Transportation Design Manual and Complete Streets Guide

Volume 1

Part 1

Transportation Design Standards

City of Bellevue

Transportation Design Standards

Prepared by the City of Bellevue, Washington

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ABBREVIATIONS/ACRONYMS

» AASHTO – American Association of State Highway and Transportation Officials

» ADA – Americans with Disabilities Act

» ADT – Average Daily Traffic

» APS – Accessible Pedestrian Signal

» APWA – American Public Works Association

» ASTM – American Society for Testing and Materials

» BBL – Buffered Bike Lane

» CBL – Conventional Bike Lane

» CO – Certificate of Occupancy

» DC – Predevelopment Review

» FHWA – Federal Highway Administration

» HMA – Hot Mix Asphalt

» ISD – Intersection Sight Distance

» LRFD – Load and Resistance Factor Design

» LTS – Level of Traffic Stress

» MEF – Maximum Extent Possible

» MIP – Mobility Implementation Plan

» MUTCD – Manual on Uniform Traffic Control Devices

» NACTO – National Association of City Transportation Officials

» PAR – Pedestrian-Accessible Route

» PC – Point of Curvature

» PROWAG – Public Right of Way Accessibility Guidelines

» PSD – Pedestrian Sight Distance

» PT – Point of Tangency

» SBL – Separated Bike Lane

» SCATS – Sydney Coordinated Adaptive Traffic System

» SMP – Speed Management Plan

» SSD – Stopping Sight Distance

» SWF – Small Wireless Facility

» TCO – Temporary Certificate of Occupancy

» TIA – Transportation Impact Analysis

» TOD – Transit Oriented Development

» TRB – Transportation Research Board

» WSDOT – Washington State Department of Transportation

1 Introduction and General Consideration (Requirements)

The City of Bellevue has adopted this Transportation Engineering Design Standards Manual to require the standardization of design elements for consistency and to assure that public safety needs are met. This manual contains engineering standards for use by professional civil engineers with experience in street and roadway design when designing facilities within the City of Bellevue. The information contained in this manual cannot provide for all situations and conditions that may be encountered. Specific provisions contained within this manual may not be appropriate for all locations and existing conditions. These standards are intended to assist, but not substitute for, competent work by professional civil engineers. The design requirements contained within this manual do not set legal standards of care but provide guidance for possible engineering treatment under some circumstances. Compliance with these standards does not alleviate the design engineer from using sound professional engineering practices and meeting the requirements of the specific utility in question. The design criteria contained herein are the minimum acceptable under standard conditions. Special conditions may require more stringent requirements that will be addressed during the plan review process.

References and Authority

The Transportation Department Director is authorized by the Transportation Development Code, BCC 14.60.40, to prepare, adopt and update design standards to establish minimum requirements for the design and construction of transportation facilities and requirements for protecting existing facilities during construction. The standards contained in this design manual constitute the design standards authorized by BCC 14.60.021. These standards are intended to be consistent with the most currently adopted provisions and editions of the Bellevue City Code, the Comprehensive Plan and the publications cited in the appendices of this manual.

Meaning of Terms

The definitions of words and phrases as contained in BCC 14.60 are hereby incorporated by reference.

Professional Qualifications

Professionals in the technical fields of civil engineering with transportation experience, structural engineering, electrical engineering, geotechnical engineering, landscape architecture, soils engineering and surveying who prepare or are responsible for the preparation of drawings, plans, specifications or technical reports for obtaining permits and approvals shall be currently licensed or registered in the state of Washington. These

professionals shall be qualified with both experience and educational background in the technical areas as warranted by the specifics of the proposed project.

City of Bellevue Planning Documents

1. Comprehensive Plan | City of Bellevue
2. Mobility Implementation Plan
3. 2009 Bicycle Pedestrian Transportation Plan
4. Downtown Transportation Plan
5. Transit Master Plan
6. Transportation Improvement Plan
7. Transportation Capital Improvement Program Plan
8. Transportation Facilities Plan
9. Vision Zero Strategic Plan

1.1 Engineering Plans

Engineering plans for transportation improvements shall be prepared and submitted for review and approval. All plans must be prepared, signed and stamped by a professional civil engineer with experience in transportation and roadway design and licensed in the state of Washington. The plans shall clearly identify all existing and proposed improvements and meet the submittal requirements for the type of plan. Refer to the City of Bellevue Preliminary Civil and Traffic Plans Requirements for details. For more information, see Appendix E and visit the following link: https://bellevuewa.gov/sites/default/files/media/file/2020/Preliminary%20Civil%20Plans%20Requirements.pdf.

The civil engineering plans shall be the controlling document on the design of all frontage improvements features. Sidewalk grading details, utilities vaults, landscape elements, street furniture, public art and any other architectural and landscape elements within the public sidewalk area must be shown on the civil engineering plans and must be signed and sealed by the professional civil engineer who prepared the plans.

After receiving comments from the City, the Design Engineer, whose signature and seal will appear on the civil engineering drawings, should provide with each review submittal a comment response letter with responses to all of the reviewers' comments in addition to a statement that confirms the following:

- The standards, codes and criteria applicable to the design have been observed.
- The design team has implemented a QA/QC Plan in which the designs, computations, drawings and other elements have been checked thoroughly and back-checked before submitting the documents to the City.

Electronic copies of the Record Drawings shall be provided after construction is approved. These plans shall include field-verified elevations, slopes and dimensions for curblines, sidewalks, ramps and other features in the right of way or public sidewalk easements.

1.2 Technical References

In addition to the standards and design criteria in this design manual and in the Bellevue City Code, decisions regarding sight distance, horizontal and vertical alignment, signage and other criteria appropriate for the design of city streets shall be consistent with the current versions of the following documents.

1. American Association of State Highway and Transportation Officials (AASHTO), A Policy on Geometric Design of Highways and Streets (Green Book, current version)
2. AASHTO, Load and Resistance Factor Design [AASHTO LRFD] Bridge Design Specifications
3. AASHTO, Guide for Design of Pavement Structures
4. AASHTO, Guide to the Development of Bicycle Facilities
5. AASHTO, Guide for Planning, Design and Operation of Pedestrian Facilities
6. AASHTO, Roadside Design Guide
7. American Society for Testing and Materials (ASTM)
8. Americans with Disabilities Act (ADA)
9. Public Right of Way Accessibility Guidelines (PROWAG)
10. Federal Highway Administration (FHWA), Manual on Uniform Traffic Control Devices (MUTCD)
11. National Association of City Transportation Officials (NACTO) Urban Street Design Guideline
12. NACTO, Urban Bikeway Design Guide
13. Transit Street Design Guide
14. Transportation Research Board (TRB), Highway Capacity Manual

15. WSDOT Design Manual
16. WSDOT Bridge Design Manual Load and Resistance Factor Design (LRFD)
17. WSDOT Geotechnical Design Manual

1.3 Specifications

Projects shall use the most recent City-adopted version of the Washington State Department of Transportation (WSDOT) Standard Specifications for Road, Bridge, and Municipal Construction (Standard Specifications) as supplemented or amended by the Washington State Chapter of the American Public Works Association (APWA); City of Bellevue General Special Provisions; Work Order General Notes; general or site-specific notes referenced on the plan set; other City design manuals or policies; or the Design Engineer's site-specific edits.

1.4 Deviations and Exceptions to the Standards and Requirements

Except as provided elsewhere in other city codes or resolutions, deviation from this design manual may be requested to the City based upon specific project constraints. Alternative designs may be allowed if they are based on accepted standards of engineering practices like AASHTO Policy on Geometric Design of Highways and Streets, WSDOT's Design Manual, National Association of City Transportation Officials (NACTO) publications, Public Rights-of-Way Accessibility Guidelines (PROWAG) and ADA requirements or other supporting manuals where specific project circumstances do not allow application of the standards and requirements of this design manual. Deviations from these standards may be granted by the Transportation Department Director or the Director's designated representative.

Before applying for deviation, exception, or maximum extent feasible (MEF), the Design Engineer shall clearly demonstrate the engineering design standard for which the deviation is being sought is not physically or technically possible, would have undesirable impacts to public or private infrastructure and property or would impact critical areas. If the applicant chooses to apply for a deviation, the City process below will be followed.

1. A design deviation from the City's standards may be requested by filling out the City of Bellevue Design Justification Form. All the applicable engineering justification documents to support the deviation shall be attached to the form. The deviation and supporting justification documents must be signed and sealed by a professional engineer licensed in the state of Washington with experience in the area of transportation engineering.
2. The responsibility of the Design Engineer and/or applicant is to submit all relevant data, calculations and figures as may be necessary to evaluate a request for

exception, deviation or MEF. All approved exceptions will be given in writing by the Transportation Department Director or the Director's designated representative.

3. The Review Engineer will evaluate the request and notify the applicant by email if additional information and/or modification will be required or with the completion of the development review plans for the current review cycle. Additional City review time may be required in certain circumstances and will be coordinated with the applicant.
4. Requests for deviation, exception and MEF may be submitted during construction if unforeseen physical constraints are identified. In such situations, the Design Engineer shall prepare a revised design that maintains accessibility to the greatest extent practical, and that modification shall be acted upon before constructing the design feature. The Review Engineer will review all modification requests and approve or deny the requested modification.
5. The Transportation Department Director or the Director's designated representative decision to grant, deny or modify the proposed deviation will be based on meeting or exceeding the corresponding City standard for the following applicable criteria:
    a. The functional intent of the design element
    b. The safety factors associated with the design element
    c. The operational concerns associated with the design element
    d. The maintenance concerns associated with the design element
    e. The capacity and/or efficiency of the design element
    f. The design life, historical performance and durability of the design element
    g. The aesthetic and visual impacts of the design element
    h. The cost effectiveness and availability of any replacement components or materials
    i. Consistency with the spirit and purpose of the corresponding City design standard
    j. Demonstration that the environment will not be adversely affected
    k. The design element is supported by published industry standards

1.5 Plans Review Process

When submitting civil engineering plans to the City for review, the following steps are required to ensure a complete submittal and timely approval of civil engineering plans:

Applicants are encouraged to apply for Predevelopment Services Review (DC) permit prior to developing complex design elements. This will ensure that applicants receive early, detailed feedback and direction from City staff on general requirements and concepts prior to developing the design and/or enable them to investigate issues that require in-depth analysis from City staff. The information City staff provides does not constitute a formal approval or permit and is dependent on the level of information received.

1. Prior to submitting the formal permit application, the applicant is required to apply for concurrency determination for the proposed development as per Chapter 14.10, Multimodal Concurrency Code in order to assess development impacts and to determine whether the proposed development meets the City's multimodal concurrency standard. The Multimodal Concurrency Implementation Guide and Application Form can be found at: https://bellevuewa.gov/city-government/departments/transportation/permits-and-standards/transportation-codes.

2. The City will advise on the type and number of permits required for each development project. To start the permitting review process for the Transportation Department, the applicant shall submit the following items electronically through www.MyBuildingPermit.com.

    a. A detailed/engineered plan set that meets the minimum requirements as set forth in the Preliminary Civil Plan Requirements listed in the link below https://bellevuewa.gov/sites/default/files/media/file/2020/Preliminary%20Civil%20Plans%20Requirements.pdf. This plan set must be standalone and independently convey the scope of work without further explanation.

    b. A copy of the conditions of improvement, if available. This may be a Hearing Examiner's report, recorded plat, concomitant agreement, short plat report or recorded short plat, a letter from the Development Service staff or a list of requirements placed on a commercial building permit application, as applicable.

    c. Electronic copies of all required reports and associated documents, including but not limited to, Transportation Impact Analysis Report (TIA), Geotechnical Report, street lighting AGI file and title Report.

    d. If the development project is to be phased, phasing plans must be submitted per the City's requirements.

3. Upon submittal, the plans will be reviewed for conformance with applicable local, state and federal requirements. The City will provide consolidated comments to the contact listed on the application form. The applicant shall make changes to the proposed project based upon the City's comments. Several review iterations may be required. The City will review projects in the order they are received.

4. With each resubmittal, the Design Engineer, whose signature and seal will appear on the civil engineering drawings, should provide a comment response letter with a statement that confirms the following:

    a. The standards, codes and criteria applicable to the design have been observed.

    b. The plans went under an internal QA/QC plan in which the designs, computations, drawings and other elements have been checked thoroughly and back-checked before submitting the documents to the City.

    All final plans, calculations, or reports submitted for review shall be stamped and signed by the professional Engineer.

5. When all City comments and requirements are addressed and resubmitted for review, when required, the City will issue the Staff Report (approval report) in which all requirements and conditions of approval for each City staff member and department are listed. The date of issuance will be followed by a 14-day appeal period for the issuance and the start date of the vesting period will be set.

6. The Review Engineer may start reviewing the Clearing and Grading permit (construction permit) plans submittal if the associated permit is near approval and all the transportation design elements are determined and finalized. Construction plans will be required for review and approval.

7. All proposed public right-of-way dedications and sidewalk and utilities easements shall be dedicated to the City prior to the issuance of the Clearing and Grading permit with the exception of plats and short plats. Refer to Section 14.60.90 and 14.60.100 of the Transportation Development Code for more information on right-of-way dedication and easements and tracts.

8. Prior to finalizing the right-of-way dedication and easements execution, a title report pulled within 30 calendar days of the application will be required to confirm property ownership and to verify that the portions of the property dedicated as right of way and/or easements have been cleared of encumbrances. The applicant is responsible for clearing all encumbrances the City determines to be inconsistent or in conflict with the intended purpose of the dedications. In addition, easement documents, including exhibits and descriptions, will need to be prepared and

submitted by the applicant using the City's standard forms. The applicant will work directly with the City's Real Property Agent to complete the documents.

9. For building permits, the applicant is required to submit a building plan that shows the area at each floor level of the proposed building that is included within the principal outside faces of the exterior walls. The plan is required to calculate transportation impact fees based on the impact fee rate schedule that is in effect at the time of the building permit issuance, or if a building permit is not required, at the time of issuance of the City's decision approving the development. Impact fees shall be payable by the applicant at the time of building permit issuance, or if a building permit is not required, at the time the City issues its decision approving the development.

1.6 Easements and Subsurface Clearance Requirements

Private developments shall grant easements for all public facilities and utilities required to serve the proposed development in accordance with the comprehensive plan and other adopted city plans, including the pedestrian and bicycle transportation plan. Easements may also be necessary for private roads, sidewalks, bicycle and pedestrian facilities, street lighting, traffic control devices or temporary construction needs. Additionally, specific street design features may require slope, wall and drainage easements. Refer to Section 14.60.100 of the Transportation Development Code for more details and requirements.

Furthermore, for sidewalk and utilities easement requirements, the City offers design guidance on subsurface clearance for use in the land use review process relating to proposed improvements within any existing sidewalk and utility easement area and any new sidewalk and utility easement area required to be dedicated to the City as part of a project. In offering this design guidance, the City does not waive its permitting or regulatory authority. An applicant's compliance with the Design Guidance for Subsurface Clearance does not ensure that a particular proposed subsurface improvement will be approved. Refer to Subsurface Clearance Requirements below for more information.

https://bellevuewa.gov/sites/default/files/media/pdf_document/2024/subsurface-clearance-requirements.pdf

1.7 Transportation Impact Analysis Report

A transportation impact analysis, or TIA, is a study of the potential transportation impacts of a development on the surrounding transportation system. The purpose of the study is to document the impacts and recommend on-site and off-site mitigation for those impacts.

A TIA is required for any new development, redevelopment or change of use (including tenant improvements) and should be submitted as part of the first review cycle documents.

The TIA must be prepared by a professional engineer, licensed in the state of Washington with experience in transportation engineering and TIA studies. For more information, refer to the TIA Guidelines.

1.8 Errors and Omissions

At the discretion of the Review Engineer, any significant errors or omissions in the approved plans or information used as a basis for such approvals may constitute grounds for withdrawal of the approvals and/or stoppage of any or all permitted work. It shall be the responsibility of the applicant, developer or contractor to show cause why such work should continue, and to make such changes in plans that may be required by the Review Engineer before the plans are re-approved.

1.9 Revisions to the Transportation Design Manual

Updating the Transportation Design Manual is an ongoing process and revisions may be issued regularly. The addition of new or modified design criteria to the design manual through the revision process does not imply that existing features are deficient in any way, nor does it suggest or mandate immediate engineering review or initiation of new projects.

2 Construction Requirements for Developments

2.1 Construction, Inspection, and Testing Procedure

All work to be done under an approved permit or within the right of way must be performed in a timely manner and conform to applicable City of Bellevue General Special Provisions and Standard Drawings, WSDOT Standard Specifications for Road, Bridge, and Municipal Construction and WSDOT Standard Plans, approved permit conditions and plans, as well as any special provisions required by the City. Failure to comply with these requirements may result in a stop work order, removal and replacement of unacceptable work, seizure of assurance devices or other penalties as established by City ordinance.

All transportation work associated with the permit(s) will need inspection by the City of Bellevue Right of Way inspectors prior to acceptance. The Inspector will monitor for compliance with City standards, codes and project specifications in addition to all approved permit conditions. The Inspector will also verify that existing City infrastructure is protected from damage and safe public access is maintained during construction. Any City assets damaged during the construction of a development project shall be restored to City standards prior to acceptance of the project.

Prior to the start of any transportation work, the applicant and contractor shall contact the ROW Inspector and schedule a preconstruction meeting. It is the responsibility of the developer to ensure all necessary inspections are requested in advance of any work.

The contractor shall have an approved, stamped set of permit plans on site during construction. This must include any post-revisions to the permit set. Required work outside of the scope as shown on the approved plans will require a revision to the permit or shall be constructed under a separate permit(s).

All materials used in the right of way must comply with City of Bellevue Standard Specification. Prior to start of construction, the City of Bellevue may require the developer to provide a manufacturer’s certificate of compliance, the source of supply and/or certified test reports. Certified tests shall be from an independent testing laboratory certified by WSDOT, AASHTO and/or American Concrete Institute. During construction, the City of Bellevue may require additional material testing to ensure any new infrastructure meets the City of Bellevue Standard Specification. All testing must be conducted by a certified testing organization acceptable to the City of Bellevue and shall be conducted at the expense of the permittee or contractor.

2.2 Infrastructure Acceptance Requirements

Upon completion of all required construction, the City will conduct an inspection to confirm that all required transportation infrastructure and conditions of the permit are completed. All defects, outstanding items or noncompliance work will be required to be completed or corrected prior to acceptance of the project. All transportation-related construction will need to be completed and inspected prior to acceptance and closure of the permit. The Transportation Development Review Team reserves the right to support approvals for Temporary Certificate of Occupancy (TCO), Certificate of Occupancy (CO), final plats and final short plats.

2.3 Assurance Device Requirements

Where a project meets the conditions outlined in BCC 14.60.260, the City of Bellevue may allow an assurance device to be in placed in order to support the issuance of a TCO or final short plat/plat permit approvals.

The City of Bellevue has two pre-approved forms for an assurance device: a surety bond and an assignment of savings. Other forms acceptable to the City, as outlined in the BCC 14.60.260, may be accepted upon review and approval of proposed forms.

2.3.1 Performance Assurance Device

A performance assurance device is a guarantee to the City that the developer will complete the required work for the permit as noted on the approved plans. The amount of the performance assurance device will be 150% of the estimated cost of the work to be done as shown on the approved permit. In any event, the assurance amount should not be less than $15,000. The assurance amount will be reviewed and approved by the City of Bellevue Transportation Director or the Director’s designated representative.

2.3.2 Maintenance Assurance Device

A maintenance assurance device provides a warranty to the City for the completed transportation work in the right of way. Per BCC.14.60260 the developer will repair any defects within the warranty period. The warranty period shall be a minimum of 12 months from the date of acceptance. The amount of the maintenance assurance device will be 20% of the estimated cost of the work as shown on the approved permit. In any event, the assurance amount should not be less than $15,000. The assurance amount will be reviewed and approved by the City of Bellevue Transportation Director or the Director’s designated representative.

3 Street Design and Construction

This section provides the geometric building blocks for planning and designing a street by describing the typical cross section elements, outlining parameters associated with horizontal and vertical alignments, providing an overview of intersection design, discussing multi-model facilities design and providing information on accessibility features for curb ramps and additional design elements. Geometric design of roadways shall conform to this manual and to the guidance and recommendations of American Association of State Highway and Transportation Officials' A Policy on Geometric Design of Highways and Streets (AASHTO Policy). It is essential that the designer carefully research the design standards to ensure that the design elements are applicable to the project conditions.

3.1 Design Controls

The selection of basic design controls and criteria occurs very early in the project development process and should consider the needs of all modes of transportation, as well as the community and context in which the project is located. The primary factors in determining street design criteria are street type, design speed, the speed at which the facilities operate, the mix and characteristics of the users, including transit vehicles, pedestrians and bicyclists and the constraints of the surrounding context.

3.1.1 Street Classifications

Each street or roadway is divided into a sub-system based on the way it is used and other characteristics. It is important to understand that travel rarely involves movement along a single roadway. Rather, each trip or sub-trip initiates at a land use, proceeds through a sequence of streets, roads and highways and terminates at a second land use.

The following are the identified types of streets and roads within the City of Bellevue.

3.1.1.1 Major Arterials

Major arterials carry moderate to high traffic volume. They serve major centers of metropolitan areas and provide a high degree of mobility. Abutting land uses can be accessed directly by driveways to specific parcels and at-grade intersections with other roadways. As major arterials are expected to provide a high degree of mobility, access to abutting properties is very restricted. In downtown areas, high intensity office, commercial and ground floor retail with high-rise residential is the typical land use for urban major arterials.

3.1.1.2 Minor Arterials

Minor arterials carry moderate traffic volume. These provide service for trips of moderate length. They interconnect and augment the higher arterial system. They provide intra-

community continuity to connect community centers and facilities. A minor arterial may also serve "through traffic." Access is partially restricted. Moderate intensity office, commercial and high-rise residential units with ground floor retail is the typical land use for minor arterials.

3.1.1.3 Collector Arterials

Urban collector arterials typically are intra-community roadways connecting residential neighborhoods with community centers and facilities. They accumulate traffic from local roadways and distribute that traffic to roadways that are higher in the hierarchy of classification. Access is partially restricted.

3.1.1.4 Local Streets

Local streets carry low-traffic volume. They provide direct access to adjacent uses and interconnect with the other portions of the functional system. There are two types of local streets that can be distinguished within the City of Bellevue. They are listed below:

3.1.1.4.1 Local Residential Streets

Local residential streets provide access to abutting residential land use and are designed to convey residential traffic to higher classification streets. A local street network usually carries no through traffic and includes a series of short, interconnected streets and cul-de-sacs. Local residential streets are not intended to serve truck traffic or through traffic. Typically, local residential streets are not striped with lane markings unless directed by the Review Engineer.

Access for 10 or more single-family lots, or dwelling units, in new subdivisions must be provided by this type of public street, and it shall be within dedicated right of way. Pavement and right-of-way widths for this type of public street in new subdivisions shall be determined by the provision of on-street parking and the number of single-family lots to be served. See Section 3.3, Cross Section Elements for more information on minimum pavement width for this type of street.

3.1.1.4.2 Local Streets in Downtown BelRed and Wilburton Areas

These streets are intended to support mixed use residential and commercial developments. Additional width may be required to provide parking in these areas. Refer to Sections 3.3 and 3.4 of this design manual for more information regarding the cross-section elements and multi-modal requirements. The majority of new streets to be built in BelRed will be this type of local street.

3.1.1.5 Half Streets

Half-streets may be required to be constructed along an edge of development to serve the access and travel needs of the development. These are typically about half of the regular width of the cross section and are permitted as an interim facility pending construction of

the other half of the street by the adjacent development owner. The intent is to have the first developing parcel establish the location and alignment of the street that will eventually serve both parcels. In this situation, the first developing parcel shall construct a half street in accordance with its associated classification or type, including full frontage improvements, drainage and curbs and gutters on both sides. However, the sidewalks and planter strips on the side opposite the development shall not be required. The adjacent parcel will complete the remaining half street and all the required improvements at a later date, when it is developed.

3.1.1.6 Green Streets

Green streets are important streets that connect the street network to parks and open space. Green streets should be considered urban trails and extensions of parks and open spaces. They are important streets for pedestrians and bicyclists and are defined by their curbless design and green elements and infrastructure. The treatments may include sidewalk widening, landscaping, traffic calming and other pedestrian-oriented features. Green streets are designed to give priority to pedestrian circulation and open space over other transportation uses but ensure that emergency response for public safety is not adversely impacted. Their purpose is to enhance and expand public open space, and to reinforce desired land use and transportation patterns on appropriate City street right of way.

3.1.1.7 Shared Streets

Shared streets are designed for priority access by nonmotorized users (pedestrians and bicyclists) and very low vehicle traffic. Residences typically front on, or very close to, the shared streets. Vehicle speeds must be kept quite low, typically a pedestrian's pace or slower, to ensure safety. Shared streets shall connect at each end to other roads or access ways so that a turnaround is not required. In general, shared streets accommodate a very small number of vehicles at low speeds, as necessary, for a secondary access type that can be used for pick-up/drop-off activities, loading, service and emergency and deliveries. They are also designed to provide clarity for people with visual impairments regarding the shared pedestrian/vehicular nature of the space. Shared streets are generally not appropriate in locations where there is a need to maintain vehicle access or through travel. The Review Engineer will review any request to implement this type of street at a specific location and either approve or deny the request.

3.1.1.8 Alleyways

Alleys provide vehicular access to abutting properties and are not intended for general traffic circulation. Dead-end alleys are generally unacceptable; however, where dead-end alleys are determined suitable by the Review Engineer, for short-term or temporary applications, they shall be provided with adequate turnaround facilities at the dead-end. All

new alleys shall be private. New alleys and existing alleys being improved shall meet requirements of this design manual. Alleys shall connect to the city streets via a commercial driveway apron. Alleys serving developments with loading activities at their access points shall include provisions for unimpeded vehicular circulation along the alley and provisions for adequate sight distances along both the alley at driveways and at intersections with public streets.

3.1.1.9 Pedestrians Streets

Pedestrian streets are seen as a specific type of local street that primarily supports more active pedestrian uses. These streets are important components of the open space network, offer comfortable pedestrian prioritized experiences, might support market, arts activity and outdoor dining or simply offer a quiet and green connection or respite. Pedestrian streets are designed to create a generous pedestrian realm with no vehicle traffic. However, emergency vehicle and maintenance vehicle access is provided as appropriate. Tree grates with pedestrian-scale lighting should be provided.

3.1.1.10 Private Streets

Private streets are privately owned and maintained and located in a tract or easement. In general, private streets shall be designed and constructed in accordance with the applicable public street standards. All private streets shall meet the following general requirements:

1. Private streets shall be contained in an easement or tract and will be allowed when:

    a. A covenant that provides for maintenance and repair of the private street by property owners has been approved by the City and recorded with King County; and

    b. The covenant includes a condition that the private street will remain open at all times for emergency and public service vehicles; and

    c. The private street would not hinder public street circulation; and at least one of the following conditions exists:

        - The street would ultimately serve no fewer than three lots and no more than nine lots; or
        - The street would ultimately serve more than nine lots, and the Review Engineer and the Fire Marshal determine that, due to physical site constraints or preexisting development, no other reasonable access is available. In addition, the proposed street would be adequate for transportation and fire access needs, and the private street would be compatible with the surrounding neighborhood character; or

- The private street would be part of a commercial or residential planned unit development; or
- The street would serve commercial or industrial facilities where no circulation continuity is necessary; or
- The private street would serve a dense residential development of four or more units, such as a unit lot subdivision or condominium, and the street is not part of any existing or future public streets grid.

Absent any of the above, public streets are required.

2. Private streets shall be designed such that vehicles attempting to enter them will not impede vehicles in the travel lane of the public street.
3. Private streets must meet all applicable standards for public streets unless otherwise explained in this manual, including those for sidewalks and ADA accessibility.
4. Combined vehicular access for adjoining properties is encouraged. Joint access shall be established in a tract or easement.
5. Access onto arterial streets from private streets may be denied at the discretion of the Review Engineer if alternate access is available.
6. The continued use of a preexisting private street is not guaranteed with the development of a site.
7. All abandoned private streets on the street frontage to be improved shall be removed and new curbs, gutters and sidewalks shall be installed.
8. Private street grades and configuration shall accommodate future street widening as described in adopted City plans and codes to prevent the need for major private street reconstruction.
9. No private street shall be approved where undesirable impacts, such as vehicles backing onto the public sidewalk or street, will occur.
10. Left turns to and from a private street may be restricted either at the time of development or in the future if such maneuvers are found by the City to be unsafe.
11. The City shall not permit more than one private street opening on any property having a street frontage of 200 feet or less. This paragraph shall not apply if the property's street frontage is less than 200 feet, and the property is at least three acres in area.

12. The design and construction of private streets shall conform to all the requirements as established in this manual, the Fire Department development standards and meet the following design considerations and requirements.

3.1.1.10.1 Private Street Widths

1. Private streets that serve or will serve from three to nine lots, or dwelling units, must be a minimum of 20 feet wide and placed in an easement or tract having a minimum width of 25 feet. See BCC 14.60.190 for nonmotorized facility requirements.
2. Where private streets are widened to allow parking, such parking areas may be constructed with a pervious surface to reduce water runoff.
3. Private streets shall be paved full-width for their entire length.
4. All private roads shall be constructed to public street standards per the specifications shown in Design Manual Standard Drawings RC-100-1 and RC-110-1 and Design Manual Standard SW-100-1 for curb and gutter requirements. For short plats, the Review Engineer may allow modifications such as an inverted crown or a thickened asphalt edge rather than curb, provided that stormwater treatment will be adequate and safety will not be compromised.

3.1.1.10.2 Other Design Considerations

See Section 3.1.2, Design Speeds for more information about the minimum design speed for private roads.

1. If the private street is to exceed 150 feet in length with no connection to other streets, then it shall be provided with a turnaround to accommodate emergency vehicle turnaround movements. See Section 3.2.4, Street End Designs for turnaround requirements.
2. Streetlights installed on private roads shall be owned and maintained by the property owners or Puget Sound Energy if accepted by them.
3. A geotechnical analysis of the proposed private street design may be required at the discretion of the Review Engineer.
4. New private streets will be named by the City's Parcel and Address Coordinator. Appropriate street name signing shall be provided by the developer per Design Manual Standard Drawings SG-100-1, SG-110-1, SG-140-1, SG-160-1 and SG-170-1. The developer shall coordinate with the Transportation Department Inspector prior to sign installation to determine appropriate sign locations.

3.1.1.11 Access Roads for Mixed-Use Developments, Planned Unit Developments and Unit Lot Subdivisions

An access road is a type of private street that provides circulation and access to parking and loading sites within mixed-use, business and industrial developments. Typically, all access roads shall meet the requirements established under Section 3.1.1.10 Private Streets. Access roads, although not owned and maintained by the City, are reviewed and inspected by the City as part of the site development for conformance with the development conditions and requirements.

3.1.2 Design Speeds

Design speed is a selected speed used to determine the various geometric features of the roadway. The design of streets and roads shall depend upon their type and usage. The City of Bellevue speed limits are established in accordance with the City Code, Title 11 Vehicles and Traffic, Chapter 11.32. Speed.

The design speed of an existing facility shall be 5 mph above the posted speed and shall in no case be less than the minimum values established in Table 3-1. On new construction or reconstruction, which alters the characteristics of the roadway, the design speed shall meet the design speed values for each street type as established in Table 3-1.

The Design Engineer should consult the City Code and coordinate with the Review Engineer to confirm the proposed design speed. All streets should be designed for consistent and safe traffic speeds and for the safety of all users and travel modes. Posted speed and the design speed per street type shall be according to Table 3-1 unless otherwise noted.

Table 3-1: Street Design Speeds

Street Classification and Type	Minimum Design Speed (mph)
Major Arterial	35-45
Minor Arterial	35-45
Collector Arterial	35-45
Local Street	25-30
Half Street	25-35
Green Street	20-25
Shared Street	15
Alleyway	15-20

In general, the design speed serves as a basis for determining geometric elements of new streets and does not imply posted or legally permissible speeds.

3.1.3 Design Vehicles

The Design Engineer shall determine the appropriate design vehicle for a facility based on street type, the presence of truck and bus routes, land use context and the relative volumes and frequencies of certain vehicle types.

Vehicle swept path analysis and turning simulation exhibits are required for the design of new developments, driveways and intersections. Exhibits shall clearly show the outermost and innermost swept path of the specified design and control vehicles negotiating an intersection or driveway.

For clarity, the design vehicle is defined as the vehicle that frequently uses a facility that should be designed without encroaching into adjacent and opposing traffic lanes, sidewalk, planter or curb and gutter (e.g., turning lane to lane). While the control vehicle is the vehicle that infrequently uses a facility, minor encroachment into adjacent or opposing traffic lanes and multiple-point turns may be allowed (i.e., using available pavement to complete a turn).

The swept path analysis shall include exhibits for the design and control vehicles entering or leaving a project site, traversing the site, maneuvering for delivery and making turns at intersections. The turning simulation exhibits shall show the design vehicle using the curb lane in a multiple-lane street to enter and leave the site unless a left turn is allowed. Furthermore, the design vehicle should make the desired right or left turn without encroaching on the adjacent lanes, curbs and gutters or conflicting with other turn movements unless otherwise approved.

More specifically, the turning simulation exhibits shall show that the appropriate design vehicle swept paths are without encroachment into:

1. **An opposing lane of traffic in a public street**. The outside of the swept path shall be at least 1 foot inside the curb or edge of outside traffic lane when entering and exiting the site on a two- or three-lane street unless otherwise approved by the Review Engineer.
2. **An opposing lane of a two-way driveway**. Adjacent swept path of entering and exiting design vehicles should show at least 1 foot of minimum separation within driveways or as determined by the Review Engineer.
3. **Any parking stalls**. No design or control vehicle swept path shall be within 2 feet of any required on-street parking stalls.

4. **Areas outside of the reinforced concrete driveway approach apron and protected driveway throat**. The inside swept paths for entering and exiting design and control vehicles should be at least 1 foot inside the reinforced concrete driveway approach apron or as determined by the review engineer.

The Design Engineer may be required to provide evidence that the design of a facility can accommodate both the design and control vehicles.

The City of Bellevue uses the following typical design and control vehicles: AASHTO SU-30, AASHTO WB-40, AASHTO WB-67, fire truck (ladder), Republic Service garbage truck, King County Metro Transit bus, and school bus, but the minimum standard design vehicle for on-site movements is AASHTO SU-30 with a 42-foot turning radius.

3.2 Geometric Design Elements

The geometric design criteria for each project have both general and specific requirements. The general requirements are based on a variety of technical references, including but not limited to:

- City of Bellevue Transportation Design Manual, including Standard Drawings
- WSDOT Design Manual
- AASHTO guidelines
- NACTO Design Guides

The specific requirements may be based upon the initial land use action, the building permit, the Review Engineer and/or other conditions pertaining to site specifics. Furthermore, the geometric design elements in this section do not represent a complete reference on any specific topic. The Design Engineer must refer to the other sources and exercise professional judgment in designing the project.

3.2.1 Sight Distance – Vehicles and Pedestrians

3.2.1.1 General

All sight distance requirements described in this section are based on the current edition of AASHTO's "A Policy on Geometric Design of Highways and Streets" unless otherwise specified.

The Stopping Sight Distance, Intersection Sight Distance and Pedestrian Sight Distance requirements set forth in 3.2.1.2, 3.2.1.3 and 3.2.1.4, respectively, shall be met at all access points and intersections, as well as at every point along the curvature of an existing, new or reconstructed street, including along a development's frontage. The Review Engineer may require sight distance improvements beyond a development's frontage only when they are

determined proportionate and necessary to ensure the health, safety and general welfare of the public.

3.2.1.2 Stopping Sight Distance

Stopping Sight Distance (SSD) is the distance needed for a vehicle traveling at or near the design speed of the street to stop before reaching a stationary object in its path. The provision of SSD is fundamental to the safe operation of the street. SSD shall be determined based on the design speed of the street, consistent with Section 3.1.2, as well as a driver's eye height of 3.5 feet and an object height of 2.0 feet above the pavement. The driver's line-of-sight may extend beyond the vehicular travel way of the street; for example, on a horizontal curve the sight line will be a chord of the curve. SSD shall be measured along the centerline of the vehicle's travel lane. The minimum SSD on streets with a grade of 3% or less is shown in Table 3-2. Sufficient SSD shall be provided at all crosswalks, including intersections and mid-block crosswalks.

Table 3-2: Stopping Sight Distance on Streets with Grades of Less Than 3%

Design Speed (mph)	Stopping Sight Distance (ft)*
20	115
25	155
30	200
35	250
40	305
45	360

Source: AASHTO 2018 7th Edition, Table 3-1
*Must be adjusted when street downgrade is 3% or greater.

Table 3-3 shall be used on streets with upgrades or downgrades of 3% or greater. SSD at grades other than those shown in Table 3-3 shall be designed in accordance with AASHTO.

Table 3-3: Stopping Sight Distance on Streets with Upgrades or Downgrades of 3% or Greater

Stopping Sight Distance											
SSD (feet) for Downgrade						SSD (feet) for Upgrade					
Design Speed (mph)	3%	6%	9%	12%	15%	Design Speed (mph)	3%	6%	9%	12%	15%
20	116	120	126	132	141	**20**	109	107	104	102	101
25	158	165	173	184	198	**25**	147	143	140	137	134
30	205	215	227	242	262	**30**	200	184	179	175	171
35	257	271	287	308	335	**35**	237	229	222	216	211

Stopping Sight Distance											
SSD (feet) for Downgrade						SSD (feet) for Upgrade					
Design Speed (mph)	**3%**	**6%**	**9%**	**12%**	**15%**	**Design Speed (mph)**	**3%**	**6%**	**9%**	**12%**	**15%**
40	315	333	354	382	417	**40**	289	278	269	261	255
45	378	400	427	462	507	**45**	344	331	320	310	301

Source: AASHTO 2018 7th Edition, Table 3-2

3.2.1.3 Intersection Sight Distance

The concept of intersection sight distance (ISD) allows drivers approaching an intersection to perceive the presence of potentially conflicting vehicles in sufficient time and distance to stop, adjust speed or wait in an effort to avoid colliding in the intersection. Sufficient ISD shall be provided at all intersecting street facilities and access points, whether private or public, to provide clear sightlines for vehicles approaching an intersecting roadway. ISD shall be determined based on the design speed of the street, consistent with Section 3.1.2, as well as a driver's eye height of 3.5 feet and an object height of 3.5 feet, assuming a passenger car as the design vehicle. ISD shall be measured along the centerline of the approaching vehicle's travel lane.

The "clear sight triangle" at an intersecting roadway is defined as the area bounded by the sight line, the ISD line, and a line that connects to a point in the center of the minor street approach lane at a specific setback point. See Standard Drawing RL-100-1. Setback distances and minimum ISD requirements for various intersection types are as follows:

1. **Major street (uncontrolled) and minor street (stop-controlled).** This type of intersection is typically a street of higher classification (with higher vehicular volumes), e.g., arterial or non-arterial (referred to as the "major street") and a street of lower classification (with less vehicular volumes), including but not limited to, collectors, local streets, driveways and private streets (referred to as the "minor street"). This intersection type typically has no control in the major street and a stop sign or flashing red signal on the minor street. Private commercial driveways (which may or may not have a stop sign) used by the public for entering any city street are also included in this intersection type.

   The right and left sight lines are defined as the lines that join a point in the center of the minor street approach lane located 14.5 feet back from the edge of the traveled way on the major street (Point A), and a point in the center of the major through-street approach lane (Point B). The locations of Points A and B in the minor street approach lane and the major through-street approach lane, respectively, are specified in Standard Drawing RL-100-1.

For this intersection type, the minimum ISD on the minor street approach shall be as shown in Table 3-4:

Table 3-4: Minimum Intersection Sight Distance

Design Speed (mph)	Intersection Sight Distance (ft)*		
	Left Turn from Stop	Right Turn from Stop	Crossing Maneuver
20	225	195	195
25	280	240	240
30	335	290	290
35	390	335	335
40	445	385	385
45	500	430	430

Source: AASHTO 2018 7th Edition, Tables 9-7, 9-9, 9-11.
*The values in this table are for a stopped passenger car attempting to turn onto, or cross, a two-lane street with no median and minor street approach grades of 3% of less. For other scenarios, adjustments will be needed. Refer to subsequent paragraph 5. Adjustments.

2. **Signalized intersection.** At signalized intersections, the first vehicle stopped on one approach should be visible to the driver of the first vehicle stopped on each of the other approaches. Moreover, vehicles making permissive movements at signalized intersections (e.g., right-turn-on-red-after-stop, permissive left turns, etc.) should have sufficient sight distance to select gaps in oncoming traffic.

   For signalized intersection approaches that permit right-turn-on-red-after-stop maneuvers, the left sight line shall join a point in the center of the minor street approach lane located 14.5 feet back from the edge of the through-street approach lane (Point A) and a point in the center of the outer through-street approach lane (Point B). The locations of Points A and B are specified in Design Manual Drawing RL-100-1.

   The minimum ISD required for the right-turn-on-red-after-stop maneuver shall be per Table 3-4.

3. **Residential driveway intersection (serving two or less dwelling units).** For the intersection of a residential driveway with a public street, the sight line shall join a point in the center of the driveway approach lane located 14.5 feet back from the edge of the through-street approach lane (Point A) and a point in the center of the outer through-street approach lane (Point B). For residential driveways with major obstacles or other special circumstances obscuring sight distance, the location of Point A may be reduced to a minimum of 10 feet from the edge of the traveled way, with approval of the Review Engineer, where the reduction in driver's eye location

will not adversely affect safety or operation. Examples where this may be allowed include: an intersection on the outside of a horizontal curve; an intersection where one approach is in a cut or fill; or where a bridge abutment obscures the line of sight from 14.5 feet back but not 10 feet. The locations of Points A and B are specified in Standard Drawing RL-100-1.

The minimum ISD on the driveway approach shall be per Table 3-4.

4. **Roundabouts.** For ISD at roundabouts, entering vehicles must have a clear view of traffic on the circulating roadway and on the immediate upstream approach in order to aid in judging an acceptable gap. Sufficient SSD and ISD at roundabouts shall be provided in accordance with the WSDOT Design Manual Section 1320.04(8)(a) and 1320.04(8)(b) Stopping Sight Distance and Intersection Sight Distance.

5. **Adjustments.** The ISD values provided in Table 3-4 are for a stopped passenger car attempting to turn onto, or cross, a two-lane street with no median and minor street approach grades of 3% or less. ISD values for access points or intersections that will handle heavy vehicles, as determined by the Review Engineer, allow vehicles to make a turning or crossing maneuver onto a multilane roadway (including turn lanes and median widths), or have approach grades in excess of 3%, shall be adjusted in accordance with AASHTO standards. AASHTO Chapter 9-5 Intersection Sight Distance, shall be referenced when making time gap adjustments for heavy vehicles, number of lanes or approach grades.

   Note that the time gap adjustment for the minor street approach grade is necessary only if the rear wheels of the design vehicle would be on an upgrade that exceeds 3% when the vehicle is at the stop line of the minor street approach.

   If a time gap adjustment is necessary, the ISD must be recalculated using AASHTO Formula 9-1:

$$\mathbf{ISD = 1.47\ V_{MAJOR}\ T_s}$$

   Where:
   - ISD = intersection sight distance in feet, measured along the major street.
   - V_{MAJOR} = design speed of major street in mph.
   - T_S = time gap for minor street vehicle to enter major street in seconds.

3.2.1.4 Pedestrian Sight Distance

The minimum sight distance for pedestrian safety shall be as shown in Design Manual Drawing RL-120-1 and determined as follows: The driver of an existing vehicle shall be able to view a 1-foot-high object 15 feet away from the edges of the exiting lane or lanes,

measured at the back of the sidewalk, when the driver's eye is 14.5 feet behind the back of the sidewalk.

The minimum sight distance defined herein shall be maintained at all driveways, buildings and garage entrances where structures, wing walls, etc., are located adjacent to, or in close proximity to, a pedestrian walkway.

3.2.1.5 Sight Obstructions

1. For the purposes of this standard, sight obstructions are objects that block or obscure the view of motor vehicle operators at the intersection of two public streets or at the intersection of a public street with a driveway (or private street), or intersecting private streets to ensure the health, safety and general wellness of the public. Sight obstructions are not permitted above a line 2 feet above the street surface and below a line 7.5 feet above the street surface.
2. Development proposals shall demonstrate that no vehicle will be parked (or any sign, fence, rail, hedge, shrubbery, natural growth or other obstruction installed) that obstructs the view of motor vehicle operators at an intersection within the sight areas established in Sections 3.2.1.2, 3.2.1.3, 3.2.1.4 and between the height limits established herein.
3. Sight lines from vehicles to traffic control devices, including but not limited to, signs and signals, shall not be obscured by landscaping, street furniture, marquees, awnings or other such obstructions.
4. Every obstruction of the sort prohibited in this section hereafter installed or permitted to remain shall be deemed a violation of this sight distance standard, unless approved through a deviation.
5. All development proposals are required to meet sight distance requirements per the Transportation Development Code (Bellevue City Code 14.60.240 and 14.60.241). It shall be the applicant's responsibility to accomplish any activities necessary to provide sight distance, such as trimming or removal of vegetation or regrading of earth.

3.2.1.6 Special Circumstances

If circumstances are different from those presented in these Standards (e.g., railroad crossings, multipurpose paths, etc.), the Engineer may establish sight distance standards and requirements that generally conform with the intent of the sight distance guidelines in the latest edition of AASHTO, WSDOT Design Manual and/or other technical references specified in Section 1.2 to ensure the health, safety and general welfare of the public.

3.2.2 Horizontal Alignments

All roadway designs shall comply with the guidance in the current edition of the AASHTO Green Book, A Policy on Geometric Design of Highways and Streets and WSDOT's Design

Manual. Centerline alignment of improvements should be parallel to the centerline of right of way and the centerline of a proposed roadway extension shall be aligned with the existing centerline. Alignment should be as direct as possible consistent with topography.

3.2.2.1 Horizontal Curves

Horizontal curves shall be designed to provide the minimum radii required for vehicles to safely negotiate a turn without leaving their driving lane and shall in no case violate minimum sight distance requirements. The designer shall refer to the AASHTO Policy and WSDOT's Design Manual for a determination of minimum acceptable horizontal curves at centerline of arterial and non-arterial streets. The vehicle speed shall be the design speed as discussed in Section 3.1.2 of this design manual. Streets shall be designed with a standard pavement cross section where feasible. However, where necessary and justified, a super-elevation greater than the standard cross slope may be considered. In general, horizontal curves shall meet the minimum radii requirements shown in Table 3-5 with no impact to the minimum sight distance requirements as per Section 3.2.1, Sight Distance - Vehicles and Pedestrians.

For design speeds above 40 mph, horizontal curve design shall comply with Chapter 1250 of the WSDOT Design Manual.

Table 3-5: Minimum Horizontal Curve Radius at Centerline

Design Speed (mph)	Minimum Horizontal Curve Radius (feet)[1,2]
45	1039
40	762
35	510
30	333
25	198
20	107
15	TBD[3, 4]

[1] Refer to Table 3-13 Minimum Radii and Super-elevation for Low-Speed Urban Streets of AASHTO Green Book, 7th Edition 2018.
[2] The horizontal curve radii shown in Table 3-5 is based on -2% reversed crown at the centerline.
[3] Design speed will be determined in coordination with the Review Engineer.
[4] Horizontal curve radii for this street type will be determined by the Design Engineer based on the specified design speed.

Additional requirements for horizontal curves include:

1. Horizontal curves should meet the minimum radius requirements as shown in Table 3-5.
2. For small deflection angles up to 5 degrees, horizontal curve lengths need to be adjusted to avoid the appearance of "kink" in order to maintain driver comfort. Refer to Table 3-6 for more information on the minimum length of curve.
3. Reversing horizontal curves should be separated by at least 50 feet of tangent (100 feet on arterials).
4. Access roads with curves must be evaluated with turning templates and made wider as needed.
5. For the minimum length of super-elevation runoff, the designer shall follow AASHTO A policy On Geometric Design of Highways and Streets, Chapter 3, Section 3.3.8 Transition Design Controls and WSDOT Design Manual.

Table 3-6: Minimum Length of Curve for Small Deflection Angles up to 5 Degrees

Design Speed (mph)	Minimum Length of Curve (feet)
45	250
40	200
35	150
30	100
25	50

3.2.2.2 Tapers and Transitions

For new development projects, tapers and transitions beyond the project frontage are required as deemed necessary for safety purposes. The lane-drop taper length for posted speed of 40 mph and less shall be computed using Table 3-7, Minimum Taper Rate and shall be in conformance with the current Manual on Uniform Traffic Control Devices (MUTCD) as referenced by AASHTO.

Table 3-7: Minimum Taper Rate

Posted Speed (mph)	Taper Rate
40	27:1
35	21:1
30	15:1
25	11:1
20	7:1

The minimum transition length is equal to the taper rate multiplied by the width of the added lane or pavement widening.

In general, transitions should be made on a tangent section whenever possible and should avoid locations with horizontal and vertical sight distance restrictions. Whenever feasible, the entire transition should be visible to the driver of a vehicle approaching the narrower section. The design should be such that at-grade intersections within the transition are avoided.

In case of increasing the number of lanes, a tangential rate of change in the range of 1:4 to 1:15 may be allowed subject to the Review Engineer's approval. For left-turn median channelization widening, refer to Design Manual Standard Drawing CH-190-1.

The street width transitions requirement may be reduced if traffic is not expected to use the shifting roadway (e.g., at the beginning or end of street frontage improvements) subject to the Review Engineer's approval.

3.2.3 Vertical Alignments

The vertical alignment of the City's public and private roadways should conform to the following general requirements:

1. Use a smooth grade line with gradual changes, consistent with the context identification and character of terrain. Avoid numerous breaks and short grades.
2. Avoid "roller coaster" or "hidden dip" profiles by use of gradual grades.
3. Avoid broken back grade lines with short tangents between two vertical curves.
4. Where at-grade intersections occur on roadways with moderate to steep grades, it is desirable to flatten or reduce the grade through the intersection.
5. When a vertical curve takes place partly or wholly in a horizontal curve, coordinate the two as per WSDOT Design Manual.

6. The minimum length of a vertical curve is controlled by design speed, stopping sight distance and the change in grade.
7. The maximum roadway gradient is based on the adjacent land use contexts, street type and design speed. Refer to Table 3-8 for maximum allowable grade.
8. Grade transitions shall be constructed as smooth vertical curves, without angle points, except as otherwise specified in Section 3.2.3.2, Longitudinal Grades and Grade Breaks.
9. Ensure that a landing is provided at intersections on the secondary or subordinate approach or on a stop-controlled approach.
10. Measure landings from the edge of pavement of the intersected roadway at full development and with an average grade no greater than 5% at signalized intersection or no traffic control intersection
11. The design and placement of vertical curves must consider ADA compliant crosswalk slopes and curb ramps.

3.2.3.1 Vertical Curves

A vertical curve is used to avoid the sudden change of direction when moving from one grade to another. They should be properly designed to provide adequate sight distance, safety, comfortable driving, good drainage and pleasing appearance.

The Design Engineer shall refer to the AASHTO Green Book and Chapter 1220 of WSDOT Design Manual for the vertical curves design requirements. Designing for the greatest possible stopping sight distance should be considered. See Section 3.2.1, Sight Distance - Vehicles and Pedestrians for more information.

In general, the design of the vertical curves shall conform to the following design requirements.

1. For new construction (building a street where one does not currently exist), the minimum length of the vertical curve must meet stopping sight distance or have a length at least three times the design speed, whichever is greater.

Table 3-8 gives the design stopping sight distances for grades less than 3%, the minimum curve length for a 1% grade change to provide the stopping sight distance for a crest (Kc) and sag (Ks) vertical curve, and the minimum length of vertical curve for the design speed (VCLm).

Table 3-8: Minimum Vertical Curve Length for Stopping Sight Distance

Design Speed (mph)	Design Stopping Sight Distance (ft)	Kc	Ks	VCLm (ft)
45	360	61	79	135
40	305	44	64	120
35	250	29	49	105
30	200	19	37	90
25	155	12	26	75
20	115	7	17	60

[1] Design speed for each street type will be determined in coordination with the Review Engineer.
[2] Refer to Tables 3-35 and 3-37, Design Controls for Crest and Sag Vertical Curves Based on Stopping Sight Distance of AASHTO Green Book, 7th Edition 2018.

For grades of 3% or steeper, use WSDOT Design Manual, Exhibit 1260-5 for crest vertical curve length (L) and Exhibit 1260-7 for sag vertical curve length (L) with S equal to the SSD from Table 3-9.

Table 3-9: Design Stopping Sight Distance on Grades

Design Speed (mph)	Stopping Sight Distance (ft)					
	Downgrade			Upgrade		
	-3%	-6%	-9%	3%	6%	9%
45	378	400	427	344	331	320
40	315	333	354	289	278	269
35	257	271	287	237	229	222
30	205	215	227	190	184	179
25	158	165	173	147	143	140

2. K-Sag values may be reduced to K-Crest values if adequate street lighting is present along the entire sag vertical curve.

Where approved, the sag vertical curve length as shown in Table 3-9 may be reduced to an absolute minimum as determined by the "comfort criteria" in accordance with the AASHTO Policy. In addition, the area must also have adequate fixed-source lighting (street lighting) already or as a part of the project.

3.2.3.2 Longitudinal Grades and Grade Breaks

Street grade should conform closely to the natural contour of the land; however, in some cases, a different grade may be required.

The minimum allowable grade will be 1% along the crown and vertical curb line. In general, maximum allowable grade is dependent upon the street type as shown in Table 3-10.

Table 3-10: Maximum Allowable Grade

Design Speed (mph)	Maximum Grade (%)[1, 2]
45	8
40	8
35	10
30	12
25	15
20	15
TBD	15

[1] The maximum grade may be modified on a case-by-case basis in areas where steep hills and grades are the norm, and the permissible grades cannot be attained. For the BelRed area streets, if a maximum grade of 12% cannot be attained, the Review Engineer may require the roadway surface to be concrete (rigid) pavement instead of the standard hot mix asphalt (HMA) surface.

[2] For other local streets and private streets, exceeding 15% grade will require Fire Department and Utilities Department approval to ensure additional fire protection requirements are met, and appropriate methods will be used to ensure drainage is controlled.

Grade transitions shall be constructed as vertical curves except at locations where algebraic difference is 0.5% or less. For private streets and access roads, a grade break will be allowed with algebraic difference in grade of 1% or less.

In addition, where pedestrian access routes are contained within a street right of way, the grade of the pedestrian access route shall be equal to the general grade established for the adjacent street. Where pedestrian access routes are not contained within a street right of way, a maximum grade of 5% is required.

3.2.4 Street End Designs

New streets shall be planned, designed and constructed to connect to existing or future streets except when existing right-of-way limitations or existing topography conditions might preclude this. If a connection to an existing or future street is infeasible, a turnaround facility shall be provided for all dead-end public streets and private streets greater than 150 feet in length that meet the following requirements:

1. A circular turnaround per Design Manual Drawing RC-130-1 shall be provided for streets that serve (or will serve) 10 or more dwelling units.

2. A hammerhead per Design Manual Drawing RC-130-1 may be used to fulfill the requirement to provide a turnaround facility where the street serves (or will serve) nine or fewer dwelling units.
3. A permanent turnaround area must have a minimum right-of-way radius of 50 feet. If the street or roadway section is not required to be accessed by fire trucks, a smaller radius circular turnaround may be allowed. Dedication of additional right-of-way width may be required to accommodate the turnaround. Sidewalks and utilities may be placed within a public easement at the discretion of the Review Engineer.
4. Hammerhead width may range from 90 feet to 120 feet depending upon street length. A width less than 120 feet is allowed only if all homes served by the hammerhead have sprinklers installed.
5. Alternative street end designs may be allowed subject to the review and approval of the Review Engineer and Fire Marshal.
6. Streets that temporarily dead-end and will be extended in the future need not have a turnaround facility unless determined necessary by the Review Engineer and the Fire Marshal. When no turnaround facility is provided, street end barricading shall be installed and must conform to the most recent edition of the Manual on Uniform Traffic Control Devices.
7. Turnaround facilities need to be accessible at all times and cannot be located on driveways.
8. Removal of the temporary cul-de-sac and reconstruction of the street shall be the responsibility of the developer who extends the street or road. Reconstruction shall include demolition and wastehaul of all temporary improvements, grading and subgrade preparation, extension, installation of storm drainage (if required), curbs, gutters, sidewalks and other improvements to make for a complete and whole street section.
9. The maximum cross grade of a street at the street end shall be 8%.

3.3 Cross Section Elements

The cross section as defined by AASHTO Green Book is the vertical section of the ground and roadway at right angle to the centerline of the roadway, including all of a street from back-of-curb line to back-of-curb line or right-of-way line to right-of-way line. This section provides information on cross section element requirements based on street types as established in Section 3.1.1 of this design manual. Standard design cross sections may include, but are not limited to, right-of-way lines and widths, roadway widths, planting strips, existing and new grades, slope lines, sidewalks, street trees, curbs, gutters, crowns,

depression lines, thickened edges, pavement, water mains, sanitary sewers and storm drains.

3.3.1 Street and Lane Widths

Minimum street width is determined by the following key elements:

1. Street type: Some street types may need narrower lane widths to design for lower-speed environments.
2. The designation of the street as part of a truck and/or bus route.
3. The need for on-street parking to be accommodated.
4. The need for a bicycle facility.
5. The need to accommodate traffic barriers and the required shy distance.

Table 3-11: Pavement and Lanes Typical Width

Street Type[2]	Typical Number of Lanes[1]	Typical Pavement Width (feet)[3, 4, 5]	Typical Vehicular Travel Lane Width (feet)[6]
Major Arterial	3-5	34-56	11-12[7, 8]
Minor Arterial	3-5	34-56	11-12[7, 8]
Collector Arterial	2-3	34-46	11-12[7, 8]
Downtown Local Street	2	22-28	11[7, 8]
BelRed Local Street	See Appendix B, BelRed Streetscape Plan		
Residential Local Street (without parking) (with parking on one side) (with parking on both sides)	2	22 28 36	10[7, 8]
Half Street	2	22	10
Alleyway	1-2	20[9]	10-16[9]

Street Type[2]	Typical Number of Lanes[1]	Typical Pavement Width (feet)[3, 4, 5]	Typical Vehicular Travel Lane Width (feet)[6]
Private Access Road for Small Lot Subdivision and Planned Unit Development	2	20 (Minimum)	10

[1] The values presented in this table are typical number of lanes and widths for streets within the City of Bellevue; where existing conditions differ from these values, the Review Engineer may allow the Designer to match existing conditions.
[2] Right-of-way width requirements vary for each street type.
[3] Pavement width as shown on Table 3-11 does not account for bicycle lane width. Additional width may be required.
[4] Pavement width as shown on Table 3-11 (except Residential Local Street) does not account for parking lanes. Additional width may be required.
[5] When guardrails are necessary, additional pavement width may be required.
[6] All lane widths must be measured from the center of the pavement markings.
[7] Lane width on arterials, collectors and local streets is inclusive of the gutter width.
[8] A median shall be in addition to, not part of, the specified street width.
[9] A minimum width of 16 feet for a one -way alleyway may be allowed if fire access is not required and the width is approved by the Fire Marshal.

3.3.2 Parking Lanes

On-street parking may be added in urban environments if approved or required by the City. The City standard is parallel parking in public right of way along the curb, and it requires a minimum of 8 feet of paved width. Angled on-street parking may only be considered if there is adequate street width; speeds are below 25 mph; and there are other constraints, such as environmental, topographical or other unique circumstances exist. The location of bicycle lanes should be carefully considered in areas with on-street parking. On-street parking may be restricted for safety and/or functionality. Further coordination with the Review Engineer is required to determine the location of the bike lane with respect to the on-street parking lane. When determining the locations of on-street parking, designers should consider sight distance, delivery access, and emergency access for existing and proposed developments along the street. On-street parking is designated for public use and will not be counted toward the required parking space that needs to be provided by the development. Where on-street parking is provided, curb extensions also known as “curb bulbs“ should be provided at intersections (and midblock crossings to minimize crossing distance, see Section 3.8.8 for more information on curb extension design requirements. To preserve safe sight distance, on-street parking is prohibited within 20 feet of the intersection, measured from the crosswalk limit. No parking or curb activity will be allowed within 15 feet of any fire hydrant.

3.3.3 Curbs and Gutters

Curbs serve the following purposes: drainage control, pavement edge delineation, set right-of-way limits, aesthetics preservation/enhancement, pedestrian walkway delineation, maintenance operations reduction and as an aid to orderly roadside development.

1. Cement concrete traffic curbs and gutters shall be used for street edges, whenever possible, and shall always be used under the following conditions:
    a. On all public streets
    b. On all development frontage as part of the required improvements unless approved otherwise by the Review Engineer
    c. In drainage low spots where special drainage facilities are required
    d. On private streets with grades greater than 8%
2. Cement concrete traffic curbs shall be used for edges of islands and medians, provided that where emergency access across the median is required, the curb shall be a cast-in-place mountable type.
3. All other curbs and gutters shall be constructed as specified in Design Manual Drawing SW-100-1.
4. For rigid pavement and where curbs and gutters or integral curbs are used, the aggregate base should extend beyond the face of the curb.
5. All curbs and gutters shall flow into the stormwater system, which might include a catch basin, curb cut or other facility. Additional catch basins or extensions of the curbs and gutters may be required to ensure stormwater is conveyed appropriately.
6. When new curbs and gutters are constructed, they shall be located in the permanent location required for the street type and the land use zone. Additional paving shall be provided between the existing edge of pavement and the new curbs, as needed.

3.3.4 Cross Slopes

Undivided traveled way on tangents, or on flat curves, have a crown or high point in the middle and a cross slope downward toward both edges. Unidirectional cross slopes across the entire width of the traveled way may be utilized as approved by the Review Engineer using the criteria below. On divided traveled way on tangent, each one-way traveled way may be crowned separately as on two-lane streets, or it may have unidirectional cross slopes across the entire width of the traveled way subject to Review Engineer approval. The design of street shall conform to the following requirements:

1. Street cross slopes must be designed in accordance with AASHTO requirements. Cross slopes for the two lanes adjacent to the crown line shall not exceed 2%. Where three or more lanes are provided in each direction, the maximum pavement cross slope should be limited to 4% (per current AASHTO 2018, 7th Edition, A Policy on Geometric Design of Highways and Streets).
2. The design of a half street section shall consider the future permanent improvements and the cross section shall be adjusted accordingly.
3. In cases where elevations are extreme between cross section points at the property lines, the street sections may be transitioned to provide a pavement crossfall in the same direction for the full width of the street pavement.
4. Alley cross sections may be V-shaped with a transverse slope of 2.5% toward a center V gutter. Runoff will thereby be directed to a catch basin in the alley or to connecting street gutters as approved by the Utilities Department. Where alleys cross sidewalks, accessibility on sidewalks must be maintained.
5. Steeper cross slope for alleys may be approved by the Review Engineer if a concrete pavement surface is proposed by the development with a minimum thickness that can withstand the load from trash collection trucks, emergency trucks and moving trucks that will commonly be operating in the alleys.
6. If existing conditions require different cross slopes, approval by the Review Engineer is required.
7. When an alley is part of an ADA-accessible route, a portion or the entire cross slope may need to be adjusted to meet current ADA standards.
8. On rigid pavement streets with an odd number of lanes, the crown should be offset to a lane line to prevent locating a joint in the middle of a traffic lane.
9. Refer to Section 3.8.1, Design Considerations, for intersection cross slope.

Table 3-12: Standards Cross Slope Per Street Type

Street Type[1]	Allowable Cross Section[2]	Standard[3,4]
Public Streets	NC, RC	2%
Alleyway	NC, RC, VC	2.5%
Private Street	NC, RC, VC	2%
Half Street	NC	2%
Access Road	NC, RC	2%

[1] The data in this table are based on the design of a full street section.
[2] Definitions - NC: Normal Crown, RC: Reversed (superelevated) Crown, VC: V-Shape Cross Section (Inverted Crown).
[3] In areas where the pavement width is being added to an existing street or must vary to accommodate existing infrastructure, the slopes may vary from the standard cross slopes shown above.
[4] To maintain the design speed, the crown of the street centerline at the horizontal curve section may be designed as a reversed cross slope (super-elevated with -2%) to overcome part of the centrifugal force that acts on a vehicle negotiating a curve section.

3.3.5 Islands and Medians

On urban streets where left-turn movements are common, medians are often used to regulate the left-turn movements and improve street aesthetics. Median Islands shall be designed using the same geometric criteria as the street on which they will be constructed. Medians shall also meet the following requirements.

1. Medians shall be in addition to, not part of, the specified street width unless otherwise specified by the Review Engineer. Medians shall be designed so as not to limit turning radius or sight distance at an intersection. Pedestrian access across medians shall be as required by the Review Engineer and shall conform to ADA standards.
2. Medians shall be designed so as to allow for the full width needed in adjacent lanes for any existing or planned bicycle facility.
3. Median edges shall be a concrete traffic curb. Where emergency vehicle access across the median is required, the curb shall be a mountable type. See Design Manual Drawing RC-140-1.
4. The minimum width of raised medians should be no less than 4 feet as measured from the edge of pavement of the travel lane, with a maximum width as appropriate for their specific corridor. Refer to Section 1239.08(2) of WSDOT Design Manual for median design on low and intermediate speed streets. Medians may be designed for collector and local streets if approved by the Review Engineer.

5. Medians and their contents (light pole pedestals, signage, etc.) must be placed such that the required sight distance in the intersection is not obstructed.
6. Nose areas must be paved back to a minimum of 5 feet, measured from the tip of the nose or as approved by the Review Engineer.
7. AASHTO Green Book policies should be followed in the sizing of islands. Islands should be at least 100 square feet in area. A shy distance of at least 12 inches should be provided between the island and edge of the traveled way.
8. A median refuge island/median cut-through is a protected space in the center of a street to facilitate bicycle and pedestrian crossings. They should be designed to provide a minimum width of 10 feet unless otherwise approved by the Review Engineer. See Standard Drawing RC-121-1 for more information.
9. When islands are built on existing pavement, the underlying pavement should be removed to provide appropriate drainage based on the soil type, tree type and topography of the island surface.
10. For pedestrian and motorist safety, trees, shrubs and groundcover plants shall not obscure the pedestrian sight distance at the refuge islands.
11. Median hardscapes shall be stamped concrete with colors and patterns as determined to be required by the Review Engineer.
12. Restricted access driveway islands are used to restrict turning movements out of or into driveways. Turning restrictions at driveway locations shall be by one or more of the following methods as deemed appropriate by the Review Engineer.
    a. Median islands
    b. Mountable curbs or C curbs
    c. Pork chops
    d. Signage

    All islands should be designed according to Chapter 1239 of WSDOT Design Manual.
13. Other types and shapes of islands that may be designed at driveways or intersections may be reviewed on a case-by-case basis to determine their function and applicability as well as design details requirements.

3.3.6 Private Property Transitions Behind Sidewalks (Cut-and-Fill Slopes)

1. Cut-and fill-slopes shall be no steeper than 2:1 unless otherwise approved. When varying from this standard, geotechnical information may be required to support the request.
2. The toe of the fill or the top of the cut (toe/top of slope) shall be a minimum of 12 inches behind the back of the sidewalk to allow for construction and maintenance of the sidewalks and shall be sloped no steeper than 2%. Refer to RC-100-1 and RC-110-1 for more information.
3. In areas where sidewalks will not be constructed at this time, the toe/top of slope shall be a minimum of 12 inches behind the future sidewalk alignment. This 12-inch transition zone shall be sloped at 2% or flatter. Special designs differing from these typical cases can be proposed and shall be evaluated on a case-by-case basis.
4. For slopes, the designer is required to refer to Section 3.4.1.2 and Standard Drawing RS-100-1 to determine whether pedestrian safety railing is warranted behind the sidewalk.
5. Refer to Section 3.6.2 for retaining walls requirements.

3.3.7 Pavement Design

3.3.7.1 Flexible Pavement

The compacted pavement thickness for arterial and collector streets shall be 10 inches minimum; the compacted Hot Mix Asphalt (HMA) Class ½" PG 58H-22 depth should conform to WSDOT standard specification 5-04. High-traffic volume roads may require HMA class PG 58V-22. The Review Engineer may require a geotechnical report/soil analysis. Additional pavement thickness may be required; it depends on the results of the soil analysis.

3.3.7.2 Rigid Pavement

The City of Bellevue follows WSDOT Standard Specification and Standard Plans for all rigid pavement work.

- Cement Concrete Pavement Joints: WSDOT Standard Plan A-40.10-04
- Cement Concrete Pavement Rehabilitation: WSDOT Standard Plan A-60.10-03
- Roundabout Cement Concrete Curbs: WSDOT Standard Plan F-10.18-03

3.3.7.3 Permeable Pavement

The City of Bellevue Transportation Department encourages project owners and designers to utilize natural drainage practices as a method to mitigate stormwater runoff resulting

from the addition of impervious surfaces to a site. Permeable pavement is an acceptable option for meeting on-site stormwater management, runoff treatment or flow control requirements and is permitted within the City of Bellevue right of way only if:

1. None of the infeasibility criteria are met as listed in the most current version of the Washington State Department of Ecology "Stormwater Management Manual for Western Washington" (BMP T5.15: Permeable Pavements).
2. All infiltration feasibility criteria requirements are met from the most current version of the City of Bellevue "Surface Water Engineering Standards."
3. The proposed pavement is for roads with very low volumes (ADT <400 per DOE SMMWW BMP T5.15: Permeable Pavements) and special design requirements and reviews will be applied.

3.3.7.4 Pavement Widening (Streets and Intersections)

If required, pavement widening shall follow Sections 3.3.7.1 and 3.3.7.2 requirements, which depends on the type of adjacent lane pavement. Regardless of the existing adjacent pavement condition, the newly placed pavement shall follow the current standard.

3.4 Multimodal Design

All multimodal facilities must be designed in accordance with the most current ADA standards and guidance and the requirements of this design manual. This section sets forth the minimum criteria to be used in the design of all multimodal requirements within the rights of way and other public easements and is based on criteria from the following references: The NACTO Urban Street Design Guide, U.S. Access Board, PROWAG, the current City of Bellevue Mobility Implementation Plan (MIP), WSDOT Standard Specifications, and all other City of Bellevue Department of Transportation requirements.

The Review Engineer will determine the specific design elements of these required facilities based upon the guides referenced above.

3.4.1 Pedestrian Design

All pedestrian improvements shall comply with the PROWAG standards for a pedestrian access route and the requirements of this design manual. The City MIP provides information for future pedestrian connectivity planned throughout the city and tools that can be used ultimately to implement a sustainable, equitable and multimodal transportation system that is safe and accessible for everyone. Additional requirements for pedestrian design are listed below:

1. Pedestrian facilities may include sidewalks, shared-use paths, trails and through-block pedestrian connections/paths. Sidewalks may be required on both sides of all city streets. Refer to the City of Bellevue Transportation Development Code, Section 14.60.190 Non-Motorized Facilities for sidewalk-specific requirements.
2. Internal pedestrian circulation systems shall be provided within and between existing, new and redeveloping commercial, multi-family and single-family developments and other activity centers and shall connect to pedestrian systems and transit facilities fronting the development. If the nonmotorized facility is intended to serve more than one property, the Review Engineer may require that it be placed within an easement as described in the City of Bellevue Transportation Development Code, Section 14.60.100.
3. Pedestrian facilities improvements like sidewalks and shared-use paths shall be constructed within the public rights of way or public easements as determined by the Review Engineer. Refer to the City of Bellevue Transportation Development Code, Section 14.60.090, 14.60.100 and Section 3.7, Utilities for easements and utility placement requirements.

3.4.1.1 Sidewalks

All public sidewalks must comply with the requirements of the most current accessibility standards and guidelines, which include requirements for sidewalk cross slopes, grades, locations, markings, surface treatments and curb ramps. In general, sidewalks are required for all public and private streets and shall be provided as listed below. Refer to the City of Bellevue Transportation Development Code, Section 14.60.190.

1. On both sides of all arterial streets.
2. On both sides of all local streets 300 feet or longer and on one side of all local streets less than 300 feet in length.
3. On both sides of all public streets that provide access to existing or planned sidewalks, activity centers, parks, schools, neighborhoods, public transit facilities or the regional trail system.
4. On one side of public dead-end streets, ending at the property line nearest the transition to a circular turnaround or hammerhead. This requirement may be waived at the discretion of the Review Engineer.
5. On one side of private dead-end streets providing access to facilities mentioned in item number 3 of this section, ending at the property line nearest the transition to a circular turnaround or hammerhead. This requirement may be waived at the discretion of the Review Engineer.

All sidewalks shall meet the following design criteria:

3.4.1.1.1 Sidewalk Accessibility

1. All public sidewalks must comply with the requirements of the most current accessibility standards and requirements for ADA and PROWAG. Furthermore, all sidewalk cross slopes shall be designed to 1.5% and not exceed 2%. The sidewalk running slope shall not exceed 5% except where the grade established for the adjacent street exceeds 5.0%. In this case, the grade of the pedestrian access route can match the grade established for the adjacent street. Refer to standard Drawing SW-110-1 for more details.

2. The grade for pedestrian access routes not contained within a street shall not exceed 5%. All sidewalks shall maintain the full required width, free of all obstructions including utilities, signage, street trees, furniture or other elements, permanent or temporary.

3. Full sidewalk widths shall be provided behind the landing of the curb ramps at intersection corners.

4. No above-ground utilities shall be permitted within planter strips, sidewalks or multi-purpose paths. Transformers and utility vaults to serve the development shall be placed inside the building or behind sidewalks or multipurpose path easements. Vaults serving a broader public purpose may be located within a public easement or right of way as approved by the Review Engineer. To the extent feasible, no utility vaults may be located within the primary walking path in any sidewalk. All new and existing utilities lids within the sidewalk must be non-slip/non-skid type per ADA requirements and as specified by the Review Engineer.

3.4.1.1.2 Sidewalk Horizontal and Vertical Alignments

Horizontal and vertical curves on all sidewalks must follow the roadway design criteria. For shared-use path criteria, see Section 3.4.1.3 for more information.

3.4.1.1.3 Meandering Sidewalks

The Review Engineer may approve meandering sidewalks away from the street without reducing the required width of the planter when the sidewalk extensions are constrained by mature trees that are required to be preserved. Additional easements may be required to accommodate the meander of the sidewalks and the surface features. Sidewalks shall maintain their full width around one side of any obstructions that cannot be relocated.

3.4.1.1.4 Landscape Planters and Street Trees

Sidewalk and other pedestrian facilities should be located adjacent to landscape strips or street trees or other physical buffers from vehicular traffic unless otherwise approved. See Section 3.4.1.6 for more information on landscape planter and street trees design.

3.4.1.1.5 Sidewalk Surfaces and Thickness

1. All sidewalks shall be constructed with 5-inch-thick Class 3000 concrete with a non-slip broom finish. Sidewalk sections at driveway approaches shall be a minimum of 6-inch-thick Class 4000 concrete with a minimum compressive strength of 3000 psi prior to opening for traffic. Sidewalk sections within commercial and heavy truck traffic entrances, including private streets and alley entrances, must be constructed with a minimum of 8-inch-thick Class 4000 concrete. Refer to the City of Bellevue Standard Drawings SW-140-1 to SW-190-1 for more details. Finishing pattern, texture and color of the sidewalk paving should continue across the private street, alley or driveway approach.
2. Specialty finishes may be allowed with the approval of the Review Engineer when the proposed material will provide an ADA-compliant non-slip surface when wet and the adjacent property owner agrees to maintain, repair and replace the specialty material at her/his own expense, even when the maintenance is made necessary because of City work. If approved, a Right-Of-Way Hold Harmless and Indemnity Agreement will be required in this case.
3. Subgrade compaction requirements shall comply with the WSDOT Standard Specifications and City of Bellevue Standard Drawing SW-110-1.

3.4.1.1.6 Sidewalk Drainage

Sidewalks should always slope away from buildings toward planter strips unless otherwise approved by the Review Engineer.

3.4.1.1.7 Sidewalk Connectivity

1. If rights of way or public easements are adequate, the applicant may be required to connect the new sidewalk to an existing sidewalk that is terminated midblock of the proposed pedestrian facility. The connection may include the associated improvements, such as curbs and gutters, and landscaping.
2. The design of all sidewalks shall provide for a gradual taper rather than an abrupt transition between sidewalks of different widths or alignments.
3. The Review Engineer may require extended off-street walkways to provide direct connections for ease and safety of pedestrians.

3.4.1.1.8 Downtown Sidewalks

Additional requirements are applied to sidewalks in the downtown area and are subject to Land Use Code 20.25A Downtown. Downtown projects are also subject to special requirements through the design review process.

1. The sidewalk and planter width in the downtown area shall be determined in accordance with Section 20.25A.090.A.1 of the Land Use Code and the relevant provisions of the Transportation Design Manual. The width of the sidewalk is measured by subtracting up to a maximum of 5 feet for the planter strip or tree pit from the total combined width prescribed in Figure 20.25A.090.A.1 of the Land Use Code. Note that the curb width is not included in this measurement. If a wider planter strip or tree pit is desired, it may be permitted, but additional width will be added to the combined sidewalk and planter width requirement.
2. If any street in the downtown area is not listed or prescribed in Figure 20.25A.090.A.1 of the Land Use Code, the minimum sidewalk width is 8 feet, exclusive of the width of the planter, tree pit or curb.
3. Sidewalk design shall be per the City of Bellevue Standard Detail DT-120-1. The surface will have a 2-foot by 2-foot square scoring pattern with a light broom finish and minimal scoring depth to allow for easy cleaning.
4. Where on-street parking is required or present, a 12-inch-wide step-off area (courtesy strip) shall be installed adjacent to the on-street parking unless otherwise approved by the Review Engineer. The step-off area width is additional to the planter and curb widths. Additionally, a 4-foot-wide sidewalk extension with a maximum spacing of 50 feet shall be provided along the frontage of the development as shown on Standard Drawings DT-120-1.
5. Full sidewalk widths shall be provided behind the landing of the curb ramps at intersection corners.
6. Curb extensions shall be integrated into corners where on-street parking is allowed, dependent upon the adjacent street geometry, presence of bus routes and bike lane or other large vehicle use, as determined by the Review Engineer. The Review Engineer shall determine specific design parameters for the corner curb extensions on a case-by-case basis, but they should be consistent with Section 3.8.8, Curb Extensions.
7. Proposed building doors are not allowed to swing open directly to a public sidewalk.
8. Doorway and entrances grades are required to be adjusted on private property without any impact to the sidewalk cross slopes and grades, as all sidewalks are required to meet ADA and PROWAG requirements.

3.4.1.1.9 Sidewalk Widths

In general, the width of a sidewalk depends on its adjacent land uses and pedestrian volume that will be generated from the proposed and adjacent developments. The sidewalk shall be a clear space, free of any obstructions and dedicated exclusively for pedestrians to travel. All above-ground elements shall be placed on private property, behind the sidewalk, or underground subject to the Review Engineer approval. Trees, light poles, signs and fire hydrants can be located in the planter strips adjacent to the sidewalks. Refer to Section 3.6.6, Lateral and Vertical Clearances for more information about clearances requirements. Concrete sidewalk widths shall be as follows:

1. For downtown sidewalk widths, see Land Use Code 20.25A.090.
2. Public streets and private streets internal to subdivisions and short subdivisions: 6 feet (minimum).
3. Non-arterial and non-collector streets outside the BelRed and Wilburton areas and external to subdivisions and short subdivisions: 6 feet (minimum).
4. Arterial and collector streets external to subdivisions and short subdivisions: 8 feet (additional width may be required as determined by the Review Engineer).
5. BelRed Subarea: See Land Use Code 20.25.D.140, BelRed Street Development Standards.
    a. Wilburton Subarea: Sidewalk width will be determined by the Review Engineer.
6. Additional 2 feet of sidewalk width is required when the sidewalk is adjacent to on-street parking and/or traffic lane.
7. Additional sidewalk width may be required for developments located in a transit-oriented development area, i.e., in the vicinity of a transit stop, RapidRide corridors, light rail stations and in the vicinity of schools and parks where higher pedestrian volume is anticipated and other design features or amenities are required to be accommodated for each condition. A pedestrian demand study may be required to determine the final sidewalk width.
8. Additional rights of way or easements may be required if any portion of the sidewalk is located outside the existing right of way. Refer to Section 14.60.100 of the Transportation Development Code for easement requirements.

Table 3-13: Minimum Sidewalk Width per Street Type

Street Type	Minimum Sidewalk Width (feet)	Landscape Planter (feet)
Major Arterial	8	5
Minor Arterial	8	5
Collector Arterial	8	5
Residential Local Street Small Lot Subdivision	6	5
Downtown Street	As per Section 3.4.1.1.8	5*
BelRed Streets Green Streets	As per Land Use Code 20.25.D.140	As per Land Use Code 20.25.D.140
Wilburton Subarea	To be determined by the Review Engineer	To be determined by the Review Engineer
Half Street	As per Street Classification or Subarea (To be determined by the Review Engineer)	As per Street location or Subarea (To be determined by the Review Engineer)
Alleyway	6	-
Private Access Road for small lot subdivision, PUD and small lot subdivision, if required	6	-

A 5-foot width requirement applies to landscape planters or tree pits.

3.4.1.2 Safety Railings

Safety railings are required when the through pedestrian zone (sidewalk, multi-use path, trail, etc.) is adjacent to a vertical drop where the lowest finished elevation is 1 foot or more below the finished surface of the sidewalk or pedestrian path or the adjacent slope is steeper than 2H:1V and the vertical drop is more than 1 foot. The required safety railing shall be provided and installed by the developer per the installation warrants of Standard Drawing RS-100-1 to RS-120-1 or as directed by the Review Engineer or the Inspector and shall conform to the following requirements:

1. All safety railings shall conform to the requirements of the Design Manual Standard Drawings RS-110-1, RS-120-1, RS-130-1 and RS-140-1.
2. For all new safety railings installation, metal railing is required unless otherwise approved by the Review Engineer.
3. Where a safety railing is placed on top of a wall, the Review Engineer may require additional sections of railing in order to prevent access behind the wall.

4. The minimum railing height for pedestrian fall protection is 54 inches.
5. If the sidewalk slope is 5% or greater, a gripping handrail may be required.
6. A combination of 5 feet shy distance and the absence of a hazardous condition at the bottom of the slope may mitigate the need for pedestrian safety railings subject to the approval of the Review Engineer.
7. The required safety railing shall be placed outside the full sidewalk width.

3.4.1.3 Multi-use Paths (Shared-use Facilities)

A shared-use path is defined as a path physically separated from the roadway for use by bicyclists, pedestrians and other micromobility users. The path must have a minimum width of 10 feet of traveled way in addition to 2-foot-wide concrete shoulders on both sides. A 12-foot-wide paved path with 2-foot concrete shoulders on both sides of the path may be required where high user volumes are expected as directed by the Review Engineer. The design of multi-use paths are required to meet the following criteria.

1. Accessibility
    a. The facility must meet the most recent ADA compliance standards (also see AASHTO Guide for the Development of Bicycle Facilities).
    b. The maximum allowable cross slope is 2%.
    c. If the multi-use path is contained within a street, the grade can match the grade established for the adjacent street. Otherwise, the grade of the multi-use path shall not exceed 5%.
    d. Standard curb ramps are to be provided at all path curb crossings to allow continuity of path use. Curb ramp width and crosswalk width shall be equal to the width of the path.
2. Design Speeds

Refer to Section 1515.02 and Exhibit 1515-2 of WSDOT Design Manual for more information on bicycle design speeds and horizontal alignments and the latest version of the Guide for the Development of Bicycle Facilities, published by AASHTO.

3. Alignment

Avoid abrupt grade changes or angle points. Vertical curves should be used to smoothly transition between grades. Refer to Chapter 1515 of WSDOT Design Manual for guidance on stopping sight distance and vertical curve length.

4. Surface Materials

    a. Acceptable surface material is concrete unless otherwise specified by the Review Engineer. Paths should be designed to sustain wheel loads of occasional emergency, patrol, maintenance and other motor vehicles that are permitted to use or cross the path.

    b. If approved, the edges of off-street asphalt paths not adjacent to a roadway shall be defined by inverted thickened edges along both sides to prevent edge deterioration.

5. Other Criteria

    a. Paths shall be located a minimum of 5 feet from the edge of the vehicular travel way. A 5-foot-wide planter shall separate the path from the travel way, and it is measured from the back of curb to the edge of the shoulder path.

    b. Rectangular rapid flashing beacons or a signal should be considered where traffic volumes and speeds on the intersecting roadway make it difficult for the multi-use path users to find a gap in traffic that allows them to cross comfortably, where motorist yielding compliance is low or where there are high volumes of path users.

    c. If asphalt path is approved, a 2-foot-wide graded shoulder is required on both sides of a paved pathway. The Review Engineer may require a wider graded shoulder if heavy pedestrian or equestrian use is anticipated.

    d. If not adjacent to a street or roadway, side slopes along shared-use paths of the embankments are no steeper than 2H:1V. Refer to Section 3.4.1.2 of this design manual for safety railing warrants and requirements.

    e. The minimum vertical clearance is 10 feet, measured from path surface to any overhead obstruction; 12 feet if equestrian accommodation is required.

    f. The designer must ensure sufficient stopping and intersection sight distance at all path intersections and curves, particularly, where steep grades are proposed at path/roadway intersections. Obstructions to the visibility of motorists or path users should be removed, or the path should be aligned around the obstruction to maximize visibility.

    g. Signs for hazards and regulatory messages should be posted. They should follow the standard signing and pavement markings as shown in MUTCD.

    h. Pedestrian-scale lightings may be required. Refer to Appendix A, Street Lighting Design Guide, for more information on pedestrian-scale lighting requirements.

3.4.1.4 Trails

Bellevue's trail system is an interconnected, multi-use trail network that guides users through Bellevue's Park and Open Space System and plays a significant role in the implementation of the City's transportation plan. Although their primary function is to provide passive recreational use, trails also provide an alternative facility and connect to larger regional systems. In general, trails are planned and constructed to provide access to a spectrum of opportunities for different users, including walkers, bicyclists, wheelchairs, joggers, skaters, hikers and equestrians. Different users may require different surfacing, widths and grades. For example, bikers or wheelchairs may require a smooth, firm, flat surface like asphalt or concrete. In general, design standards for trails within the Parks & Community Services Department facilities shall follow the Environmental Best Management Practices that can be accessed through the following link: Environmental Best Management Practices | City of Bellevue (bellevuewa.gov).

For other trails that are maintained by the Transportation Department, the design should meet the following requirements:

1. For paved trails facilities, Section 3.4.1.3 requirements are applied.
2. For gravel surface trails, unpaved trail surface should be no less than 10 feet wide with 2-foot shoulders on each side. Additional area may be needed for slope and fill maintenance.
3. Minimum vertical clearance is 12 feet in height to the first tree limb, guywire or other object.
4. Trail surface should be constructed of HMA, crushed gravel or similar materials as specified by the Review Engineer.
5. Unless otherwise approved by the Review Engineer, shoulders should allow for machine maintenance of the vegetation.
6. Placement of benches and other trail amenities should allow for machine maintenance of the vegetation with at least 10 feet of clearance around any feature and not interfere with equestrian users when applicable.
7. Where the trail intersects with a paved roadway, with no frontage improvements, the trail approach may be paved from the edge of the traveled lane to the right-of-way line. Otherwise, the pavement will start at the back of the sidewalk.
8. Appropriate signs shall be provided to indicate the location of street crossings for trails.
9. Bollards with reflective materials may be used if there is ambiguity between motor vehicle travel-way and trail crossing subject to approval by the Review Engineer.

10. Curb bulb-out may be used to enhance visibility of trail users at crossings.
11. Right-of-way priority should not automatically be assigned to motor vehicles. Trail user volumes and behavior must be considered, observed and adjusted as volumes shift over time.
12. Rectangular rapid flashing beacons or a signal should be considered where traffic volumes and speeds on the intersecting roadway make it difficult for trail users to find a gap in traffic that allows them to cross comfortably, where motorist yielding compliance is low or where there are high volumes of trail users.
13. Raised crosswalks may be considered on lower volume roadways.

3.4.1.5 Through-Block Pedestrian Connections/Paths

All existing and proposed development shall provide safe, direct and convenient pedestrian access routes (referred to as private walkways) connecting main entrances of buildings, establishments or uses on a site that allows for public access, with all other such entrances and with available access points. This includes, but is not limited to, parking sites, passenger loading zones, streets, sidewalks and transit stops. On-site walkways shall also be provided to any abutting public park, trail, major open space or other civic or institutional use. The following are the general requirements for the through-block pedestrian path.

1. Through-block pedestrian access on proposed developments shall consist of 6-foot-wide accessible, direct, clearly discernible and ADA-compliant walkways, or as required by the applicable Land Use Code.
2. Pedestrian walkways between buildings will be as required by the Building Reviewer.
3. Pedestrian walkways located on private property shall be constructed of concrete, asphalt or other firm, stable and slip-resistant material as approved by the Review Engineer.
4. Pedestrian walkways that connect to a roadway or access road shall be physically separated from vehicular surface areas by a traffic curb, except where required to cross a drive aisle; such crossings shall be perpendicular wherever practicable.
5. Pedestrian walkways may be required in areas served by any street.
6. Private pedestrian walkways shall provide general pedestrian access within the development served or as required by the Land Use Code and shall connect with all public sidewalks.

7. Objects are not allowed to protrude into the required clear width of the through-block pedestrian connection. For example, objects such as tree branches, vehicle bumpers, mailboxes, sign posts and tree grates are not allowed to reduce the minimum required clear width of the walkway.
8. The minimum vertical clearance for objects, such as trees and canopies that protrude into or overhang a walkway is 7 feet unless otherwise specified in the MUTCD.
9. The cross slope of a walkway shall be 2% maximum. It is recommended that cross slopes be designed to less than the allowed maximum to allow for some tolerance in construction.

3.4.1.6 Landscaped Planter Strip Requirements

Landscaping planters or drainage swales between curbs and sidewalks are required. The planter strip width shall be maximized based upon site conditions. The minimum planter strip width shall be 5 feet, measured from the back of curb. The downtown and BelRed subareas may have greater minimum requirements. Landscaping design must conform to Water Utility Code (BCC 24.02) requirements for water conservation. Contact the Review Engineer for projects located within the downtown or BelRed subareas for specific planter width and landscaping requirements. Spray irrigation may be required within all landscaped rights of way and public access easements. Irrigation water supply and power sources shall be fed from a private-metered water source unless the Review Engineer approves a connection to a City-owned meter. A separate right-of-way irrigation system and 24-hour outdoor accessible irrigation controller may be required. Planting types, including street trees and ground cover, is to be determined by the Review Engineer (see SW-130-1 for soil profile and root barrier).

If proposed by a private development, holiday lighting receptacles may be permitted within the planter strip area. These receptacles must be connected to the City of Bellevue power source and comply with the requirements outlined in Standard Drawing SL-370-1. Holiday lighting receptacles within a tree pit area will be reviewed on a case-by-case basis and will be subject to the Review Engineer approval.

The City will review the proposed street frontage improvements for compliance with this section and other applicable City policies and codes.

1. Preservation of Existing Street Trees and Landscaping
    a. Retention of existing vegetation may be required along city streets. When retention is not feasible, native plant species or species with a proven ability to survive in an urban environment are preferred for landscaping.

b. When permitted to remove or relocate plant materials from the right of way in connection with the widening of the street or highway, the paving of a sidewalk, or the installation of ingress or egress, the developer shall replant such trees or replace them according to the applicable City standards.

c. Any landscaping in the right of way that is disturbed by construction activity on private property, including but not limited to, damaged trees or trees that need to be removed, shall be replaced or restored to their original condition by the developer or the entity. If such replacement or restoration is not physically or practically possible, as determined by the Review Engineer, the developer may be required to instead reimburse the City for the value of the removed, damaged or destroyed landscaping. Such reimbursement value shall be determined under the methods described in the Guide for Plant Appraisal, published by the International Society of Arboriculture, now or as hereafter amended. The value of other landscape plants shall be determined by the City based upon reasonable estimates.

d. Landscaping and other improvements such as fencing and rockeries within the right of way are subject to removal by the City or at the request of the City.

2. Street Tree and Landscaping Installation Requirements

Street landscape installation or improvement is required when applicable projects are to be undertaken along any public street as identified in, and according to, the guidelines of city codes, standards, adopted street design plans and adopted city plans, including the Capital Investment Plan, Transportation Facilities Plan, Pedestrian and Bicycle Transportation Plan, Comprehensive Plan and Environmental Stewardship Initiative. Where not in conflict with other applicable code provisions, ground cover shall be provided for street frontage of the site in order to control erosion.

3. Species Selection

Refer to LUC 20.25A.060 and Chapter 20.25D LUC or Appendix B, BelRed Streetscape manual for selection of tree species. If not otherwise specified in code, tree species selection shall be listed in the City of Bellevue Environmental Best Management Practices and Design Standards, now or as hereafter amended.

4. Maintenance of Plant Materials

a. Landscaping in the right of way shall be maintained by the abutting property owner(s) unless maintenance has been accepted by the City.

b. All landscape materials in the right of way shall be maintained to industry standards. Trees shall be pruned according to ANSI A300 and ANSI Z133

standards adopted by the International Society of Arboriculture. Street trees already accepted/owned by the City shall not be pruned by adjacent property owners without approval from the Parks & Community Services Department.

c. The property owner is responsible for ensuring that landscaping fronting his/her property does not impair driver or pedestrian sight distance as described in Section 3.2.1 of this design manual.

d. Topping of street trees and other pruning that does not conform to industry standards is a civil violation under Chapter 1.18 BCC and subject to penalties set forth in BCC 1.18.045. (Ord. 6319 § 2, 2016; Ord. 6181 § 2, 2014).

5. Additional Requirements

a. The final grade of soil surfaces in planting strips must accommodate runoff from sidewalk surfaces cross-sloped to drain toward the street. Refer to Standard Drawing SW-130-1 for more information on the planter cross slope. Where steep cross slopes exist, a drainage system may be required.

b. Tree pits should be graded to provide a soil surface 1.5 inches below the adjacent sidewalks and curb elevation and be top dressed with bark, wood chips, cinders or crushed angular aggregate material that is routinely maintained to minimize the grade differential between the sidewalk and open pit area.

c. Where required, tree grates are often proposed as an architectural design element and/or as a means to maximize the pedestrian accessible area in the right of way. Tree grates may be permitted but are not recommended. When permitted, tree grates shall be maintained routinely by the property owner to ensure a flush condition between the grate surface and surrounding pavement, to replace broken segments, and to expand the opening as appropriate to accommodate the growth of the tree.

d. Within the sight distance triangle, non-plant materials and perennials should be no more than 2 feet high, and tree limbs should begin at a height of no less than 7.5 feet.

e. Street trees and streetlights must be shown on the same plan sheet with the proper separation (generally 25 feet apart).

f. Street trees are to be planted at the proper spacing from driveways (10 feet from Point A in standard drawing SW-140-1 or equivalent).

g. Trees should be located in the middle of the planting space and must be placed to ensure drivers can see all regulatory signs.

3.4.1.6.1 Pet Relief Areas

A pet relief area is defined as a location designated and designed to attract pets to relieve themselves.

Animal relief in the right of way is a public amenity to those using the public sidewalk. The amenity does not just serve those with animals but everyone as it helps the viability of the public streetscape planters. It is not the intent that this infrastructure will address all animal relief demands from adjacent private development, but it will lessen the impacts of animal relief on the public street scape planters. It is important that private development provides additional designated animal relief on private property and within the building to address the full demand for animal relief.

The adjacent property owner will own, maintain and, if given notice by the City, remove this infrastructure per a recorded indemnification and maintenance agreement with the City.

1. Animal relief shall be located at least 3 feet from the nearest tree, utility vault, bike racks or any other right-of-way feature.
2. A pet waste station may be installed in the animal relief area when it is within 15 feet of the building entrance. The adjacent property owner is responsible for emptying and refilling the station.
3. The number and location of permitted animal relief areas are to be determined through the permit review process. In no case shall there be more than one animal relief area for every 400 linear feet of public sidewalk.
4. Animal relief shall be located within 5 to 15 feet from a building entrance, measured from the closest end of the animal relief to the nearest edge of the door. The Review Engineer may not allow pet relief directly across from doors in locations where sidewalks may be narrow.
5. Target materials are permitted but must be located within the relief area and be located such that there are at least 3 feet from the face of the target material to the face of the curb.
6. A water spigot is required to be located on the building face with new development and shall be within 20 feet of the permitted animal relief area. Relief areas shall be rinsed a minimum of twice weekly by irrigation spray heads in the dry season and by hose in the wet season when irrigation is off and winterized.
7. Animal relief may not be compatible with all frontages, including those that have multi-purpose paths. In the case of a multi-purpose path, animal relief would need to be located outside of the 2-foot clear zone.
8. The slope of a planter shall be 5% or less to accommodate animal relief.

9. A recorded indemnification and maintenance agreement is required, specifying that the adjacent property owner will own, maintain, remove the animal relief and restore the area at the City's discretion.

3.4.1.7 Street Furniture

Street furniture such as benches, kiosks, newspaper stands, lighting, public art, bicycle racks, trash bins, etc., play a major role in creating an inviting and comfortable pedestrian environment and can contribute to a neighborhood's identity and character. If required by the Land Use Code, street furniture and other structure installation needs to conform to the following requirements:

1. Street furniture shall be installed along the entire street frontage of the property at the sole cost of the developer as directed by the Review Engineer.
2. All street furniture must be installed to provide a minimum of 3 feet of clearance between the face of a curb and the outermost edge of any structure.
3. Street furniture shall not intrude on the clear width of the sidewalk. Sidewalk width shall always be free from any obstructions.
4. A minimum of 2 feet of clearance distance from the front or back edge of a sidewalk shall be provided for benches and seating features.
5. Wayfinding signage and public art structural design details for the foundation shall be provided by the developer's consultant and will be reviewed and approved by the Review Engineer. The structural plan shall be included as part of the civil plan set to show the proposed location for a new or relocated existing structure.
6. Nonmotorized wayfinding signs are permitted, but may not be retroreflective, and may not be placed in such a manner that they would appear to be directed at automobile traffic.
7. A Right-of-Way Hold Harmless and Indemnity Agreement will be required for placing street furniture in the right of way or public sidewalk and utilities easements.

3.4.2 Bicycle Design

Bicycle facility construction or improvements are required for all developments, unless otherwise specified by the Review Engineer, to accommodate and meet City MIP targets and to develop bicycle routes that mitigate the direct transportation impacts resulting from development projects. Bicycle facility improvement is also required when necessary for the mitigation of adverse environmental impacts identified pursuant to the State Environmental Policy Act. Bikeways shall be designed in accordance with AASHTO's current "Guide for the Development of Bicycle Facilities," the latest adopted edition of the FHWA

MUTCD, NACTO "Urban Bikeway Design Guide," and WSDOT Design Manual. The City MIP establishes performance metrics on the bicycle network and priority bicycle corridors. The performance metrics used to describe the user experience on the bicycle network is the level of traffic stress (LTS). The concept of LTS is illustrated in Figure 3-1 below. Refer to the City MIP for more information on the applicable LTS for each bicycle facility.

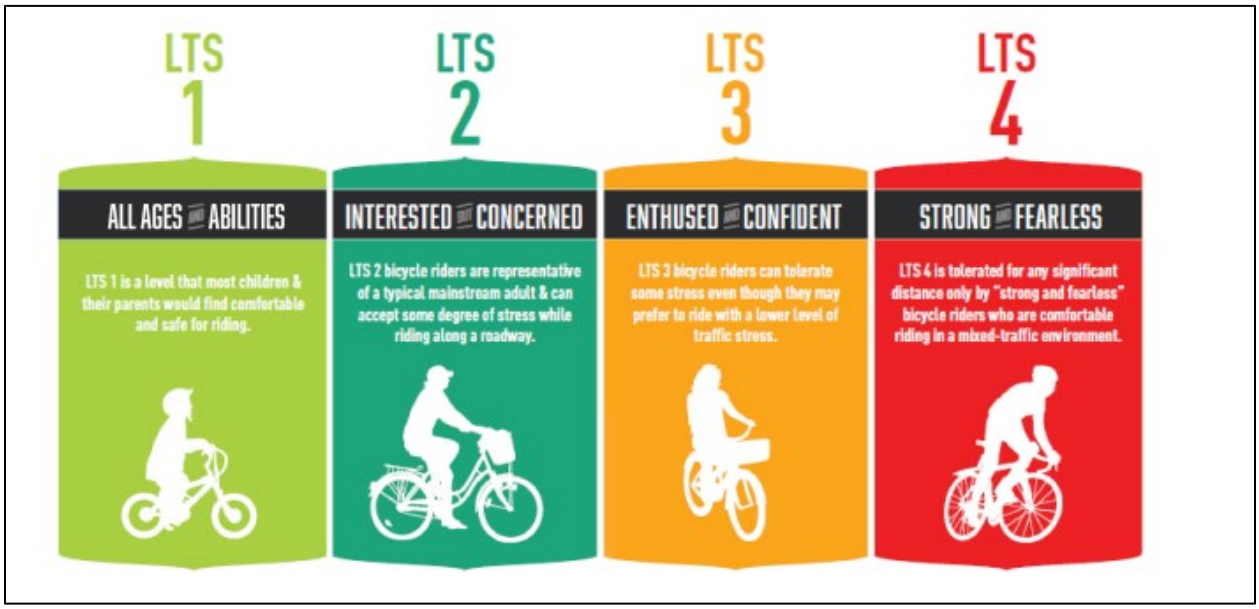


Figure 3-1: Bellevue Bicycle Level of Traffic Stress (LTS) Categories

For bicycle network corridors, LTS is a function of the posted speed limit, the average daily volume of traffic on the street and the type of bicycle facility provided. Table 3-14 shows this relationship. Table 3-15 shows how this concept applies to intersections.

Table 3-14: Bicycle Level of Service/Level of Traffic Stress

Roadway Characteristics		Bicycle Facility Components: Guideline to Achieve Intended Level of Service/Level of Traffic Stress					
Speed Limit	Arterial Traffic Volume	No Marking	Sharrow Lane Marking	Striped Bike Lane	Buffered Bike Lane (Horizontal)	Protected Bike Lane (Vertical)	Physically Separated Bikeway
</=25	<3k	1	1	1	1	1	1
	3-7k	3	3	2	1	1	1
	>/=7k	3	3	2	2	1	1
30	<10k	3	3	2	2	1	1
	10-25k	4	4	3	3	2	1
	>/=25k	4	4	3	3	3	1
35	<25k	4	4	3	3	3	1
	>/=25k	4	4	4	3	3	1
>35	Any	4	4	4	4	3	1

Table 3-15: Bicycle Intersection Treatment Selection by Target LTS

Bicycle LOS/LTS	Bike Signal	Street Crossing	Approach to Intersection	Approach to Intersection with Right Turn Lane
1	Bike Signal	Green solid or skip-stripe	Green bike box	Curb ramp to wide sidewalk, Dutch Intersection
2	Bike Signal	Skip stribe	Bike box	Green bike lane to left of turn lane
3	Green Cycle Length	Sharrow lane markings	Automatic signal actuation	Bike lane to left
4	No specific design guideline for LTS/LOS 4			
Trail or Mid-Block Crossing	Full signal or HAWK or RRFB	Green solid or skip-stripe	N/A	N/A

All new bike facilities should be designed with an asphalt lane width of at least 5 feet, measured from the edge of the pavement to the center of the bicycle lane marking or center-to-center of the bike lane markings. If a curb and gutter is present, the width of the gutter pan shall not be considered part of the bike facility. The following factors should also be considered when determining the desirable or minimum width of a bike facility:

- The minimum bike lane width of 5 feet also applies where the bicycle lane is routed between a through travel lane and a right turn.

- If no curb is present, a minimum 2-foot-wide graded shoulder is also required adjacent to the paved surface.
- The desirable bike lane width adjacent to a guardrail or other physical barrier is 2 feet wider than otherwise required in order to provide a minimum shy distance from the barrier.

In general, there are different types of dedicated bicycle facilities. Conventional bike lanes (CBLs) have a paint stripe, signing and pavement markings to provide a clear indication to bicyclists and drivers about the purpose of the facility. Buffered bike lanes (BBLs) are similar to conventional bike lanes, except they also provide a painted buffer to improve rider comfort and provide the benefit of having greater space between cyclists and motor vehicle traffic. Furthermore, separated bike lane (SBLs) also provide a painted buffer, but also include vertical elements to further improve rider comfort and improve the buffer's visibility and the driver's awareness of the buffer. The width of a bicycle lane with a buffer (BBLs and SBLs) does not include the width of the buffer. In addition, shared-use paths are another option of bicycle facilities that provides physical separation from traffic. See Section 3.4.1.3 of this design manual for more information on shared-use path design requirements. The following are more details on the different types of bicycles facilities.

3.4.2.1 Conventional (Striped) Bike Lanes

CBLs are at grade and adjacent to motor vehicle traffic lane. Refer to Figure 3-2, Roadway Bicycle Facilities for a conventional bike lane illustration. They are designated by a single, solid wide stripe between the motor vehicle lane and the bike lane. Refer to Standard Drawing CH-241-1 for more information and details. The design of a conventional bike lane shall conform to the following criteria:

1. The width shall be measured from the edge of the pavement to the center of the bicycle lane marking or center-to-center of the bike lane markings.
2. Additional width is considered when higher volumes of cyclists (such as high bicycle priority corridors) are anticipated or when adjacent to parallel on-street parking.
3. Gutter seams, drainage inlets and utility covers should be flushed with the ground and oriented to prevent conflicts with bicycle tires.
4. This type of facility is only allowed under special circumstances such as site constraints, topography limitations or other types of physical barriers and it is subject to Review Engineer approval.

3.4.2.2 Buffered Bike Lanes

BBLs are at grade with the roadway and the preferred bicycle facilities within the City of Bellevue. They include a bike lane and a buffer area. Bike markings in the bike lane and signage are employed. The lane shall conform to the following requirements.

1. A minimum width of 5 feet, not including the gutter width, is required exclusively to the bike lane to enable passing maneuvers between cyclists, and to account for the effective width needs of bicyclists when drainage features are present in the bike lane. Consider a 3-foot-wide buffer strip whenever possible. Otherwise, a 2-foot-wide bike lane is required.
2. When a buffered bike lane is positioned adjacent to an on-street parking zone, the bike lane and buffer should be adjacent to the curb and gutter and separated from the vehicular travel lane by the on-street parking lane. See NACTO's Urban Bikeway Design Guide and Urban Street Design Guide for examples.
3. Standard flexible tubular markers or delineators in the buffer strip are required to help distinguish the bicycle facility from the motor vehicle lane.
4. High bicyclist volume locations such as high bicycle priority corridors or those supported by count data should consider more width to facilitate mobility performance for this mode.

3.4.2.3 Separated Buffered Bike Lanes

SBLs are at grade with the roadway, and they include a bike lane, a buffer area and some type of vertical physical feature that reduces the likelihood of encroachment into the bike lane by motor vehicles and increases user comfort. Bike markings in the bike lane and signage are employed. The use of dual-faced curbing, raised medians or the parking zone adjoining the buffer area as directed by the Review Engineer will be required to accomplish the physical barrier requirements for this type of bike facility. The same requirements for buffered bike lanes are applied to the separated buffered bike lanes as listed below:

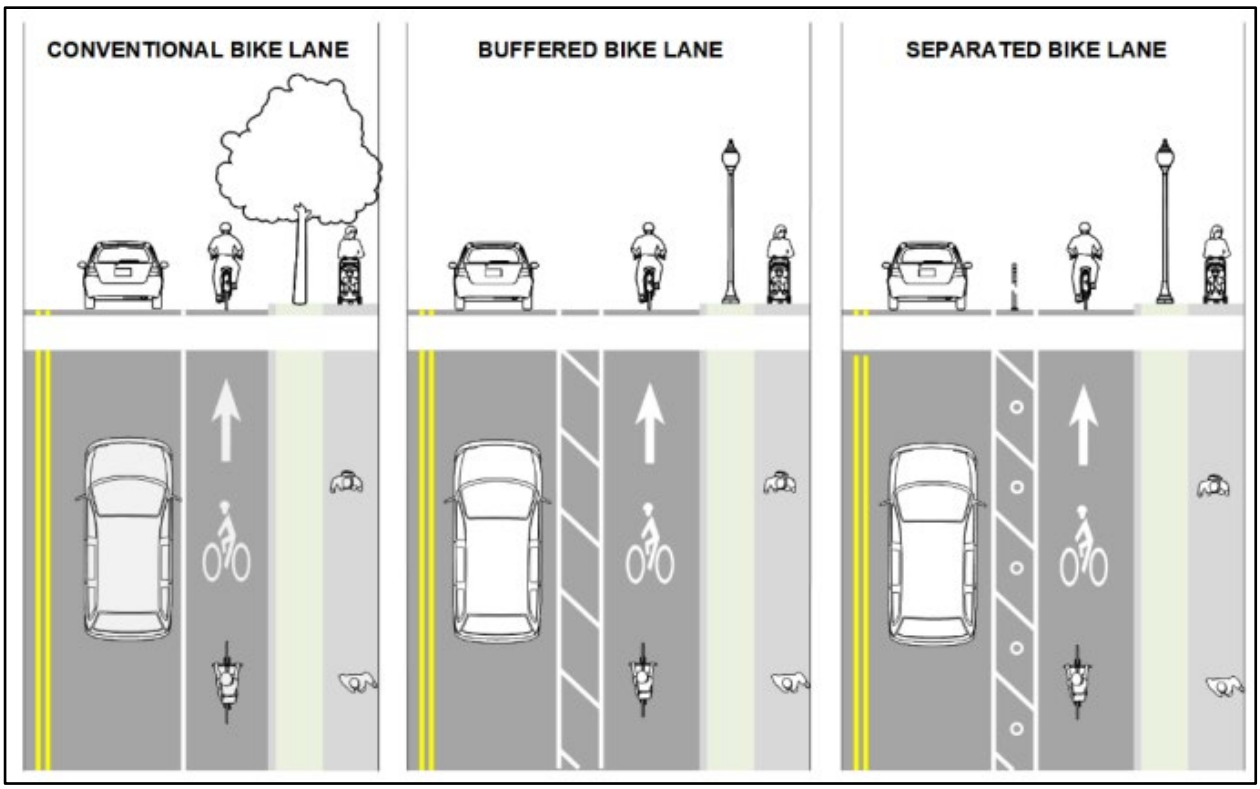
1. A minimum width of 5 feet is required exclusively to the bike lane to enable passing maneuvers between cyclists, and account for the effective width needs of bicyclists when drainage features are present in the bike lane. Consider a 3-foot-wide buffer strip whenever possible. Otherwise, 2-foot-wide bike lane is required.
2. When a buffered bike lane is positioned adjacent to an on-street parking zone, the bike lane and buffer should be adjacent to the curb and gutter and separated from the vehicular travel lane by the on-street parking lane. See NACTO's Urban Bikeway Design Guide and Urban Street Design Guide for examples.

3. High bicyclist volume locations such as high bicycle priority corridors or those supported by count data should consider more width to facilitate mobility performance for this mode.

3.4.2.4 Raised and Curb-Separated Facilities

These facilities are considered protected because they are vertically separated from motor vehicle traffic. When a raised and curb-separated bicycle facility is applied, it is considered part of the streetside zone; however, it cannot be combined with other zone areas such as planter strips or sidewalks because the intent is also segregation from pedestrians. The raised and curb-separated facility is dedicated for bike users and delineated with pavement markings, signing and, in some cases, pavement material. See Figure 3-3, Examples of Protected Bike Lane Configurations. The raised and curb-separated bike lanes shall follow the following requirements:

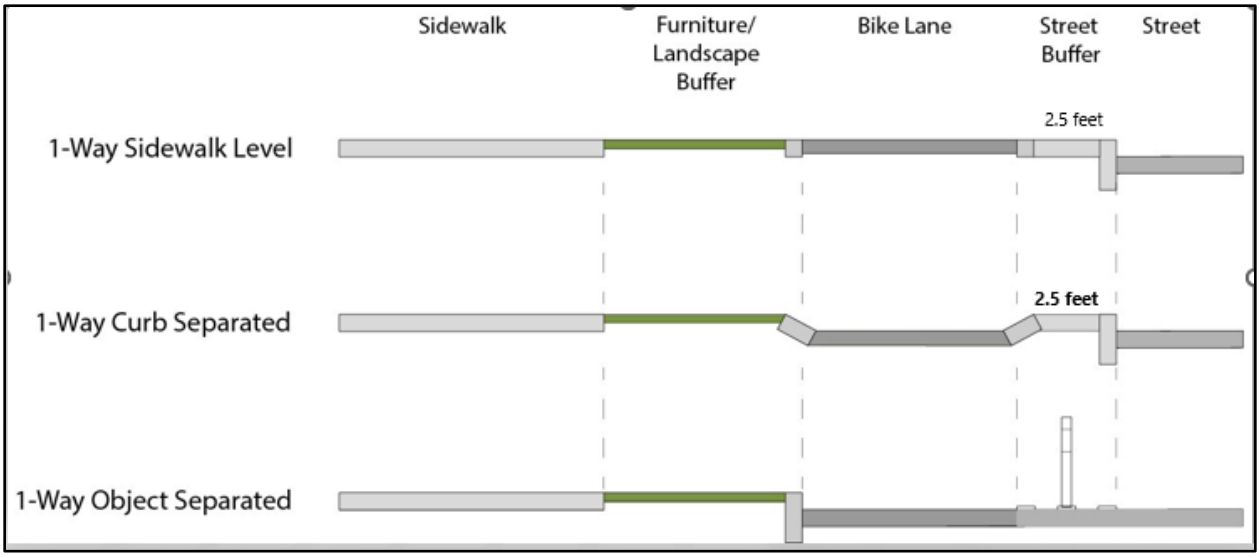
1. A minimum width of 2.5 feet is required for the border area that separates cyclists from motor traffic. The distance is measured between the outside edge of the bike lane and the back of curb.
2. HMA surface is required unless otherwise specified.



Source: (Edited) Exhibit 1520-1 Exhibit 1520-1 Roadway Bicycle Facilities-WSDOT Design Manual.

Figure 3-2: Roadway Bicycle Facilities

Different types of protected bike lane configurations are shown on Figure 3-3 below.



Source: Figure T Protected Bike Lane Configuration, City of Seattle Right of Way Improvements Manual.

Figure 3-3: Examples of Protected Bike Lane Configurations

The following are general requirements applied to all bicycle facilities.

1. Safety railings shall be provided and installed by the developer when warrants for safety railings as shown in Design Manual Drawing RS-100-1 are met, or as directed by the Review Engineer or the Inspector.
2. When hard surfaces are disturbed, all junction boxes within the hard surface shall be replaced with new junction boxes with non-skid lids.
3. The bicycle facility type selection will be determined by the Review Engineer in coordination with other City staff and in accordance with the current Bellevue Pedestrian and Bicycle Transportation Plan and MIP during the permit application review process.
4. Accommodating bicycle users on the shoulder is common on some streets within the City of Bellevue. Therefore, shoulder improvements to facilitate bicycle travel including the widening of shoulders to a minimum of 4 feet and removing surface obstacles such as drain grates that are not compatible with bicycle tires may be required on certain streets as directed by the Review Engineer.

3.4.2.5 Intersection Design Treatments

The principal objective when designing intersections for bicycle mobility and safety performance is to provide a visible, distinct, predictable and clearly designated path leading to and through the intersection while managing potential conflicts between all other users and cyclists. For design criteria, refer to Chapter 1520 of WSDOT Design Manual.

Intersection treatments may include the following:

1. **Bike boxes**. These features are designated at the heads of traffic lanes at signalized intersections. They provide bicyclists a safe and visible refuge, as well as a way to get ahead of queuing traffic during the red signal phase. Bike boxes have also been found to prevent cyclist and motor vehicle encroachment into the pedestrian crossing, reducing conflicts with pedestrians at intersections.
2. **Intersection crossing markings**. Crossing markings indicate the intended path of bicyclists through the intersection. They are typically required when the approach and receiving leg both have bicycle lanes.
3. **Two-stage turn queue boxes**. These features offer a safe way to make left turns at multi-lane signalized intersections from a right-side cycle track or bike lane or right turns from a left-side cycle track or bike lane; they may be used to orient bicyclists properly for safe crossings.

4. **Median refuge island/median cut-through**. These features offer a protected space in the center of a street to facilitate bicycle and pedestrian crossings.
5. **Bicycle signals**. Bicycle signals shall be implemented at locations where the bicycle movement needs to be separated from vehicle or pedestrian movements. Refer to Section 4.1 Traffic Signals for more information on bicycle signal requirements.

Refer to Chapter 1520 of WSDOT Design Manual for additional requirements for bike facilities.

3.4.2.6 Bicycle Racks

Bike racks, if required, shall be installed to provide a 3-foot setback distance from the vehicular travel lane and oriented such that parked bicycles do not encroach on the required sidewalk full clear width or infringe in any way into the clear pedestrian's path.

In general, bike racks must have the following characteristics:

1. Have a no-maintenance finish that will chip, peel or rust. Galvanized steel finishes are preferred.
2. Have a minimum height of 32 inches so it is not a tripping hazard.
3. Are installed as close to, without being directly in front of, the main entrance(s) of a building or site.
4. Have adequate clearance from driveways, curb ramps, transit loading areas and be immediately adjacent to shelters and utility poles.
5. Must consider the widest variety of bicycles (family bikes and mobility trikes) at high volume locations and allow for greater clearances than the standards referenced above.

3.4.3 Transit Design

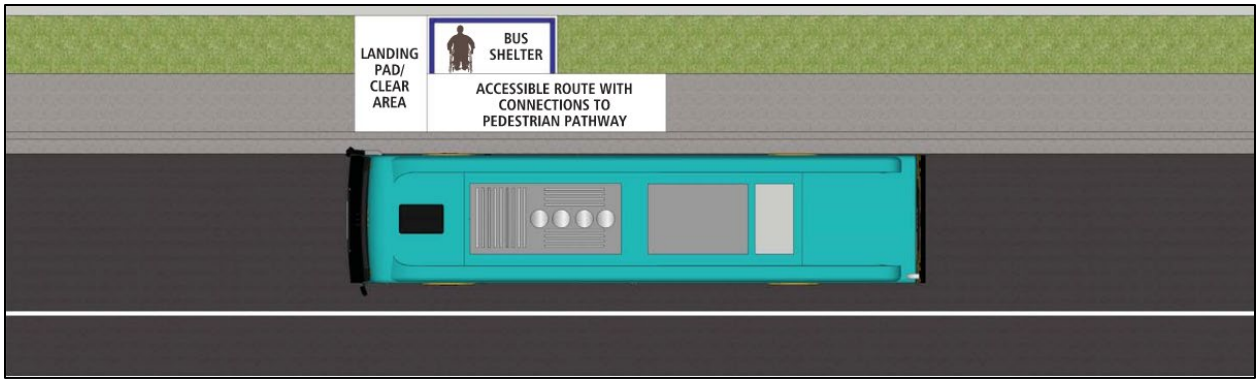
City of Bellevue is served by King County Metro and Sound Transit. Refer to King County Metro Transit Facilities Guidelines for guidance and criteria to plan and design bus stops that are easily identifiable, safe, accessible and comfortable to wait for and access a bus. Because each transit facility is located in a unique built environment, each facility is also unique and requires early coordination with the Review Engineer and King County Metro to determine and confirm the requirements. The Review Engineer may also require provisions, including easements, for transit facilities along transit streets where a need for bus stops, bus pullouts or other transit facilities within or adjacent to the development have been identified.

3.4.3.1 General Requirements

1. All transit stops, shelters and associated appurtenances must be designed and constructed per the PROWAG.
2. Placement of waste receptacles, signs, seating or any other appurtenance must not infringe on the full clear width of the sidewalk (pedestrian circulation route). Placement also must not compromise direct access between the ADA waiting area and the ADA landing area or the access between either the ADA area or the sidewalk.
3. The installation of new transit stops or improvements to existing stops, including shelter installations or associated appurtenances, requires coordination with King County Metro prior to obtaining approval from the Review Engineer during the permit review process. Coordination is necessary to confirm specific improvement requirements for transit stops and shelters. The design and configuration of bus zones are customized for each location, depending on factors such as service levels, amenities, route numbers, ridership and turning movements.
4. As part of the plan review process, the development project must evaluate transit stops, shelters and associated appurtenances for adequate sight distance.

3.4.3.2 ADA Landing Area Requirements

1. In circumstances where right of way is limited or a site is otherwise significantly constrained, landing pads or clear areas can be 5 feet wide by 8 feet deep. This is the absolute minimum allowed by ADA guidelines and should only be used where construction of larger landing pads or clear areas is not reasonably feasible.
2. Where rear-door ADA landing areas are provided, they shall comply with this section.
3. Parallel to the roadway, the grade of ADA landing areas shall be the same as the roadway. Perpendicular to the roadway, the designed grade of ADA landing areas shall be 1.5% or less.
4. ADA landing areas shall connect to streets, sidewalks or pedestrian circulation paths by ADA-accessible pedestrian access routes.



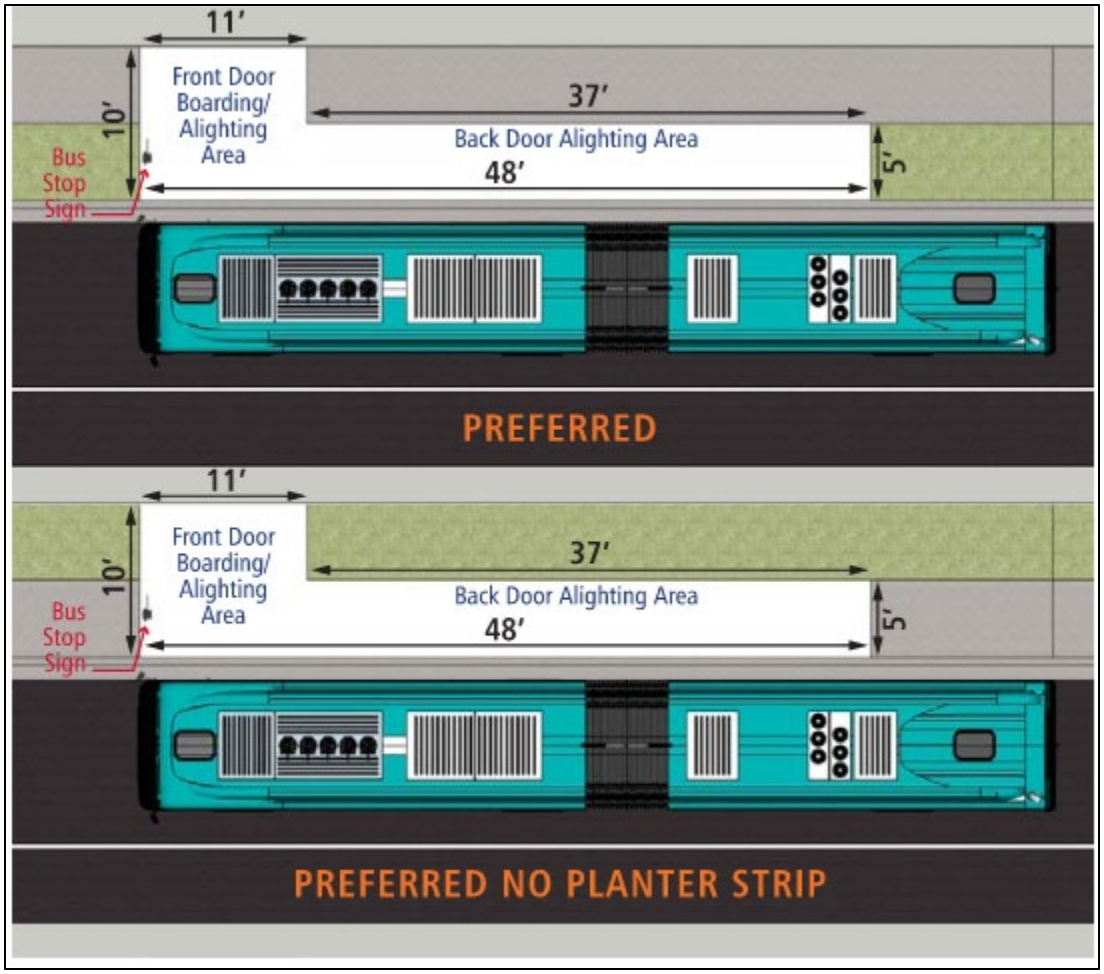
Source: King County Metro Transit Facilities Guidelines.

Figure 3-4: ADA Accessibility Requirements

3.4.3.3 Landing Pad and Clear Area Layouts

The length of the landing pads and clear areas is a 60-foot concrete pad without planting strips, trees or other vertical features and depends on the length of the bus serving the stop. This allows for the maximum space for passenger circulation when buses are loading and unloading.

1. When development of a continuous landing pad or clear area is not feasible, the following dimensions for landing pads and clear areas are required unless approved otherwise by the Review Engineer:
    a. Front door: 11 feet wide by 10 feet deep
    b. Middle door: 10 feet wide by 5 feet deep
    c. Rear door: 11 feet wide by 5 feet deep
2. The absolute minimum allowed by ADA guidelines is 5 feet wide by 8 feet deep and should only be used where construction of larger landing pads or clear areas is not reasonably feasible.
3. In areas that are only served by 40-foot coaches, two landing pads or clear areas may be installed subject to Review Engineer approval.
4. Because King County Metro has a number of different bus lengths and styles, the location for multi-door landing pads can vary. A single stop may be served by multiple buses of varying lengths and/or styles. The dimensions of the landing pads shown in Figure 3-5 is an example of landing pads that may accommodate access to all doors on all King County Metro coach types.



Source: King County Metro Transit Facilities Guidelines.
Note: Sidewalk width is for illustration purpose only. For required sidewalk width, refer to Section 3.4.1.1 for full sidewalk requirements.

Figure 3-5: Examples of Landing Pads for all Metro Coaches

3.4.3.4 Transit Shelters

Transit shelter placement and orientation must provide the following:

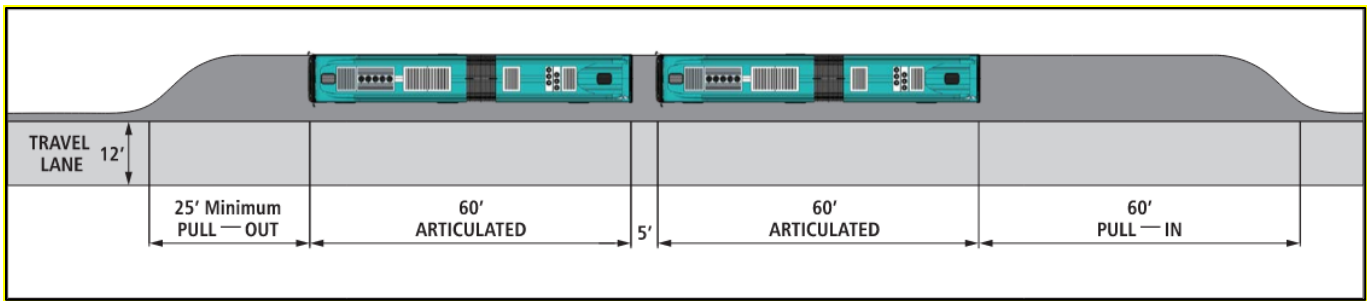
1. Be located behind the sidewalk with no encroachment on the public sidewalk.
2. Provide a minimum 5 feet of clearance from poles, hydrants and other obstacles.
3. Provide an ADA landing area adjacent to the bus stop sign and outside of the shelter.
4. Provide a clear pathway from the ADA waiting area inside the shelter to the ADA landing area.
5. Provide a clear pathway from the rear-door landing area to the pedestrian access route.

6. Provide interior lighting at the shelter for passenger visibility and security.
7. Ensure that the shelter does not block motorists' or pedestrians' lines of sight.

3.4.3.5 Transit Stop Layovers

Regular/layover stops are similar to regular stops in their design and function. These are located along bus routes and serve as designated spaces to stop to load and unload passengers. However, these areas also serve as layover stops for operators and are often located at the beginning or end of a route. Regular/layover stops are typically pull-out stops, have bus stops that are long enough to accommodate two or more buses and have comfort stations.

1. The typical component of a layover facility for multiple buses should be 60 feet of straight curb line for each bus intended. In addition to this curb line required to park the bus, space must also be provided for buses to pull in and pull out (see Figure 3-6).
2. When the adjacent travel lane is 12 feet wide or greater, 60 feet should be provided for buses to pull in and at least 25 feet for buses to pull out. Additional space is needed if the lane width is less than 12 feet.
3. An adequate pull-out length must be provided whenever buses are expected to merge back into travel lanes with competing general traffic. This length is dependent on the posted speed and the level of service of the roadway. For a high-traffic and high-speed roadway, the MUTCD is used to determine the length of the pull-out to provide adequate space for acceleration to the traffic speed.
4. Within a total dependent bus parking area, 5 feet should be provided between coaches along the curb line, recognizing that the buses would not actually park bumper-to-bumper and that space should factor into the bike rack mounted on the front of the bus.
5. The parking lane used for parking, pull-in and pull-out should be 12 feet wide.



Source: King County Metro Transit Facilities Guidelines.

Figure 3-6: Typical Dimensions for Parking Multiple Coaches at Layover Facilities and Transit Centers

3.4.3.6 Pavement Requirements for Transit Facilities

Sidewalk repairs must be completed according to standard drawing SW-100-1.

In roadway areas where buses start, stop or turn—or along roadways with high bus volumes—the following requirements may be applied:

1. Concrete pavement may be required on streets carrying a high number of buses per day.
2. A reinforced concrete pad may be required at high-volume bus stops and bus pullouts.

3.5 Access Design

Access design focuses on the location, spacing and design of driveways, private streets and alleyways. Each access location creates conflict points where vehicles interact with other vehicles or pedestrians, causing delay and potential safety concerns. Determination of permitted access, including number, location and size, shall be the responsibility of the City.

3.5.1 Driveways

A driveway under this section is defined as a private way of vehicular ingress and egress to a site, extending into the site from a public street or private street. Driveways shall be designed in accordance with Section 14.60.150 of the Transportation Development Code and shall conform to the following general requirements:

1. Driveways and parking areas shall be designed such that vehicles attempting to enter the driveway or parking area will not unreasonably impede vehicles in the travel lane of the public street.
2. The installation of driveways onto arterials may be denied at the discretion of the Review Engineer if alternate access is available.

3. Driveways onto arterials may be restricted to right-in, right-out only movements in order to improve access management along public streets.
4. The continued use of preexisting driveways is not guaranteed with the development of a site.
5. All abandoned driveways on the street frontage to be improved shall be removed and new curbs, gutters and sidewalks shall be installed, or the frontage shall be improved to match existing improvements.
6. All driveways greater than 150 feet in length shall be designed to provide fire access and an emergency vehicle turnaround area at or near the driveway termination as per Section 3.24, Street End Designs and as determined necessary by the Review Engineer and the fire marshal.
7. The City may not permit more than one driveway opening on any property having a street frontage of 200 feet or less. This requirement may not apply to a property with street frontage less than 200 feet and the property is at least three acres in area.

3.5.1.1 Access Types

Driveways are divided based on the intended land use into the following types.

1. **Commercial/industrial driveways**. Commercial use is defined in Title 14.60, Transportation Development Code as any land use other than a detached single-family dwelling. Commercial driveways may serve the following, but are not limited to, multi-family developments, offices, retail, services, mixed-use properties, institutional developments, shopping centers, parking structures or any other non-single-family dwelling developments. No commercial driveway shall be approved where backing onto the sidewalk or street will occur.
2. **Residential driveways**. This type of driveway will serve one single-family residential lot only.
3. **Residential shared-use driveways**. Shared-use driveways provide access to two single-family residential lots only. Combined or shared-use driveways for adjoining properties are encouraged. The driveways or accesses in this case shall be established in a tract or a private access easement.

   Driveways that serve three or more residential lots must be served by a private street and shall meet the requirements of Section 3.1.1.10, Private Streets of this design manual.

4. **Emergency vehicle access driveways**. This type of driveway provides access to emergency vehicles only and it is required to be gated with a Knox lock or other physical break-away barrier devices as approved by the Fire Department. Such barriers shall be constructed in such a manner that they will immediately break away in an emergency situation. Emergency driveways shall meet the requirements of this section.

3.5.1.2 Design Requirements

The following requirements shall apply to all driveway types.

1. All new or altered driveways required to meet ADA accessibility standards shall meet the PROWAG standards for a Pedestrian Access Route where there are an intersect sidewalk, multi-use path or trail.
2. Sight distance for motor vehicle operators and for pedestrian and safety shall be provided per the provisions of Section 3.2.1 Sight Distance. Where the building façade or other design element is less than 10 feet behind the sidewalk (as is typical downtown), both pedestrian and vehicular sight distances shall be maintained. Sight distance and setback requirements shall be specified per Design Manual Standard Drawings RL- 100-1 and RL-120-1.
3. For multi-use paths crossing a driveway approach, sight distance for bicyclists' safety shall be provided.
4. All driveways shall intersect the streets at a 90-degree angle, unless designated as right-turn-in/ right-turn-out only.
5. For commercial driveways located on arterials, no parking stalls shall be located closer than 20 feet from the face of the curb (or the edge of the driving lane if there is no curb) in order to preclude conflicts with entering vehicles. No such clear area is required for driveways serving multi-family developments on non-arterial streets.
6. Sidewalk sections within commercial and heavy truck traffic driveways, including private streets and alleyway entrances must be constructed with a minimum concrete thickness of 8 inches. Refer to Section 3.4.1 for more information on sidewalk requirements.
7. For driveways subject to fire access requirements, roadway base, bridges and culverts shall meet the AASHTO HL-93 design load in order to withstand the load of the fire truck ladder.

8. Where a driveway is designed with a turn, the centerline radius shall be 38 feet as a minimum, unless a larger centerline radius is necessary for safe fire truck turning.
9. Gates shall be placed a minimum of 30 feet from back of sidewalk or edge of pavement. If queues are likely to extend into the travel lane of the nearest roadway, then a queuing analysis shall be provided as required by the Review Engineer to determine the location of the gate or parking garage door. The minimum 30-foot requirements may be reduced to a minimum of 20 feet for single-family homes located on non-arterial streets.
10. All driveways shall have a minimum vertical clearance of 15 feet unless otherwise approved by the Review Engineer.
11. No fixed objects, including fire hydrants, trees, mail boxes and streetlight poles are allowed within 10 feet of a driveway edge, defined as Point A in standard drawing SW-140-1 or equivalent. Fixed objects are defined as anything with breakaway characteristics greater than a 4-inch by 4-inch wooden post.

3.5.2 Driveway Width

Table 3-16: Driveway Width

Driveway Type	Minimum Pavement Width (feet) [8, 11]
Two-way Commercial Driveway (with exclusive right- or left-turn lane)	30[1, 6, 9, 10, 12]
Two-way Commercial Driveway (without exclusive right- or left-turn lane)	26[2, 6, 9, 10, 12]
One-Way Entry or Exit Commercial Driveway	20[3, 6, 9, 10, 12]
Residential Driveway	10[4, 7]
Residential Shared-use Driveway	16[5, 7]
Emergency Vehicle Access Driveway	20[6]

[1] Two-way 36-foot-wide commercial driveways may be allowed. A two-way commercial driveway wider than 36 feet may be approved by the Review Engineer where a substantial percentage of oversized-vehicle traffic exists.
[2] The width of commercial driveways shall be as required by the Review Engineer. Two-lane commercial driveways should generally be 26 to 36 feet wide, with 36 feet preferred on the approach to an arterial street.
[3] One-way entry or exit commercial driveway width less than 20 feet will require approval from the Fire Department.
[4] A greater width, but not more than 30 feet, may be considered for new single-family and duplex residences along streets with posted speeds 30 mph or greater. A greater width, but not more than 24 feet, may be considered for new single-family and duplex residences with driveways along streets with speed limits of less than 30 mph.
[5] Greater tract or easement width up to 25 feet may be required for residential shared-use driveways to account for future expansion of the plat.
[6] Vehicle swept path analysis and turning simulation for the design vehicle are required for all commercial driveways to confirm driveway width is adequate for two-way traffic. Refer to Section 3.1.3, Design Vehicles, for more details on the auto-turn requirements.
[7] Residential and residential shared-use driveways must be paved full width for the entire length.
[8] Pavement width as shown in Table 3-16 does not include space for a median or a sidewalk.
[9] Commercial driveways shall maintain the driveway approach width for the length of the landing (see Table 3-16 and Table 3-17).
[10] Commercial driveways, including multi-family developments, shall maintain the driveway approach width for the length of the landing (see Table 3-17).
[11] Vehicle access driveway width will be confirmed by the Fire Department during the permit review process.
[12] A minimum tract or easement width of 25 feet is required for private streets.

3.5.3 Driveway Vertical Alignments and Profile Elements

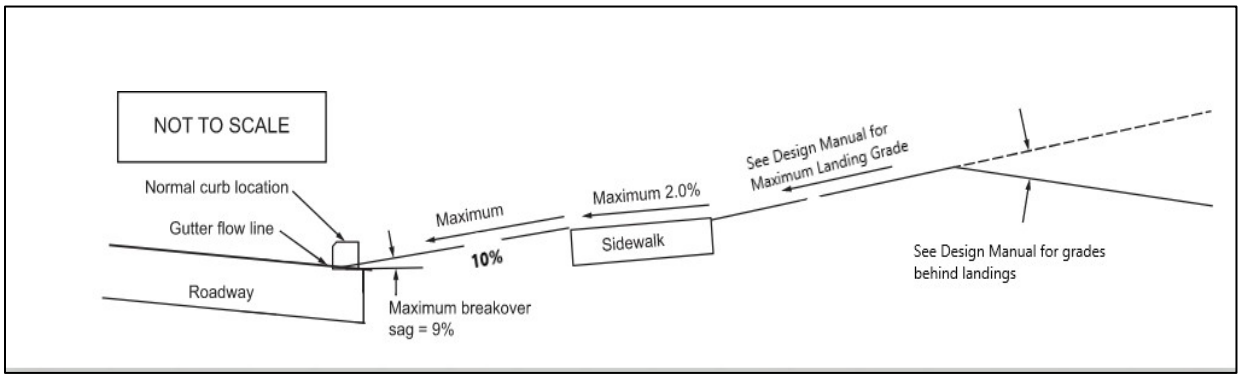
Vertical alignment elements are important in driveway design and should allow vehicles to be operated efficiently as they enter or exit the driveway. Profiles should be designed to minimize the possibility of a vehicle dragging or hanging up on the driveway. Driveway vertical profile includes the following elements:

1. **Driveway approaches**. Is the portion of the driveway lying in the public right of way and sidewalk easement between the curb face or roadway of a public street or private street and the private property line? Driveway approach grade and configuration shall accommodate planned future street widening to prevent the need for major driveway reconstruction in the future. Where a new driveway is constructed as part of the development frontage improvements, the driveway approach shall be a formed concrete structure as specified in Design Manual Standard Drawings SW-140-1 and SW-150-1. Driveways with dropped sidewalks as shown on Standard Drawings SW-160-1 and SW-170-1 will only be allowed in situations where an existing driveway is being reconstructed without the adjacent sidewalk or where it is infeasible to construct other allowed driveway options due to, but not limited to, site constraints and topography. In cases where public street improvements or sidewalks do not exist and they are not required by the Transportation Development Code, the driveway approach may be asphalt and constructed as specified in Design Manual Standard Drawings SW-180-1 and SW-190-1. If there is a taper from the driveway to the driveway approach, the taper design shall be as specified by the Review Engineer.

   The driveway approach includes the following elements:

   a. Driveway apron, which is the portion of the driveway approach extending from the gutter flow line to the front of the sidewalk. A minimum of a 5-foot-wide apron is required for all driveway types with a maximum running slope of 10% as shown on Figure 3-7 below. The Review Engineer may allow a maximum of a 1-inch drop in sidewalk elevation in order to maintain the required apron maximum slope of 10%. On a case-by-case basis, the Review Engineer may allow the apron to be extended to the side up to 8 feet beyond the driveway opening width to accommodate the turning movements of oversized vehicles. This type of configuration will only be allowed if site constraints prevent the full widening of the driveway.

   b. Side slopes (wings) are the two portions of the driveway approach that provide a transition from the normal curb or sidewalk grade to the grade of the apron by means of a sloping surface. The horizontal distances of these side slopes are measured at the curb line and illustrated on the Design Manual Drawing SW- 140-1 or equivalent.



Source: [Edited] Figure 4-12. Driveway Vertical Alignment and Profile Elements of AASHTO Green Book, 7th Edition 2018.

Figure 3-7: Driveway Vertical Alignment

2. **Sidewalks, multi-use paths or trails**. The sidewalk, multi-use path or trail shall continue across the driveway without a change of elevation unless otherwise approved by the Review Engineer. Sidewalks intersect new or altered driveways and are required to meet ADA accessibility standards and the PROWAG standards for a Pedestrian Access Route. Refer to Section 3.4.1, Pedestrian Design for more details on the requirements.

3. **Landings**. Landings are the flattened portion of a driveway or private street located on the private property and immediately past the sidewalk section for a certain length. They provide a transition, with the approach, from the traveled way to the driveway or private street. All landings shall be limited to a grade of 10% or less for 20 feet past the back of the driveway approach, as listed in Table 3-17 below, and shall be limited to a maximum grade of 15% thereafter. Landing grade requirements are necessary to accommodate sight distance requirements per Design Manual Standard Drawings RL-100-1 and RL-120-1, and Design Manual Standards 3.2.1 and 3.2.2. Grade changes must be rounded off so that vehicles do not bottom out and abrupt grade changes do not interfere with the sight distance requirements.

Table 3-17: Landing Grades for Private Streets and Driveways

Access Types	Arterial		Non-Arterial	
	Maximum Grade	Minimum Length Past Driveway Approach (feet)	Maximum Grade	Minimum Length Past Driveway Approach (feet)
Residential single-family driveway	10%	20	10%	20
Residential shared-use driveway	10%	20	10%	20
Commercial driveway with no parking garage at back of sidewalk	7%	30	10%	20
Commercial driveway with parking garage at back of sidewalk	7%	30[1]	10%	30[1]
Emergency Vehicle Access Driveway[2]	7%	30	10%	30

[1] If queues are likely to extend into the travel lane of the nearest roadway, then a queuing analysis shall be provided as required by the Review Engineer to either set the location of the parking garage door such that it will not create any spillover to the street or adjust the operation of the garage door during the business hours to minimize any waiting time or delay at the garage access.

[2] Final requirements will be confirmed by the Fire Department during the permit review process.

3.5.4 Driveway Spacing, Offsets and Setbacks from Intersections

All driveways shall be aligned with driveways, private streets and public streets located on the opposite side of the street. Offset and setback distance requirements are shown on Table 3-18 below. If compliance with this requirement is infeasible, driveway opening must meet the offset and setback distance requirement as shown on Table 3-18.

Table 3-18: Offset and Setback Distance Requirements

Driveway Type	Requirements	Minimum Distance (feet)[1, 2, 3, 4, 5]
Commercial Driveway	Offset distance from driveways, private streets, and public streets located on the opposite side of the street.	100
Commercial Driveway	Setback distance from the nearest parallel public street or intersection	150
Commercial Driveway	Setback distance from any other parallel driveway or private street.	100[6]
Commercial Driveway	Setback distance from any private property line	10
Residential Single-family Driveway Residential Shared-use Driveway	Setback distance from any other parallel residential driveways	10
Townhouses PUD Duplex or Triplex	Setback distance from any other parallel residential driveways	5

[1] The offset or setback distance from a driveway or private street approach shall be measured from Point A to Point A. Point A is defined in Design Manual Standard Drawings SW-140-1, SW-150-1, SW-160-1 and SW-170-1.
[2] The offset or setback distance from a public street or private street shall be measured from Point A to the point of tangency (PT) or point of curvature (PC) of the curb return. Point A is defined in Design Manual Standard Drawings SW-140-1, SW-150-1, SW-160-1 and SW-170-1.
[3] Conflicting access movements within the 95th percentile queue of any traffic movement should be avoided.
[4] Driveways shall be separated as far as possible from the nearest adjacent parallel public street. If the minimum separation distances shown on Table 3-18 cannot be achieved, the Review Engineer may request a safety and operational analysis study from the applicant to confirm that the proposed location will not have any adverse impacts on the adjacent public street or intersection.
[5] Emergency vehicle access driveway setbacks and offset distances will be determined by the Review Engineer during the permit review process.
[6] The offset distance from a parallel existing driveway may be reduced to a minimum of 20 feet subject to Review Engineer approval.

3.5.5 Restricted Access Driveways

Restricted access driveways are used to restrict turning movements out of or into driveways. Turning restrictions at driveway locations shall be by one or more of the following methods as deemed appropriate by the Review Engineer:

- Median islands
- Mountable curb or C curbs
- Pork chops
- Signage

3.5.6 Access Requirements at Street Ends

In cases where a development site is abutting a dead-end street or private street with no turnaround area, the new driveway or access may not be allowed to extend from the street end; instead, the owner is required to construct a new circular turnaround area as per Design Manual Standard Drawing RC-130-1 in order to create a driveway access off the public street or private street end. For a residential single-family lot, if creating a circular turnaround is infeasible due to land availability or other constraints, the Review Engineer may allow an alternative type of turnaround area such as a hammerhead or offset type hammerhead to be created at the end of the street in order to gain access off the new turnaround. In such cases, the new driveway shall not be allowed to be placed on the hammerhead branches. The hammerhead shall be fully accessible for emergency vehicles at all times. All applications will be reviewed by the Review Engineer on a case-by-case basis to determine the final requirements during the permit application process.

New driveways shall be perpendicular on the horizontal curve for the turnaround to maximize the sight lines at the driveway.

3.6 Roadside and Bridge Design

3.6.1 Bridges

1. All bridges, whether on public streets or private roads, shall meet the minimum requirements set forth in the latest edition of the AASHTO LRFD Bridge Design Specifications, the AASHTO Guide Specifications for LRFD Seismic Bridge Design and the WSDOT Bridge Design Manual. Vehicular live load design criteria shall be HL-93, as modified by the WSDOT Bridge Design Manual, except as allowed by the City of Bellevue Transportation Director. Additional loading and design considerations may be required by the Fire Marshal or the Transportation Director.

2. All bridges shall match the full width and configuration of the street, private road or path being served (traveled way plus curbs, sidewalks, walkways, bike lanes, equestrian lanes and shoulders on one or both sides). Requirements of utilities shall be considered. Traffic barriers and pedestrian railings or combination traffic barrier/pedestrian railings shall meet AASHTO specifications and the requirements of the WSDOT Bridge Design Manual. Vertical clearance shall be a minimum of 16.5 feet (or state standard, whichever is greater).

3. All information required to create the Bridge Record file as described in Chapter 1.09 of the WSDOT Bridge Inspection Manual shall be supplied by the developer prior to acceptance of the finished structure by the Transportation Department.

3.6.2 Retaining Walls and Transportation Structures

1. Retaining walls located within the right of way shall be installed to benefit the general public by supporting or protecting public transportation infrastructure and shall not be for private development gain.

2. Walls located on private property or rights of way that support or protect public transportation infrastructure shall meet the minimum requirements set forth in the latest edition of the WSDOT Design Manual, Bridge Design Manual, and the International Building Code. The wall type shall be approved by the Review Engineer, who may take into account long-term maintenance requirements, constructability and recommendations from the applicants' or third-party engineers. The Review Engineer may require a third-party structural review prior to approval of the wall. Additional easements may be required for the maintenance, operation and replacement of the wall. Rockeries that are load-bearing or over 4 feet in height are not an acceptable retaining wall type. An architectural finish or engineered block shall be chosen that fits the character of the surrounding neighborhood with approval from the Review Engineer. Timber laggings are not considered a permanent structure when building soldier pile walls and shall require a reinforced concrete finish. Concrete walls that are prone to graffiti shall be coated with a moisture barrier and anti-graffiti paint.

3. Retaining walls shall be located such that there is a minimum of 2 feet clear of the sidewalk and a minimum of 3 feet clear of the curb face where there is no sidewalk. Barriers, railings or fencing at the top of the wall may be required.

4. Private and public retaining walls shall not be built integrally. Total structural isolation is required for adjacent walls.

5. Acceptance for privately built retaining walls within the public right of way, which will be maintained and/or owned by the City of Bellevue, shall require As-Built shop drawings with final design calculations and plans to be filed with the City.

3.6.3 Clear Zone and Fixed Objects Placement

Fixed objects are defined as an object, a side slope or water that, when struck, can result in impact forces on a vehicle's occupants that may result in injury or place the occupants in a situation that has a high likelihood of injury. A fixed object can be either constructed or natural. Examples of fixed objects include, but are not limited to: a wooden pole or sign post (that do not have a breakaway feature) with cross-sectional areas greater than 16 square inches, trees with a diameter of 4 inches or more measured at 6 inches above the ground surface, illumination poles, camera poles, objects extending above the ground surface by more than 4 inches like boulders, signal/electrical/ITS cabinets, piers, retaining walls and drainage elements, such as culvert and pipe ends.

Clear Zone means the total roadside border area defined by the "Clear Zone Distance Table" found in Chapter 1600 of the WSDOT Design Manual, starting at the edge of traveled way and within the road right of way that is available for safe use by errant vehicles and where the placement or relocation of fixed objects is controlled.

1. A clear recovery area is a consideration when placing fixed objects along the roadside or within medians. The intent is to provide a traversable recovery area when opportunity allows. The design clear zone, as defined by the WSDOT Design Manual, is 10 feet for roadways with a speed limit of 35 mph or less. See the WSDOT Design Manual for speed limits above 35 mph. It is acknowledged by the WSDOT Design Manual that within urban areas, it will not always be practical to provide this 10-foot clear zone area.
2. When placing new fixed objects along a roadside or along a median with a traffic curb, the designer must attempt to select locations with the least likelihood of an impact by an errant vehicle and always meet the minimum operational offset of 3 feet from the face of curb to the face of the object.
    a. New fixed objects placed along a roadside or median that do not have a curb shall meet the clear zone requirements listed below. Minimum clear zone offset distance from roadside or median without a curb and with a speed limit of 35 mph or less is 10 feet subject to Review Engineer approval.
    b. Minimum clear zone offset distance from roadside or median without a curb and with a speed limit of 40 mph or greater shall be determined from the WSDOT Design Manual.
3. Fixed objects shall not be located or be allowed to remain closer than 10 feet to the edge of a driveway, identified as Point A in Design Manual Standard Drawings SW-140-1, SW-150-1, SW-160-1, SW-170-1, SW-180-1 and SW-190-1, unless modification is approved by the Review Engineer. Fixed objects shall be located such

that they do not violate the vehicle and pedestrian sight obstruction requirements of Transportation Standards as in Section 3.2.1. See Design Manual Standard Drawings RL-100-1, and RL-120-1 as well.

3.6.4 Breakaway Objects

Breakaway objects are defined as objects having properties up to and including that of a 4-inch by 4-inch wooden post. The following separation distances shall apply:

1. The minimum operational separation distance from roadside or median with a traffic curb is 3 feet.
2. The minimum operational separation distance from roadside or median without a traffic curb is 10 feet unless otherwise approved by the Review Engineer.

3.6.5 Mailboxes

1. Mailboxes shall be clustered together where practical and where reasonably convenient to the houses being served. For groupings of three or more boxes within a new residential development, a neighborhood delivery and collection box unit consisting of locked boxes on a single pedestal shall be provided.
2. When mailboxes are located within the sidewalk, the sidewalk shall be widened to provide the full design width around the mailboxes.
3. In the case of new street construction, or street reconstruction that requires mailboxes to be installed or moved, the designer and builder shall coordinate with the Station Master or Postmaster at the post office that serves the location. Mailbox locations approved by the U.S. Postal Service and approved by the City of Bellevue Transportation Department to facilitate vehicle, bicycle and pedestrian safety shall be shown on approved street construction plans and installed at the approved locations.
4. Mailboxes shall be installed as follows:
    a. The base of the box shall be 41 to 45 inches above the street, or per U.S. Postal Service requirements.
    b. The front of the mailbox shall be 1 foot behind the back of the sidewalk on walking delivery routes, or 1 foot behind the curb face on vehicular delivery routes.
    c. The mailbox shall be placed on posts strong enough to give firm support, but not to exceed the breakaway characteristics of a 4-inch by 4-inch wood post or

2-inch standard steel or aluminum diameter pipe. See Design Manual Standard Drawings RC-270-1 and RC-280-1.

d. Additional non-breakaway fixtures shall not be installed adjacent to mailbox locations. See Sections 3.6.3 and 3.6.4.

e. Clustered mailboxes mounted on new concrete pads require a right-of-way permit.

3.6.6 Lateral and Vertical Clearances

Clearances are the minimum distances between elements in, under and above the street right of way and public sidewalk easement. Clearance requirements are a key factor in how space within the right of way and on private property adjacent to the right of way can be used. Maintaining appropriate clear distances between certain elements in the right of way, sidewalk easement and on private property is necessary for a variety of reasons. Safety is a key consideration for the traveling public, the property owners and for operations and maintenance crews who must access elements in the right of way and public sidewalk easements for routine maintenance or repair. Appropriate clearances also enable the proper growth and development of trees and landscaping and help protect and maintain both overhead and underground utilities.

Table 3-19 summarizes the required minimum lateral clearances for objects and trees in the right of way and public sidewalk easement. Table 3-20 summarizes minimum lateral clearances for stair risers, fences and seating features from the sidewalk.

Table 3-19: Minimum Lateral Clearances

Features	Minimum Lateral Clearance (feet)	Limits of Measurements
Utility Poles (street lighting and signal poles)	3	Measured from face of curb to the face of the pole.
Retaining Walls	2	Measured from the back of the sidewalk to the face of the wall.
		Where there is a planned sidewalk, the clearance is measured from the back of the planned sidewalk limit to the face of the wall.
	3	Where there is no sidewalk or planned sidewalk the distance is measured from the face of curb to the face of wall.
Public Art	3	Measured from face of curb to the face of the object.
Fire Hydrants	3	Measured from face of curb to the face of the hydrant.

Features	Minimum Lateral Clearance (feet)	Limits of Measurements
Trees	3	Measured from face of curb to the tree trunk.
	10	Measured from the tree to Point A of any driveway as defined on driveway standard drawings.
	25	Measured from the center of the tree to the center of any street light or signal poles.

Table 3-20: Minimum Lateral Clearances from Sidewalk

Features	Minimum Lateral Clearance (feet)	Limits of Measurements
Stair Risers and Fences	2	Measured from the back of the sidewalk to the stair riser or fence.
Seating and Benches	2	Measured from the back of the sidewalk if placed on private properties.
	2	Measured from the front of the sidewalk if placed within the planter area.

Table 3-21 shows the minimum vertical clearance for any horizontal projection over the sidewalk and utilities easement area.

Table 3-21: Vertical Clearances Above Sidewalk Easements

Feature	Minimum Vertical Clearance (feet)	Measurement Limits
Removable Awnings or Canopies for Weather Protection Over Sidewalks	10[1]	Measured from the finished surface of the sidewalk to the bottom of the awning or canopy.
Awnings Over Multi-Use Paths	10	Measured from the finished surface of the multi-use path to the bottom of the awning or canopy.
Tree Limbs Over Driveways	14	Measured from the finished surface of the multi-use path to the bottom of the limbs.
Covered Commercial Driveways	15[2]	Measured from the driveway surface to the bottom of the driveway overhang.

1The minimum vertical clearance may be reduced over the sidewalk if a designated bicycle facility is present on the street.
[2] Reduced vertical clearance may be allowed for driveways that are designated for passenger cars only.

3.7 Utilities

3.7.1 Small Wireless Facilities in the Right of Way

Small wireless facilities (SWF) in the city's public right of way shall meet location and design requirements outlined in Title 6 of Bellevue City Code. Pursuant to BCC 6.02.030, prior to submitting an SWF permit, any telecommunication carrier that desires to install an SWF within the city right of way shall have a valid right-of-way use agreement with the City. Additionally, pursuant to BCC 6.08.070, if any component of the proposed SWF involves the use of a city pole, the applicant shall have a valid master license agreement with the City.

The applicant shall complete the SWF permits checklist, which shall be attached to every SWF permit application.

All plans and drawings submitted for an SWF permit must comply with the terms and requirements outlined in the SWF Standards for Plans and Drawings document. For additional information on small wireless facilities, see Appendix D.

SWF communication infrastructure shall follow the City's "Fiber Optic Design Requirements" (see Appendix C) for SWF deployments and is intended for application in new construction projects within the city.

When the installation of a new street light or the replacement of an existing street light is required as part of a development project, the developer has the option to install an aluminum roadway lighting pole per standard drawing SL-111-1 or a SWF-compatible steel roadway lighting pole per standard drawing SL-100-2.

If the temporary or permanent relocation of a street light pole that contains a SWF is required due to commercial or residential development, the developer shall consider alternate options to leave the street light pole in place. If the pole must be relocated, the developer shall coordinate with the telecommunications carrier on relocation. A separate right-of-way use permit shall be required for the relocation of the street light pole.

3.7.2 Private Utilities in Public Right of Way

1. When relocation of franchise utilities located in the right of way or city easement is necessary to accommodate public street improvements associated with a new development as per BCC 14.60.110, such relocation is subject to the terms of any applicable franchise agreement, right-of-way use agreement or state code.
2. When the street improvements are part of, or consistent with, the City's capital investment program plan, transportation improvement program, or transportation facilities plan, then some portion of the cost or expense in relocating franchise utility facilities may be the responsibility of the franchise utility, if such is provided for in a

franchise or right-of-way use agreement. Refer to BCC 14.30.185 for more information.

3. All franchise utility distribution systems in new subdivisions and short subdivisions, including power, telephone and TV cable, shall be installed underground unless otherwise provided in a franchise agreement or right-of-way agreement.
4. All existing and new franchise utility distribution systems, including power, telephone and TV cable, fronting or serving a commercial development site shall be undergrounded. The extent of the undergrounding required by this section may be limited to the nearest support or connection point(s) as determined by the Review Engineer.
5. To minimize repetitive impacts to public streets due to multiple utility installations, developers will coordinate public and franchise utility service installations and associated pavement restoration with the goal of consolidating disruption to a short time period and minimal area.
6. No above-ground utilities shall be permitted within planter strips, sidewalks or multi-purpose paths. Transformers and utility vaults to serve the development shall be placed inside the building or behind the sidewalk or multi-purpose path easement. Vaults serving a broader public purpose may be located within a public easement or right of way as approved by the Review Engineer. To the extent feasible, no utility vaults may be located within the primary walking path in any sidewalk. All new and existing utilities lids within the sidewalk must be non-slip/non-skid type per ADA.
7. No new overhead utility lines will be allowed within or across any right of way or sidewalk.
8. Easements and existing overhead lines must be relocated underground.

3.7.3 Pavement Restoration and Trench Backfill for Utilities Work

Materials and workmanship shall be in conformance with the WSDOT/APWA Standard Specifications for Road, Bridge, and Municipal Construction. Construction shall be in conformance with the Design Manual Standard Drawings, the details and conditions outlined in the Right of Way Use Permit and the following:

1. Trench restoration shall be accomplished with a patch or an overlay as required by the Pavement Restoration Requirement Map or the Review Engineer.
2. If a patch is used, the trench limits shall be sawcut prior to final patch.

3. All trench and pavement cuts shall be made by sawcuts or by grinding. The sawcuts or grinding shall have a minimum distance outside the trench width as shown in Design Manual Standard Drawings RC-190-1, RC-200-1, RC-210-1 and RC-220-1.
4. If the Right-of-Way Use Permit requires an overlay, then the contractor may use a jackhammer or drum grinder for the cutting of the existing pavement.
5. Within the top 4 feet of trenching, backfill shall be crushed surfacing materials or a controlled-density fill material conforming to Section 4-04 of the WSDOT/APWA Standard Specifications. Backfill materials must be inspected and accepted by the Review Engineer.
6. If the existing material is determined by the Inspector to be suitable for backfill and the trench is not perpendicular to a travel lane or driveway, the contractor may use the native material as long as the top 8 inches is crushed surfacing material.
7. Material used for backfill below 4 feet in depth must be approved by the Inspector.
8. All trench backfill shall be compacted to 95% maximum density, as described in Section 2-03 of the WSDOT/APWA Standard Specifications.
9. Backfill compaction shall be performed in 8-inch to 12-inch lifts. The compaction tests shall be performed in maximum backfill increments of 2 feet. The test results shall be given to the Inspector for review and approval prior to paving. Material testing will be required for trench backfill (native or imported), asphalt and concrete. Testing shall be performed by a certified independent testing laboratory. The cost of testing is the responsibility of the franchise utility or contractor. The number of tests required shall be the same as for asphalt density testing, or as directed by the Inspector. Acceptance testing may also be performed as directed by the City Materials Engineer as required.
10. Temporary restoration of trenches for overnight use shall be accomplished by using HMA or steel plates. HMA used for temporary restoration may be dumped directly into the trench, bladed out and rolled. After rolling, the trench must be filled flush with asphalt to provide a smooth riding surface.
11. HMA shall be placed to the compacted depth as shown on Design Manual Standard Drawings RC-190-1, RC-200-1, RC-210-1, RC-220-1, RC-230-1, RC-240-1 and RC-250-1, and as directed by the Review Engineer. Asphalt cement shall be paving asphalt. Materials shall conform to the WSDOT/APWA Standard Specifications.
12. Tack shall be emulsified asphalt grade CSS-1 as specified in the WSDOT/APWA Standard specifications and shall be applied to the existing pavement and edges of sawcuts as specified in the WSDOT/APWA Standard Specifications.

13. HMA shall be placed on the prepared surface by an approved paving machine and shall be in accordance with the requirements of the WSDOT/APWA Standard Specifications. Fine and coarse aggregate shall be in accordance with the WSDOT/APWA Standard Specifications. Asphalt concrete over 2 inches thick shall be placed in equal lifts not to exceed the guidelines set forth in the WSDOT/APWA Standard Specifications. See Design Manual Standard Drawings RC-100-1 and RC-110-1.

14. Cuts for trenches in all street surfaces, walks and driveways shall be either ground or sawcut. Ground joints shall be feathered and shimmed to provide a smooth surface. Feathering and shimming shall be accomplished by raking out the oversized aggregates from the mix. Surface smoothness shall conform to the WSDOT/APWA Standard Specifications. The paving shall be corrected by removal and repaving of the trench only.

15. Compaction of all lifts of asphalt shall be at an average of 92% of maximum density as determined by the WSDOT Field Operating Procedures for AASHTO 209 Test Method. The number of tests required per square foot of trenching shall be as follows:

    a. One set of three tests for less than 300 square feet of trenching area

    b. One additional test for every 200 square feet over 300 square feet of trenching area or every 100 lineal feet of trench, if applicable

    Testing shall be performed by a certified independent testing laboratory. The cost of testing is the responsibility of the franchise utility or contractor. Acceptance testing may also be performed as directed by the City Materials Engineer. The testing is not intended to relieve the contractor from any liability for the trench restoration. It is intended to show the Inspector and the City that the restoration meets these specifications.

16. All joints shall be sealed using paving asphalt.

    a. Contractors performing asphalt restoration work must be pre-qualified by the Transportation Department. To be pre-qualified, a contractor must submit qualifications in writing to the Pavement Manager. Past performance and available paving equipment will be reviewed to determine eligibility for the approved contractor list.

    b. A five-year moratorium on pavement excavation and trenching will be enforced following the completion of a new street or street overlay. This requirement restricts all street trenching except in the event of an emergency or as

authorized by the Transportation Director or his/her designee (the Right of Way Manager) per BCC 14.60.250.

c. Patch depths will vary based upon the classification of the streets being trenched. The asphalt depths shall be shown on the Right-of-Way Use Permit and the work shall be performed as required per Design Manual Standard Drawings RC-190-1, RC-200-1, RC-210-1, RC220-1, RC-230-1, RC-240-1 and RC-250-1. The minimum paving depths for all trenching shall be approved by the Inspector prior to restoration activity.

d. When trenching occurs within the street shoulder, the shoulder shall be restored to its original or better condition within 30 days of first opening the trench.

e. The final patch shall be completed within 30 days of first opening the trench. This timeframe may be adjusted if delays are due to inclement weather or other adverse conditions. Delay of the final patch or overlay work must be approved by the Review Engineer and will require an assurance device to guarantee completion.

f. Any patch or overlay located downtown shall be permanent and be completed as soon as possible.

g. Upon completion of asphalt restoration, the restored area shall be swept clear of loose material.

h. Additional pavement restoration may be required by the Inspector if warranted by field conditions.

3.8 Intersections

An intersection is the common area where two or more roadways join or cross, where speed and direction may change and conflicts may occur. Intersections must be designed to provide for the safety of motorists, pedestrians and bicyclists. By their nature, intersections are conflict locations where vehicles, pedestrians and bicycles all cross paths. Each crossing is a conflict point. Intersections should be designed to make the movements for modes of transportation intuitive and safe.

This section of the design manual is based on criteria from the following documents: AASHTO, A Policy on Geometric Design of Highways, NACTO Urban Bikeway Design and Urban Street Design Guide, NACTO Urban Street Design Guide, MUTCD – FHWA, WSDOT Design Manual.

In general, intersections shall be designed to accommodate the design vehicle appropriate for the highest classified street forming the intersection. The intersection design shall take

into account the presence of any designated truck route, public bus route or school bus route. All elements of the intersection shall be designed so the design vehicle will not encroach onto curbs, sidewalks, traffic control devices, medians or the travel lanes of opposing travel flow. The minimum design vehicle shall be an AASHTO SU-30 vehicle unless otherwise approved by the Review Engineer. Turning templates for the appropriate design vehicle(s) should be used to verify curb radii. Documentation may be requested by the Review Engineer. Refer to Section 3.1.3, Design Vehicles for more information on requirements.

Intersection design criteria will cover the following:

1. **Physical area of an intersection**. This area is defined by a line connecting the center of corner curbs (points of intersection extensions). This area is shared by traffic traveling in different directions.
2. **Functional area of intersection**. This area includes all queue storage areas, auxiliary lanes and perception and reaction lengths.

3.8.1 Design Considerations

Designers must consider all potential users of the facility in the design of an intersection. This involves addressing the needs of a diverse mix of user groups, including passenger cars, heavy vehicles of varying classifications, bicycles and pedestrians. Often, meeting the needs of one user group results in a compromise in service to others. Intersection design balances these competing needs, resulting in appropriate levels of operation for all users. In addition, the following should also consider:

- Minimize points of conflict.
- Simplify areas of conflict.
- Limit conflict frequency.
- Limit conflict severity.
- Facilitate safe and efficient flow of multi-modal traffic.
- Reduce impacts on surrounding intersections.
- Reduce pedestrian exposure.
- Accommodate future land use.

3.8.2 Intersection Horizontal Alignments

Generally, the design of intersections should be driven primarily by factors that maximize the safety of the intersection, minimizing the number of conflict points, reducing the number of legs of multi-leg intersections, where feasible, providing perpendicular crossing alignments, where feasible, and reducing driveway access points within the functional area of a controlled intersection.

Horizontal alignment for intersections includes the elements listed below.

3.8.2.1 Intersection Angles

Crossing streets should intersect at a 90-degree angle whenever possible. If a 90-degree angle is not feasible, the Review Engineer may allow an angle that varies between 85 and 95 degrees.

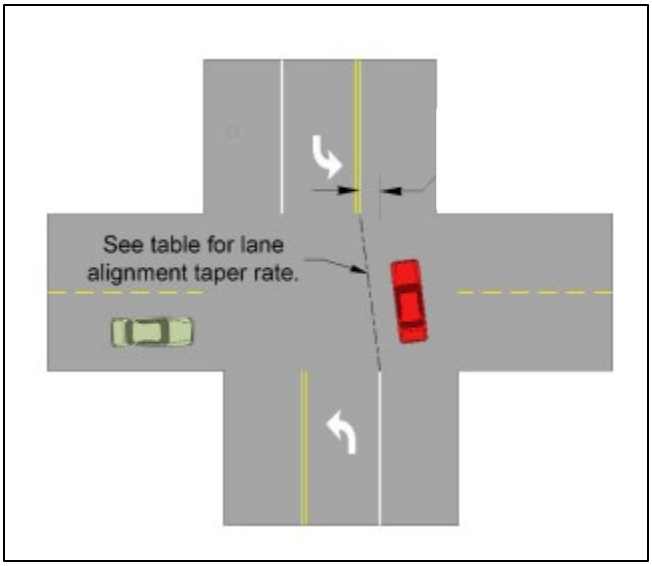
3.8.2.2 Lane Alignments

All lanes must be aligned properly through an intersection in situations where irregular intersections are created due to either successive urban developments or unaligned properties lines, which often occur at the threshold between adjacent grids, or where new or pre-existing streets cut through the conventional neighborhood layout.

Intersection design with lanes offset up to 6 feet (Figure 3-8) may be allowed given that the following conditions are met:

- Illumination is provided.
- The intersection is not within a horizontal curve, nor is it within a crest vertical curve.
- The taper rates as shown on Table 3-22 are provided.
- Lane channelization through the intersection is provided.

The designer must ensure that there is sufficient distance between new and adjacent intersections so that they form distinct intersections. A short distance between intersections should be avoided, if practical, because it tends to impede traffic operations. Intersections need to be far enough apart to operate as two intersections, or close enough to operate as one.



Source: [Edited] Exhibit 1013-1 Lane Alignment Taper Rate-WSDOT Design Manual.

Figure 3-8: Lane Alignment

Table 3-22: Lane Alignment Taper Rate

Posted Speed	Taper Rate
25	1:11
30	1:15
35	1:21
40	1:27

When feasible, locate intersections such that curves do not begin or end within the intersection area. It is desirable to locate the point of curvature (PC) and point of tangency (PT) 250 feet or more from the intersection so that a driver can settle into the curve before the gap in the striping for the intersection area. Do not locate short curves where both the PC and PT are within the intersection area.

For intersections on which a major roadway curves and a minor roadway is located tangent to that curve, it is highly desirable to realign the minor roadway as close to 90 degrees as possible.

3.8.3 Intersection Vertical Alignments

Intersections should be carefully located to avoid steep profile grades and to provide adequate approach sight distance. An intersection should not be situated just beyond a

short crest vertical curve or on a sharp horizontal curve. When there is no practical alternate to locating an intersection on a curve, the approach sight distance on each leg shall be provided and the horizontal or vertical curves lengthened to provide the required sight distance. The vertical profile of an intersection includes the elements listed below.

3.8.3.1 Approach Grades and Landings

The grades of the intersecting streets should be as flat as practical on those portions that will be used for storage of stopped vehicles. This is referred to as the intersection landing. The desirable grade of landing is 2% wherever practical but the maximum grade on each intersecting leg within the expected storage distance on the leg should not exceed 5%.

At a minimum, the storage platform should be at least 100 feet long for arterials and non-arterial streets unless greater length is required to accommodate queued vehicles. The landing length is measured in feet from the nearest intersecting curbline or edge of pavement.

3.8.3.2 Grades Through Intersections

The cross slope within both marked and unmarked crosswalks should be limited when establishing roadway profiles at intersections such that the crosswalk is accessible to and usable by individuals with disabilities. To achieve this cross slope, the intersection area may need to be tabled, which will affect the vertical alignment of the roadway and intersection drainage. More specifically, cross slope of the pedestrian accessible route (PAR) contained within an intersection crosswalk depends on the intersection traffic control as follows:

- Crosswalks at yield or stop-control devices. The cross slope shall not exceed 2.0%.
- Crosswalks at uncontrolled approaches. The cross slope shall not exceed 5%.
- Crosswalks at Traffic Control Signals or Pedestrian Hybrid Beacons. The cross slope shall not exceed 5%.
- Crosswalks at midblock and roundabouts. The cross slope shall not exceed street grade.

For intersection design, the following requirements should be considered:

1. Where the minor street is stop-controlled, the profile and cross section of the major street will be maintained through the intersection. The cross slope of the minor street legs will be transitioned to match the major street cross slope and profile.

2. If both intersecting streets have approximately equal importance, the designer may want to consider transitioning both roadways to form a plane section through the intersection.

3. At a signalized intersection or one to be signalized in the future, the most desirable rotation option will be to transition all approach legs into a plane section through the intersection. The grade of the approach roadway where vehicles may be stored should not be steeper than 2% where practical. A grade steeper than 5% should be avoided.

4. When a minor street intersects an existing major street, the new minor street profile should tie into the major street's travel lane cross slope as shown in Figure 3-9 below. However, it will be acceptable for the minor street profile to tie into the major street's shoulder cross slope. Actual field conditions will determine the final design.

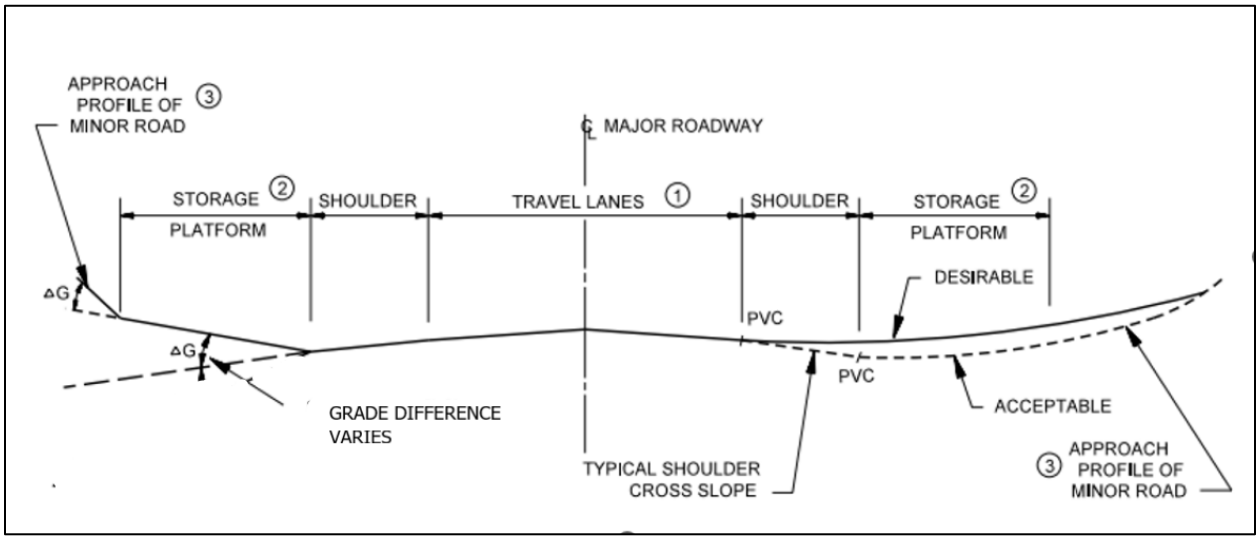


Figure 3-9: Intersection Cross Section and Alignment

5. Where the cross section of the approach is warped to meet grade requirements, a vertical curve to transition to the required grade will need to be created by the designer. The vertical curve at the intersection approach should be designed for full stopping sight distance as discussed in Section 3.8.3, Intersection Vertical Alignments. The profile and transitions at each intersection should be evaluated for impacts on drainage.

3.8.4 Intersection Spacing

The minimum distance between adjacent parallel non-arterial streets shall be 150 feet, measured from nearest curb edge to nearest curb edge. For intersections on arterial streets, the minimum spacing distance between intersections will be advised by the Review Engineer on a case-by-case basis and will depend on the proposed type of traffic control.

When creating a new intersection, the designer must ensure that there is sufficient distance between the new and adjacent intersections so that they form distinct intersections.

3.8.5 Corners and Curb Returns

Intersections should be designed with corner radii adequate for the selected design and control vehicles, See Section 3.13 for information on design and control vehicles. See Table 3-23 for information on minimum turning radius. At intersections, there are two distinct radii that need to be considered: the effective turning radius of the turning vehicle and the radius of the curb return (see Figure 3-10). The effective turning radius is the minimum radius appropriate for turning from the right-hand travel lane on the approach street to the appropriate lane of the receiving street. If a bicycle lane or on-street parking exists on both intersecting streets the effective turning radius is required to be checked using the appropriate design vehicle for the streets being designed and the lane on the receiving street into which that design vehicle will turn.

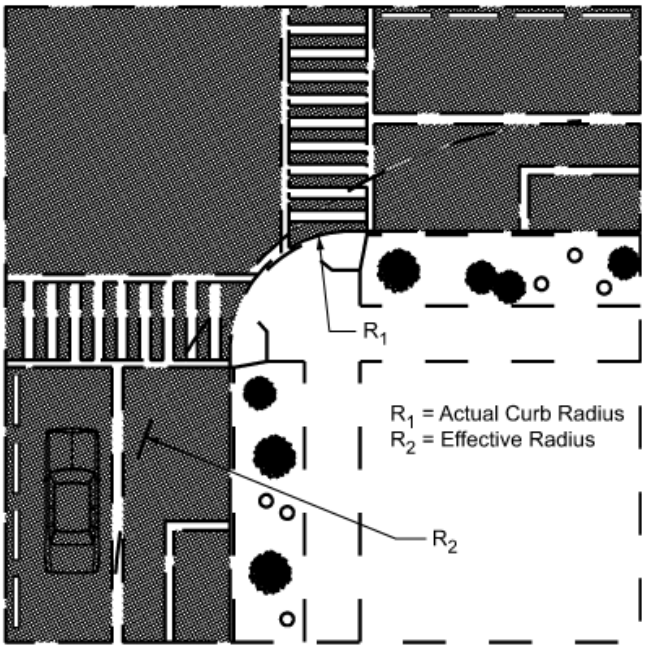


Figure 5-3. Actual Curb Radius and Effective Radius for Right-Turn Movements at Intersections

Source: Figure 5-3. Actual Curb Radius and Effective Radius for Right-Turn Movements at Intersections, AASHTO Green Book, 7th Edition 2018.

Figure 3-10: Actual Curb Radius and Effective Radius for Right-Turn Movements at Intersections

The selected design and control vehicles at the intersection will make a right turn while maintaining approximately a 2-foot clearance from the pavement edge or face of the curb and, at a minimum, will not come closer than 1 foot.

The typical curb radius at intersections is shown in Table 3-23:

Table 3-23: Typical Curb Radius at Intersections

Intersection Type	Curb Radius Dimension (feet)
Non-Arterial Street ADT*<400	15
Non-Arterial Street ADT*>400	20
Arterial	25
Bus/Truck Route	30
Where Turn is Illegal	10

The Review Engineer may determine that additional right of way is required at or near intersections to accommodate auxiliary traffic lanes and equipment for existing or future traffic signals and street lights.

3.8.6 Turn Lanes

The need for left- or right-turn lanes shall be based on a traffic operational analysis and as dictated by the City of Bellevue Transportation Facilities Plan, City Capital Improvement Program, or the applicable Land Use Code. The following general rules will apply:

- Queue storage estimates shall be based upon a traffic operational analysis.
- Left-turn lanes, when provided, shall have a storage queue of at least 100 feet.
- Left- or right-turn lanes analysis shall be based on Chapter 1310 of WSDOT Design Manual and City of Bellevue Standard Drawings CH-190-1, CH-200-1 and CH 210-1.

Turn lane length may be modified by the Review Engineer if necessary.

3.8.7 Sight Distances

Sight distances shall be determined and approved according to Section 3.2.1 Sight Distance of this design manual.

3.8.8 Curb Extensions

Curb extensions extend the line of the curb into the traveled way, reducing the width of the street. They are typically placed at intersections (Figure 3-11) but can be used at mid-block locations to shadow the width of a parking lane, bus stop or loading zone, if allowed by the City. In general, curb extensions can provide the following benefits:

1. Reduce pedestrian crossing distances and exposure to traffic.
2. Improve driver and pedestrian sight distances and visibility at intersections.
3. Separate parking maneuvers from vehicles turning at the intersections.
4. Visually and physically narrow the traveled way, resulting in a calming effect.
5. Encourage and facilitate pedestrian crossings at preferred locations.
6. Keep vehicles from parking too close to intersections and blocking crosswalks.
7. Provide wider waiting areas for pedestrians at crosswalks and intersection bus stops.
8. Reduce the effective curb return radii and slow-turning traffic.
9. Enhance ADA requirements by providing space for level landings.

Curb extension design should meet the following requirements:

1. Reduce crossing width at intersections and mid-block crossings by extending the curbline into the street no more than 5 to 7 feet from the curb of the adjacent parking lane, providing additional width to the roadway for turning movements. Ensure curb extension does not extend into travel or bicycle lanes.
2. Apply a minimum of 20 feet for curb return radius in the design of a curb extension. If necessary, use three-centered or asymmetric curb returns to accommodate design vehicles.
3. If required, curb extensions can be used at bus stops or bus layover areas to define the location of the stop and create additional waiting areas and space for pedestrian facilities. Refer to Section 3.4.3, Transit Design for more information on curb extensions and layover design requirements.
4. Align ramps, curb extensions and crosswalks with no unnecessary meandering.
5. Design curb bulbs such that they do not reduce the resulting width of the traveled way below the requirement for the street type.
6. Ensure that curb bulbs do not impede current or future planned bicycle and travel lanes. Curb bulbs may be designed with protected or elevated/separated intersection elements to allow for appropriate bicycle access.

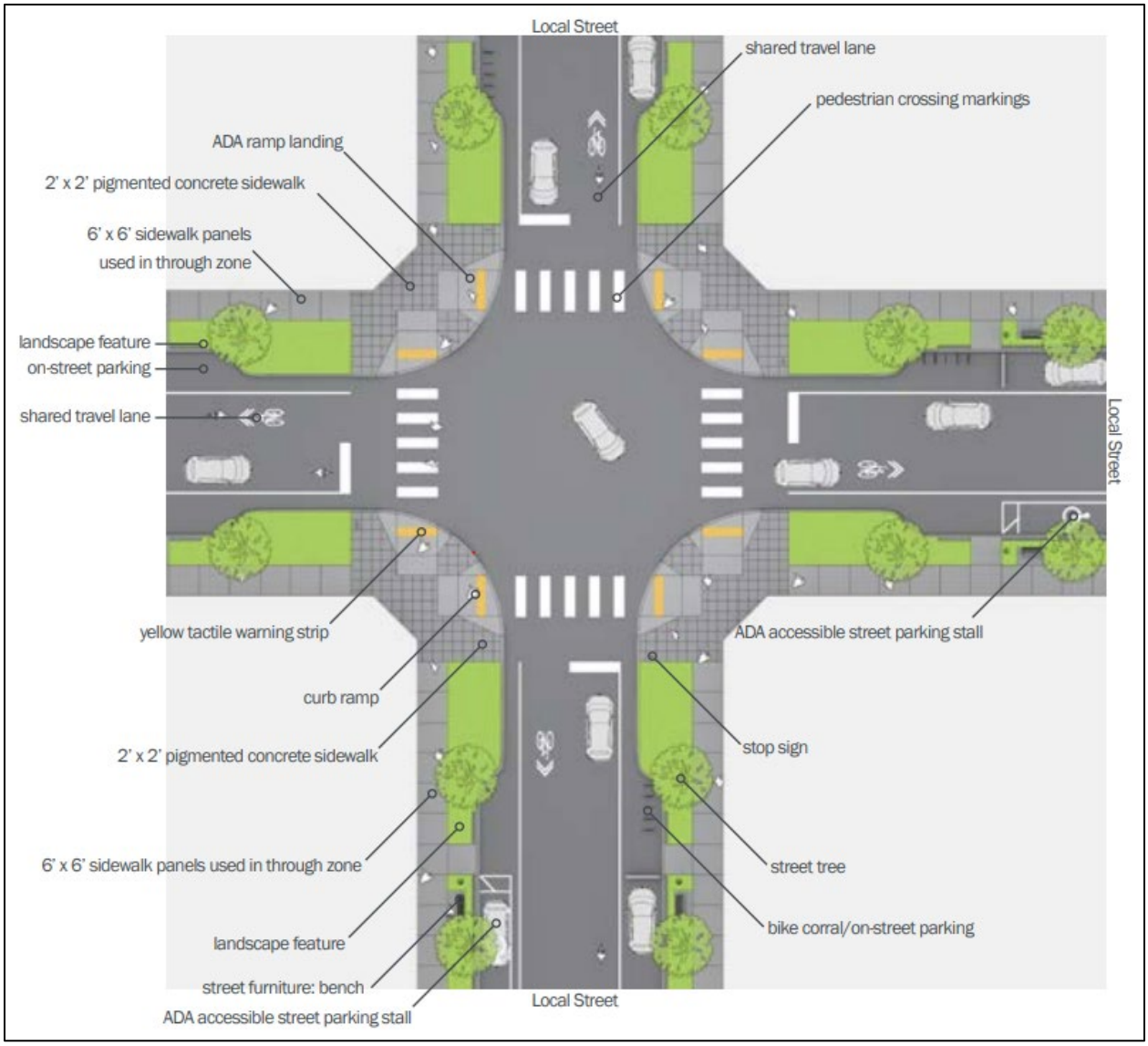


Figure 3-11: Example of an Intersection with Curb Extension

7. Select and place site features such as landscaping, cabinets, poles, benches, planters, bollards and newspaper stands so they do not obstruct the vision of pedestrians or drivers within curb extension areas.

3.8.9 Private Intersections

If permitted, a private intersection opening shall be designed per Section 3.8, Intersections of this design manual and Standard Drawing CH-290-1. When a private intersection opening is allowed, the following criteria must be met:

- Projected driveway usage is greater than 2,000 vehicles per day.
- Traffic signalization and easements are provided if approved by the Review Engineer.
- A 100-foot minimum storage area shall be provided between the face of the curb (or edge of the travel lane where no curb exists) and any turning or parking maneuvers within the site.
- The opening is at least 150 feet from the near-side face of the curb (or edge of the travel lane where no curb exists) of the nearest intersecting street.
- The opening is at least 100 feet away from any other driveway on the property frontage under the control of the property owner.

3.8.10 Curb Ramps

Curb ramps provide an accessible connection from a raised sidewalk down to the roadway surface. A curb ramp, or combination of curb ramps, is required to connect pedestrian accessible routes (sidewalks, multi-use paths and any other pedestrian facilities) to crosswalks (marked or unmarked) where curbs and sidewalks are present, except where pedestrian crossing is prohibited. For new construction projects, provide curb ramps oriented in each direction of pedestrian travel within the width of the crosswalks they serve. Refer to R203.6.1.1 of the PROWAG. "At an intersection corner, one *curb ramp* or *blended transition* shall be provided for each *crosswalk*, or a single *blended transition* that spans all *crosswalks* at the intersection corner may be provided."

For reconstruction of existing ramps, curb ramps oriented in each direction of pedestrian travel within the width of the crosswalk they serve are required. Every curb ramp must have a curb ramp at the other end of the crosswalk it serves unless there is no curb or sidewalk on that side (RCW 35.68.075). Curb ramps are also required at mid-block crossings where curbs and sidewalks are present.

The following are a few standard ADA curb ramps:

1. **Perpendicular curb ramps (Type 1)**. These ramps are aligned to cut through the curb and meet the gutter grade break at a right angle. The landing is to be located at the top of the curb ramp. See standard drawing SW-230-1.
2. **Parallel curb ramps (Type 2)**. These ramps are aligned with their running slope in line with the direction of sidewalk travel, parallel to the curb. The landing is located at the bottom of the curb ramp. See standard drawing SW-210-1.
3. **Combination curb ramps**. In applications where a combination of perpendicular and parallel types of curb ramps are used, landings may be shared by multiple ramps. Buffer areas and pedestrian curbing that define the pedestrian path of travel

are inherent design elements for this type of curb ramp. See standard drawing SW-220-1.

4. **Directional cement concrete curb ramp (Type 3)**. See standard drawing SW-240-1.
5. **Blended transitions curb ramps**. See Figure 3-12. This type of curb ramp is only allowed when the other types are infeasible due to site and topography constraints.

Figure 3-12: Example of Blended Transitions Curb Ramp - Main Street, Bellevue

3.8.10.1 Accessibility Criteria for Curb Ramps

The accessibility criteria for pedestrians' facilities also apply to curb ramps unless superseded by the following accessibility criteria specifically for curb ramps.

3.8.10.1.1 Curb Ramp Widths

The clear width of curb ramps and their landings shall be 6 feet, excluding flares. For directional ramps in the downtown area, the minimum clear width is 8 feet.

3.8.10.1.2 Running Slopes

The running slope of curb ramps shall not exceed 8.3% maximum. It is recommended that running slopes be designed to be less than the maximum to allow for some tolerance in construction. For example, designing for a maximum 7.5% curb ramp running slope (rather than the 8.3% maximum). The curb ramp maximum running slope shall not require the ramp length to exceed 15 feet.

3.8.10.1.3 Cross Slopes

The cross slope of curb ramps shall not be greater than 2%, measured perpendicular to the direction of travel. It is recommended that cross slopes be designed between 0.5% minimum to 1.5% maximum to allow for some tolerance in construction. Instances where curb ramps are at mid-block crossings, the cross slopes are permitted to match the street grade.

3.8.10.1.4 Landings

A landing of at least 4 feet minimum length by 6 feet minimum width, is required either at the top or bottom of a curb ramp. The running and cross slopes of a curb ramp landing shall not exceed 2% maximum. It is recommended that cross slopes be designed between 0.5% minimum to 1.5% maximum to allow for some tolerance in construction. At shared-use paths, the landing must be as wide as the shared-use path.

3.8.10.1.5 Flares and Pedestrian Curbing

Flared sides are to be used where a pedestrian circulation path crosses the curb ramp from the side. Flared sides are to have a maximum slope of 10% for a maximum flare length of 7.5 feet, measured parallel to the back of curb. Pedestrian curbs are to be used only where there is landscaping or other appurtenances that prevent cross travel by pedestrians. Pedestrian curbs are to be located outside the pedestrian path (sidewalk or multi-use path).

3.8.10.1.6 Counter Slopes

The counter slope of the gutter or street at the foot of a curb ramp or landing shall be 5% maximum.

3.8.10.1.7 Detectable Warning Surfaces

Detectable warning surfaces are required where curb ramps or landings connect to a street. Detectable warning surfaces shall contrast visually with the adjacent walkway surface, gutter or street (see the City Standard Plans for placement details and other applications).

3.8.10.1.8 Construction Materials

Construction materials of curb ramps shall meet the sidewalk surface and thickness specified in Section 3.4.1.1 of this design manual. Gratings, access covers, utility objects and other appurtenances shall not be located on curb ramps, landings or gutters.

3.8.10.1.9 Grade Breaks

Grade breaks at the top and bottom of curb ramps shall be perpendicular to the direction of travel. Surface slopes that meet at grade breaks shall be flush.

3.8.10.1.10 Clear Space

A clear space, to facilitate pedestrian turning maneuvers, is required within the roadway for all non-directional curb ramps. The 4-foot (minimum) by 4-foot (minimum) clear space shall

be located beyond the curb face where the bottom of a non-directional curb ramp or landing meets the gutter, contained within the width of the crosswalk and located completely outside the parallel vehicle travel lane.

3.8.10.1.11 Curb Ramp Drainage

Stormwater runoff from the roadway can flood the lower end of a curb ramp. Measures to prevent ponding at the base of curb ramps and landings (see Figure 3-13) must be taken. Verify that drainage structures will not be located in the PAR. Coordination with the Utilities Department will be required.

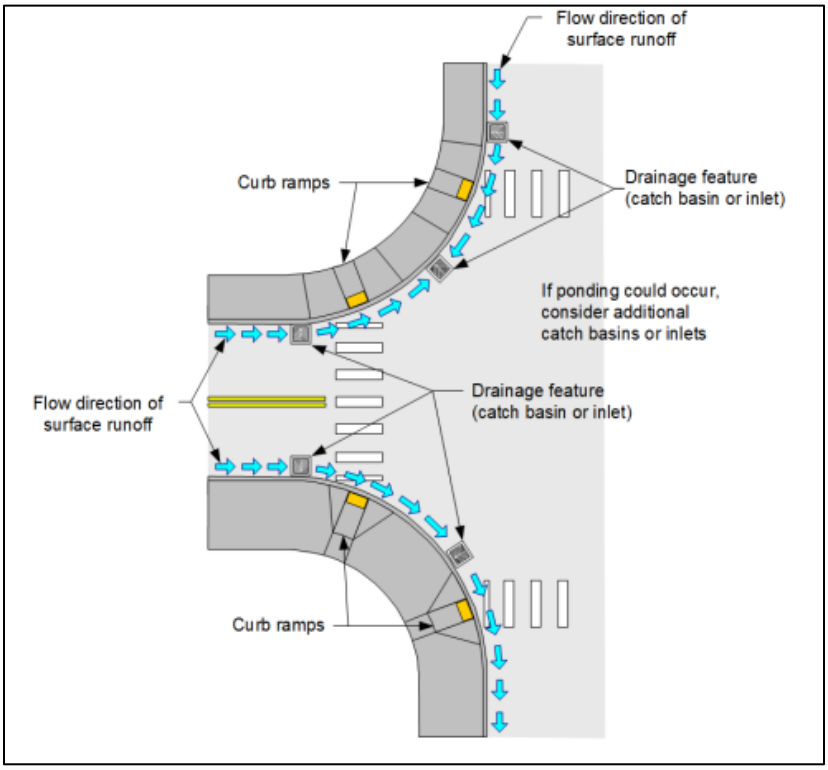


Figure 3-13: Typical Curb Ramp Drainage

3.8.10.2 Companion or Receiving Ramps

All curb ramps at the receiving ends of crosswalks are required to be verified for meeting the current ADA standards and the City of Bellevue requirements for curb ramp design criteria. Uncompliant companion ramps need to be upgraded to meet ADA standards regardless of whether the receiving end of the crosswalk is located within or outside the project scope of work.

4 Traffic Engineering

4.1 Traffic Signals

Traffic signal design requirements should be utilized for design of new, modified and temporary traffic signal systems. The documents submitted should include the information needed to provide a complete and fully functional traffic signal system.

New traffic signals are signals that are designed and installed at a location that does not currently have a traffic signal system or completely replaces one traffic control system for another.

A modified traffic signal is a signal that exists today; however, only a portion of the system is being replaced. Common traffic signal modifications include development or capital projects that rebuild one corner of an existing traffic signal, or projects that trigger replacement of ADA curb ramps and thereby also trigger modifications to existing pedestrian detection and traffic signal indication changes resulting from new channelization or operations at an intersection.

In addition to the information provided in this design manual, the Design Engineer preparing to design traffic signal plans shall:

1. Utilize the latest editions of the WSDOT Standard Plans and Standard Specifications for Road, Bridge, and Municipal Construction.
2. Utilize the latest edition of the City of Bellevue Standard Special Provisions.
3. Utilize the latest edition of the City of Bellevue Design Manual and Standard Drawings.
4. Utilize the latest edition of the MUTCD-recommended design practices adopted by WSDOT, where applicable.
5. Be in accordance with the National Electric Code.
6. Utilize the NACTO Design Guides, where applicable.
7. Reference the latest edition of the WSDOT Design Manual Chapter 1330 Traffic Control Signals where design guidance is not specified in this document.

4.1.1 Signal Operations

4.1.1.1 Signal Phasing and SCATS Staging

The City operates and maintains hundreds of traffic signals that are programmed using The Sydney Coordinated Adaptive Traffic System (SCATS). This traffic signal system utilizes a

series of traffic movement stages in its programming in place of the more widely used eight stage "ring-and-barrier" phase diagram. Prior to plan development, the Design Engineer shall confirm both the SCATS signal staging and an equivalent phase diagram for equipment identification with the City's Smart Mobility team.

4.1.1.2 Pedestrian Phases

Signalized pedestrian crossings shall be provided for every approach to the signalized intersection unless otherwise approved by the Review Engineer. Written justification for the lack of pedestrian crossings must be documented and provided to the Review Engineer. For signal modification, the closed pedestrian crossing may remain closed if the original or new justification is still valid for the closed crossing. If the justification for the closed crossing is no longer relevant, a new pedestrian crossing shall be added during signal modification.

For additional information about pedestrian signal operations, refer to the current version of the Bellevue Pedestrian Signal Operations Guidelines, which can be provided by the City's Smart Mobility upon request.

4.1.1.3 Left-turn Phasing

Signalized left-turn movements may be permissive-only, protected-only or protected-permissive, depending on geometry and operational demands. Left-turn phasing may alternate between these modes based on current traffic conditions. Restricted left-turn movements may be considered in cases of geometry constraints, access restriction or other traffic operations factors that indicate improvement to safety and efficiency.

1. **Permissive-only left-turn movements**. Indicates turns made on the green ball or flashing yellow arrow after yielding to oncoming traffic and pedestrians.

    a. Evaluation of Bellevue's permissive left-turn guidelines must be completed to implement permissive left-turn operations. This evaluation must include, but is not limited to, the following considerations:

        - Speed
        - Collision history
        - Sight distance
        - Number of opposing lanes
        - Presence of a U-turn
        - Turning volume
        - Cross product of turning volume and conflicting movement(s)
        - Delay

b. When no dedicated left-turn lane is present at an approach, the preferred signal indication control is:

- A green ball signal indication when permissive left-turn movement is allowable
- Split-phase operations or restricted left-turn movement when permissive left-turn movement is not allowable
- When a left-turn lane is present at an approach, the preferred signal indication control is:
  - A four-section flashing yellow arrow signal indication when permissive left-turn movement is allowable
  - A three-section left arrow signal indication when permissive left-turn movement is not allowable (protected only)

c. If multiple left-turn lanes are present, protected three-section left-turn arrow signal indications shall be used.

d. Alternative left-turn signal indications or phasing not outlined in this document must be approved by the City's team.

2. **Protected-only left-turn movements**. Indicates turns made only when the left-turn green arrow signal is displayed.

3. **Protected-permissive left-turn movements**. Indicates both modes occur on an approach during the same cycle.

4.1.1.4 Right-turn Phasing

Signalized right-turn movements may be permissive, protected or protected-permissive, depending on geometry and operational demands. Right-turn movements may only be protected or protected-permissive when there is a dedicated right-turn lane present. Restricted right-turn movements may be considered in cases of geometry constraints, access restriction or other traffic operations factors that indicate improvement to safety and efficiency. When a right-turn lane is present, a signal indication face shall be provided for and aligned with the right-turn lane.

1. **Permissive right-turn movements**. These movements may be controlled either by a green ball indication or a flashing right-turn yellow arrow indication. A green ball indication is standard practice for permissive right-turn movements when there is not an independent right-turn lane present. A green ball indication may also be used for a right-turn lane when there is minimal conflicting volume with the permissive right-turn movement, for example, the adjacent pedestrian phase or oncoming permissive left turns.

A flashing right-turn yellow arrow indication is standard practice when:

- A right-turn lane is present.
- The right turn would benefit from a protected right-turn or overlap phase.
- The right turn may utilize the flashing arrow feature while the adjacent crosswalk is serving a pedestrian phase to increase awareness of nonmotorized users.
- At intersections with fewer stages or phases, for example T-intersections.

2. **Protected right-turn movements**. These movements may only be used when a right-turn lane is present unless otherwise approved by the City's Smart Mobility team. Protected right turns may be controlled by a three-section right arrow display.
3. **Protected-permissive right-turn movements**. These movements may be controlled by a four-section right flashing arrow display, or a four-section bimodal display. If multiple right-turn lanes are present, protected-only, three-section right-turn arrow signal indications shall be used.

It is desirable to include right-turn overlap phases where possible. Typically, a right-turn overlap may be combined with the receiving approach left-turn phase when a U-turn is not present for the left turn.

4.1.2 Traffic Signal Displays

Signal equipment may be relocated if it meets current City specifications and City staff confirm substantial life remains for the asset.

Signal head numbering shall follow standard drawing SL-280-1.

4.1.2.1 Vehicle Signals

All signal displays shall conform to the current MUTCD edition. All vehicle signal displays shall have 12-inch lenses and backplates with reflective tape. Signal displays shall be spaced at 8 feet minimum unless physical constraints exist. Signal display spacing under 8 feet must be approved by the Review Engineer. Signal displays shall be positioned to ensure visibility to the associated driver(s) and a minimum vertical clearance from the roadway as shown in standard drawing SL-360-1. WSDOT Standard plan J-75.20-01 Type M mounting of signal heads on the mast arms is preferred. Alternate mounting types may be used to meet vertical signal head clearances or other requirements and must be approved by the Review Engineer.

For through movements, there shall be at minimum two signal displays provided for the through movement. These signal displays typically shall be three-section ball indications, but may be combined with larger displays, such as a bimodal four-section display, or use arrow indications depending on the geometry and phasing of the intersection. When there is one through lane, at least one of the signal displays must be positioned within the

approach through lane. When there are two or more through lanes, signal displays shall be centered over each approach lane.

When there is no through movement, at minimum two signal displays shall be provided for the major movement of the approach.

For left-turn lanes, there shall be one signal display per left-turn lane and one “follow-through” display mounted on the far-left corner of the intersection from the left-turn lane(s). The “follow-through” display shall be placed and oriented such that a driver has a clear view of the display as they complete their turn into the receiving lane. When possible, the “follow-through” head should also be oriented such that a driver behind a larger vehicle obstructing the overhead signal displays, may see the “follow-through” signal display.

For right-turn lanes, one signal display per right-turn lane shall be provided and shall be centered over the turn lane.

Signal displays shall be positioned such near side displays that do not block the view of the far-side displays for the approaching driver or cyclists.

Signalization of right-turn slip lanes should be considered when:

- There are high pedestrian volumes crossing the slip lane.
- There are high volumes on the receiving lanes.
- The originating or receiving approach exceeds 30 mph.

A ”No Right Turn” symbol blank-out sign shall be provided with the right-turn signal indication when there is a protected bicycle or high-volume nonmotorized phase that would conflict with the right-turn movement.

4.1.2.2 Pedestrian Signals

The pedestrian signal system includes pedestrian detection and pedestrian signal displays. For each pedestrian signal crossing, accessible pedestrian signal (APS) pushbutton detection, LED countdown-style pedestrian signal display, crosswalk markings and a compliant pedestrian path shall be provided unless the pedestrian movement is prohibited.

If a pedestrian signal display is updated to LED countdown-type, the paired pedestrian signal display across the crosswalk shall also be updated to LED countdown-type. Pedestrian signal display location shall be in accordance with the MUTCD.

It is desirable to maintain all pedestrian crossings during construction whenever possible. Closure of any pedestrian pathways or crossings must include ample signage guiding pedestrians to alternate paths. When construction impacts access to the permanent pedestrian signal, temporary pedestrian detection and signal indications must be installed

whenever a traffic control officer is not present to guide pedestrian movement. It is preferred to use APS pushbuttons for temporary pedestrian detection; however alternate pedestrian detection, like video detection, may be permitted with approval from the City's Smart Mobility team.

4.1.2.3 Bicycle Signals

Bicycle signal displays shall be installed at traffic signals with protected bike movements. Conditions where a protected bicycle movement is warranted include, but are not limited to:

- Providing a bicycle jump interval
- Providing an unusual movement through the intersection specific to bicyclists
- Where heavy turn movements are present and conflict with the bicycle crossing

Bicycle detection shall be included for all bike lanes, protected bicycle phases, and multi-purpose paths at traffic signals as described in Section 4.1.3.3.

Turn-on-red restriction must be provided where a bicycle signal is provided and a turning vehicle on red would cross the protected bicycle crossing.

At minimum, one 12-inch, three-section bicycle signal display shall be provided at the far side of the intersection for a protected bicycle movement. The far-side bicycle display shall include a sign indicating the display is for bicyclists. A near-side bicycle signal display is desirable to supplement the far-side bicycle signal display when it improves visibility of the bicycle phase to cyclists. In cases where bicyclists should use the pedestrian signal display as guidance, a R9-5 "[bicycle] use ped signal" or equivalent sign shall be provided.

4.1.2.4 Transit Signals

Transit signal displays shall be included for all locations where a transit-specific movement is present, including transit jump operations. Light rail transit signal displays as described by MUTCD Chapter 8C shall be used for all signalized light rail movements. Light rail transit signal displays or programmable three-section vehicle displays with a supplemental sign may be used for signalized bus exclusive movements.

4.1.3 Detection

Detection shall be provided for each mode and movement at a traffic signal.

4.1.3.1 Vehicles

Vehicle detection shall be provided for each lane at a signalized intersection. Induction vehicle detection shall be installed at every intersection per standard drawings SL-290-1, SL-300-1, SL-310-1, SL-320-1, SL-330-1 and SL-340-1. For advanced detection in a turning lane, the advance detection may either be placed in accordance with the loop distance

table provided in standard drawing SL-290-1 or at the end of the turning lane, whichever is shorter.

A junction box shall be provided adjacent to the stop bar detection and each series of advance detection for every approach to minimize sawcut length in the roadway.

Induction loop detection installation shall adhere to the following:

- For full-depth HMA roadway sections or roadways with at least 3 inches of overlay over concrete pavement, induction loops shall be installed using sawcuts after completion of pavement construction.
- For cement concrete roadway sections, induction loops shall be pre-formed and placed wholly within a concrete slab. An induction loop shall not span across a joint in the roadway.

Permanent or temporary video detection may be permitted when:

- An approach to a signalized intersection falls outside of right of way, such as a private driveway.
- Loop detection is not anticipated to be reliable, such as during construction.

Detection of all lanes must be maintained during construction.

4.1.3.2 Pedestrians

APS push-button detection must be provided for every signalized pedestrian crossing. See MUTCD for guidance of push-button placement. Push buttons should be placed in locations that are safe and accessible to all users. Pedestrians should have sidewalk and curb ramps or other physical separation from vehicle traffic in the waiting area. Push buttons shall be placed such that a clear, level area is provided in front of the push button. Users should not have to reach more than 6 inches beyond the clear, level area to activate the push button. Extension arms may be used for push buttons installed on poles or standards set behind the sidewalk, curb ramp or guard rail to minimize reaching distance.

When curb ramps or other pedestrian-accessible routes are being altered at a signalized intersection, the associated pedestrian push button(s) shall be updated and relocated to meet city, PROWAG and MUTCD requirements. There shall not be a mix of pedestrian push button types or generations at an intersection. If some push buttons are required to be updated at the intersection, the remaining push buttons must be the same type and generation by the conclusion of work. Coordinate replacement of any additional pedestrian push buttons with City staff.

4.1.3.3 Bicycles

Thermal video detection shall be used for dedicated bicycle signal phases. Bicycle detection is required for bike lanes at traffic signals. Bicycle detection may be:

- Thermal video detector
- Video image detector
- Induction loop
- Pushbutton activation

Video type detection, thermal or imagery, is preferred where bicyclists may not stop at a precise location to maintain activation of an induction loop or where vehicles may track over the bicycle detection zone. Induction loop or pushbutton detection may be used instead of or to supplement video-type detection if bicyclists will be waiting in close proximity to pedestrians, such as mixing zones, or if there is no good location to install a video-type detection for a clear view of the bicycle detection zone. Push buttons are not a preferred detection type as they are difficult to place in a convenient location for bicyclists and cannot detect whether a bicyclist is no longer present after initial detection.

Video-type detection, thermal or imagery, must be used during construction that impacts existing detection to maintain bicycle detection. Consider advanced bicycle detection on high-volume bicycle routes with protected bicycle movements at the traffic signal.

4.1.4 Signal Poles

The placement of signal poles shall adhere to the following:

- Minimize visibility obstruction to drivers and other roadway users.
- Avoid conflict with other roadway features and utilities.
- Meet equipment placement requirements.
- Meet pole and equipment clearance requirements.
- Ensure an accessible pedestrian pathway is provided around the corner.
- Provide clear space from face of curb to minimize likelihood of pole strikes from errant vehicles.

City of Bellevue standard type II and III pre-approved mast arm poles shall be used at all signal locations unless otherwise approved by the Review Engineer. Mast arm attachment heights shall be in accordance with meeting signal display attachment height standards, (see standard drawing SL-360-1). Dimensions of pre-approved poles may be provided by the Smart Mobility Team upon request. Each mast arm pole shall have a terminal cabinet installed facing away from the intersection. Mast arm foundations shall be designed per WSDOT standard plan J-26.10-03 using geotechnical soil information at the foundation location and wind load calculations. If no geotechnical investigation has been conducted, foundations shall be sized assuming a lateral bearing pressure of 1000 psf. Wind load

calculation assumptions shall be noted on the traffic signal plan sheets beneath the signal standard detail chart.

Signal pole consolidation is desirable; however, mast arm poles may be placed at back of or behind the sidewalk instead of being consolidated in sidewalks to improve visibility and accessibility around the corner, minimize likelihood of damage from a vehicle collision or maximize compatibility with future projects.

Unless otherwise approved by the Review Engineer, pot-holing for utility conflicts is required prior to approval of the signal plans and should be conducted prior to the 90% submittal.

4.1.5 Preemption

Emergency preemption shall be provided for all approaches at every signal. Emergency preemption shall have both infrared and GPS capabilities. Typically, one infrared preemption sensor is placed on each signal mast arm pole and one GPS preemption sensor is placed on the pole closest to the signal cabinet. Alternate or additional infrared preemption sensor locations may be used to ensure there are no obstructions between the sensor and its related approach lanes. Preemption conductors shall not be broken or spliced and shall have a continuous wire run between the unit and the controller cabinet.

4.1.6 Signing

Determination of sign placement shall be in accordance with the MUTCD and City of Bellevue Standard Pole Chart.

Each signal pole mast arm shall have one street name sign that is clearly visible from all approach lanes. Typically, the street name signs are placed to the far right of all signal heads, close to or on the vertical shaft of the pole. See Bellevue Standard Drawing SG-170-1 for street name sign specifications.

4.1.7 Controllers and Cabinets

The controller cabinet should be placed so that an operator can see the traffic signal while accessing the controller. The door to the controller cabinet shall always open in the direction away from the intersection and the intersection indications must be clearly visible from the cabinet location. The controller cabinet shall be placed such that there is a level space in front of the controller cabinet clear of any obstructions that would inhibit opening the cabinet door or operating the equipment within the cabinet. The controller cabinet shall be placed in a location such that it should not require relocation if widening of the intersection happens in the future. Where possible, the controller cabinet should be located outside of sight triangle lines for safe right-turn-on-red turning movements.

Communication shall be provided to every signal cabinet following City Fiber Optic Design Requirements (Appendix C).

The signal service cabinet shall be located adjacent to the controller cabinet. See Bellevue Standard Drawings SL-200-1 and SL-210-1 for controller cabinet and service foundation dimensions and placement.

4.1.7.1 Power Sources

The location of power sources shall be identified on the plans. If possible, the location should be in the same corner as the service cabinet. The power source shall be 120/240 volt single phase.

It is the responsibility of the Design Engineer to contact the power company to determine the power location and add hook-up coordination instructions to the plans prior to plan approval. The signal design shall include enough cable and conduit for the contractor to bring the power cable to the power source and leave enough left over for the utility company for hook-up.

4.1.8 Wiring, Conduit and Junction Boxes

Underground conduit and junction boxes shall be used for all signal wiring. Overhead signal wiring may only be permitted for temporary signal systems and must be approved by the Review Engineer.

Whenever possible, separate junction boxes and conduit runs shall be provided for signal wiring runs and should not be shared with illumination, communications or SWFs.

4.1.8.1 System Wiring

Signal head termination numbering shall follow standard drawing SL-350-1. Signal conductor sizing and use shall follow Table 4-1.

Table 4-1: Signal Conductor Sizing

Cable	Area (inch by inch)	Use of Cable
#12	0.026	Power
#10	0.033	Power
#8	0.056	Illumination/Ground
#6	0.073	Controller-Service
#0/3	0.113	Service-Power Source
2cs-#14	0.090	Pedestrian Push Buttons
3cs-#20	0.070	Emergency Preemption
5c-#14	0.140	Vehicle/Pedestrian Heads

Cable	Area (inch by inch)	Use of Cable
7c-#14	0.170	4 Section Vehicle Heads (FYA)
3PR-#12 or #14	See SL-320-1	Loop Lead In
6PR-#12 or #14	See SL-320-1	Loop Lead In
2cs-#14	0.090	Loops
CCTV	See Special Provisions	Video Camera

Each signal display shall have its own conductor cable between the signal display and the terminal cabinet. Between the terminal cabinet and the controller, one conductor cable may service up to three signal displays sharing the same phase.

4.1.8.2 Conduit

All conduit shall be schedule 40 PVC for signal systems. Conduit runs shall not exceed 250 feet in length or 360 degrees of total bend.

Conduit size is based on total area of cable enclosed in the conduit and shall be determined by Tables 4-2 and 4-3. See City of Bellevue Special Provisions for cable and conduit type.

Table 4-2: Conduit Fill Area

Size (inches)	Max Cable Fill – New Conduit (sq. inches)	Max Cable Fill – Existing Conduit (sq. inches)
1	0.22	0.33
1.5	0.52	0.79
2	0.89	1.36
3	1.95	3.00

Typical conduit runs between junction boxes, poles and cabinets shall follow Table 4-3. Number and size of conduit runs shall be confirmed by conduit capacity calculations at every submittal and may vary from Table 4-3.

Table 4-3: Conduit Run Sizing

Size (inches)	Number of Conduits	Run Description
1 (signal)	1	From PPB Post
2 (signal)	1	From Ps or Type 1 Pole
3 (signal)	1	From Mast Arm
2 (illumination)	1	Or Strain Poles
3 (signal)	2	Roadway Crossing
3 (signal)	2	To Signal Cabinet
2 (service)	2	To Service Cabinet

4.1.8.3 Junction Boxes

Junction boxes shall be provided at each corner of a signalized intersection. Typically, at least one Type 8 junction box shall be provided at each corner for pole and roadway crossing connections. At least one Type 8 junction box shall be provided next to the signal controller cabinet. Type 1 or 2 junction boxes shall be provided adjacent to each set of loops at the intersection. Additional junction boxes shall be provided as needed for capacity or to meet the requirements described in this design manual. For junction boxes located in landscape areas or on a steep slope, where overgrowth or the slope may make it difficult to open the junction box lid, the junction box shall follow Bellevue Drawing SL-160-1. Junction boxes carrying the wire between the service cabinet and the power source shall have a locking lid and shall not contain any other wires. All junction boxes carrying signal equipment and/or interconnect and/or illumination wires shall have the letters “TS/SL” or “COB COMM” inscribed on the lid.

Junction boxes shall be placed according to the following guidelines:

1. When space permits, place junction boxes outside of pedestrian walking paths, such as at the back of a sidewalk or behind a sidewalk.
2. Do not place junction boxes in locations that would conflict with vegetation, irrigation or other elements that would limit access for maintenance. Place junction boxes away from the curb when possible to provide safe access for maintenance.
3. Do not place junction boxes in curb ramps or at grade breaks.
4. Do not place junction boxes at locations that minimize the length and number of bends in conduit runs between boxes.
5. Do not place junction boxes adjacent to the pole(s) or loop(s) they are servicing.

Existing junction boxes within the project footprint shall be replaced if:

1. The junction box does not meet current standards and specifications, such as if the junction box does not have a non-skid lid.
2. There are significant grade changes at the junction box location.
3. Additional conduits are being added to the junction box that require the junction box to be upsized.
4. The junction box has multiple systems (such as both signal and illumination conduits) and the scope and footprint of the project can accommodate separating those systems.

4.1.9 Signal Calculations

The Design Engineer should complete each of the following signal design calculations as is applicable to the extent of work.

1. **Conduit fill calculations**. Conduit fill calculations shall be completed for each conduit run with proposed conduits being added. The results of the conduit fill calculations may be included on the plans or provided to the Review Engineer separately upon each submittal. Reference Section IV, Tables IV-1 and IV-2 for conduit and conductor areas. The requirements for conduit fill calculations are as follows:
   a. Maximum allowable conduit fill for existing conduit is 40% of the total inside conduit area.
   b. Maximum allowable conduit fill for proposed conduit is 26% of the total inside conduit area.
2. **Junction box sizing**. All junction boxes, existing or proposed, with proposed conduit being added as part of the signal installation must undergo junction box sizing calculations. See Table-4-4 for maximum allowable total conduit area for each junction box.

Table 4-4: Maximum Allowable Conduit Areas in Junction Boxes

Junction Box Type	Total Allowable Conduit Area
Type 1	6 inches
Type 2	12 inches
Type 8	24 inches

3. **Wind load and signal pole foundation sizing.**
    a. Wind-load calculations shall assume 9.2 square feet of area for a 3-section signal head, and 11.6 square feet for a 4-section signal head.
    b. Wind load calculations shall round the total X*Y*Z square footage up to the nearest hundred. The wind load value used to determine foundation size shall be the calculated total wind load plus 500 CF or 25% of the calculated wind load total, whichever is greater, to account for potential future loading.
4. **Signal poles**. Signal pole foundation sizing shall be based on the soil-bearing pressure reported in the geotechnical findings at each intersection corner and the total wind load that accounts for possible future loading.
5. **Signal loads**. Signal load calculations shall include the total load (watts) for each piece of signal equipment at the intersection.

The Design Engineer shall submit the signal design calculations with the PS&E documents to the Review Engineer.

4.1.10 Construction and PS&E

All traffic signal plans shall follow City of Bellevue Design and PS&E Submittal Requirements.

For signal modifications, if construction replaces roadways, sidewalks or other finished surfaces where existing traffic signals are in place, the project shall:

1. Ensure the existing traffic signal is maintained and operational until a temporary or new traffic signal system is ready for turn-on.
2. Ensure construction does not undermine or impact the structural integrity of the traffic signal poles and foundations unless it is part of removal efforts.
3. Replace any traffic signal poles, foundations and equipment that were damaged during construction.
4. Update the equipment, conduit and junction boxes within the footprint of the project to meet current City specifications unless otherwise approved by City staff.
5. Replace pole(s) and foundation(s) within the project footprint unless otherwise approved by City staff.

Mast arm signal poles and foundations may be protected in place if the pole and foundation are less than 15 years old and show no signs of damage.

Age and condition of existing signal equipment, foundations and poles shall be confirmed with the City's Smart Mobility team.

When signal modification work triggers construction that must turn off part or all of the existing signal system without the new system being ready for turn-on and uniform police officers cannot manage traffic at the intersection during the change-over period, a temporary traffic signal plan must be developed and installed.

4.1.11 Clearances

Signal poles shall be placed such that the face of the poles are no closer than 3 feet from the face of the curb. For locations that do not have a sidewalk, the WSDOT requirements for clear zone distance apply (see Figure 700-1 of the WSDOT Design Manual).

Traffic signal foundations shall be placed at least 5 feet, measured edge to edge from the nearest underground utilities unless otherwise approved by the Review Engineer.

Traffic signal equipment or signage installed on traffic signal poles shall not protrude into the roadway prism except when mounted on mast arm or spanwires and meet vertical clearance requirements. Pole mounted traffic signal equipment shall maintain 3 feet horizontal clearance between edge of equipment and face of curb.

4.2 Illumination

The street lighting system should be a complete, unified design that addresses the various mobility needs within the City of Bellevue in accordance with BCC 14.60.210.

Street lighting system designs shall follow the City's Street Lighting Design Guide (see Appendix A) and must be stamped by a licensed engineer experienced with lighting design.

- Illumination plan sheets shall be submitted with every submittal. Illumination plans should be separate from other plans, including signal plan sheets. Illumination installed on signal poles for signalized intersections shall be on the signal plans.
- An AGI32 file shall be submitted with every submittal.
- Materials must be submitted to and approved by the City prior to procurement.

Street lighting system design requirements are as follows:

1. Designs shall contain luminaire with pole type and location, illumination level, uniformity ratio, line losses, power source, the electrical and physical layout, installation details and plans and specifications.
2. The lighting system shall default to City-owned street lights, metered via Puget Sound Energy power, unless otherwise allowed by the Review Engineer.

3. Electrical service cabinet installations may be required if an existing service is not in the vicinity of the project. This requires the owner to work directly with Puget Sound Energy on finding service locations and coordinating power connections prior to turn-on.
4. All street lights shall be LED.
5. Street light poles cannot be relocated or reused in new locations.
6. When required, street light pole bases and foundations shall be removed in their entirety.

A combined street tree and street light plan is required for review and approval prior to completion of engineering and landscape plans for installation. The goal is to provide the optimum number of street trees while not compromising the light and safety provided by streetlights. Street trees and street lights must be shown on the same plan sheet with the proper separation (generally 25 feet apart) and the proper spacing from driveways (10 feet from Point A in Design Manual Standard Drawings SW-140-1, SW-150-1, SW-160-1 and SW-170-1).

Street lighting is preferred but not required along private roads. Street lighting systems for private roads shall be designed and constructed on a separate power source from the public street lighting system. All street light maintenance, installation and power costs for private road systems shall be paid by the property owner, homeowner or homeowner's association.

Temporary illumination shall be required under the scenarios described in the Street Lighting Design Guide (Appendix A), unless otherwise approved by the Review Engineer. A temporary illumination plan shall be designed and stamped by a licensed engineer with experience in lighting design and provided with the right-of-way permit and approved by the Review Engineer. The temporary illumination plan must meet light levels presented in the Street Lighting Design Guide (Appendix A), regardless of it being a temporary condition.

4.3 Channelization and Signing

Channelization and signing plans should be shown on a separate plan and prepared by a licensed engineer. The channelization and signing information shall not be placed on other discipline sheets.

1. All signs, including street name and nonmotorized, shall be clearly indicated on the plans with construction notes. A signing schedule and sign details shall be provided on the plans indicating sign removals, relocations and additions. Sign details shall show all legend and background sizing and color. Standard MUTCD signs do not need a sign detail but sizing shall be called out specifically in the sign schedule.

2. Sign installations shall be verified and approved by the Review Engineer and the Inspector in the field. It is the responsibility of the property owner to ensure that signs are maintained in good condition until the development is accepted and the right-of-way permit is closed by the City. Any damaged signs must be replaced by the property owner at her/his expense.
3. The channelization plan sheet shall show all removals and installations of new channelization with construction notes and stationing.
4. All channelization and pavement markings, such as raised pavement markers, paint, thermoplastics, etc., shall be pre-marked by a City-approved striping contractor, and the layout approved by the Review Engineer prior to permanent installation by the contractor.
5. Temporary traffic control and construction zone signing and barricades to ensure traffic safety during construction activities shall be provided by the developer.
    a. Temporary traffic control signing and channelization must meet City of Bellevue standards and specifications.
6. The Review Engineer shall review and approve all traffic control devices. All traffic control devices used on public streets and private roads shall conform to the MUTCD.

4.4 Communication System

The City operates and maintains an expansive, citywide fiber optic communication system that provides network connectivity for critical city functions. These critical functions include, but are not limited to, network connectivity for traffic signal operations, traffic cameras, emergency services and operations at off-site city facilities. Bellevue requires available conduit and fiber optic infrastructure to establish network connections and accommodate future system expansion.

For projects where the fiber optic system is impacted, or where new communication systems are required, designs must follow the City's "Fiber Optic Design Requirements" (see Appendix C) and be stamped by a licensed engineer with experience in fiber optic design.

4.5 Traffic Calming

Bellevue's Vision Zero initiative aims to eliminate traffic deaths and serious-injury collisions on city streets by 2030. To achieve this goal, the Bellevue City Council adopted the Safe System approach—a holistic-based approach to road safety that bundles strategies

focused on people, streets, speeds and vehicles safety, as well as the supporting elements of leadership, culture, partnerships and data. An aspect of that directly flows out of the safe speeds strategy of the Safe Systems Approach is that of traffic calming and speed management.

The City's Neighborhood Traffic Safety program has a long-standing history of managing vehicle speeds and traffic through traffic calming measures. The City has employed many traffic calming measures to reduce speeds, support livability and improve safety and mobility. In consultation with the community, these tools work to discourage excessive vehicle speeds, minimize cut-through traffic and support a multimodal transportation system, including walking and biking.

Traffic calming measures are self-enforcing in that they modify the streetscape with horizontal deflection (e.g., traffic circles, mini roundabouts, chicanes, lateral shifts and lane/ roadway narrowing), vertical deflection (e.g., speed humps, speed cushions, raised crosswalks and raised intersections), signing, pavement markings and other cues to remind drivers to travel at appropriate speeds for the context of the roadway. Traffic calming is most effective when applied with multiple tools or measures (e.g., sidewalks with curb extensions and raised crosswalks).

Traffic calming should be considered based on engineering judgment whenever there is a need to reduce vehicle speeds and/or cut-through traffic on a roadway. Increased consideration should be given to the following areas: 1) along the City's high-injury network (HIN), 2) in locations or facilities that generate high concentrations of bicyclists and pedestrians, and/or 3) to support transitions from higher speed to lower speed contexts. The traffic calming measures listed within this section can be found in the City’s Residential Traffic Guidebook (Guidebook) and the Speed Management Plan (SMP). The Guidebook and SMP detail additional information and traffic considerations for each tool.

4.4.1 Traffic Calming Considerations

When considering traffic calming on a roadway, there are numerous site-specific and traffic calming-specific contexts that should be evaluated during the planning, scoping, design, construction and maintenance phases. The Design Engineer should consider the following guidelines that apply to the City's traffic calming measures. Prior to designing any traffic calming measure, the Design Engineer shall consult and coordinate with the Review Engineer, Neighborhood Traffic Safety Services staff and Traffic Engineering staff to confirm the need and appropriateness for the traffic calming measure.

1. Traffic calming measures should be designed consistently to create a predictable roadway environment. Many traffic calming measures in Bellevue have a

corresponding, adopted standard drawing associated with them to impart standard designs into roadway projects.

2. Traffic calming measures can be used in a variety of roadway contexts and in many different street types and areas, including urban core and commercial land uses. Some measures may be more effective in certain conditions. Traffic volumes, speed limits, adjacent land use context, presence of pedestrians and bicyclists, presence of curves, roadway grade and other traffic and roadway considerations should be evaluated to determine appropriateness of the use of traffic calming measures.
3. Vertical deflection like speed humps and raised crosswalks can delay emergency response vehicles such as fire trucks. Coordination with the Fire Department is critical during the planning and design phases when considering traffic calming measures to ensure the proposed countermeasures do not unreasonably impact response times. The City's transportation network has identified primary and secondary emergency response routes that indicate, generally, which streets are used the most when responding to calls.
4. The design and placement of traffic calming measures should not degrade the pedestrian and biking environment.
5. Traffic calming—while helpful in addressing the top transportation-related concerns from residents (speeding, for example)—can still create unintended consequences such as increased noise. Any traffic calming project requires a commitment to working with the community and adjacent households to ensure the project is aligned with community concerns.
6. When applicable, standard signing and pavement markings shall be consistent with the MUTCD.

4.4.2 Type of Traffic Calming Measures

The following are traffic calming measures commonly used in Bellevue. A brief description of the measure is provided along with considerations for implementation. The standard drawing associated with the measure is referenced, if applicable. The Guidebook and SMP provide additional information and traffic considerations for each measure in more detail.

1. **Chicanes/slow points/lateral shifts**. Chicanes are a series of two to three curb extensions that alternate from one side of the street to the other forming S-shaped curves on what would be an otherwise straight roadway. Slow points are curb extensions that narrow a roadway, sometimes allowing only one car at a time to pass. Lateral shifts alter the path of the travel lane to disrupt the propensity to travel unabated in an effort to reduce vehicle speeds.

If implementing chicanes or lateral shifts along a two-way road with two full-width lanes, a centerline treatment should be considered to prevent drivers from cutting a straight path across the centerline. Along roads with bike lanes, continuing the bike lanes straight through and between the curb extension and the curb or edge of roadway should be considered.

2. **Curb extensions**. Curb extensions narrow the roadway by extending the curb toward the center of the street helping to reduce vehicle speeds. Curb extensions can be applied at intersections to increase visibility of pedestrians and narrow the roadway, as well as at mid-block locations to narrow the roadway and shorten pedestrian crossing distances. They can be installed in conjunction with speed humps or raised crosswalks. Consideration should be given to potential effects to bicyclists.

3. **Medians**. Medians are raised islands placed in the center of a roadway to separate opposing traffic. They can be placed mid-block or at entrances into neighborhoods. Medians are used to narrow the roadway and are often landscaped to provide a visual enhancement and create a perception of a narrower roadway. Designs should consider how well landscaping can be established and maintained. If landscaping is not feasible or determined appropriate for the context, medians can also be hardscaped. For more guidance on medians, refer to Section 3.3.5 Islands and Medians.

   Standard drawing: RC-121-1 Median Nose Layout (Updated).

4. **Neighborhood entrances**. A neighborhood entrance is a raised island in the center of a roadway and/or a raised concrete pavement treatment with a decorative brick pattern that identifies the entrance into a neighborhood. Neighborhood entrances typically include Bellevue's custom blue "residential area" sign to alert drivers they are entering a neighborhood with a lower speed limit. Patterned concrete entry treatments should be placed far enough away from the intersection so that they do not impede the pedestrian access route and are not located in the same space as the crosswalk.

   Standard drawing: RC-160-1 Patterned Concrete Entry Treatment.

5. **Raised crosswalks**. A raised crosswalk is an area of roadway pavement that has been raised approximately 3 inches and includes a crosswalk marked on top. Raised crosswalks are typically implemented on streets where speed control at pedestrian crossings is desired, such as in school zones or adjacent to neighborhood parks. Raised crosswalks can be used in conjunction with other traffic calming measures such as speed humps, speed cushions or curb extensions to maximize effectiveness

of reducing speeds, increase visibility of crossing pedestrians and shorten pedestrian crossing distances.

Standard drawings: CW-120-1 Raised Crosswalk, CW-130-1 Raised Crosswalk with Perpendicular Curb Ramp, CW-140-1 Raised Crosswalk with Parallel Curb Ramp, CW-150-1 Raised Crosswalk Signing, CW-160-1 Raised School Crosswalk Signing.

6. **Raised intersections.** A raised intersection is an elevated area covering an intersection with ramps for drivers on all legs of the intersection. This treatment improves intersections for pedestrian and bicyclist use by slowing driver operating speeds and increasing visibility of pedestrians and bicyclists. Since raised intersections are typically flush with the sidewalk and create blended transitions, curb ramps are typically not required. However, care should be taken in the design of raised intersections to ensure that all other ADA requirements are still met, such as providing detectable warning surfaces. In addition, bollards may be required to delineate corners and pedestrian areas from the raised intersection. Raised intersections can be implemented at signalized or all-way stop-controlled intersections with three or more legs near locations with high-transit and high-pedestrian volumes. The maximum running slope of the roadway should not exceed 8%.

7. **School zone flashing beacons**. To reinforce reduced speed limits near schools, flashing beacons are installed in combination with a speed limit sign to establish a 20-mph school speed zone. These round, yellow beacons are installed in school zones alerting drivers to slow to 20 mph during school start and dismissal times.

   Standard drawings: SL-151-1 Typical School Zone Flashing Beacon Assembly, SL-212-1 'Tiny' Service Cabinet Foundation Detail, SL-221-1 'Tiny' Service Cabinet Detail. If used in combination with a school crosswalk, see CW-160-1 Raised School Crosswalk Signing and CW-170-1 At-Grade School Crosswalk Signing.

8. **Speed cushions, speed humps, split-speed humps**. These traffic calming measures create a change in the height of the roadway pavement that produces sufficient discomfort for drivers and encourages them to slow down. The ideal placement of these measures is 150 to 300 feet apart from one cushion or hump to another. During the design and construction, special attention should be paid toward the running slope of the roadway to ensure that the raised approaches offer sufficient deflection to ensure that drivers slow down. The maximum running slope of the roadway should not exceed 8%. The design should consider space at the edge of the hump/cushion and the curb/edge of the pavement to ensure there is space for people biking to travel through with minimal vertical deflection.

a. Speed cushions consist of two or more raised and rounded areas of pavement placed laterally across a road. There are gaps that allow for the expedient passing of emergency vehicles.

b. Speed humps are raised areas of roadway pavement, 3 inches in height, which encourage drivers to reduce their speed when traveling over them.

c. Split-speed humps are modified speed humps that allow emergency vehicles to navigate around them. Multiple speed humps should be placed along a corridor to increase speed reduction efficacy.

Standard drawing: RC-170-1 Speed Hump, RC-180-1 Elongated Speed Hump, RC-181-1 Speed Cushion for Two-Lane Roadways and RC-182-1 Speed Cushion Signing for Two-Lane Roadways.

9. **Speed dots**. A speed dot is a small circular or oval island located in the center of the road at mid-block locations. It reduces vehicle speeds by narrowing the roadway and redirecting vehicles around the circle. Multiple speed dots can be applied along a corridor to maximize speed reduction efficacy.

10. **Speed mounds**. Speed mounds are slightly raised areas of pavement that guide drivers through a designated area. Unlike traffic circles that force drivers around the device, speed mounds allow vehicles to pass over the raised pavement.

11. **Vehicle speed feedback signs**. Vehicle speed feedback signs or stationary radar signs direct a driver's attention to the posted speed limit and digitally display the speed of the driver's vehicle on a message board. This instant feedback results in a greater awareness of the speed limit and encourages motorists to adjust their speed accordingly. Vehicle speed feedback signs are used on any functional class of street. These signs have shown to be most effective on streets in the uphill direction but have proven effective at reducing speeds on streets with a variety of street contexts.

    When installing and maintaining vehicle speed feedback signs, several factors should be considered, including, but not limited to:

    a. Existing and future landscape and vegetation that could impact sign visibility should be considered.

    b. Whenever possible, vehicle speed feedback signs should be located near an existing power source and should be located in an area with sufficient space to install the required service cabinet.

    c. Consistent with the MUTCD, when used to supplement a horizontal alignment warning sign with an advisory speed plaque, the feedback sign shall be an

independent installation placed downstream of the warning sign near the point of curvature of the horizontal curve.

Standard drawing: SL-152-1 Typical Radar Feedback Sign Assembly, SL-212-1 'Tiny' Service Cabinet Foundation Detail, SL-221-1 'Tiny' Service Cabinet Detail.

12. **Traffic circles**. A traffic circle is a raised circular island located in the center of an intersection. This design requires vehicles to keep right and travel through the intersection in a counterclockwise direction around the island. Traffic circles can be placed at four-legged and three-legged intersections. Careful attention should be paid to the available lane width and turning radius used with traffic circles. Traffic circles may include center landscaping and are typically not mountable.

    Standard drawing: RC-140-1 Traffic Circle Details (Updated), RC-150-1 Traffic Circle Dimensions.

13. **Mini-roundabouts or compact modern roundabouts.** A mini-roundabout is a raised island placed at an unsignalized intersection. The center island design requires vehicles to keep right and travel through the intersection in a counterclockwise direction. Roundabouts shall be designed in accordance with roundabout design principles and designed so that all vehicles can circulate counterclockwise. The center island is typically partially or fully mountable to accommodate trucks, buses and emergency vehicles. Spitter islands should be included in the design on all approaches to direct traffic entering the circle and create enough deflection to slow vehicles and discourage one movement from free flowing into the intersection. Traffic entering the intersection yields to vehicles within the roundabout.

14. **Travel lane width reduction.** The designed width of traffic lanes has direct effects on driving speed, pedestrian crossing distances and the ability to add facilities for other modes such as pedestrian refuge islands, bike lanes, sidewalks and landscaping. Roadways may have existing lane widths that unintentionally encourage high driving speeds. Narrowing travel lanes can promote slower driving speeds while also providing new or enhanced facilities for other modes by repurposing the reclaimed space for other uses, such as bike lanes, sidewalks, shoulders, bus lanes, parking, landscaping or pedestrian refuge islands. At signalized intersections, narrower lanes can reduce the pedestrian crossing distance, allowing for shorter pedestrian crossing phase lengths and reducing pedestrian exposure. For more guidance on street and lane widths, refer to Section 3.3.1 Street and Lane Widths.

5 Appendices

Appendix A Street Lighting Design Guide (includes Street Light Level Map)

Appendix B BelRed Streetscape Plan

Appendix C Fiber Optic Design Requirements

Appendix D Small Wireless Facilities

Appendix E Preliminary Civil and Traffic Plans Requirements

Appendix F Wilburton Transit Oriented Design (TOD) Access Concepts Design Guide