Chapter 4 Multimodal Planning and Design/Operational Considerations

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4-1 Introduction

Washington's Transportation Plan envisions an integrated system safely connecting people and communities – fostering commerce and economic opportunity for all, operating seamlessly across boundaries, and providing travel options to achieve an environmentally and financially sustainable system. Achieving a complete transportation system requires us to provide a variety of transportation options to all users. Not only will such a system serve everyone, but it will also function more efficiently. The benefits are significant and wide - such as a cleaner environment, a stronger economy, and a more mobile and healthy population.

Transportation system integration requires all partners to pull from a larger, multimodal toolbox to consider solutions that can best serve the interests of communities and the traveling public. Highways and streets can be community assets when access to transit facilities and services is seamless; bicycle and pedestrian connections are complete; and access to major employment, education, social service, and residential destinations is prioritized.

The roadway system needs to feel safe for all users and it should both benefit and respond to the needs of people and communities around it.

Chapter 4 of the *Traffic Manual* is intended to provide a process to consider and enhance active transportation crossings and provide multimodal guidance for intersections and interchanges. The guidance provided in this chapter complements the design guidance provided in the *Design Manual*. The *Design Manual* is typically updated every one to two years and may include more up-to-date guidance than is included in this chapter; in cases where guidance in this chapter conflicts with guidance in the *Design Manual*, the *Design Manual* guidance supersedes guidance provided here.

Additional information can be found in various *AASHTO*, NACTO, and FHWA polices and guides.

4-2 Policy

4-2.1 United States Department of Transportation

23 CFR § 652.5 states, "the safe accommodation of pedestrians and bicyclists should be given full consideration during the development of Federal-aid highway projects, and during the construction of such projects. The special needs of the elderly and the handicapped shall be considered in all Federal-aid projects that include pedestrian facilities. Where current or anticipated pedestrian and/or bicycle traffic presents a potential conflict with motor vehicle traffic, every effort shall be made to minimize the detrimental effects on all highway users who share the facility. On highways without full control of access where a bridge deck is being replaced or rehabilitated, and where bicycles are permitted to operate at each end, the bridge shall be reconstructed so that bicycles can be safely accommodated when it can be done at a reasonable cost. Consultation with local groups of organized bicyclists is to be encouraged in the development of bicycle projects."

It is the policy of the United States, as described in 49 U.S.C. §70101 to maintain and improve the condition and performance of the National Multimodal Freight Network to ensure that the network provides a foundation for the United States to compete in the global economy.

Chapter 53 of Title 49 of the U.S. Code establishes the authority for FTA. It incorporates the Urban Mass Transportation Act originally enacted in 1964 and states that "it is in the interest of the United States, including its economic interest, to foster the development and revitalization of public transportation systems that (1) maximize the safe, secure, and efficient mobility of individuals; (2) minimize environmental impacts; and (3) minimize transportation-related fuel consumption and reliance on foreign oil."

4-2.2 Agency Policies

Executive Order 1090 *Advancing Practical Solutions*: Practical Solutions uses tools, data analytics, performance measures, and stakeholder input to (1) seek lower-cost approaches and efficiencies in expanding and operating the multimodal transportation system to reduce travel demand and the need for building costly new infrastructure, (2) identify, evaluate, analyze, and manage risk to WSDOT's strategic objectives, and (3) identify and implement agency efficiencies. See *Design Manual Division* 11 for guidance on implementing Practical Solutions.

Executive Order 1113 *Sustainability:* This policy directs WSDOT's actions in a manner that helps Washington's economy, environment, and communities prosper now and for generations to come. To sustain prosperity, WSDOT must address current needs while preserving the ability of future generations to meet their needs. WSDOT employees are directed to take actions that sustain economic, environmental, and societal prosperity for current and future generations through a focus on energy efficiency, pollution reduction, and enhanced resilience.

Executive Order 1085 *Road Safety – Advancing the Safe Systems Approach for all Users*: The purpose of this order is to achieve the goals of the Washington State Strategic Highway Safety Plan, known as Target Zero, and the Washington State Department of Transportation (WSDOT) Highway Safety Improvement Program Implementation Plan, titled Getting to Zero.

4-2.3 State Multimodal Transportation Plans

- WSDOT Strategic Plan
- Washington Transportation Plan
- Washington State Strategic Highway Safety Plan (Target Zero)
- WSDOT Highway Safety Improvement Program Implementation Plan (Getting to Zero)
- WSDOT Active Transportation Plan
- Statewide Human Services Transportation Plan (HSTP)
- Washington State Public Transportation Plan
- Highway Systems Plan
- Freight System Plan
- Washington State Ferries Planning
- Washington State Rail Plan
- Washington Aviation Systems Plan
- Diversity, Equity, and Inclusion Plan

4-3 Crosswalks on State Highways

Crosswalks on state highways are established, modified, and maintained in accordance with federal and state laws, regulations, and department policy. This section provides an overview of the legal framework, agency responsibilities, and approval processes associated with pedestrian crossings on state highways.

Federal Law

FHWA's *Manual on Uniform Traffic Control Devices for Streets and Highways, or* MUTCD, defines the standards used by road managers nationwide to install and maintain traffic control devices on all public streets, highways, bikeways, and private roads open to public travel. Links to the MUTCD and amendments adopted by Washington State can be found at https://wsdot.wa.gov/engineering-standards/all-manuals-and-standards/manuals/manual-uniform-traffic-control-devices-mutcd.

State Law

Legal crosswalks exist at all street intersections, whether marked or not, per RCW 46.04.160. Marked crossings at other locations are called mid-block crossings and can occur at schools, commercial areas, parks, transit stops, or other locations where pedestrians need to cross the roadway away from a street intersection. See *Design Manual* Chapter 1510 for additional discussion on marked and unmarked crossings.

Agency Application

Crosswalks guide pedestrians and, in conjunction with other measures, help alert road users to a pedestrian crossing a roadway. There are many factors to consider when deciding whether a marked pedestrian crossing is recommended at a specific location and what type of treatment is appropriate. Because every situation is unique, it is not practical to prescribe a single evaluation process that applies in every circumstance. The evaluation process and criteria here are presented as guidance.

The decision to establish, modify, or enhance a pedestrian crossing on a state highway is subject to review and approval by the Region Traffic Engineer.

4-3.1 Closed Crossings

Choosing to close a crossing is a last resort and must remain infrequent. Formally closed crossings apply to all non-motorized users. The decision to close a crossing requires approval of the WSDOT Region Traffic Engineer with concurrence from the HQ ADA compliance manager. See *Design Manual* 1510.09 and for preservation projects, Project Delivery Memo 21-01 for more information.

When a location includes an existing closed crossing, the existing closed crossing should be evaluated for potential re-opening using current policy and procedures. Documentation would typical including completing the Pedestrian Crossing Memo Template.

The documentation process outlined in Section 4-4 may be used to evaluate a closed crossing.

4-3.2 Work by Others

Other agencies (e.g., cities and counties) or private developers may request to install, modify, or enhance crosswalks on state highways. Because these facilities are located within state highway right of way, prior approval from the Region Traffic Engineer is required before any markings, signs, signals, beacons, or related features are added or altered.

Requests must be submitted to the region for review and include documentation appropriate to the scope and complexity of the proposed work, consistent with Section 4-4, unless otherwise approved by the Region Traffic Engineer.

Maintenance responsibilities must be clearly defined. This responsibility is typically formalized through an interagency agreement executed before permit approval and applies to all associated appurtenances such as markings, signs, beacons, signal systems, lighting, and accessibility features.

4-4 Crosswalk Evaluation Documentation

The Region Traffic Engineer considers the level of documentation needed for individual or a series of locations when determining whether a marked crosswalk should be provided at existing legal crossing locations or at new mid-block locations, and the enhancements that should accompany it. The scope and level of analysis for crossing locations vary depending on site conditions or context and identified concerns. In some cases, a field or virtual review and professional discussion may be sufficient to determine an appropriate course of action; in others, a more in-depth evaluation or analysis may be desired, including engagement with agency partners, local organizations, and the general public.

Decisions may be documented in other reports, analyses, or plans such as Intersection Control Evaluations, Access Revision Reports, Traffic Analysis, Corridor Studies, Pre-Design Reports, Complete Streets-related reviews and documents, or local agency studies and plans.

Generally speaking, the crosswalk evaluation process should proceed along the following steps:

1. Analyze and review the existing conditions
2. Identify the crossing enhancement category
3. Select the crossing enhancement(s)

Additional crossing considerations and information regarding enhancements are provided in Sections 4-5 and 4-6.

4-4.1 Step 1: Existing Conditions

The elements listed below represent existing conditions considerations that may inform the evaluation of a pedestrian crossing, or a series of crossings, on state highways. They are not a required checklist, and only those relevant to the site conditions and study objectives need to be assessed or documented.

A. Location description and physical data collection
B. Establishment of the crossing needs
C. Community connectivity (interconnectivity)
D. Safety data discussion
E. Crosswalk analysis resources

A. Location Description and Physical Data Collection

The following location and physical data collection items are not an exhaustive list but can be used as a guide to review a crossing(s). The Region Traffic Engineer will determine which items listed below are necessary to make a sound judgment.

- Roadway characteristics, including geometrics, sight distance, traffic control type, lighting, number of travel lanes, presence of a median, presence and orientation of on-street parking, and roadway type
- Motor vehicle traffic characteristics, including volume, vehicle type, and traffic speeds
- Bicycle and pedestrian facility characteristics, including facility type, width, and presence of buffer; this information can be used to identify the Bicycle and Pedestrian Level of Traffic Stress (LTS), *Design Manual* Section 1510.02(5) and 1520.03(3)).
- Crossing locations and characteristics, including proximity to adjacent crossings, location of closed crossings, traffic control, pedestrian and/or bicyclist delay
- Proximity to pedestrian and/or bicyclist generators, such as transit stops, other intermodal connections like ferry landings and rail stations, trails/shared-use paths, or other origins/destinations (employment centers, schools, parks, restaurants, bars, businesses, health services, etc.)
- Land use context and future land use changes, growth, or development patterns
- Demographics of the population within 1 mile of the location (typical walking distance)
- State or local agency plans and maps that include the location as a part of their pedestrian/bicycle network
- School district information on walk routes, including plans or maps that indicate crossing locations and bus stops

The items below may also inform crossing considerations. Note, both may not provide complete information on how many people might use the crossing or how comfortable the crossing feels.

- Pedestrian/bicyclist safety data, including crash severity and frequency (noting that crashes may not be a good indication of issues since they may occur infrequently, or be underreported (see Section 4-4.1.D for more information).
- Pedestrian/bicyclist volumes recognizing that observed volumes may not fully reflect potential demand where facility, connectivity, accessibility, or crossing limitations exist.

A field visit to the project site, potentially with agency partners or community members, is recommended as part of this step.

B. Establishment of Crossing Need

Consider pedestrian/bicyclist needs at a location, or at a series of locations along a corridor, as well as the suitability of the location based on roadway, traffic, and adjacent land use characteristics. The following is not an exhaustive list, but if any of the following are indicated, it may indicate that a crossing need exists:

- Pedestrian/bicyclist crash and near miss history (consider crash types and contributing factors)
- Known pedestrian/bicyclist crossing activity, especially in dark or nighttime conditions; this may include the presence of desire lines (e.g. worn pathways), or known/observable bicycle routing that may be unintuitive
- Proximity to adjacent crossings (crossing spacing), also noting how well those crossings meet pedestrian needs
- Proximity to pedestrian and/of bicycle generators, like transit stops, trails/shared-use paths, or other origins/destinations (employment centers, schools, parks, restaurants, bars, businesses, health services, and roadways that connect to these destinations)
- Land use context and future land use changes, growth, or development patterns
- Demographics of the population within 1 mile of the location (typical walking distance). Give special consideration in communities where there are higher numbers of people over 65, youth, people with disabilities, areas of low vehicle ownership rates, and areas of lower income.
- High pedestrian/bicyclist delay at existing, or nearby crossing locations
- State or local agency plans include the location as a part of their pedestrian/bicycle network and/or school walk route

C. Community Connectivity (Interconnectivity)

Community connections to state highways are critical because these corridors often provide primary access to schools, transit service, commercial and business nodes, and other community destinations. Pedestrian demand is generally concentrated at these locations, making continuous and accessible connections such as sidewalks, shared-use paths, crossings, and transit stop access essential. Connectivity may occur outside the highway right of way; local walkways, trails, county routes, and other off-system routes can create more direct paths to crossing points or transit, influencing where pedestrians choose to cross. Evaluating and, where feasible, providing or improving these connections can provide

practical route choices, support use of designated crossing locations, and enhance the functionality of crossings and multimodal access along the state highway.

Contact local agencies, school districts, transit providers, and communities to help understand the local context early to help aid in evaluating the project site. Collaboration is a priority, so improvements are consistent with state and local plans, goals, and overall network connectivity.

D. Safety Data

Crash data are the most used statistics for evaluating safety. However, the frequency and accuracy of pedestrian and bicyclist crash data are generally low, and research has found that crashes are underreported. Additionally, unlike motor vehicle use of a roadway, where there is a relatively constant flow of traffic that leads to statistically informative crash data, bicycle and pedestrian use of many corridors tends to be more sporadic, which in turn reduces the statistical value of active transportation crash data. Therefore, using crash data as the sole method by which crossings are evaluated is not usually practical. Surrogates for crash data include information collected in the steps above, such as highway speeds, conflict points, number of lanes, vehicle volumes, transit use, population density, and population demographics such as age and ethnicity. These and other factors can support a systemic, data-driven approach to identifying locations with similar characteristics and may help guide and prioritize crossing enhancements at individual locations, along corridors, or across broader geographic areas. FHWA guidance on the determination and use of pedestrian risk factors can be found in the following FHWA documents:

- Systemic Pedestrian Safety Analysis
- Synthesis of Methods for Estimating Pedestrian and Bicyclist Exposure to Risk at Area wide Levels and on Specific Transportation Facilities
- Data-Driven Safety Analysis, FHWA

E. Crosswalk analysis resources

- Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations, Federal Highway Administration, 2018. https://highways.dot.gov/safety/pedestrian-bicyclist/step/resources.
- National Academies of Sciences, Engineering, and Medicine. 2022. *Guide to Pedestrian Analysis*. Washington, DC: The National Academies Press. https://www.nationalacademies.org/publications/26518. ***Note:*** to access the document for free, a National Academies login account will need to be created.
- National Academies of Sciences, Engineering, and Medicine. 2018. *Systemic Pedestrian Safety Analysis*. Washington, DC: The National Academies. https://www.nationalacademies.org/publications/25255. ***Note:*** to access the document for free, a National Academies login account will need to be created.

- Synthesis of Methods for Estimating Pedestrian and Bicyclist Exposure to Risk at Areawide Levels and on Specific Transportation Facilities, Federal Highway Administration, 2017. https://highways.dot.gov/safety/pedestrian-bicyclist/safety-tools/synthesis-methods-estimating-pedestrian-and-bicyclist-0.
- Estimating Benefits of Closing Gaps in Active Transportation Networks: A Guide https://trid.trb.org/View/2666816

4-4.2 Step 2: Identification of crossing enhancement category

Uncontrolled pedestrian crossings are marked or unmarked crosswalks that do not include a stop sign, yield sign, or traffic signal for the primary traffic movements that intersect the crosswalk. Uncontrolled crossings can be located at intersections or midblock locations.

Many of the design considerations for uncontrolled crossings can be incorporated into locations with controls as well; controls may need to be increased based on traffic volumes and speed.

Once the review of existing conditions is complete and the need for a pedestrian crossing is established, with the location(s) identified, the next step is to consider possible enhancements. Crossing enhancements, when implemented, should follow the WSDOT *Design Manual*, WSDOT Standard Plans, the MUTCD, and consider other relevant AASHTO, FHWA, and other guidance.

Use Exhibit 4-1 to identify the crossing enhancement category. The table below uses existing roadway and motor vehicle characteristics, such as the number of travel lanes crossed, the motor vehicle traffic volumes, and the posted speed limit, as the primary factors to determine the level of enhancement that may need to be considered.

Exhibit 4-1 Crosswalk Enhancement Category Identification

Exhibit 4-1 Crosswalk Enhancement Category Identification															
Lanes Crossed	Refuge Island	Motor Vehicle Traffic Volume and Posted Speed Limit													
		< 3,000 vehicles/day			3,000 to 9,000 vehicles per day			9,000 to 12,000 vehicles per day			12,000 to 15,000 vehicles per day			> 15,000 vehicles/day		
		≤30 mph	35 mph	40-45 mph	≤30 mph	35 mph	40-45 mph	≤30 mph	35 mph	40-45 mph	≤30 mph	35 mph	40-45 mph	≤30 mph	35 mph	40-45 mph
1	N/A	A	B	C	B	B	C	B	B	C	B	B	C	B	B	C
2	Yes	A	B	C	B	B	C	B	B	C	B	B	C	B	B	C
	No	A	B	C	B	B	C	B	B	C	C	C	C	C	C	D
3	Yes	B	B	C	B	B	C/D	B	C	C/D	B	C	D	C	C	D
	No	B	B	C	B	B	C/D	C	C	D	C	C	D	C	D	D
4+	Yes	B	B	C	B	B	C/D	B	C	C/D	B	C	D	C	C	D
	No	B	B	C	C	C	C/D	C	C	D	C	D	D	D	D	D
Adapted from Oregon Department of Transportation's uncontrolled marked crosswalk treatment table 310.3-A, Traffic Manual, 2026															

Notes:

1. Consideration for volume fluctuation may be necessary, depending on the location, such as a crossing near a ferry terminal, school, or event center.
2. Consider using operating speed if known.
3. Number of lanes crossed include all lanes (thru lanes, turn lanes, and two-way-left-turn-lanes) at the crossing.
4. Locations with posted speeds greater than 45 mph may present conditions not fully addressed by this exhibit and should be evaluated in accordance with Section 4-5.4.
5. These guidelines include intersection and midblock locations with no traffic signals or stop signs on the approach to the crossing; these guidelines may be used to reevaluate existing crossing locations - see 4-5.3 for additional considerations.
6. The application of these guidelines is not directly intended for, but may be used for uncontrolled bicyclist crossings, trail crossings, freeway ramp terminals, or designated school zones; additional considerations may apply.
7. These guidelines are not intended for roundabout crossings, see Section 4-6.8.

Enhancement Legend

The following category group crossing enhancements by their primary safety function and typical application as site risk and complexity increase. The categories are intended to guide the selection of appropriate strategies from basic visibility improvements to measures that reduce exposure, manage speeds, or provide positive control. They may be applied individually or in combination based on site conditions and professional engineering judgment.

Category A – High visibility crosswalk markings and signs

Location may be suitable for a marked crosswalk with marking and signing in accordance with the MUTCD and Standard Plan M15-10, lighting in accordance with *Design Manual* 1510, and parking restrictions for appropriate sight distance. Other enhancements are optional within this category, but may be appropriate based on local context.

For crosswalks associated with school walk routes, crosswalks located within commercial-core contexts, and other places where crossing activity is concentrated (e.g. transit stops), marked crosswalks are recommended within Category A.

As detailed in *Design Manual* Section 1103.5(1) Speed Management, marked crosswalks are a possible feature of a speed management strategy that helps indicate a change in context to drivers; within Category A, consideration for marking crosswalks within an overall speed management strategy should be assessed. See also Section 4-6.2 Crossing Spacing.

Category B - Enhancing visibility of users

Location may be suitable for a marked crosswalk with marking and signing, lighting, and parking restrictions (Category A), with other visibility enhancements recommended.

Other visibility enhancements in this category generally aim to increase the conspicuity of people at the crossing location and increase the predictability of all roadway users. Enhancements such as high-visibility markings, advance stop lines with signing, and curb extensions are examples of Category B strategies. Active warning enhancements are optional within this category, but may be appropriate based on crossing needs.

Category C – Reducing exposure and vehicle speeds

Location may be suitable for a marked crosswalk with marking and signing, lighting, and parking restrictions (Category A). Inclusion of visibility enhancements (Category B) and enhancements that address motor vehicle speed, pedestrian crossing distance, and roadway geometry are recommended. Additionally, active warning enhancements (e.g. RRFBs) are recommended.

When pedestrian crossing distance, motor vehicle operating speed, or pedestrian exposure are primary concerns, Category C treatments emphasize roadway geometric and motor vehicle speed-management strategies, including median refuge islands, raised crossings, vehicle lane reallocation, right turn on red restriction, pedestrian signal phase separation from motor vehicle left turns (e.g. “protected” phase), turn radii reduction, removal of channelized turn lanes, and other measures that reduce pedestrian exposure and simplify the crossing task. In some cases, speed-management strategies may be used to modify the posted speed limit in conjunction with the crossing, which may change the category identified in Exhibit 4-1.

Category D – Positive control or separation

Marked and signed crosswalks require additional control . Strategies may include a pedestrian signal, pedestrian hybrid beacon (PHB), roundabout, or grade separation (*Design Manual* Section 1510.11).

4-4.3 Step 3: Identification of crossing enhancement(s)

After identifying the crossing category using Exhibit 4-1, the next step is to consider potential enhancements that address the specific elements present at the location. Crossing categories provides a general indication of overall conditions, while the functional characteristics described below help identify how improvements may influence safety, comfort, and user experience.

Enhanced crossings are typically achieved by incorporating strategies that improve one or more of the six functional characteristics identified in *Design Manual* Section 1310.03 affecting active transportation users. Understanding which characteristics are most relevant at a given site can help guide the selection of appropriate treatments, individually or in combination, to address the underlying issues affecting crossing performance. These functional characteristics include:

- **Decreasing pedestrian/bicyclist exposure to points of conflict with motor vehicle traffic**; Exposure can be reduced by shortening crossing distances, simplifying intersection geometry, consolidating conflict points, or providing refuge areas that allow users to cross in stages.
- **Decreasing motor vehicle operating speed;** Lower operating speeds provide drivers with more time to detect and respond to pedestrians and bicyclists and reduce stopping distance requirements, while substantially improving survivability in the event of a collision.
- **Increasing pedestrian/bicyclist user conspicuity;** Conspicuity can be enhanced through markings, lighting, contrast, and positioning that draws attention to crossing activity and highlights potential conflicts. Increased visibility is especially important in low-light conditions, complex environments, or locations where drivers may not expect pedestrian or bicycle activity.
- **Increasing the predictability of movements of different user groups through the intersection;** Predictability can be improved through consistent facility placement, intuitive geometry, clear control devices, and alignment with natural travel paths, all of which support orderly movement of all users.
- **Increasing separation in time between motorists and pedestrians/bicyclists.** Time separation manages conflicts by allowing different user groups to occupy the same space at different times rather than simultaneously. Signal phasing, protected intervals, or other control strategies can reduce interactions between turning vehicles and crossing users, improving safety and operational clarity. Time separation is often especially beneficial at complex intersections or locations where spatial separation is constrained.
- **Increasing separation in space between motorists and pedestrians/bicyclists;** This may include buffers, medians, refuge islands, protected facilities, or other features that create distance between motor vehicles and vulnerable users. Spatial separation is particularly important on higher-speed or higher-volume roadways.

A. Using Enhancement Selection Guide

Exhibit 4-2 is intended as a screening tool to help identify potential crossing enhancements based on site conditions. Treatments are organized by crossing category (identified in Exhibit 4-1), which generally progresses from A (crossings with lower speeds and volumes) to D (crossings with higher speeds, volumes, or complex operating conditions). Users should first consider the overall context of the location identified in Step 1, then review treatments within defined and adjacent categories to identify strategies that address the primary elements present (e.g., visibility, speed, exposure, or driver yielding).

Enhancements are not mutually exclusive and are often most effective when implemented in combination. Lower-category treatments emphasize visibility, sight distance, and user expectancy, while mid-category treatments introduce geometric and speed-management strategies to reduce exposure and simplify the crossing task. Higher-category treatments provide active control or physical separation where reliable yielding or gaps cannot be expected. The table is not intended as a warrant or checklist; final selection should consider site-specific factors such as those identified in Step 1, operational elements, feasibility, maintainability, and professional judgment, and may involve combining measures across tiers to achieve the desired performance.

The list of enhancements in Exhibit 4-2 is not exhaustive and does not represent a full range of investments that can be made at a crossing.

Exhibit 4-2 Crossing Enhancement Selection Guide

Crossing Category (Exhibit 4-1)	Pedestrian Crash Enhancements for Crossing	Decreasing Exposure	Decreasing Vehicle Speeds	Increasing Conspicuity	Increasing Predictability	Separation in Time	Separation in Space
A	Improve sight distance or sight lines			●	●		
A	Crosswalk marking and signing			●	●		
A	Parking restriction on the crosswalk approach			●			
A	Improved nighttime lighting			●			
B	Advance Stop Here For Pedestrian sign and stop line	●		●			
B	In-Street Pedestrian Crossing sign			●	●		
B	Curb extension	●	●	●	●		●
B	Centerline hardening		●		●		
B/C	Rectangular Rapid-Flashing Beacon			●	●		
C	Smaller corner radius	●	●	●			●
C	Raised crosswalk		●	●			
C	Pedestrian refuge island	●	●		●		●
C	Travel Lane narrowing	●	●	●			
C	Advance Warning beacon			●	●		
C/D	Corridor Speed Management		●	●			
C/D	Roadway Reallocation	●	●	●	●		●
C/D	Reduced crossing conflicts	●	●	●	●	●	●
D	Pedestrian Hybrid Beason or Signal	●		●	●	●	
D	Roundabout	●	●	●	●		●
D	Grade Separation	●					●

* See Section 4-4.3 for discussion of six functional characteristics identified in *Design Manual* Section 1310.03 and 4-4.3A for additional guidance in using Exhibit 4-2.

4-5 Crossing Considerations

4-5.1 Sight Distance

See *Design Manual* Chapter 1320 for establishing sight lines at roundabouts and Chapter 1510 for establishing sight lines at other crossings.

4-5.2 Crossing Spacing

Pedestrians typically seek the most direct route between origins and destinations and are less likely to detour significant distances to use designated crossing locations. Where intersection crossings are widely spaced, consideration should be given to providing midblock crossing opportunities to support convenient crossings.

Examples include:

- Where spacing between adjacent crossings is large
- Where a shared-use path intersects or crosses a roadway,
- At a midblock transit stop,
- Where a high number of pedestrians are already crossing,
- Where a new development that will generate pedestrian traffic is planned at a midblock location,
- Where a natural path exists between pedestrian traffic generators (such as a parking lot and an office building), and
- At a school where the entrance is located midblock.

The determination of crossing frequency along a corridor is a function of the land use context and the roadway type. Maximum crossing spacing based on these characteristics is established in WSDOT's Pedestrian Crossing Spacing Project Delivery Memo 2026-03. When documenting an analysis including multiple crossings along a corridor, these guidelines establish a process for determining crossing frequency.

4-5.3 Evaluation of existing crossings

When evaluating existing crossings, especially in the context of a corridor study where crossing spacing is being considered, physical data and crossing needs should be collected and evaluated in the manner described in Step 1 of this Section 4-4. At a minimum, existing crossings (including closed crossings) should be reviewed to determine whether they meet current WSDOT policies, with further review of the treatments identified in *Design Manual* Exhibit 1310-31 to determine if the existing enhancements are appropriate for the current conditions, or if additional enhancements should be applied to address the six function characteristics affecting active transportation users (see *Design Manual* Section 1310.03).

Improving existing crossings that are not part of a new construction, and alterations can be challenging for many reasons, such as the natural or built environment, funding, and resource availability.

Field investigations are encouraged, and the application of sound professional judgment is essential when selecting countermeasures for these conditions.

4-5.4 High-Speed Crossing Locations

Higher-speed crossing locations may present conditions that are not fully addressed by the tables or typical treatment matrices in Section 4-4 of this Chapter. Use Section 4-4 to evaluate the location; however, consideration in this section may help inform the selection of crossing enhancements where higher speeds are present. While speeds are an important consideration, other factors such as roadway geometry, land use, traffic patterns, crossing demand, and available crossing opportunities may also influence the selection of crossing enhancements.

Site-specific evaluation, field investigation, and professional engineering judgment are important when determining appropriate crossing enhancement.

A. Population Centers (Urban, Suburban, Or Rural Town Centers)

Locations in population centers with urban, suburban, or rural town center land use contexts with posted speeds greater than 45 mph may not be fully addressed by the crossing enhancement categories identified in Section 4-4. Category D enhancements should be considered as an initial starting point for review; however, speed management, geometric modifications, intersection control changes, and other site-specific factors may influence the final enhancement selection.

B. Natural and Rural Areas

In natural and rural land use contexts, uncontrolled crossings may exist at a variety of locations, including bus stops, park and rides, shared use paths, and recreational destinations (e.g. State Parks); small population centers, often unincorporated, may also be located in rural land use contexts. In these environments, higher motor vehicle speeds may be present, despite relatively low traffic volumes. Further, these locations are typically two-lane and may have minimal shoulders present, with fewer roadside destinations compared to other, more urban and suburban areas.

These locations should be evaluated for site-specific factors such as operating speeds, sight distance, roadway geometry, traffic patterns, active transportation demand, nearby land uses, and the feasibility of potential enhancement strategies. Because department regions often encompass large geographic areas with varying climate, access, and operational constraints, long-term maintainability and reliability of treatments should also be considered.

Understanding the origins and destinations of active transportation trips under these contexts is critical, as the typical crossing patterns and use of the roadway may not be intuitive. For example, it may be that active transportation users typically walk some distance along the corridor prior to crossing, which should be factored into decision-making about the type of investment that is necessary. Strategies that reduce exposure (minimum crossing distance), introduce conspicuity and predictability (communicating the expected activity and increasing visibility), and increase separation in space are commonly appropriate.

4-5.5 Freeway or Expressway Interchanges

Crossings at freeway or expressway ramp terminals, whether controlled or uncontrolled, present unique challenges for active transportation users and may not be adequately addressed by typical tables or treatment matrices in Section 4-4 of this Chapter. Drivers at these locations are often focused on merging or gap selection and must make multiple decisions in a short distance, which can reduce awareness of crossing users. These areas frequently have higher vehicle volumes, represent areas of speed transition, and typically have larger or more complex intersection configurations, further increasing conflict potential.

Evaluation of site-specific factors, including speeds, sight distance, ramp geometry, traffic volumes, and turning movements, signal operations (if present), and pedestrian demand, is necessary. Field investigation and the application of professional engineering judgment are essential when selecting appropriate countermeasures.

Refer to *Design Manual* Section 1510.11(3) Interchanges and 1520.05(8) Interchange Considerations for additional information.

4-6 Crossing Enhancements

The following crossing enhancements represent a range of strategies that may be considered to address crossing visibility, exposure, speed management, and user predictability. The descriptions are intended to provide general information and references to additional guidance and design resources and are not intended to prescribe the use of any particular treatment.

4-6.1 Lighting

In Washington state, the majority of severe crashes between motorists and pedestrians tends to occur in hours of darkness. The *Design Manual* Chapter 1510 notes that illumination of pedestrian crossings and other walkways is an important design consideration because lighting increases the likelihood of a pedestrian's being seen at night as well as a personal sense of security. Illumination provided solely for vehicular traffic is not always effective in lighting parallel walkways for pedestrians. For additional information regarding lighting and illumination, see *Design Manual* Chapter 1040 and Chapter 1510 and PedSafe Lighting and Illumination website.

4-6.2 Parking Restrictions

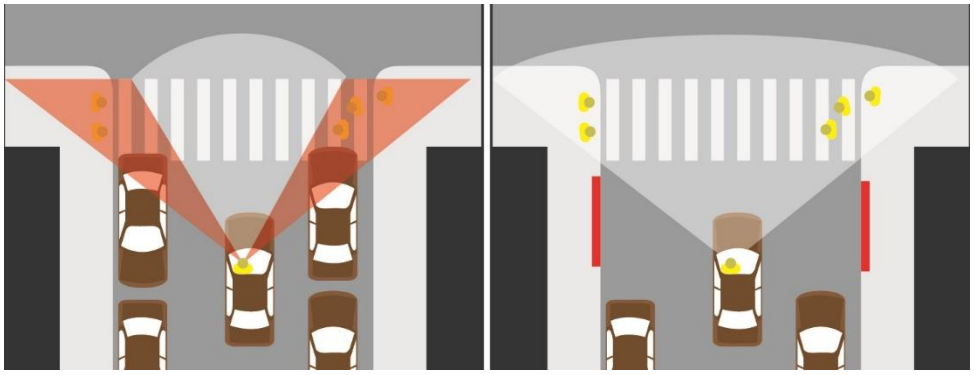
Parking restrictions near intersections can improve sightlines for both pedestrians and motorists by removing obstructions that limit visibility at crossings. This may include removing parking spaces, modifying parking markings, or installing curb paint and signage to prohibit parking near crosswalk approaches. Improving visibility allows pedestrians to better see approaching vehicles and helps drivers detect pedestrians waiting to cross.

Parking setbacks should provide adequate visibility for both pedestrians and motorists to see and react to one another. In some locations, physical measures such as curb extensions may also be appropriate to reinforce parking restrictions, improve sightlines, and shorten pedestrian crossing distances.

Consult Revised Code of Washington Chapter 46.61.570 for statutory parking limitations at crosswalks, and Chapter 47.24.020 for regulation and enforcement requirements.

Methods can vary to identify or physically enforce no parking restrictions and those include curb paint, signs, painted bulb-outs, and curb extensions or bulb-outs.

Refer to the MUTCD, Chapter 3J for standards and guidance when creating sidewalk extensions using pavement markings.



Source: San Francisco Municipal Transportation Agency

E. Thomas St at Bellevue Ave E, Seattle

State Route 507, Tenino

State Route 104, Edmonds

4-6.3 Pedestrian Refuge Islands

A pedestrian refuge island is typically constructed in the middle of a street at an intersection or midblock locations. It provides a place for pedestrians to stand and wait for a gap in traffic or for drivers to stop. See *Design Manual* Chapter 1510 for more information.

A. Alternatives to Pedestrian Refuge Islands

A median is the portion of the roadway separating the traveled lane portions of opposing directions or turn lanes. Medians may be depressed, raised, or flush with the road surface. Medians less than six feet and not raised do not qualify as a pedestrian refuge. However, they still provide benefits by narrowing the roadway, providing additional and more visible delineation, and contributing to speed management, which could be considered a low-cost modification.

When considering a median, a full pedestrian refuge is desired; if project conditions limit the applicability of such a device, then consider alternatives that may still shorten the curb-to-curb crossing designs or influence vehicle speeds and turning paths. Strategies include:

- Adding a median that is less than the minimum width required for a pedestrian refuge; note that parking restrictions and horizontal deflection may be strategies to create additional space for a median and introduce traffic calming to manage motor vehicle speeds.
- Adding a hardened centerline; like medians, hardened centerlines can control motor vehicle turning speeds by reinforcing the desired radius, thus increasing separation in time between motorists and people crossing, and reducing exposure.
- Adding a curb extension; reducing the crossing distance by adding a curb extension on one, or both sides of the crossing may be more feasible than adding a median under certain conditions, resulting in lower exposure and reduced motor vehicle turning speeds.
- Adding an edge line buffer; narrowing the outside motor vehicle lanes by creating an edge line buffer between the outside lane line and the curb may be an alternative when medians are not feasible.
- Adding a bicycle lane buffer (with or without a vertical element such as curbing); when a bicycle lane is present, a buffer can be added at the crossing location, acting in a similar manner to the edge line buffer, to narrow the motor vehicle lane and reduce exposure at the crossing location.

10th Ave E and E Highland Dr, Seattle

SR 99 and N 135th St, Seattle

State Street at Cherry Ave, Olympia
Source: Google

4-6.4 Rectangular Rapid Flashing Beacons (RRFB)

RRFBs are considerably less expensive to install than mast-arm-mounted pedestrian signals and are considered a practical crosswalk improvement strategy.

When considering the use of RRFBs, consult the following design, guidance, and policy resources:

- The Manual on Uniform Traffic Control Devices, Chapter 4L, provides requirements and guidance for the application of RRFBs.
- *Design Manual* Chapter 1330, which includes policy guidance and documentation requirements for the use of RRFBs on state highways.
- *Design Manual* Chapter 1320, which includes policy guidance and requirements for multilane roundabout crossing enhancements.
- WSDOT Illumination, Signals, and ITS Plan Sheet Library, including Rectangular Rapid Flashing Beacon (RRFB) Details and Pedestrian Crossing Details (IS-22 and IS-23) for system layouts.

When RRFB's are selected, use Exhibit 4-3 for placement or location of beacons for different lane configurations and median situations.

Exhibit 4-3 Rectangular Rapid Flashing Beacon Placement on State Highways

Roadway Configuration			Placement			
Traffic Direction	Number of Lanes in One Direction	Median Present (note 1)	Right Shoulder	Left Shoulder	Median (note 1)	Overhead
One-way	Two	N/A	X	X		
	Three	N/A	X	X		Note 3
Two-way	One	N/A	X	X		
	Two	Yes	X		X	
		No	X			Note 3
Roundabout Approach	Two	Yes	X	Note 2	X (Note 2)	
	Three	Yes	X	Note 2	X (Note 2)	Note 3

Notes:

1. Median includes open medians, median islands, pedestrian refuge islands, and roundabout approach splitter islands; medians must be wide enough to meet sign clearance illustrated in Standard Plan G-20.10-03.
2. For one-way roundabout approaches, such as a freeway off-ramp, the left side beacon shall be installed on the left shoulder, since no splitter island is present.
3. Consider overhead installation as a supplement to ground-mounted signs and beacons.
4. For purposes of evaluating the number of lanes in one direction of a roundabout, a multilane roundabout lane segment is defined as an entry or exit that includes two or more vehicle lanes, and pedestrians are required to cross multiple lanes in a single stage.

4-6.5 Pedestrian Hybrid Beacon

A pedestrian hybrid beacon (PHB) is a special type of beacon used to warn and control traffic at an unsignalized location to assist pedestrians in crossing a street or highway at a marked crosswalk. PHB systems, sometimes referred to as “HAWK” (High Intensity Activated Crosswalk) signal, are effectively identical to a conventional pedestrian traffic signal with the following exceptions: They use a specialized arrangement of signal displays, there is no vehicle detection, and the phase sequence is different.

- The Manual on Uniform Traffic Control Devices, Chapter 4J, outlines requirements and guidance on the use of PHBs.
- *Design Manual* Chapter 1330 regarding the use of Pedestrian Hybrid Beacons and documentation requirements for use on State Highways.

4-6.6 Reducing Crossing Conflicts

Reduced conflict intersection crossing is when a vehicle-to-vehicle and vehicle-to-active transportation user interaction is eliminated or modified. Reducing conflicts is typically done by eliminating vehicle movements, such as mainline right and left turns, or restricting minor street movements. These approaches can work well within corridors with a good local grid network and lower volume intersecting streets because some traffic may be redirected. The most common method is by installing a center median refuge island through the intersection, including median cut-throughs, and often include beacon (e.g., RRFB) or signalized crossings.

Reducing conflicts may include roundabouts, other alternative intersections, or roadway reallocation. See Section 4-7.7 for roadway reallocation and *Design Manual* Chapter 1300 and 1320 for alternative intersections and roundabouts, respectively.

California Street and Broadway, Everett

N 100th Street at Greenwood Ave, Seattle
Source: City of Seattle

7th Ave at Plum Street, Olympia
Source: Google

4-6.7 Roadway Reallocation

Wide street crossings can be major impediments to pedestrian access, and connectivity, and increase crash potential; therefore, an effective countermeasure for pedestrians is a roadway reallocation. A roadway reallocation, sometimes referred to as a road diet or roadway reconfiguration, offers several high-value improvements at a low cost when applied to traditional undivided highways. The primary benefits include reduced crossing distance, space for separated travel, mobility, and access for road users and a "complete streets" environment to accommodate a variety of transportation modes.

NCHRP Research Report 1036: Roadway Cross-Section Reallocation: A Guide, provides a decision-making framework for how to reallocate roadway cross sections.

A FHWA report (HRT-08-063) suggests in rural and suburban areas, lane narrowing can reduce intersection crash potential by reducing traffic speeds and improving conspicuity of intersections.

Roadway reallocation benefits include a crash reduction of 19 to 47 percent of all crashes, all severities according to FHWA's Publication SA-18-066. Roadway reallocations also result in reduced vehicle speed differential, improved mobility and access for all road users, and integration of the roadway into surrounding uses that results in an enhanced quality of life.

Benefits of Roadway reallocation

Four to three lane roadway conversions have documented crash reductions from 19 to 47 percent according to FHWA

What about traffic volume?

NACTO advises roads with traffic volumes of 25,000 or less are good candidates for road reallocations. City of Seattle has successfully implemented projects on roads greater than 20,000 vehicles per day. Reports on City of Seattle's road diets are available on their reports and studies website.

The key is to understand the purpose and need for intervention, understand community priorities, and communicate tradeoffs such as increased side street delays. Often communities are willing to trade some additional peak hour congestion for safer more livable roads.

4-6.8 Roundabouts

Roundabouts are near-circular intersections at grade. They are an effective intersection type with fewer conflict points and lower speeds, and they provide easier decision-making than other intersection types. They also require less maintenance than traffic signals. Well-designed roundabouts have been found to reduce crashes (especially fatal and severe injury collisions), traffic delays, fuel consumption, and air pollution. They also have a traffic-calming effect by reducing vehicle speeds using geometric design rather than relying solely on traffic control devices. Exhibit 4-4 identifies crossing enhancements for roundabouts based upon land use and lane configuration.

Exhibit 4-4 Roundabout Crossing Enhancements

Lane Approach or Exit Segment	Land Use Area	Crosswalk Marking and Signs	Other Enhancements
Single Lane	Rural and Natural Areas	Optional	See notes 1 and 2
Single Lane	All urban and population centers	Yes	See note 2
Multilane	Rural and Natural Areas	Optional	See notes 1 and 3
Multilane	All urban and population centers	Yes	See note 3

NOTES

1. Provide crosswalk markings and signing if a pedestrian access route exists. A shoulder is not considered a pedestrian access route.
2. For single lane roundabouts, there may be locations where additional enhancements may be considered based upon transportation context, land use context, and intersection geometry.
3. Additional enhancements may be required. See *Design Manual* 1320.05(3(e).
4. For purposes of evaluating pedestrian crossing enhancements, a multilane roundabout lane segment is defined as an entry or exit that includes two or more vehicle lanes, and pedestrians are required to cross multiple lanes in a single stage.

4-6.9 Corridor Speed Management

Motor vehicle corridor and turning speed influences driver reaction time, stopping distance, and the likelihood that drivers will yield to pedestrians at uncontrolled crossings, and is one of the six functional characteristics influencing transportation user comfort and safety. Speed management strategies may be used corridor-wide, at targeted locations, and at intersections. When considering the use of speed management enhancements, consult the following design, guidance, and policy resources:

- *Design Manual* Chapter 1103.05(1) Speed Management.
- *Design Manual* Chapter 1310.03 Designing for Active Transportation
- Traffic Manual Section 6-4, Regulating Speed Limits
- *FHWA Speed Management Reference Materials.*

4-6.10 Resources for crossing enhancements

A variety of resources are available to support the evaluation and selection of pedestrian crossing enhancements. These include national guidance, state design manuals, and research-based tools that provide information on treatment effectiveness, appropriate applications, and design considerations. These resources can be used to supplement site-specific evaluation and help identify strategies that address the unique conditions and needs of each crossing location.

- WSDOT *Design Manual*
- WSDOT *Traffic Manual*
- Manual on Uniform Traffic Control Devices, Federal Highway Administration. https://wsdot.wa.gov/engineering-standards/all-manuals-and-standards/manuals/manual-uniform-traffic-control-devices-mutcd.
- Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations, Federal Highway Administration, 2018. Safe Transportation for Every Pedestrian (STEP) | FHWA
- Toolbox of Pedestrian Countermeasures and Their Potential Effectiveness, Federal Highway Administration, 2018. https://highways.dot.gov/safety/pedestrian-bicyclist/safety-tools/toolbox-pedestrian-countermeasures-and-their-potential
- Proven Safety Countermeasures, Federal Highway Administration. https://highways.dot.gov/safety/proven-safety-countermeasures.
- Pedestrian Safety Guide and Countermeasure Selection System (PEDSAFE), Federal Highway Administration. www.pedbikesafe.org/pedsafe/.
- Pedestrian and Bicycle Information Center (pedbikeinfo), Federal Highway Administration. www.pedbikeinfo.org/.
- *Low-cost pedestrian safety zones: countermeasure selection resource*, Dunlap and Associates, Inc., UNC Highway Safety Research Center, and Center for Education and Research in Safety. 2023

4-7 Public Transportation

The need for public transportation in Washington continues to grow in many ways. Washington is a diverse state with various public transportation markets such as urban and rural, commuter and off-peak, regional and local; and services, such as fixed-route, on-demand, telework, demand management tools and more.

Washington's economy benefits demonstrably from public transportation's contribution to access, mobility, and capacity of the transportation system.

The 2015 WSDOT Corridor Capacity Report noted that delays on state highways cost Washington citizens and businesses over $800 million in 2014.13 By increasing the person-carrying capacity of our roadways, public transportation supports the speed and reliability of freight movement critical to our statewide economy, and reduces crash potential by lowering the amount of vehicles on the roadway.

Public transportation also benefits the financial well-being of individuals in Washington State. According to the American Public Transportation Association, a person who lives in Seattle can save about $15,000 a year by simply switching from driving to riding the bus. Transit is also important to support growth; space is currency as the transportation system strains from traffic demands. Transit will increase in importance as communities, transit agencies, local agencies, and WSDOT examine ways to maximize the efficiency of the existing transportation system. Exhibit 4-5 illustrates the space needed for different transportation modes.

A robust public transportation network can also support the development of compact, walkable, bikeable communities with lower infrastructure demands and can create hubs of activity that support local economies.

Primary Goal of Public Transportation

Baseline needs of transit capital projects on urban WSDOT right-of-way can relate to travel time and reliability of service. It may also be to provide access to key destinations, such as schools, hospitals, recreational destinations, or places of business.

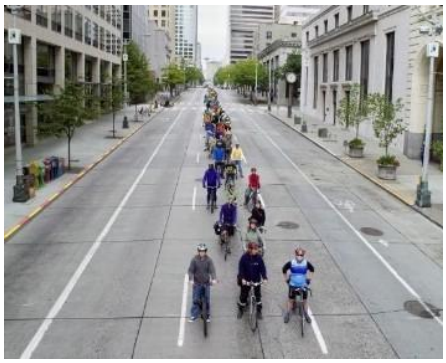
Public Transportation Definition

Public Transportation includes a broad array of transportation services and systems, public and private, that are accessible and available to the public and do not involve a single person in a motorized vehicle.

Exhibit 4-5 Illustration of 200 people using different transportation modes, and illustrates the space usage by different transportation modes

200 people in 177 cars
Source: ISS

200 people in 3 Buses
Source: ISS

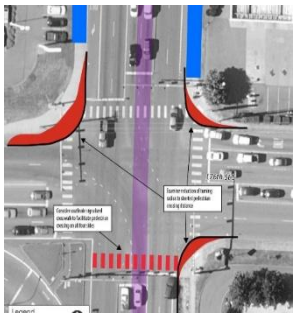


200 people on bikes
Source: ISS

200 People on one light rail train
Source: ISS

4-7.1 Public Transportation Design Considerations

Extend biking and walking routes
Source: WSP



Improved Intersections
Source: WSP

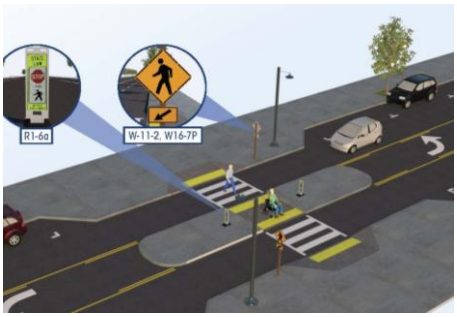
Storm drainage
Source: Metro

Pedestrian Lighting
Source: Riverside Transit Agency

Fix old Infrastructure
Source: National Complete Streets Coalition

Placemaking
Source: National Complete Streets Coalition

Bike Storage
Source: King County Metro



Enhanced crossings
Source: FHWA

Complete transit stops
Source: National Complete Streets Coalition

Traffic Signal Queue Jump

Roundabout Queue Jump
Source: Lochner

4-7.2 High Priority Bus Corridor Considerations

Transit agencies in Washington are implementing high-priority Bus Rapid corridors and other bus speed and reliability treatments on state highways. Treatments such as transit signal priority (TSP), Business Access and Transit (BAT) lanes, and bus queue jumps are part of creating effective bus service, which increases the person-carrying capacity of WSDOT facilities cost-effectively, meeting WSDOT's strategic vision.

Consider public transportation agencies as partners working toward common goals. While mindful of key topics such as safety and ongoing operating costs, work with transit agencies to support the WSDOT overall mission and vision. Public transportation projects differ from private development or WSDOT projects in that the former generate vehicle trips or expand system capacity, while transit projects may reduce vehicle trips and increase the people-moving capacity of the highway. When working with public transportation partners, also consider the following while developing rapid transit systems on state highways:

What is Bus Rapid Transit?

BRT can best be described as a combination of facility, systems, and vehicle investments that convert conventional bus services into fixed-facility transit service, greatly increasing their efficiency and effectiveness to the end user.

What are baseline needs for transit projects?

- Reducing transit travel time
- Increasing transit reliability
- Improving transit connections
- Improving transit priority
- Improving pedestrian and bicycle access to stations
- Enhancing system identity
- Increasing travel comfort
- Enhancing safety and security

Issue Resolution

Identify processes to navigate issues as they arise to minimize effects on scope, schedule, and budget. This would be a multi-agency process and should include all WSDOT offices involved, such as WSDOT regions, Public Transportation Division, and the HQ Transportation Operations Division.

Practical Solutions

Follow the intent of the *Design Manual* Practical Solutions Section 1100 in defining the project purpose and context. It is essential to work with the transit agency to define baseline needs and measures, such as transit travel time, transit reliability, transit priority, pedestrian access to stations, connectivity between transit routes, and safety. Contextual needs should include examination of existing general purpose vehicle travel, impacts to active transportation travel/safety, and existing/planned land use.

Performance Measures

Identify key performance measures that will guide the collaborative selection of alternatives. *Design Manual* Chapter 1101 provides guidance on defining baseline needs, performance metrics, and contextual needs. When considering performance metrics, consider transportation measures beyond vehicle-based capacity analysis.

Coordination is necessary to communicate expectations, reduce misunderstandings, and promote efficiency and quality control. This helps reduce unexpected issues, delays, and extra costs.

Design Considerations

- Rapid transit systems may run in a dedicated pathway separate from the general-purpose lanes of traffic. As such, they are expected to run independently of other traffic. At intersections, however, buses must interact with general traffic.
- High-priority transit corridors may need priority or pre-emption at signalized intersections.
- Roundabouts have shown efficiencies, serious and fatal injury crash reductions, and travel time improvements when applied as corridor improvements. This may allow for narrower cross sections between intersections that can be re-allocated to other modes, such as bus lanes.
- Pedestrian and bicycle crossings are an important aspect of public transportation systems, especially for connecting to other routes, light rail, or other public transportation or bike share systems. Additional midblock or enhanced crossings may be necessary.
- Coach dimensions vary, and their turning radii can affect intersection design and interaction with general traffic. For example, an articulated bus typically has a tighter turning radius than the 40-foot coaches. The designer needs to check with local transit agency to get information to use in modeling swept paths. AutoTURN default inputs may not always represent coach turning movements.
- Consider opportunities to increase the number of, and improve the safety and convenience of, active transportation facilities on and adjacent to these routes, including first and last-mile connections.

Operations and Maintenance

- Identify infrastructure elements and agency maintenance responsibilities. Responsibilities should be included in an intergovernmental agreement.

4-7.3 Public Transportation References

- Statewide Human Services Transportation Plan (HSTP)
- Washington State Public Transportation Plan
- Transportation Demand Management Strategic Plan
- Transit Street Design Guide, National Association of City Transportation Officials
- Manual on Pedestrian and Bicycle Connections to Transit, Federal Transit Administration, 2017
- TCRP Synthesis 117, Better On-Street Bus Stops, Transportation Research Board, 2015
- TCRP Report 183, A Guidebook on Transit-Supportive Roadway Strategies, Transportation Research Board, 2016
- TCRP Synthesis 169, Pedestrian and Bicycle Safety in Bus Rapid Transit and High Priority Bus Corridors, Transportation Research Board, 2023
- TCRP Report 207, Fast-Tracked: A Tactical Transit Study, Transportation Research Board, 2019

4-8 Freight Transportation

Every day, people stop by a store to pick up what they need. Virtually every business and household depends on freight delivery for shipping and receiving goods, in many cases multiple times a day. The growth of e-commerce has increased the simplicity of purchasing products and masks the details of a complicated system that permits and sustains such activity. Freight transportation and goods movement involve a complex and dynamic network of logistics and supply chains and rely on the multimodal transportation system.

On a per capita basis, Washington is the second- most trade-dependent state in the nation, behind Michigan, with total imports and exports valued at $126.8 billion.- 2017 Washington State Freight. It underpins the national and state economies, supports national defense, directly sustains hundreds of thousands of jobs, and delivers the daily necessities of life to residents.

As the population grows, freight traffic and distribution of products will grow to adapt as the ways to order and deliver goods and services change. Freight traffic in Washington State is expected to grow by about 30 percent by 2035.

How WSDOT designs highways could influence freight mobility? This section will cover two concepts: 1) background on the freight network in Washington State, and 2) Examples of design considerations when dealing with freight as part of the multimodal network.

4-8.1 Freight Transportation System

The following is an introduction to the various freight networks in Washington State. These networks will help define modal priorities and context for the project. See *Design Manual* Chapter 1102 for context determination guidance.

A. National Multimodal Freight Network (interim)

In 2016, USDOT established the Interim National Multimodal Freight Network (NMFN). This network, when finalized, is intended to inform freight transportation planning and funding processes. NFMN maps for Washington State are available from the USDOT.

B. National Highway System

The National Highway System (NHS) is considered the backbone of the nation's economy, as well as being critical to its defense and mobility networks. The NHS is an important component of the eligibility criteria for the Nationally Significant Freight and Highway Projects Program for highway or bridge projects. A total of 4,556 centerline miles are designated as NHS routes in Washington, including 3,577 miles of state highways and 979 miles of local roads. Subsets of the NHS include:

Intermodal Connectors. These highways provide access between major intermodal facilities and the other four subsystems making up the National Highway System. There are 87 designated NHS intermodal connectors in Washington, some of which are freight-related. Port intermodal connectors are the most common type of freight intermodal connector representing 45 percent of all NHS intermodal connectors in the state.

Strategic Highway Network. The Strategic Highway Network (STRAHNET) is a designated national network that is important to national strategic defense and used for emergency mobilization and peacetime movement of military vehicles. This 63,000- mile network provides defense access, continuity, and emergency capabilities for defense purposes. This network is a component of the NHS.

C. National Highway Freight Network

In 2015, USDOT established the National Highway Freight Network (NHFN) in consultation with WSDOT and other partners to strategically direct federal resources and policies toward improved performance of highway portions of the U.S. freight transportation system.

Components of the NHFN include:

- Primary Highway Freight Systems (PHFS) is a network of highways identified as the most critical highway portions of the U.S. freight transportation system, determined by measurable and objective national data. The network consists of 41,518 centerlines miles, including 37,436 centerline miles of Interstate and 4,082 centerline miles of non-Interstate roads.
- Non-Primary Highway Freight Systems (non-PHFS). These highways consist of the remaining portion of Interstate roads not included in the PHFS. These routes provide important continuity and access to freight transportation facilities. These portions amount to an estimated 9,843 centerline miles of Interstate, nationwide, and will fluctuate with additions and deletions to the Interstate Highway System

- Critical Rural Freight Corridors (CRFC). These are public roads not in an urbanized area which provide access and connection to the PHFS and the Interstate with other important ports, public transportation facilities, or other intermodal freight facilities. Nationwide, there are 4,412 centerline miles designated as CRFCs.
- Critical Urban Freight Corridors (CUFC). These are public roads in urbanized areas which provide access and connection to the PHFS and the Interstate with other ports, public transportation facilities, or other intermodal transportation facilities. Nationwide, there are 2,213 centerline miles designated as CUFCs.

D. Freight and Goods Transportation System

The Freight and Goods Transportation System (FGTS) is a Washington-specific designation system, separate from the national designation. FGTS truck corridors classifies all highways, county roads, and city streets by reported annual gross truck tonnage, ranging from T-1, with the highest tonnage, to T-5, with the least tonnage. Corridor classification and maps can be found at the WSDOT interactive maps.

E. Truck Freight Economic Corridors

The designations were built on the FGTS classification by considering resiliency and first-mile and last-mile connectivity. A truck freight economic corridor designation helps inform how freight connectors are being used by industry, and inform future planning efforts to identify the needs and opportunities for improving those connectors. The Truck Freight Economic Corridors include the following components:

- High volume truck corridors: T-1 and T-2 freight corridors (as defined in the FGTS) carrying at least 4 million tons of gross truck tonnage per year.
- Alternate freight routes: routes that serve as alternatives to primary cross-state freight routes during severe weather or other disruptions to increase freight system resiliency.
- First-mile or last-mile connector routes: routes that connect freight intensive land uses to high volume and alternate routes. These routes provide important freight linkage to strategic national defense facilities, significant intermodal facilities, warehouse districts, industrial land and distribution centers, and agricultural processing centers.

4-8.2 Types of Commercial Vehicles

Trucks and buses come in a variety of sizes. These sizes and overall dimensions are dictated by the type of transit route or goods and materials being transported. Trucks typically range from 8.5 to 10.0 feet wide, and with permits, can be even wider.

The American Association of State Highway and Transportation Officials (AASHTO) has classified the most common-sized trucks on United States roadways based either on the overall length of the vehicle (buses and single unit trucks) or vehicle wheel base (tractor- trailers). The classifications include, but are not limited to:

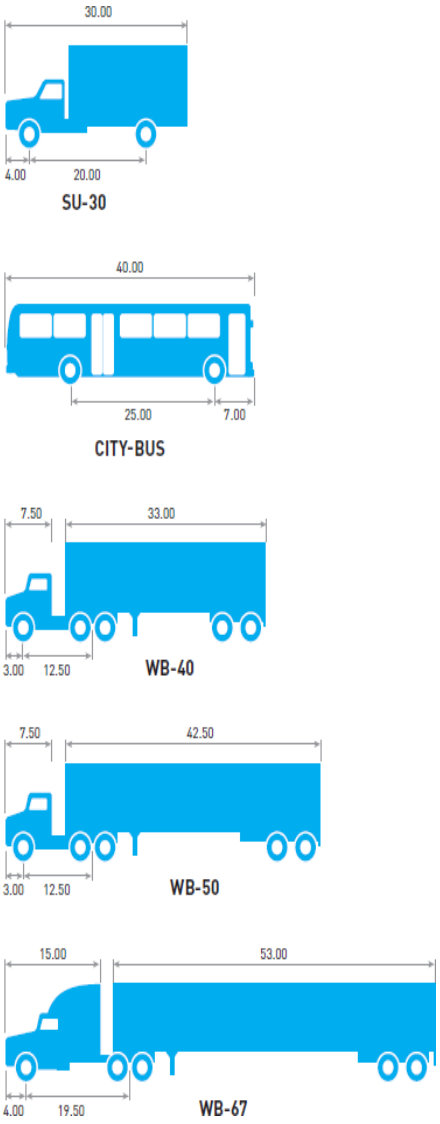
- SU-30: 30.0-foot, single-unit vehicles typical of most local delivery vehicles.
- WB-40 and WB-50: small tractor trailers with wheelbases in the 40.0-foot and 50.0-foot range.
- WB-67: 67-foot wheelbase long haul trucks, sometimes called the interstate design vehicle, which has an overall length of 74.0 feet.

Transit agencies operate a wide variety of city buses. For purposes of determining the swept path contact transit agencies affected by the project to city bus dimensions and turning specifications.

Other vehicles include various emergency vehicles and public works maintenance trucks.

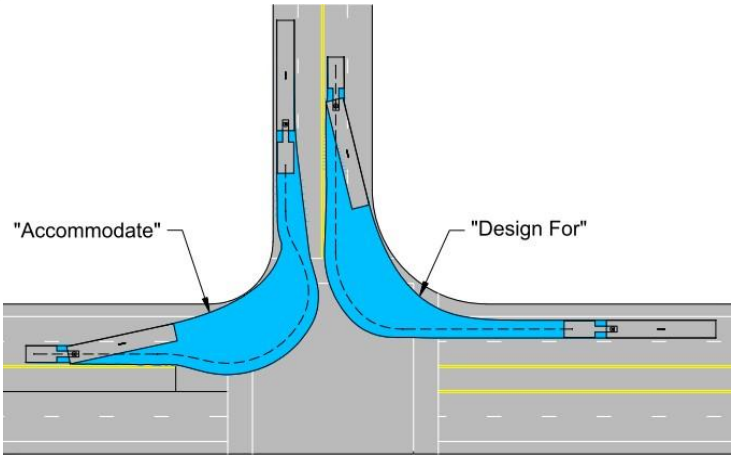
The figure on this page shows the typical dimensions of the most commonly used AASHTO design vehicles.

Additional information on these and other design vehicles can be found in the AASHTO Policy on Geometric Design of Highways and Streets.



4-8.3 Designing versus Accommodating Vehicles

Selection of design vehicles is discussed in *Design Manual* 1103 and 1310. In selecting the appropriate design vehicle, many factors such as the number and type of trucks, functional classification of the highway, transit use, pedestrians, and bicyclists shall be considered. See *Design Manual* Chapter 1102 for guidance on defining project context.



Designing for vs. Accommodating
Source: City of Seattle

The concept of design vehicle involves providing a path for the vehicle that is free of encroachments upon other lanes and facilities, such as sidewalks. The Design Vehicle is the largest typical vehicle that will commonly use the street. It is acceptable for the design vehicle to use all the first lane and part of the second lane of the receiving street. In multilane roundabouts, it is considered "designing" for large trucks to take both lanes to navigate the roundabout.

Providing a design that accommodates a vehicle means that some level of encroachment upon other lanes is inevitable for the vehicle to make a particular movement. The accommodated vehicle is the largest vehicle that will rarely use the street. It is expected to use mountable elements and may enter the lane adjacent to its lane of origin. The decision to design or accommodate will be based upon the context of the highway/intersection under consideration. A balanced design approach takes into consideration more than just the amount of room required by the design vehicle. For example:

- What is the intended operating speed of the facility?
- What is the context? Designing for the largest but rare vehicle may result in an overdesigned intersection that is not compatible with other modes.
- How does the project design affect pedestrians and bicyclists? For example, large turning radii at intersections may increase the speed of drivers making the turns, and the time it takes to cross the road for pedestrians.

4-8.4 Oversize-Overweight and other unique vehicles

Planning for freight does not end with selecting a standard design vehicle. Other types of freight traffic may be affected by a highway or intersection project. For example, if the highway is near a port, then accommodating very long loads such as wind turbine blades may be necessary. Identifying vehicle types includes reviewing the surrounding land use, transit plans, and community input. Contact the Rail, Freight, and Ports Division and Commercial Vehicle Services to obtain information on how unique freight could possible effect the project site.

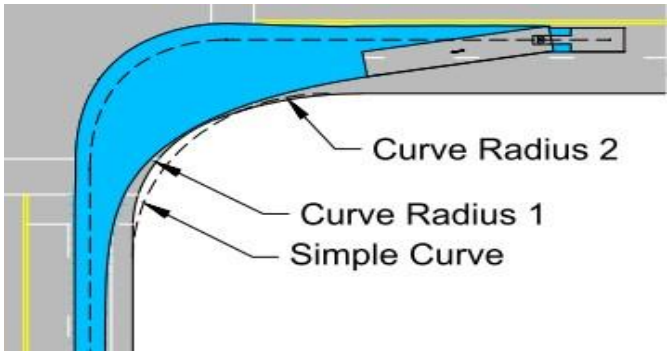
Truck with Wind Turbine
Source: Washington Public Ports Association

4-8.5 Design Considerations

A. Multi-centered corners (compound curves)

When trucks turn, particularly tractor-trailers, they sweep a path that can best be simulated by a series of curves. A simplified approach shown by the figure to the right would use two or three compound curves to best match the pathway of the truck. By using this approach, the full swept path of the design vehicle can be designed for larger vehicles checked for accommodation, if appropriate, while still minimizing the amount of roadway surface.

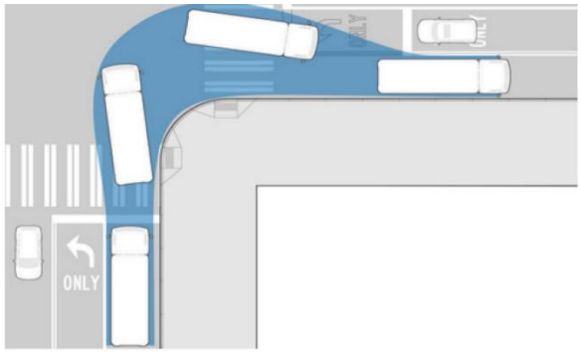
Minimizing roadway surface also manages crossing distances, signal pole arm lengths, maintenance, improves the distance vehicles travel through the intersection, and reduces project cost. These designs also allow for a tighter radius corner, which will help promote speed reduction for drivers of smaller vehicles making the turn. This figure illustrates this. Also see Section 4-6.6 and *Design Manual* Chapter 1310.



Compound Curve
Source: City of Seattle

B. Setback for Stop Line Placement

Signalized intersections can be striped to improve the overall geometry for turning trucks without compromising traffic engineering requirements. Stop bar location on both the street a truck is turning from, as well as the cross street approach the truck driver is turning into, can have a dramatic effect on the accommodation of truck driver turning movements. Moving back the STOP bar can also assist pedestrian crossing movements and allow for a relatively small curb radii.



Stop Line Setback
Source: City of Seattle

C. Mountable Curbs

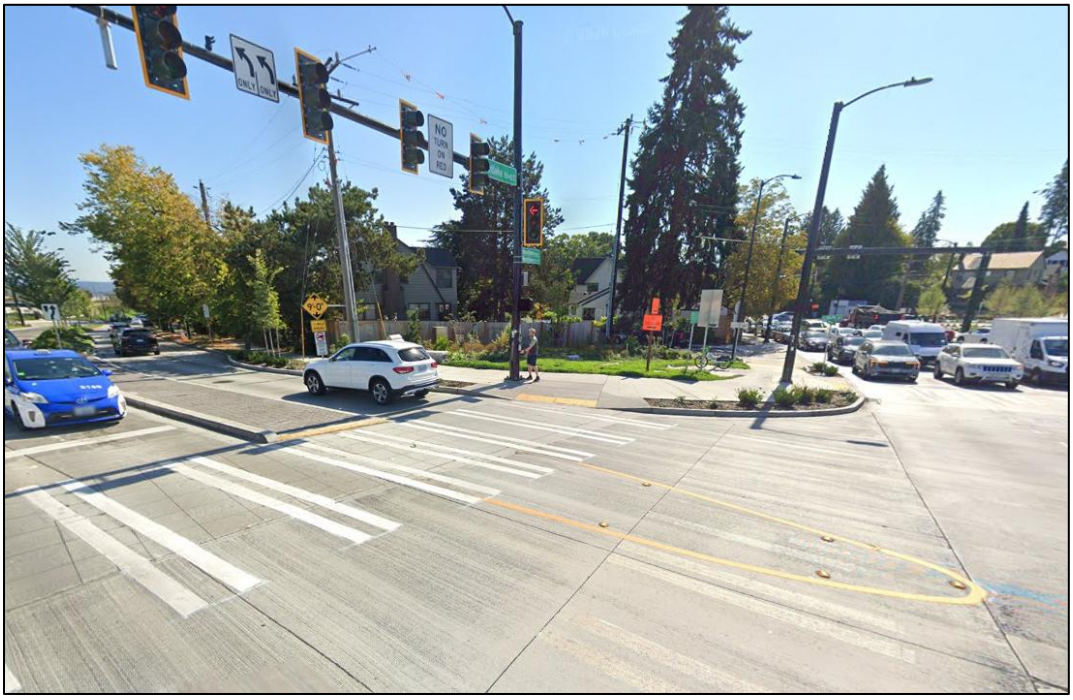
Mountable curbs can provide a means for large vehicles to be more easily accommodated while navigating an intersection. The most common application is for truck aprons, but mountable curbing can be used in many situations where large vehicle accommodation is being considered. Standard Plan F-10.18, which is specific to roundabouts, includes mountable curbing, but may be considered at non-roundabout locations.

Mountable curbing with a truck apron
State Route 520 at 148th Ave NE (Redmond, WA)

D. Center Medians at intersections

Left-turning vehicles are generally subject to more control and conflict management than right-turning vehicles, resulting in more predictable vehicle paths through an intersection. Medians can provide pedestrian refuge, reduce crossing exposure, and help manage vehicle turning movements, particularly at larger intersections. Raised medians and pedestrian refuge islands commonly use vertical curbs; however, these treatments may require additional design consideration to accommodate freight, transit, emergency vehicles, and other larger design vehicles where vehicle encroachment is expected, mountable curbs, traversable treatments, or painted islands may be considered to balance crosswalk benefits with operational needs.

Mountable Median Nose
Regent St at Monroe St, Madison, WI
Source: Google



Painted Median Nose
East Lake Washington Blvd at MontLake Blvd E, Seattle
Source: Google

E. Bicycle Treatments

Bike boxes, bicycle signals, and protected bike lanes can be helpful for routes that are also used as freight routes. See *Design Manual* Chapter 1520 and Part 9 of the MUTCD for additional information on intersection design treatments for bicycles.

F. Roundabouts

Roundabouts have design features or operational characteristics that specifically intend to serve large vehicles:

- Raised but traversable portions of central islands called aprons (commonly called truck aprons) for trucks to use when traversing the roundabout. Aprons are common around the non-traversable portion of a central island and may be integrated as traversable portions of splitter islands. They may also be used on the outside of roundabout entries and exit next to external curbs.
- Mountable curbs are included to provide a means for large vehicles to be more easily accommodated while navigating an intersection
- Designs generally allow buses to stay within the circulatory roadway.
- For multilane roundabouts, designs allow trucks to straddle lanes throughout the roundabout.

Oversize-Overweight (OSOW) vehicles often have one or more characteristics that influence roundabout planning and design:

- Long wheelbases that result in a larger swept path than those of a standard truck.
- Larger overswing that extends beyond the curbs, impacting signs, poles, and other street appurtenances.

OSOW vehicles may require special consideration during roundabout design because the geometric features used to manage vehicle speeds and define travel paths may not accommodate all permitted vehicle movements. In most cases, OSOW vehicles are checked rather than considered as design vehicles and may be accommodated through a combination of truck aprons, bypass lanes, central island crossings, or other context-sensitive design features. The selected strategy should balance the accommodation needs of permitted vehicles with the roundabout's intended safety, operational, multimodal, and maintenance objectives.

The following includes a series of examples of different strategies to accommodate large vehicles at roundabouts.

Approach by-pass
US 20, Sisters, Oregon
Source: Google

Truck Apron
SR 9 at SR 542, Whatcom County, WA
Source: Google

Danby Street/Wembley Street
Fairbanks, Alaska
Source: Google Earth

Mid Valley Drive/Scheuring Road
Green Bay Wisconsin
Source: Google Earth

County Road T/I-94 Westbound Ramps
Saint Croix County, Wisconsin
Source: Google Earth