitways and busways are types of managed lanes.

Center transitways are separated from other vehicle traffic by medians or other vertical separation elements, and prioritize transit movements at intersections. Center transitways provide a high level of capacity and reliability for bus or rail service, and typically require the most space of any transit treatment, with a configuration similar to that of an off-street transitway. They can be configured as shown to support right-side median stops, or with center-median stops.

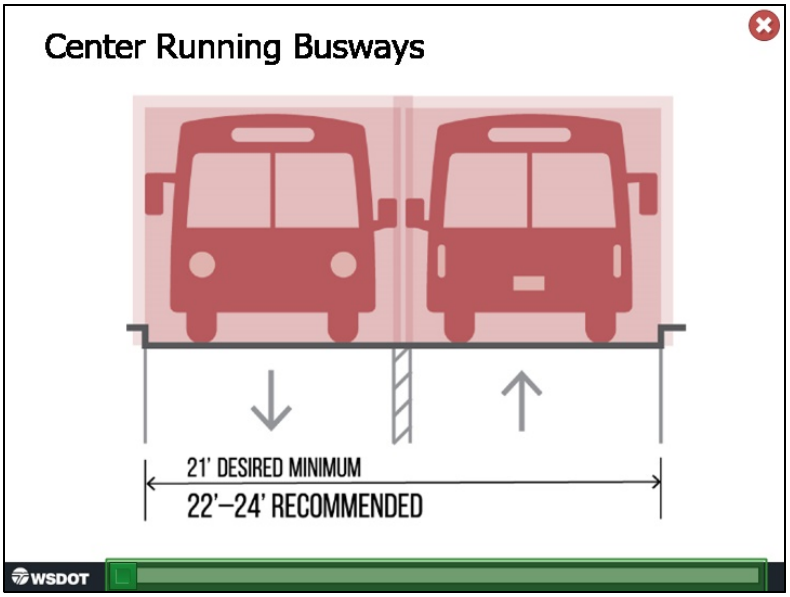
Transitways are discussed for highway applications in WSDOT's Design Manual Chapter 1231.

5.9 Widths to consider

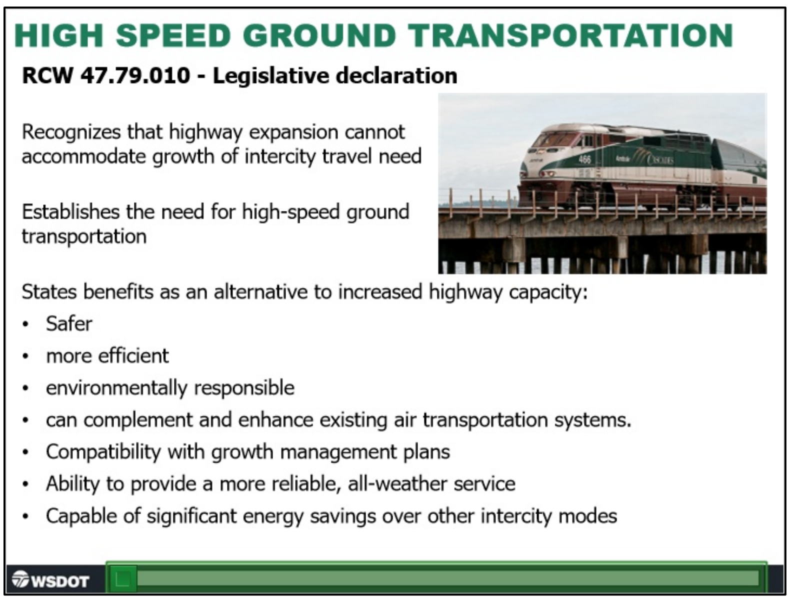


Notes:
Bus lanes may be ten to twelve feet wide when offset, and eleven to twelve feet when configured curbside or in a transitway adjacent to an opposing lane of bus traffic.

In-street rail vehicles, including streetcar, tram or trolley, and multi-unit light-rail vehicles, or LRVs, can operate in travel lanes ten to eleven feet wide, depending on the vehicle model. Mirror clearance may be a more significant factor for streetcars than for buses. Guideway and vehicle operating space must remain clear of obstacles, such as wide vehicles parked in an adjacent lane.



5.10 High speed ground transportation



Notes:

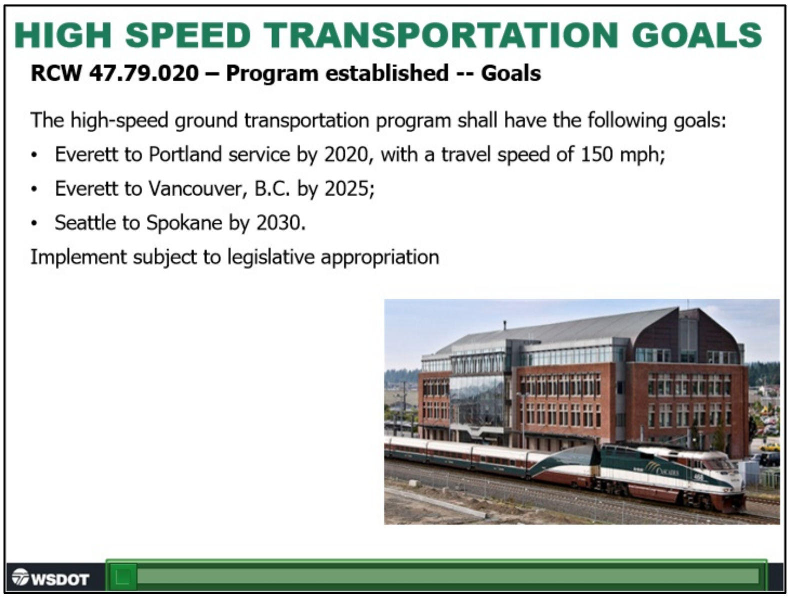
This is a simple declaration effectively recognizing the need for high speed rail, and its necessity in developing high speed ground transportation. While this doesn't seem highway-related, it is based on the fact that we have congestion now and that its growing faster than we could expand the highway.

RCW 47.79.010 - Legislative declaration.

The legislature recognizes that major intercity transportation corridors in this state are becoming increasingly congested. In these corridors, population is expected to grow by nearly forty percent over the next twenty years, while employment will grow by nearly fifty percent. The estimated seventy-five percent increase in intercity travel demand must be accommodated to ensure state economic vitality and protect the state's quality of life.

The legislature finds that high-speed ground transportation offers a safer, more efficient, and environmentally responsible alternative to increasing highway capacity. High-speed ground transportation can complement and enhance existing air transportation systems. High-speed ground transportation can be compatible with growth management plans in counties and cities served by such a system. Further, high-speed ground transportation offers a reliable, all-weather service capable of significant energy savings over other intercity modes.

5.11 High speed transportation goals



Notes:

There have been little to no appropriations for this program. The Rail office went aggressively after American Recovery and Reinvestment Act funds - $500 million - for new locomotives for the Point Defiance Bypass project. What if state funds had been supplemented?

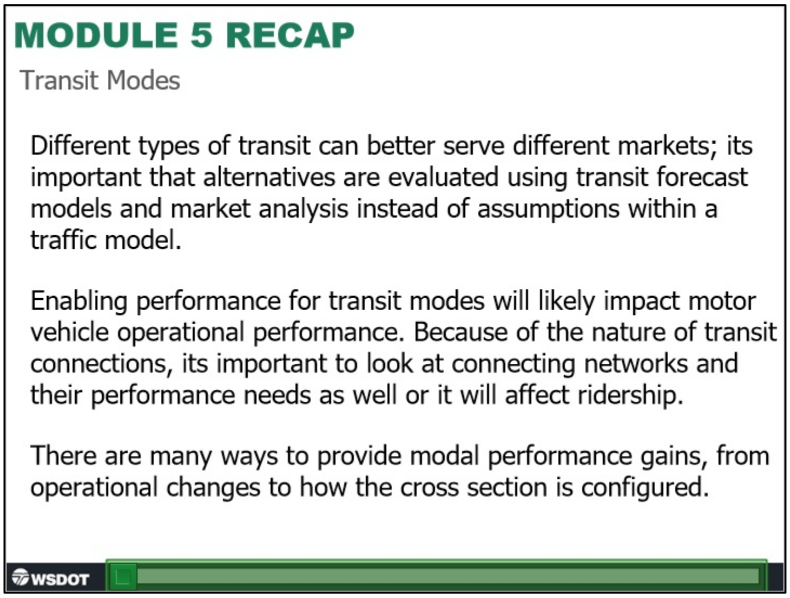
Goals were set around the high speed ground transportation, but ultimately the funding needs to be there to meet these goals, set in 1993.

RCW 47.79.020 Program established-Goals.

The legislature finds that there is substantial public benefit to establishing a high-speed ground transportation program in this state. The program shall implement the recommendations of the high-speed ground transportation steering committee report dated October 15, 1992. The program shall be administered by the department of transportation in close cooperation with the utilities and transportation commission and affected cities and counties.

6. Recap

6.1 Module recap



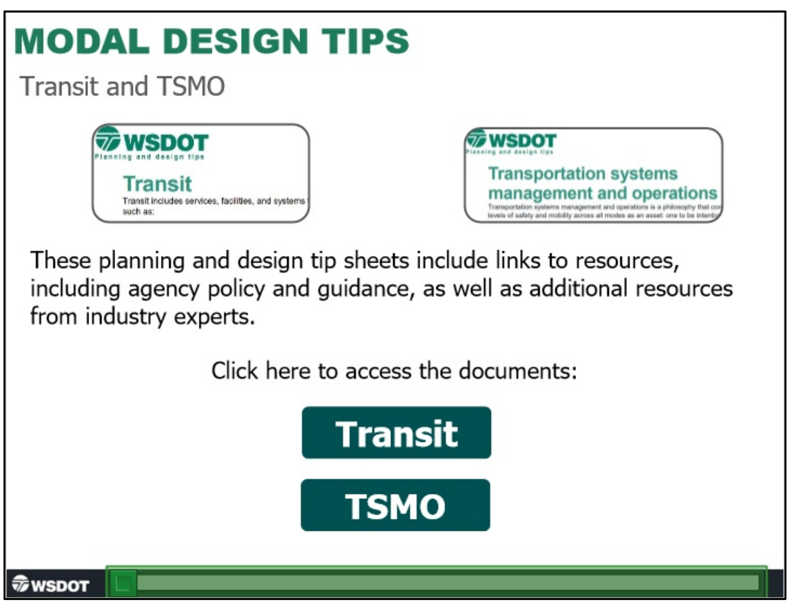
Notes:

Different types of transit can better serve different markets. It is important that alternatives are evaluated using transit forecast models and market analysis instead of assumptions within a traffic model.

Enabling performance for transit modes will likely impact motor vehicle operational performance. Because of the nature of transit connections, it is important to look at connecting networks and their performance needs as well or it will affect ridership.

There are many ways to provide modal performance gains from operational changes to how the cross section is configured.

6.2 Modal design tips



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